Municipal Infrastructure Support Agent (MISA)

REPUBLIC OF SOUTH AFRICA

TENDER NO: MISA/RBWTW/FS/031/2026/27

APPOINTMENT OF A CONTRACTOR FOR THE REFURBISHMENT OF BETHLEHEM WASTEWATER TREATMENT WORKS.

PROCUREMENT DOCUMENT

(Based on NEC3 Engineering and Construction Contract – Option B: Priced Contract with Bill of Quantities)

NOVEMBER 2026

Issued by:

Chief Executive Officer

Municipal Infrastructure Support Agent

1303 Heuwel Avenue

Riverside Office Park, Letaba House

Centurion, PRETORIA 0046

TEL: 012 848 5300

Name of Bidder: _____

Total Bid Price: _____

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT

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Tender Procedure: Open Tender Procedure

Based on

MISA Supply Chain Management Policy dated 12 February 2026

SANS 10845-1, Construction procurement Part 1: Processes, methods and procedures

SANS 10845-2, Construction procurement Part 2: Formatting and compilation of procurement documentation

SANS 10845-3, Construction procurement Part 3: Standard conditions of tender

- **Standard for Uniformity in Construction Procurement (Board Notice 423 of 2009 Government Gazette No 42622 of August 2019), as termed as *SFU*.**

Preferential Procurement Regulations 2022 *(Ref: government gazette no. 47452; dated: 04 November 2022 issued according to the preferential procurement policy framework act (PPPFA), act no. 5 of 2000)*

Contract Documents

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2. Contract data
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5. Conditions of Contract: NEC 3
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7. Works Information
8. Site Information

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T1 Tendering Procedure

T1.1 TENDERING NOTICE AND INVITATION TO TENDER

Municipal Infrastructure Support Agent (MISA) hereby, invites bids from suitably qualified contractors for the Refurbishment of Bethlehem Wastewater Treatment Works.

Tenderers should have a CIDB contractor grading of 7ME or higher.
Contracts will be based on the NEC3 Engineering and Construction Contract (Option B: Priced Contract with Bill of Quantities).

The project details are hereunder,

TENDER NO.	PROJECT NAME	COMPULSORY BRIEFING SESSION AND SITE VISIT: PLACE, DATE and TIME	TENDER CLOSING DATE and TIME
MISA/RBWTW/FS/031/2026/27	**APPOINTMENT OF A CONTRACTOR FOR THE REFURBISHMENT OF BETHLEHEM WASTEWATER TREATMENT WORKS.**	**Dihlabeng Local Municipality Town hall (side hall):** Muller Street, Bethlehem, 9701. PO Box 551, Bethlehem, 9701 **Compulsory Site Visit on 14 December 2026 at 11:00am** **Failure to attend and sign the attendance register will lead to your DISQUALIFICATION.**	**25 January 2027** **11.00 AM** **All Bid documents to be submitted to:** **1303 Heuwel Avenue, Riverside Office Park, Letaba House, Centurion, PRETORIA 0046** **TEL: 012 848 5300**

Compulsory briefing session and site visit will take place at the place and on the date and time shown above unless otherwise amended later. Representative(s) from MISA will meet prospective Bidders to provide details of the Contract.

The requirement of submissions is detailed in the Tender Data (Ref: T1.2 Tender Data). Bidders who satisfy the eligibility criteria as set in the tender documents (Ref: T 1.2 Tender Data) are to submit their tenders.

Telegraphic, telephonic, telex, facsimile, e-mail and late tenders will not be accepted. Bidders must submit their tenders using only the tender documentation issued.

Bidders must note that by submitting bid proposal you give MISA permission to process or access bidders, members and its director's information in compliance with Protection of Personal Information Act (POPIA).

Tenders will be evaluated based on preferential procurement framework Act 5 of 2000 and on functionality as prescribed in the Preferential Procurement Regulation 2022.

Requirements for sealing, addressing, delivery, opening and assessment of tenders are stated in the Tender Data.

Issued by:

Municipal Infrastructure Support Agent

1303 Heuwel Avenue

Riverside Office Park, Letaba House

Centurion, PRETORIA 0046

TEL: 012 848 5300

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T1.2 TENDER DATA

TENDER DATA

The conditions of tender are as contained in the latest edition of SANS 10845-3, *Standard conditions of tender*.

SANS 10845-3 makes 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 provisions of SANS 10845-3 *and* as contained in **the Standard for Uniformity in Construction Procurement (Board Notice 423 of 2009 Government Gazette No 42622 of August 2019), as termed as *SFU***.

Each item of data given below is cross-referenced to the clause in SANS 10845-3 to which it mainly applies.

Clause number	Tender Data
3.1	The employer is the **Municipal Infrastructure Support Agent (MISA)**, an entity within the South African Ministry for Cooperative Governance and Traditional Affairs (CoGTA), established in terms of Presidential Proclamation No. 29 of 2012.
3.3	The Tender documents issued by the employer comprise the documents listed on the contents page.
3.4	The Employer's Representative is: **Name:** Ms. Mapatane Kgomo **Physical Address**: 1303 Heuwel Avenue, Riverside Office Park, Letaba House, Centurion, Pretoria 0046 Private Bag X 105, Centurion 0046 **Telephone**: 012 848 5300 **Email**: tenders@misa.gov.za
3.5	The language of communications is English
4.1	**ONLY** those tenderers who satisfy the following **ELIGIBILITY CRITERIA** and who provide the required evidence in their tender submissions, are eligible to submit tenders and have their tenders evaluated: The tenderer: 1) Only those tenderers who are registered with the **CIDB or** are capable of being so prior to the evaluation of submissions, in a contractor grading designation equal to or higher than a contractor grading designation

Clause number	Tender Data
	determined in accordance with the sum tendered, or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations, for a **7ME Or Higher** class of construction work, are eligible to have their tenders evaluated. Joint ventures are eligible to submit tenders provided that: 2) every member of the joint venture is registered with the **CIDB**; 3) The lead partner has a contractor grading designation in the **7ME Or Higher** class of construction work; or not lower than one level below the required grading designation in the class of works construction works under considerations and possess the required recognition status. 4) 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 7ME **Or Higher** class of construction work or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations. 5) In case of a Joint Venture/ Consortium submission, shall submit a Joint Venture Agreement signed by all parties and a valid combined CIDB Grading Certificate. 6) Bidders must attend a compulsory site-briefing meeting and sign the attendance register. 7) Only Tenderers who have the following resources must have a BSc Degree/ B-tech in Mechanical Engineering (Mechanical Engineer/Contract Manager) & Electrical Engineering (Electrical Engineer/Technologist) respectively and demonstration of a minimum 5years post qualification relevant experience in Water and Sanitation (Attach proof of Certificate, CV and Qualification for each resource): • **Mechanical Engineer (Contract Manager)** • **Electrical Engineer/Technologist**
4.7	The arrangements for a compulsory clarification meeting and a site visit are as stated in the Tender Notice and Invitation to Tender (ref: T1.1). **No Tender will be considered unless the Bidder attends the compulsory briefing session and site visit.** Bidder /their authorised representatives must complete and sign the attendance register and detailed contacts in favour of the tendering entity therein. Addenda, if any, will be issued to the tenders only who attended the compulsory briefing sessions.
4.12	No alternative tender offer will be considered.
4.13 4.15	The employer's details and address for delivery of tender offers and identification details that are to be shown on each tender offer package are: **Location of tender box:** Reception area of MISA Offices Municipal Infrastructure Support Agent's Office **Physical Address**: 1303 Heuwel Avenue, Riverside Office Park, Letaba House, 1st Floor, Centurion, Pretoria 0046, Private Bag X 105, Centurion 0046 **Telephone**: 012 848 5300 **Identification details on the Tender package(s):** 1. Name and Reference number of the tender; 2. Address of the employer; 3. Names of the tendering entity and the contact person; 4. Physical address and contact details of the Bidder; 5. Date of submission
4.13.4	The Bidder is required to meet the following conditions in addition to the requirement for eligibility criteria as mentioned in Clause 4.1.

Clause number	Tender Data
4.13.5	Tender offer shall be submitted as **original**, **one copy of the original** and **one scanned copy of the original completed and signed tender documents in a memory stick.**
4.13.6	Telephonic, telegraphic, telex, facsimile or e-mailed tender offers will not be accepted.
4.15	The closing time for submission of tender is as stated in the Tender Notice and invitation to Tender (ref: T1.1)
4.16	The tender offer validity period is 120 days.
5.1	The employer will respond to requests for clarification received up to 7 working days before the tender closing time.
5.2	The employer shall issue addenda until 10 working days before tender closing time.
5.	The time and location for opening of the Tender offers are as detailed in the Tender notice and invitation to tender (ref: T1.1) or in any addendum thereafter if applicable.
SFU (clause 4.3.1)	The procedure for the evaluation of responsive tenders is **Compliance, Financial offer and Preference** as explained in the **CIDB**'S Standard for Uniformity in Construction Procurement August 2019 (clause 4.3.1). Breakdown points for Functionality points are outlined in below. The procedure for the evaluation of responsive tenders is **detailed as follows: Phase 1:** The eligibility criteria, and mandatory requirements. **Phase 2:** Bidders must meet the minimum requirements outlined in the functionality criteria and score the at least the minimum functionality points to be considered for further evaluation in Stage 3. Bidders which do not meet minimum functionality **points of 60** will not proceed to the next evaluation criteria. **Phase 3:** Price and preference (80/20 system). **PHASE ONE: RESPONSIVENESS TO THE ELIGIBILITY CRITERIA, BID AND MANDATORY REQUIREMENTS AND RULES** As per 4.1 above. **Other Conditions of bid (Non eliminating, unless expressly mentioned in the document):** 1. The bidder must be registered on the Central Supplier Database (CSD) prior the award 2. All bidder's tax matters must be in order prior award. Bidders' tax matters will be verified through CSD 3. Should the bidder intend to sub-contract more than 25%, It is compulsory to submit a valid B-BBEE Certificate issued by SANAS accredited Agency OR a valid original or certified copy of a (CSC000) sector code sworn affidavit (for EMEs or QSEs) attested by a Commissioner of Oaths in terms of the Justices of the Peace and Commissioners of Oaths Act 16 of 1963 as amended for all proposed sub-contractors.

Clause number	Tender Data
	4. A valid original or certified copy of amended Construction Sector Codes (CSC000) **B-BBEE Certificate issued by SANAS accredited Agency** must be submitted with the tender OR a valid copy of a sworn affidavit attested by a commissioner of Oaths in terms of justices the peace and commissioners of oaths act 16 of 1963 as amended, prepared and issued in terms of the amended B-BBEE Construction Sector Codes (CSC000) must be submitted with the tender in order to qualify for preference points for B-BBEE. In the case of a joint venture or consortium a valid copy of a consolidated amended Construction Sector Codes (CSC000) **B-BBEE Certificate issued by SANAS accredited Agency** must submitted. Failure to comply, will automatically results in the non-awarding of points for B-BBEE. 5. Bidders that are EMEs or QSEs must make use of the attached Construction Sector Codes (CSC000) compliant Sworn affidavits, to claim B-BBEE points. Generic sector codes or any other sector code sworn affidavits (which are not Construction Sector Codes) will not be accepted for purposes of claiming B-BBEE points. 6. In cases where key personnel have qualifications that were obtained outside South Africa, the bidder must submit a SAQA Verification Certificate indicating the relevant equivalent South African Qualification. 7. **Bill of quantities or Pricing schedule and or Form of offer/Total tender** amount shall be completed in all respect and shall not contain erasable ink or correction fluid on them. Any wrong entry, in case of correction, must be cancelled by a single stroke and initialled by the Authorised signatory **PHASE TWO: TENDER/S WHO PASS STAGE 1 WILL THEN BE EVALUATED ON FUNCTIONALITY CRITERIA, AS OUTLINED BELOW:** 1. The tenderer will be expected to submit substantial information (valid copies and detailed information) in order to claim points for each of the criteria or sub criteria set. 2. The Bidder must demonstrate to the satisfaction of the Employer that it has sufficient skill and capacity to execute the works. 3. A Tender scoring an average score below **60 points** in Functionality will be considered as DISQUALIFIED from evaluation and will be discarded from any further evaluation. 4. Non-submission or poorly completed schedule or incomplete information will result in a Bidder losing points on Functionality. CVs which do not substantially detail relevant experience will also lead to a bidder losing points on Functionality. It is the responsibility of the Bidder to ensure that all copies are clear and certified when the conditions require them to be so. No second chance will be given to a Bidder to submit some information after tender closure on this stage of evaluation i.e. functionality **PHASE THREE: EVALUATION FOR PRICE AND SPECIFIC GOALS** During this phase, bid proposals that passed phase 2 will be further evaluated based on the Preferential Procurement Regulations 2022, will be used to evaluate this proposal as per the applicable threshold value. Bid proposals will be evaluated based on the 80/20 preference points system in accordance with the PPPFA Act (Act no.5 of 2000), where a maximum of 80 points will be awarded in respect of price and a maximum of 20 points will be awarded for specific goals

Clause number	Tender Data

The 80/20 preference point system for acquisition of services, works or goods up to Rand value of R50 million:

Allocation of points

The following table shows allocation of points:

Criteria	Points
POINTS ON PRICE	**80**
Specific Goals	**20**
TOTAL	**100**

a) A maximum of 80 points is allocated for **price** on the following basis:

80/20

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

Where:

Ps = Points scored for price of tender under consideration

Pt = Price of tender under consideration

Pmin = Price of lowest acceptable tender

b) A maximum of 20 points may be awarded to a Bidder for the specific goal specified for the tender.

c) The points scored for the specific goal must be added to the points scored for price and the total must be rounded off to the nearest two decimal places.

d) Subject to section 2(1)(f) of the Act, the contract must be awarded to the Bidder scoring the highest points.

e) Allocation of Points

SPECIFIC GOALS

The Employer reserves the right to apply other specific goals in accordance with PPPF Regulations 2022 as contemplated in section 2(1)(d)&(e) of the PPPF Act No 5 of 2000 which may include contracting with persons, or categories of persons, historically disadvantaged by unfair discrimination on the basis of race, gender and disability including the implementation of programmes of the Reconstruction and Development Programme as published in Government Gazette No. 16085 dated 23 November 1994.

The Specific goals will be allocated as per the table below:

The specific goals allocated points in terms of this tender	Number of points allocated (80/20 system)
Women-owned enterprise: 51% or more ownership by women	**5**
Who has disability (51% or more owned)	**3**

Clause number	Tender Data

Enterprise owned by Persons with Who are youth (51% or more)	**5**
Location of enterprise (Thabo Mofutsanyana District Municipality)	**4**
B-BBBEE status level contributors from level 1 to 2 which are QSE or EME	**3**
Total scored points	**20**

Definitions

"Specific goals": means specific goals as contemplated in section2(1)(*d)* of the PPPFA Act which may include contracting with persons, or categories of persons, historically disadvantaged by unfair discrimination on the basis of race, gender and disability including the implementation of programmes of the Reconstruction of Development Programme as published in *Government Gazette No.*16085 date 23 November 1994

"Ownership "means the percentage ownership and control, exercised by individuals within and enterprise.

"Disability" means, in respect of a person, a permanent impairment of a physical, intellectual, or sensory function, which results in restricted, or lack of, ability to perform an activity in the manner, or within the range, considered normal for a human being.

Means of Verification (Specific Goals)

Procurement Requirement	Required Proof Documents
Women	Certified ID copies of Directors + CIPC Company Registration Documents
Disability	Doctor's letter/report confirming the disability and/or Proof receipt of Disability Grant
Youth	Certified ID copies of Directors + CIPC Company Registration Documents
Location	Municipal bill/Lease agreement/ letter from Local authority
B-BBEE status level contributors from level 1 to 2 which are QSE or EME	Valid certificate/ sworn affidavit Consolidated BEE certificate in cases of Joint Venture Full CSD Report

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

Tenderers that fail to submit supporting documents to substantiate their B-BBEE rating, as indicated under "Clause: SFU (clause 4.3.1): **Other Conditions of Bid**" paragraph 3 and 4, will not be awarded B-BBEE preference points.

5.11.9	**Functionality Criteria.** **A Tender scoring below 60 points in Functionality shall be considered as DISQUALIFIED for further evaluation and shall be discarded from evaluation.**

<table>
<tr><th>Clause number</th><th>Tender Data</th></tr>
<tr><td></td><td>
<table>
<tr><th>Quality criteria</th><th>Evaluation schedule</th><th>Maximum number of points (A)</th></tr>
<tr><td>Bidder’s Relevant Project Experience</td><td>Schedule 1</td><td>50</td></tr>
<tr><td>Expertise of Key Personnel
<table>
<tr><td>Contracts Manager (Mechanical Engineer)</td><td>30</td></tr>
<tr><td>Electrical Engineer/Technologist</td><td>20</td></tr>
<tr><td>Total</td><td>50</td></tr>
</table></td><td>Schedule 2</td><td>50</td></tr>
<tr><td>Maximum possible score for quality (M_s)</td><td></td><td>100</td></tr>
</table>
</td></tr>
<tr><td>5.13</td><td>Before award, successful Bidders will be accepted only if:
1. The Bidder or any of its directors/ shareholders is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector.
2. the Bidder has not:
a. abused the Employer’s Supply Chain Management System, or
b. failed to perform on any previous contract and has been given a written notice to this effect,
3. The Bidder demonstrated that they have capacity and capability to complete the works.
4. The Bidder does not pose a risk to the employer such as not having capacity in the tendered project region.
5. The Bidder does not pose commercial risk in relation to financial offers and market related rates.
6. the Bidder has duly completed and signed the SBD 4, Incomplete or unsigned or poorly completed forms will lead to a bidder being declared nonresponsive.
7. the Bidder is registered with the Construction Industry Development Board in an appropriate contractor grading designation.
8. the Bidder/s is registered on CSD prior submitting bids (open tenders). Any prospective bidder found to have Tax matters not in order with SARS (verified through CSD) during the evaluation process (after being given an opportunity to rectify tax matters) will be eliminated and not be considered further in the process. Preferred bidder/s will be afforded an opportunity to rectify their tax affairs within 7 days. A bidder that fails to rectify its tax matters with SARS will be eliminated.
9. A Resolution of signatory form has been completed and signed by director/s or a letter bearing a letterhead of the Bidder has been attached (specific to this bid) to the bid submission, it must be duly signed by all directors and submitted the bid. Only a duly authorised official can sign the bid.</td></tr>
<tr><td>5.14</td><td>Only one signed copy of the contract will be provided by the employer to successful Bidder after award during handover meeting.</td></tr>
<tr><td>5.17</td><td>The additional conditions of tender are:</td></tr>
</table>

Clause number	Tender Data
	Wherever a brand name is specified in this document (i.e. specifications, pricing schedule, bill of quantities or anywhere), the department requires an item similar/equivalent or better.
5.17	**Cancellation and re-invitation of tenders** MISA may, prior to the award of the tender, cancel the tender if- (a) due to changed circumstances, there is no longer a need for the services, works or goods requested; or (b) funds are no longer available to cover the total envisaged expenditure; or (c) no acceptable tenders are received; or (d) Tender validity period has expired; or (e) Gross irregularities in the tender processes and/or tender documents; or (f) No market related offer is received (after attempts of negotiation processes) Where applicable, the decision to cancel the tender will be published in the CIDB website and in the Tender Bulletin or the media in which the original tender invitation was advertised.
	TENDER AWARD A. The tender obtaining the highest number of total points may be awarded the contract, unless the Employer decided otherwise (ref: T1.1 Tender notice and invitation to tender). B. Preference point shall be calculated after prices have been brought to a comparative basis taking into account all factors of non-firm prices and all unconditional discounts. C. Point scored must be rounded off to the nearest 2 decimal places. *(If the value of the 3rd decimal place is 1 up-to 4, the points up to 2nd decimal place will be considered and if it is 5 up to 9, 1 will be added to the number at 2nd decimal place and the resulting point will be considered.)* D. In the event that two or more Tenders have scored equal total point, the successful Bid must be the one scoring the highest number of **Specific goals points.** E. However, in the event that two or more Tenders have scored equal point including equal **Specific Goals**, the successful tender must be the bidder scoring the highest points for **Functionality.** F. Should two or more Tenders be equal in all respects, the award shall be decided by drawing of lottery by the Employer. **ADDITIONAL CONDITIONS OF TENDER** The additional conditions of Tender are: **A. Joint Venture** Tenders may form a joint venture acceptable to the Employer as detailed in the tender documents.

Clause number	Tender Data
	B. Costs incurred by Bidder The Employer will neither be responsible for nor pay any expenses incurred or losses suffered by any Tenderer in the preparation of the tender or in attending the compulsory briefing session and site visit in connection therewith. The employer reserves the right to accept the whole works or part of the works. **C. Acceptance of Bid** The Employer does not bind itself to accept the lowest or any Tender or to furnish any reason for the acceptance or rejection of a tender. The employer reserves the right to accept the whole works or part of the works. **D. Withdrawal of Tender during validity or Failure in signing Contract Agreement at Award** **Should a Tenderer** a) Withdraw his Tender during the period of its validity; or b) Give notice of his inability to execute the Contract or fail to execute the Contract; or c) Fail to sign the Contract Agreement or furnish the required security/ insurance(s) within the period fixed in the Contract Data (ref: C1.2) in the Tender documents or any extended time agreed to by the Employer; **then the Tenderer shall be liable for and pay to the Employer –** i. All expenses incurred in calling for fresh Tender, if it should be deemed necessary by the Employer to do so; ii. The difference between Tender's tender and any less favourable tender accepted either by fresh tender being called or by another tender being accepted from those already received; iii. Any escalation of the Final Contract Price resulting from any delay caused in calling for fresh tender or accepting another tender from those already received, as the case may be. And the Employer shall have the right to recover such sums by set-off against any money which may be due or become due to the Tenderer, under this or any other tender or Contract between the Employer and the Tenderer, or against any guarantee or deposit which may have been furnished by or on behalf of the Tenderer for the due fulfilment of this or any other tender or Contract between the Employer and the Tenderer. Pending the ascertainment of the amount of the Tenderer's liability to the Employer in terms of this Condition of Tender, the Employer may retain such monies, guarantee or deposit as security for any loss, which the Employer may sustain by reason of the Tenderer's default. **E. Repudiation of Tender or Invalidation of Contract** If the Employer is satisfied that the Tenderer or any person is being an employee, partner, director, member or shareholder of the Tenderer or a person acting on behalf of or with the knowledge of the Tenderer has offered, promised or given a bribe or other gift or remuneration to any person in connection with obtaining or execution of a Contract; a) has acted in a fraudulent or corrupt manner in obtaining or executing a Contract;

Clause number	Tender Data
	b) has approached an officer or employee of the Employer with the object of influencing the award of a Contract in the Tenderer's favour; c) has entered into any agreement or arrangement, whether legally binding or not, with any other person, firm or company: d) to refrain from Tendering for this Contract; e) as to the amount of the Tender to be submitted by either party; f) has disclosed to any other person, firm or company other than the Employer, the exact or approximate amount of his proposed Tender except where the disclosure, in confidence, was necessary in order to obtain insurance premium and surety quotations required for the preparation of the Bid. The Employer may, in addition to using any other legal remedies, repudiate the Bid or declare the Contract invalid should it have been concluded already. **F. South African Jurisdiction** The laws of the Republic of South Africa shall be applicable to each Contract created by the acceptance of a Tender and each Tenderer shall indicate a place in the Republic and specify it in his Tender as his domicilium citandi et executandi where any legal process may be served on him. Each Tenderer shall bind her/ himself to accept the jurisdiction of the Courts of Law of South Africa. **G. Amendments to Tender by Employer** **Arithmetical Errors** The Employer shall check and correct arithmetical errors for responsive Tenders in the following manner as per CIDB guideline (Ref: Practice # 2, version 1 – August 2006): i. Where there is a discrepancy between the amounts in figures and in words, the amount in words shall govern. ii. If the pricing (or bills of quantities or schedule of quantities or schedule of rates) 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. iii. 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 bidder'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. **Imbalance in Tender Rates** In the event of there being Tendered rates or lump sums being declared by the Employer to be unacceptable to him because they are either excessively low or high or not in proper balance with other rates or lump sums, the Tenderer may be required to produce evidence and advance arguments in support of the tendered rates or lump sums objected to. If, after submission of such evidence and any further evidence requested, the Employer

Clause number	Tender Data
	is still not satisfied with the tendered rates or prices objected to, s/he may request the Tenderer to amend these rates and prices along the lines indicated by him. 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 total tendered sum.

T2 Returnable Documents

T2.1 LIST OF RETURNABLE DOCUMENTS

A. Documentation to demonstrate eligibility to have tenders evaluated

The required documentation as listed in **Clause 4.1 of T1.2 Tender Data**, must be submitted along with the tender for determining the eligibility of the tender.

B. Returnable schedules required for tender evaluation purposes

The tenderer must complete the following returnable schedules as relevant, which are attached here with the tender documents.

1. SBD 1 - Invitation to Bid
2. SBD 4 - Declaration on Interest
3. SBD 6.1 – Preference Points claim form
4. Samples of CSC000 sector coders Sworn Affidavits- A. EMEs and B. QSES (For tenderers with no B-BBEE Certificates)
5. CSD report Annexure
6. Tender's certificates Annexure
7. Resolution for Signatory
8. Certificate of Joint Ventures
9. C.V and qualification for each resource (Electrical Engineer and Mechanical Engineer as a Contract Manager).
10. Schedule 1: Schedule of Experience of the Bidder
11. Schedule 2: Schedule of Expertise of Key Personnel

C. Other documents contained herein in the tender documents required for tender evaluation purposes as listed below.

1. Record of Addenda to Tender Documents
2. Proposed Amendments and Qualifications

D. Documentation that will be used for evaluation and to incorporate into the contract, if the tender offer resulted in an award

1. The offer portion of C1.1 Form of offer and acceptance
2. Part 2 of C1.2 Contract data relevant to tenderer
3. C2.2 Price List

T2.2RETURNABLE SCHEDULES

1. PART A – INVITATION OF BID: SBD 1

YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF THE (MUNICIPAL INFRASTRUCTURE SUPPORT AGENT)					
BID NUMBER:	**MISA/RBWTW/FS/031/2026/27**	**CLOSING DATE:**	**25 January 2027**	**CLOSING TIME:**	**11:00am**
DESCRIPTION:	**APPOINTMENT OF A CONTRACTOR FOR THE REFURBISHMENT OF BETHLEHEM WASTEWATER TREATMENT WORKS.**				

BID RESPONSE DOCUMENTS MAY BE DEPOSITED IN THE BID BOX SITUATED AT *(STREET ADDRESS)*
1303 Heuwel Avenue, Riverside Office Park, Letaba House
1st Floor, Centurion, Pretoria 0046

BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO		TECHNICAL ENQUIRIES MAY BE DIRECTED TO:	
CONTACT PERSON	**Ms. Mandy Batyi**	CONTACT PERSON	**Mr. Zola Mshumpela**
TELEPHONE NUMBER	**012 848 5300**	TELEPHONE NUMBER	**012 848 5300**
FACSIMILE NUMBER		FACSIMILE NUMBER	
E-MAIL ADDRESS	**tenders @misa.gov.za**	E-MAIL ADDRESS	**tenders @misa.gov.za**

SUPPLIER INFORMATION					
NAME OF BIDDER					
POSTAL ADDRESS					
STREET ADDRESS					
TELEPHONE NUMBER	CODE		NUMBER		
CELLPHONE NUMBER					
FACSIMILE NUMBER	CODE		NUMBER		
E-MAIL ADDRESS					
VAT REGISTRATION NUMBER					
SUPPLIER COMPLIANCE STATUS	TAX COMPLIANCE SYSTEM PIN:		**OR**	CENTRAL SUPPLIER DATABASE No:	MAAA
B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE	TICK APPLICABLE BOX] ☐ Yes ☐ No		B-BBEE STATUS LEVEL SWORN AFFIDAVIT	[TICK APPLICABLE BOX] ☐ Yes ☐ No	

[A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE ISSUED BY AGENCY ACCREDITED BY SANAS / SWORN AFFIDAVIT (FOR EMES and QSEs) MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS FOR B-BBEE]

ARE YOU THE ACCREDITED REPRESENTATIVE IN SOUTH AFRICA FOR THE GOODS /SERVICES /WORKS OFFERED?	☐Yes ☐No [IF YES ENCLOSE PROOF]	ARE YOU A FOREIGN BASED SUPPLIER FOR **THE GOODS /SERVICES /WORKS OFFERED?**	☐Yes ☐No [IF YES, COMPLETE QUESTIONNAIRE BELOW]

QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS

IS THE ENTITY A RESIDENT OF THE REPUBLIC OF SOUTH AFRICA (RSA)?	☐ YES ☐ NO
DOES THE ENTITY HAVE A BRANCH IN THE RSA?	☐ YES ☐ NO
DOES THE ENTITY HAVE A PERMANENT ESTABLISHMENT IN THE RSA?	☐ YES ☐ NO
DOES THE ENTITY HAVE ANY SOURCE OF INCOME IN THE RSA?	☐ YES ☐ NO
IS THE ENTITY LIABLE IN THE RSA FOR ANY FORM OF TAXATION?	☐ YES ☐ NO

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

PART B – TERMS AND CONDITIONS TERMS AND CONDITIONS FOR BIDDING

1. BID SUBMISSION:

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

1.2. **ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS PROVIDED– (NOT TO BE RE-TYPED) OR IN THE MANNER PRESCRIBED IN THE BID DOCUMENT.**

2. TAX COMPLIANCE REQUIREMENTS

2.1 BIDDERS MUST ENSURE COMPLIANCE WITH THEIR TAX OBLIGATIONS.

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

2.3 APPLICATION FOR TAX COMPLIANCE STATUS (TCS) PIN MAY BE MADE VIA E-FILING THROUGH THE SARS WEBSITE WWW.SARS.GOV.ZA.

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

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

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

2.7 NO BIDS WILL BE CONSIDERED FROM PERSONS IN THE SERVICE OF THE STATE, COMPANIES WITH DIRECTORS WHO ARE PERSONS IN THE SERVICE OF THE STATE, OR CLOSE CORPORATIONS WITH MEMBERS PERSONS IN THE SERVICE OF THE STATE."

NB: FAILURE TO PROVIDE / OR COMPLY WITH ANY OF THE ABOVE PARTICULARS MAY RENDER THE BID INVALID.

SIGNATURE OF BIDDER: .....

CAPACITY UNDER WHICH THIS BID IS SIGNED: .....
(Proof of authority must be submitted e.g. company resolution)

DATE:

BIDDER'S DISCLOSURE

1. PURPOSE OF THE FORM

1.1 Any person (natural or juristic) may make an offer or offers in terms of this invitation to bid. In line with the principles of transparency, accountability, impartiality, and ethics as enshrined in the Constitution of the Republic of South Africa, 1996 (Constitution), and further expressed in the various applicable legislation, it is required for the bidder to make this declaration in respect of the details required hereunder.

1.2 If a person is listed in the Register for Tender Defaulters and/or the List of Restricted Suppliers, that person will automatically be disqualified from the bid process.

2. DECLARATION ON EMPLOYMENT BY ORGAN OF STATE

2.1 Is the bidder, or any of the directors / trustees / shareholders / members / partners of the bidder employed by an organ of state, as defined in section 239 of the Constitution? **YES/NO**

2.2 If YES, furnish particulars of the names, individual identity numbers, in the table below:

Full Name	**Identity Number**	**Name of organ of state**

2.3 Do you, or any person connected with the bidder, have a relationship with any person who is employed by the procuring institution? **YES/NO**

2.3.1 If so, furnish particulars:

……
……
……

2.4 Does the bidder or any of its directors/trustees/shareholders members/partners or any person having a controlling interest in the enterprise have any interest in any other related enterprise, whether or not they are bidding for this contract? **YES/NO**

2.4.1 If so, indicate all companies registered in the CSD in the table below:

Supplier registration number (MAAA)	Status (active/inactive/deleted)

Failure to disclose all CSD-registered active companies linked to all Directors will lead to disqualification.

3 GENERAL DECLARATION

I, ……....., the undersigned, in submitting the accompanying bid, do hereby make the following statements that I certify to be true and complete in every respect:

3.1 I have read and I understand the contents of this disclosure.

3.2 I understand that the accompanying bid will be disqualified if this disclosure is found to be false.

3.3 The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor.

3.4 In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications, prices, including methods, factors or formulas used to calculate prices, market allocation, the intention or decision to submit or not to submit the bid, bidding with the intention not to win the bid and conditions or delivery particulars of the products or services to which this bid invitation relates.

3.5 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.

3.6 There have been no consultations, communications, agreements or arrangements made by the bidder with any official of the procuring institution in relation to this procurement process prior to and during the bidding process except to provide clarification on the bid submitted where so required by the institution; and the bidder was not involved in the drafting of the specifications or terms of reference for this bid.

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

I CERTIFY THAT THE ABOVE IS CORRECT.

I ACCEPT THAT THE PROCURING INSTITUTION MAY REJECT THE BID OR TAKE APPROPRIATE ACTION AGAINST ME IF THIS DECLARATION IS FALSE.

…… ……
Signature Date

…… ……...
Designation Name of bidder

SBD 6.1

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

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

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

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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

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

(*delete whichever is not applicable for this tender*).

a) The applicable preference point system for this tender is the 80/20 preference point system.

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

(a) Price; and

(b) Specific Goals.

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

The maximum points for this tender are allocated as follows:

	POINTS
PRICE	80
SPECIFIC GOALS	20
Total points for Price and SPECIFIC GOALS	**100**

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

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

2. DEFINITIONS

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

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

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

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

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

3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

3.1. POINTS AWARDED FOR PRICE

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

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

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

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

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**

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

Where

Ps = Points scored for price of tender under consideration

Pt = Price of tender under consideration

Pmax = Price of highest acceptable tender

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.

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

(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 claimed (80/20 system) (To be completed by the tenderer)**
Women-owned enterprise: 51% or more ownership by women	**5**	
Who has disability (51% or more owned)	**3**	
Enterprise owned by Persons with Who are youth (51% or more)	**5**	
Location of enterprise (Thabo Mofutsanyana District Municipality)	**4**	
B-BBBEE status level contributors from level 1 to 2 which are QSE or EME	**3**	
Total scored points	**20**	

DECLARATION WITH REGARD TO COMPANY/FIRM

4.3. Name of company/firm……..

4.4. Company registration number: ……...

4.5. TYPE OF COMPANY/ FIRM

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

[TICK APPLICABLE BOX]

4.6. I, the undersigned, who is duly authorised to do so on behalf of the company/firm, certify that the points

claimed, based on the specific goals as advised in the tender, qualifies the company/ firm for the preference(s) shown and I acknowledge that:

i) The information furnished is true and correct;

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

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

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

(a) disqualify the person from the tendering process;

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

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

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

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

	…… **SIGNATURE(S) OF TENDERER(S)**
SURNAME AND NAME:	……
DATE:	……
ADDRESS:	……
	……
	……
	……

1. SAMPLES OF GENERIC SECTOR CODERS SWORN AFFIDAVITS- A. EMES AND B. QSES (FOR TENDERERS WITH NO B-BBEE CERTIFICATES SWORN AFFIDAVIT - TEMPLATES

(IF APPLICABLE, CHOOSE THE CORRECT FORM AND COMPLETE)

NB: CHOOSE ONE i.e EME or QSE!!!!)

B-BBEE EXEMPTED AFFIDAVIT FOR <u>EXEMPTED MICRO ENTERPRISES</u> (EME)

I, the undersigned,

Full name and Surname	
Identity number	

Hereby declare under oath as follows:

1. The contents of this statement are to the best of my knowledge a true reflection of the facts.
2. I am a Member / Director / Owner of the following enterprise and am duly authorized to act on its behalf:

Enterprise Name:			
Trading Name (If Applicable):			
Registration Number:			
Enterprise Physical Address:			
Type of Entity (CC, (Pty) Ltd, Sole Prop etc.):			
Nature of Construction Business:	BEPs (Built Environment Professional)	Contractor	Supplier
Definition of "Black People"	As per the Broad-Based Black Economic Empowerment Act 53 of 2003 as Amended by Act No 46 of 2013 "Black People" is a generic term which means Africans, Coloureds and Indians – (a) Who are citizens of the Republic of South Africa by birth or descent; or (b) Who became citizens of the Republic of South Africa by naturalization- i. Before 27 April 1994; or ii. On or after 27 April 1994 and who would have been entitled to acquire citizenship by naturalization prior to that date		

3. I hereby declare under Oath that as per Amended Code Series 100 of the Amended Codes of Good Practice issued under section 9 (1) of B-BBEE Act No 53 of 2003 as Amended by Act No 46 of 2013,

- The Enterprise is _____% Black Owned
- The Enterprise is _____% Black woman Owned
- The Enterprise is _____% Owned by Black Designated Group (provide Black Designated Group Breakdown below as per the definition in the table above)

o Black Youth % _____%

o Black Disabled % _____%
o Black Unemployed % _____%
o Black People living in Rural areas % _____%
o Black Military Veterans % _____%

Based on the Financial Statements/Management Accounts and other information available on the latest financial year-end of_____(DD/MM/YY), the annual Total Revenue was equal to/or less than the applicable amount confirmed **by ticking the applicable box below**.

Contractor / Consultancy	R10 million	
Supplier	R10 million	

If the turnover exceeds the applicable amount in the table above then this affidavit is no longer applicable and an EME certificate must be obtained from a rating agency accredited by SANAS or when applicable a B-BBEE Verification Professional Regulator appointed by the Minister of Trade and Industry.

❑ Please confirm on the table below the B-BBEE level contributor, **by ticking the applicable box.**

100% Black Owned	**Level One** (135% B-BBEE procurement recognition level)	
At least 51% Black Owned but less than 100% black owned	**Level Two** (125% B-BBEE procurement recognition level)	
Less than 51% black owned	**Level Four** (100% B-BBEE procurement recognition level)	

4. I know and understand the contents of this affidavit and I have no objection to take the prescribed oath and consider the oath binding on my conscience and on the owners of the enterprise which I represent in this matter.
5. The sworn affidavit will be valid for a period of 12 months from the date signed by commissioner.

Deponent Signature:_____

Date:_____

_____

Commissioner of Oaths Signature and stamp

Date:_____

B-BBEE EXEMPTED AFFIDAVIT FOR <u>QUALIFYING SMALL ENTERPRISES (QSE)</u>

I, the undersigned,

Full name and Surname	
Identity number	

Hereby declare under oath as follows:

1. The contents of this statement are to the best of my knowledge a true reflection of the facts.
2. I am a Member / Director / Owner of the following enterprise and am duly authorized to act on its behalf:

Enterprise Name:		
Trading Name (If Applicable):		
Registration Number:		
Enterprise Physical Address:		
Type of Entity (CC, (Pty) Ltd, Sole Prop etc.):		
Nature of Construction Business:	Supplier / Service provider	Consultancy services Supplier
Definition of "Black People"	As per the Broad-Based Black Economic Empowerment Act 53 of 2003 as Amended by Act No 46 of 2013 "Black People" is a generic term which means Africans, Coloureds and Indians – (a) Who are citizens of the Republic of South Africa by birth or descent; or (b) Who became citizens of the Republic of South Africa by naturalization- i. Before 27 April 1994; or ii. On or after 27 April 1994 and who would have been entitled to acquire citizenship by naturalization prior to that date	

3. I hereby declare under Oath that as per Amended Code Series 100 of the Amended Codes of Good Practice issued under section 9 (1) of B-BBEE Act No 53 of 2003 as Amended by Act No 46 of 2013,

- The Enterprise is _____% Black Owned
- The Enterprise is _____% Black Female Owned
- The Enterprise is _____% Owned by Black Designated Group (provide Black Designated Group Breakdown below as per the definition in the table above)
  - o Black Youth % _____%
  - o Black Disabled % _____%
  - o Black Unemployed % _____%

o Black People living in Rural areas % _____%

o Black Military Veterans % _____%

Based on the Financial Statements/Management Accounts and other information available on the latest financial year-end of_____(DD/MM/YY), the annual Total Revenue was equal to/or less than the applicable amount confirmed **by ticking the applicable box below**.

Contractor / Consultancy services	R50 million	
Supplier	R50 million	

If the turnover exceeds the applicable amount in the table above then this affidavit is no longer applicable and an EME certificate must be obtained from a rating agency accredited by SANAS or when applicable a B-BBEE Verification Professional Regulator appointed by the Minister of Trade and Industry.

❑ Please confirm on the table below the B-BBEE level contributor, **by ticking the applicable box.**

100% Black Owned	**Level One** (135% B-BBEE procurement recognition level)	
At least 51% Black Owned but less than 100% black owned	**Level Two** (125% B-BBEE procurement recognition level)	

4. I know and understand the contents of this affidavit and I have no objection to take the prescribed oath and consider the oath binding on my conscience and on the owners of the enterprise which I represent in this matter.

5. The sworn affidavit will be valid for a period of 12 months from the date signed by commissioner.

Deponent Signature:_____

Date:_____

_____

Commissioner of Oaths
Signature and stamp

Date: _____

2. CSD REPORT ANNEXURE - PROOF OF REGISTRATION ON THE NATIONAL TREASURY CENTRAL SUPPLIER DATABASE (CSD REPORT)

(ATTACH HERE)

3. VALID CERTIFICATES OF A TENDERER

(ATTACH HERE)

4. RESOLUTION FOR SIGNATORY

A: CERTIFICATE OF AUTHORITY FOR SIGNATORY

Signatory for companies shall confirm their authority hereto by attaching a duly signed and dated copy of the relevant resolution of the board of directors to this form or on company letterhead.

An example is given below:
"By resolution of the board of directors passed at a meeting held on _____

Mr/Ms_____, whose signature appears below, has been duly authorised to

Sign all documents in connection with the tender for Contract No. _____

and any Contract which may arise there from on behalf of (Block Capitals) _____

_____

_____

SIGNED ON BEHALF OF THE COMPANY: _____

IN HIS/HER CAPACITY AS: _____

DATE:_____

SIGNATURE OF SIGNATORY: _____

WITNESSES:

DIRECTOR (NAMES)		SIGNATURE	
DIRECTOR (NAMES)		SIGNATURE	
DIRECTOR (NAMES)		SIGNATURE	
DIRECTOR (NAMES)		SIGNATURE	
DIRECTOR (NAMES)		SIGNATURE	
DIRECTOR (NAMES)		SIGNATURE	

If you cannot complete this form, attach a separate sheet (in a company letterhead, project specific and signed by all directors):

5. CERTIFICATE OF AUTHORITY FOR JOINT VENTURES

This Returnable Schedule is to be completed by joint ventures.

1.
We, the undersigned, are submitting this tender offer in Joint Venture and hereby authorise Mr/Ms . . . . . .

. . . ., authorised signatory of the company . . . . . .

....., acting in the capacity of lead partner, to sign all documents in connection with the tender

offer and any contract resulting from it on our behalf.

PROJECT TITLE	
BID NUMBER	**MISA/RBWTW/FS/031/2026/27**

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

6. EVALUATION SCHEDULE 1: BIDDER'S RELEVANT PROJECT EXPERIENCE (50 POINTS)

a) Requirements

The experience of the bidder as a company (as opposed to key staff members) in the refurbishment, upgrade, or installation of mechanical and electrical equipment for waterworks, pump stations, or similar industrial infrastructure projects. This shall include experience in electrical panels, motor control centers, variable speed drives, electric motors, pumps, valves, and associated control systems, executed as a main contractor or sub-contractor. Only projects completed within the previous **ten (10) years** prior to the closing date for submissions shall be considered.

b) Points Scoring

Points will be allocated per project as per the table below.

Table : Project points allocation

No	Project Value	Points per Project
a)	**R6 000 000 – R10 000 000**	**15 points (maximum of 4X projects)**
b)	**R10 000 001 – R20 000 000**	**25 points (maximum of 2X projects)**
c)	**R20 000 001 and above**	**50 points (maximum of 1X project)**

c) Means of Verification: Bidders are requested to submit practical completion/ completion certificates and corresponding appointment letters/Purchase Orders.

- Appointment letters and Practical Completion or Completion certificates must be from the relevant municipality or organ of state and must indicate details of the contact person from the municipality or organ of state
- In cases where the municipality or organ of state made use of a consulting engineer (consultant), the appointment letter and completion certificate must clearly stipulate:
    (i) Form of Contract used at that time such as GCC, NEC, FIDIC etc
    (ii) The details of the project including description, tender number, contract amount, contractual dates and contract period.
    (iii) The name of the municipality or organ of state that is the client or employer.
    (iv) The details of the contact person from the municipality or organ of state
    (v) The practical completion or completion certificate must be signed by the Engineer, the Employer and the Contractor depending on the form of contract used.

d) Listing of Completed Projects

Bidders are requested to list one and or up to a maximum of four (4) highest value projects including contactable references by completing **SCHEDULE OF COMPLETED PROJECTS** appended to this schedule on the next page.

SCHEDULE OF COMPLETED PROJECTS

No	ame and Brief Description of the Project	Value in Rands R'000	Date		Employer		
			Started	Completed	Name of employer	Contact Person	
						Name and Surname	Tel. No
1.							
2.							
3.							
4.							

MISA reserves the right to verify all information presented by the bidder.

BIDDERS ARE REQUESTED TO COMPLETE THE ABOVE TABLE AND REFRAIN FROM REFERING THE COMPLETION THEREOF TO AN ATTACHMENTS. PLEASE ATTACH ONLY INFROMATION REQUESTED BY THE EMPLOYER

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Name of Bidder:……Date:……

Signature……Position:…….

Full name of signatory: …….....

EXPERTISE OF KEY PERSONNEL (RELEVANT QUALIFICATION AND EXPERIENCE OF STAFF ALLOCATED TO THE PROJECT (50 POINTS)

All personnel submitted by the Respondent cannot be changed without prior written approval from the employer.

The qualification and experience of key personnel allocated to the project responsible for various functions, on behalf of the Service Provider, will be evaluated in relation to her/ his academic and professional qualifications and experience on projects having scope of work relevant to this project as presented in the table below. For foreign qualifications, a SAQA certificate must be submitted.

A CV of each of the key personnel of no more than 3 pages should be submitted along with the Submission referring to this schedule.

The CV of individuals will be used for evaluation of the each of the personnel for this section.

Total Points for key personnel will be as follows,

Key Personnel	**Points**
1. Contracts Manager (Mechanical Engineer)	30 Points
2. Electrical Engineer	20 Points
TOTAL	**50 points**

Key Personnel	**=**	**(50 Total Points)**
1. CONTRACTS MANAGER (MECHANICAL ENGINEER)	**=**	**(30 points)**
Requirements • BSc/ Btech degree in Mechanical Engineering • 5 years' experience post qualification and above		
1.1. Experience	**=**	**15 points**
a) Below 5 years	**=**	00 points
b) 5 years and above	**=**	15points
1.2. Qualifications	**=**	**15 points**
a) BSc or B Tech in Mechanical	**=**	15 points

Key Personnel	=	(50 Total Points)
2. ELECTRICAL ENGINEER	=	**(20 points)**
Requirements • BSc/ Btech degree in Electrical Engineering • 5 years' experience post qualification and above		
2.1. Experience	=	**10 points**
a) Below 5 years	=	00 points
b) 5 years and above	=	10 points
2.2. Qualifications	=	**10 points**
b) BSc/ Btech in Electrical Engineering	=	10 points

SCHEDULE OF PROPOSED PERSONELL

No	Key Personnel	Name and surname	Qualifications	Total Number of years of experience after Qualification
1	Mechanical Engineer (Contracts Manager)			
2	Electrical Engineer/Technologist			

Means of Verification: Bidders are requested to attach brief CV's, Proof of Qualification for all the staff referred to above table.

MISA reserves the right to verify all information presented by the Bidder.

BIDDERS ARE REQUESTED TO COMPLETE THE ABOVE TABLE AND REFRAIN FROM REFERING THE COMPLETION OF THE ABOVE TABLE TO AN ATTACHMENTS. PLEASE ATTACH ONLY INFORMATION REQUESTED BY THE EMPLOYER.

The undersigned, who warrants that he / she is duly authorized to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Name of Bidder: ……Date: ……

Signature: ……Position: ……

Full name of signatory: …….....

C. OTHER DOCUMENTS CONTAINED HEREIN IN THE TENDER DOCUMENTS REQUIRED FOR TENDER EVALUATION PURPOSES AS LISTED BELOW.

7. RECORD OF ADDENDA TO TENDER DOCUMENTS

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

	Date	**Title or Details**
1.		
2.		
3.		
4.		
5.		
6.		

Attach additional pages if more space is required.

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

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

Bidder .....

8. PROPOSED AMENDMENTS AND QUALIFICATIONS

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

The Bidder's attention is drawn to clause 5.8 of SANS 10845-3 regarding the employer's handling of material deviations and qualifications.

Page	Clause or item	Proposal

Signed ---------- Date ----------

Name ---------- Position ----------

Bidder ----------

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT

Reference no.: **MISA/RBWTW/FS/031/2026/27**

APPOINTMENT OF A CONTRACTOR FOR THE REFURBISHMENT OF BETHLEHEM WASTEWATER TREATMENT WORKS.

The Contract

Based on

NEC 3:
ECC: Option B: Price contract with Bill of Quantities

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT

Tender no: **MISA/RBWTW/FS/031/2026/27**

APPOINTMENT OF A CONTRACTOR FOR THE REFURBISHMENT OF BETHLEHEM WASTEWATER TREATMENT WORKS.

C1 Agreements and Contract Data

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 provision of services as described in Part 1 of the Contract Data.

The bidder, 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 bidder, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance, the bidder 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.

Total Amount: ..... (in figure),

.....

.....

........**(in words).**

This Offer may be accepted by the *Employer* by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document including the Schedule of Deviations (if any) to the bidder before the end of the period of validity stated in the Tender Data, or other period as agreed, whereupon the bidder becomes the party named as the *Contractor* in the conditions of contract identified in the Contract Data.

Signature(s) ....

Name(s) ....

Capacity ....

For the Bidder:

.....

(Insert name and address of organisation)

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

A C1.2 ACCEPTANCE

By signing this part of this Form of Offer and Acceptance, the *Employer* identified below accepts the bidder's Offer. In consideration thereof, the *Employer* shall pay the Consultant the amount due in accordance with the *conditions of contract* identified in the Contract Data. Acceptance of the bidder's Offer shall form an agreement between the *Employer* and the bidder 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 Data, (which includes this Form of Offer and Acceptance)

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 the above listed Parts.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Returnable Schedules as well as any changes to the terms of the Offer agreed by the bidder and the *Employer* during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Form of Offer and Acceptance. No amendments to or deviations from said documents are valid unless contained in this Schedule.

The bidder shall within two weeks of 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 securities, 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 bidder receives one fully completed original copy of this document, including the Schedule of Deviations (if any). Unless the bidder (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.

Signature(s) _____

Name(s) Ms. Pati Kgomo

Capacity Chief Executive Officer

for the *Employer* 1303 Heuwel Avenue
Riverside Office Park, Letaba House
Centurion, PRETORIA 0046

Name and signature of witness ……..

……. Date: . . . . . .

Schedule of Deviations

1 Subject: Additional Conditions: Tender Data

Details: Reference is made to the additional Conditions as reflected in the Tender Data: Part T1 of this document to be noted by the Bidder and will form part of the contract as reflected in this schedule. The additional conditions are as follows;

Condition D. Withdrawal of Tender during validity or Failure in signing Contract Agreement at Award

Condition E. Repudiation of Tender or Invalidation of Contract

. . . . . .

2 Subject . . . . . .

Details . . . . . .

. . . . . .

. . . . . .

. . . . . .

3 Subject . . . . . .

Details . . . . . .

. . . . . .

. . . . . .

. . . . . .

4 Subject . . . . . .

Details . . . . . .

. . . . . .

. . . . . .

. . . . . .

5 Subject . . . . . .

Details . . . . . .

. . . . . .

. . . . . .

. . . . . .

By the duly authorised representatives signing this agreement, the *Employer* and the Bidder 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 returnable schedules, as well as any confirmation, clarification or changes to the terms of the offer agreed by the Bidder 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 Bidder of a completed signed copy of this Agreement shall have any meaning or effect in the contract between the parties arising from this agreement.

APPOINTMENT OF A CONTRACTOR FOR THE REFURBISHMENT OF BETHLEHEM WASTEWATER TREATMENT WORKS.

C1.2 CONTRACT DATA

The *Conditions of Contract* are the core clauses and the clauses for main **Option B,** dispute resolution option W1 and Secondary options X1, X7, X13, X16, Z Of the NEC3 Engineering and Construction Contract (April 2013 edition) published by the Institution of Civil Engineers (ICE), copies of which may be obtained from Engineering Contract Strategies (+27) 011 803 3008

Each item of data given below is cross-referenced to the clause in the NEC3 Engineering and Construction Contract to which it mainly applies.

C1.2.1 PART ONE - DATA PROVIDED BY THE *EMPLOYER*

Clause	Data
1 General	
10.1	*The Employer is* Municipal Infrastructure Services Agent Physical Address: Letaba House, Riverside Office Park 1303 Heuwel Avenue, Centurion, Pretoria 0046 Postal Address: Private Bag X105, Centurion 0046 Telephone: 012 848 5300
10.1	The Project Manager is : Zola Mshumpela
10.1	The Supervisor is : Klok Engineering
11.2 (1)	The Accepted Programme is the programme identified in the Contract Data or the latest accepted by the Project Manager. The latest accepted programme supersedes previously accepted programmes.
11.2 (13)	The *works* are as described in Part C3**.**
11.2 (14)	The following matters will be included in the Risk Register: • Public safety • Working in a hazardous environment • Infrastructure and Environmental Constraints • Financial and Cost Overruns

11.2 (15)	The *boundaries* of the sites are as per the proposed site layout and locality plan as per C3: Scope of Works.

Clause	Data
11.2 (16)	The Site Information is in section Part C4: Site information of this tender document
11.2 (19)	The Works Information is in section Part C3: Scope of works of this tender document
12.2	The *law of the contract* is the law of the Republic of South Africa
13.1	The *language of this contract* is English
13	The *period of reply* is seven working days
2	**The Parties' main responsibility**
26.1	If the *Contractor* subcontracts work, he is required to submit a signed agreement with proposed Subcontractor / consultant detailing the proposed scope and exclusivity of the relationship and intention to get into a subcontracting agreement based on the NEC3 Engineering and Construction Subcontract should he be successful.
26.2	The Contractor must submit proposed Sub-contractor / consultant with an ECSA registration as Professional Electrical Engineer or Professional Electrical Technologist (appropriate certificates to be submitted).
26.3	The conditions of contract for the Subcontractor shall be the NEC3 Engineering and Construction Subcontract Edition: 3 Reprinted with Amendments 2013, which is to be signed by both parties should the Contractor be successful.
3	**Time**
30.1	The *starting date* is **14 days** after the issuance of the appointment letter.
33.1	The *access* date is 14 days after the issuance of the appointment letter.
30.2	The *completion date* for the whole of the *services* is nine **(9) Calendar Months after the start date (maximum)**.
31	The *Contractor* submits programme with the tender according to the *Scope*, considering the *starting date* and *completion date*, which will be adjusted, if need be, based on proposed duration in the programme through consultation.
32	The *Contractor* submits revised programme at intervals no longer than 4 weeks
4	**Testing and Defects**
42	The *defects date* is 12 months after Completion of the whole of the works.
43	The *defect correction period* is two weeks after completion of the whole of the works.
5	**Payment**
50.1	The *assessment interval* is monthly on or before the 20th day of each successive month.

51.1	The *currency of this contract* is the South African Rand.
51.2	Each certified payment is made within 30 days of the assessment.
51.4	The *interest rate* is the Prime lending rate of the *Employer's* Bank.

Clause	Data
6	**Compensation events**
60.1 (13)	The place where the weather is to be recorded is Bethlehem in Dihlabeng Local Municipality.
60.1 (13)	The weather measurements to be recorded for each calendar month are • The cumulative rainfall (mm) • The number of days with rainfall more than 5mm
7	**Title** No data required for this section of the *conditions of contract*.
70.2	80% of the value of materials on site could be claimed by the contractor
8	**Indemnity, Insurance and Liabilities**
84.1	The Contractor is to provide the insurances stated in the Insurance Table in Section 84.2
84.2	*The minimum amount of cover for insurance against the Contractor's liability for loss of or damage to property (except the works, Plant and Materials and Equipment) and liability for bodily injury to employees of the Contractor to or death of a person (not an employee of the Contractor) caused by activity in connection with this contract as prescribed in section 84.2 of the NEC 3 ECC.*

Insurance against	**Minimum amount of cover or minimum limit of indemnity**	**Period following Completion of the whole of the services or earlier termination**
Loss of or damage of the works, Plant and Materials	The replacement cost, including the amount stated in the Contract Data for the replacement of any Plant and Materials provided by the Employer	Till the end of the *defects date*.
Loss of or damage to Equipment	The replacement cost	Till the end of the *completion date*.
Liability for loss of or damage to property (except the works, Plant and Materials and Equipment) and liability for bodily injury to or death of a person (not an employee of the Contractor) caused by activity in connection with this contract.	R5 million without limit to the number of claims	Till the end of the *completion date*.
Liability for death of or bodily injury to employees of the *Consultant* arising out of and in the course of their employment in connection with this contract	That which is prescribed by the Compensation injuries and Diseases Act No. 130 of 1993 as amended and whatever	Till the end of the *completion date*.

Clause	Data		
		the Consultant deems desirable in addition	
85.1	Before the starting date and on each renewal the Contract shall provide applicable insurance policies to the Project Manager for acceptance. The certificates are signed by the Contractor's insurer or insurance broker		
86.1	The *Employer* provides no insurance cover.		
9	**Termination** There is no Contract Data required for this section of the conditions of contract.		
10	**Data for main Option clause**		
B	**Priced Contract with Bill of Quantities**		
Option W1	**DISPUTE RESOLUTION**		
W1.2	The *Adjudicator* is the person selected by the Parties in terms of the relevant Z Clause from the Panel of NEC Adjudicators set up by ICE-SA, a Joint Division of the Institution of Civil Engineers and the South African Institution of Civil Engineering (see www.ice-sa.org.za).		
W1.2	The *adjudicator nominating body* is the Chairman of ICE-SA, a Joint Division of the Institution of Civil Engineers and the South African Institution of Civil Engineering (see www.ice-sa.org.za).		
W1.4	The *tribunal* is **arbitration**		
W1.4	The *arbitration procedure* is as set out in the latest edition of Rules for the Conduct of Arbitrations published by the Association of Arbitrators (Southern Africa) or its successor body The place where arbitration is to be held is to be Advised The person or organisation who will choose an arbitrator • if the Parties cannot agree a choice or • if the *arbitration procedure* does not state who selects an arbitrator, is the Chairman of the Association of Arbitrators (Southern Africa) or its successor body		
Option X7	**Delay Damages**		
X7	The *delay damages* for completion of the whole of the works are calculated as 0.04% of the contract sum (excluding VAT) per calendar day.		
Option X13	**Performance Bond**		
X13	The amount of the performance bond is **10%** of value of Contract		
Option X16	**Retention**		
X16	The retention percentage is **10%**		
Z	***Additional Conditions of Contract***		

Clause	Data
	The *additional conditions of contract* are
Z1	**Selection and appointment of the *Adjudicator*** A Party may at any time notify the other Party of the names of two persons he has chosen from the Panel of NEC Adjudicators set up by ICE-SA, a Joint Division of the Institution of Civil Engineers and the South African Institution of Civil Engineering (see www.ice-sa.org.za) whose availability to act as the *Adjudicator* the notifying Party has confirmed. The other Party selects one of the two persons chosen to be the *Adjudicator* within four days of receiving the notice, failing which the person chosen by the notifying Party will be the *Adjudicator.* The Parties appoint the selected *Adjudicator* under the NEC3 Adjudicator's Contract, April 2013.
Z2	**Tax invoices** **The *Contractor*'s invoice.** Delete the first sentence of core clause 51.1 and replace by: The Employer makes each payment within **thirty** days from the date of receipt (exclusive) of the *Consultant*'s invoice showing the details, which this contract requires or, if a different period is stated in the Contract Data, within the period stated.
Z3	**Acts or omissions by mandatories** In terms of Section 37(2) of the Occupational health and Safety Act of 1993 (Act 85 of 1993), the *Contractor* hereby agrees that the *Employer* is relieved of any and all of its liabilities in terms of Section 37(1) of this Act in respect of any acts or omissions of the *Contractor* and his employees to the extent permitted by this Act, and that this contract comprises the written agreement between the *Employer* and the *Contractor* contemplated in section 37(2).
Z4	**Subcontractors** The *Contracto*r submits the name of each proposed subcontractor to the *Employer's* representative for acceptance. A reason for not accepting the subcontractor is that his appointment will not allow the Contractor to Provide the Works. The Contractor does not appoint a proposed subcontractor until the Project Manager has accepted him.

Z5

Guarantee

The maximum guaranteed sum is equal to **10** % of the total of the Prices and reduces to the following diminishing amounts:

Guarantor's liability expressed as a percentage of the total of Prices	**Period of liability**
Maximum guaranteed sum of 10 %	From the date this demand bond comes into effect and until the date by when the Price for Work Done to Date has reached or exceeds **50** % of the total of Prices
Reducing to the guaranteed sum of **6** %	From the date by when the Price for Work Done to Date has reached or exceeds the amount

Clause	Data
	stated above and until the date of Completion of the whole of the *works*
Reducing to the guaranteed sum of **3** %	From the day after the date of Completion of the whole of the *works* and until the date of issue of the last Defects Certificate.
Reducing to the guaranteed sum of **1** %	From the day after the date of issue of the last Defects Certificate and up to and including the day on which there are no amounts due by either Party to the other.

Transfer of rights

The *Employer* owns the *Contractor's* rights over material prepared for this contract by the *Contractor* except as stated otherwise in the Works Information. The *Contractor* obtains other rights for the *Employer* as stated in the Works Information and obtains from a subcontractor equivalent rights for the *Employer* over the material prepared by the subcontractor. The *Contractor* provides to the *Employer* the documents which transfer these rights to the *Employer*

C1.2.2 PART TWO - DATA PROVIDED BY THE CONTRACTOR

The *Contractor* is advised to read the NEC3 Engineering and Construction (Third edition of April 2013) and the relevant Guidance Notes and Flow Charts, published by the Institution of Civil Engineers, in order to understand the implications of this Data, which is required. Copies of these documents may be obtained from Engineering Contract Strategies (telephone (27) 011 803 3008).

Each item of data given below is cross-referenced to the clause in the NEC3 Engineering and Construction Short Contract to which it mainly applies.

Clause	Data
10.1	*The Contractor is* Name: _____ Physical Address: _____ _____Post Code: _ Postal Address: _____ _____Post Code: _ Telephone: _____Fax: _____ _____ Mobile: _____ Email: _____
11.2 (8)	The Direct fee percentage is _____
11.2 (8)	The subcontracted fee percentage is _____
11.2 (18)	The working areas are the site and _____
24.1	The *Contractor's* key persons are: **1. Name:** **Position in the Project Team: _____** **Responsibilities:** _____ **Qualifications:** _____ **Experience:** _____ Physical Address: _____ _____Post Code: _ Postal Address: _____ _____Post Code: _ Telephone: _____Fax: _____ _____ Mobile: _____ Email: _____

	(Please use separate pages referring to this clause for detailing this information for all *Contractor's* key persons)
11.2(14)	The following matters will be included in the Risk Register
11.2 (21)	The *bill of quantities* is ……..
11.2 (31)	The tendered total of the Prices is …….
52.1	The percentage for overheads and profit added to the Defined Cost for people is..... **%**
52.1	The percentage for overheads and profit added to other Defined Cost is.....**%**

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT

Reference no.: **MISA/RBWTW/FS/031/2026/27**

APPOINTMENT OF A CONTRACTOR FOR THE REFURBISHMENT OF BETHLEHEM WASTEWATER TREATMENT WORKS.

C1.3 SECURITIES: PERFORMANCE BOND

(to be reproduced exactly as shown below on the letterhead of the Surety)

{Insert name and registered address of the Contractor}

Date:

Dear Sirs,

PERFORMANCE BOND FOR CONTRACT NO.

With reference to the above numbered contract made or to be made between

{Insert registered name and address of the *Contractor*}

(the *Contractor*), for

{Insert details of the *works* from the Contract Data} (the *works*).

I/We the undersigned

on behalf of the Surety .....

.....

of physical address .....

.....

and duly authorised thereto do hereby bind ourselves as Surety and co-principal debtors in solidum for the due and faithful performance of all the terms and conditions of the Contract by the *Contractor* and for all losses, damages and expenses that may be suffered or incurred by the *Employer* as a result of non-performance of the Contract by the *Contractor*, subject to the following conditions:

1. The terms *Employer*, *Contractor*, *works* and Defects Certificate have the meaning as assigned to them by the *conditions of contract* stated in the Contract Data for the afore said Contract.

2. We renounce all benefits from the legal exceptions "Benefit of Excursion and Division", "No value received" and all other exceptions which might or could be pleaded against the validity of this bond, with the meaning and effect of which exceptions we declare ourselves to be fully acquainted.

3. The *Employer* has the absolute right to arrange his affairs with the *Contractor* in any manner which the *Employer* deems fit and without being advised thereof, the Surety shall not have the right to claim his release on account of any conduct alleged to be prejudicial to the Surety. Without derogating from the foregoing compromise, extension of the construction period, indulgence, release or variation of the *Contractor's* obligation shall not affect the validity of this performance bond.

4. This bond will lapse on the earlier of

   a) the date that the Surety receives a notice from the *Employer* stating that the last Defects Certificate has been issued, that all amounts due from the *Contractor* as certified in terms of the contract have been received by the *Employer* and that the *Contractor* has fulfilled all his obligations under the Contract, or

   b) the date that the Surety issues a replacement Performance Bond for such lesser or higher amount as may be required by the *Employer*.

5. Always provided that this bond will not lapse in the event the Surety is notified by the *Employer*, (before the dates above), of the *Employer's* intention to institute claims and the particulars thereof, in which event this bond shall remain in force until all such claims are paid and settled.

6. The amount of the bond shall be payable to the *Employer* upon the *Employer's* demand and no later than 7 days following the submission to the Surety of a certificate signed by the *Employer* stating the amount of the *Employer's* losses, damages and expenses incurred as a result of the non-performance aforesaid. The signed certificate shall be deemed to be conclusive proof of the extent of the *Employer's* loss, damage and expense.

7. Our total liability hereunder shall not exceed the sum of:

R _____

8. This Performance Bond is neither negotiable nor transferable and is governed by the laws of the Republic of South Africa, subject to the jurisdiction of the courts of the Republic of South Africa.

Signed at _____ on this _____ day of _____ 200_

Signature(s)	
Name(s) (printed)	
Position in Surety company	
Signature of Witness(s)	
Name(s) (printed)	

C1.3 SECURITIES: REDUCING VALUE GUARANTEE

(to be reproduced exactly as shown below on the letterhead of the Surety)

{Insert name and registered address of the Employer}

Date:

Dear Sirs,

R REDUCING VALUE GUARANTEE FOR CONTRACT NO.

With reference to the above numbered contract made or to be made between

{Insert registered name of the *Employer*} (the *Employer*) and

{Insert registered name and address of the *Contractor*}

(the *Contractor*), for

{Insert details of the *works* from the Contract Data} (the *works*).

I/We the undersigned .....

on behalf of the Guarantor .....

of physical address .....

and duly authorised thereto, do hereby undertake to pay the *Employer* forthwith on receipt of written demand from the *Employer* up to the maximum guaranteed sum of

(say) _____

R _____

in respect of amounts due by the *Contractor* to the *Employer* for whatever reason in terms of the contract between the *Employer* and the *Contractor* in respect of the *works.* The following further terms shall apply:

1 The Guarantor's liability shall be limited to the diminishing amounts of the guaranteed sum as set out below:

	Guarantor's Liability	**Period of Liability**
1.1	Maximum guaranteed sum: R _____	From the date this demand bond comes into effect and until the date by when the Price for Work Done to Date has reached or exceeds R _____
1.2	Reducing to the guaranteed sum of: R _____	From the date by when the Price for Work Done to Date has reached or exceeds the amount stated in 1.1 above and until the date of Completion of the whole of the *works*
1.3	Reducing to the guaranteed sum of R _____	From the day after the date of Completion of the whole of the *works* and until the date of issue of the last Defects Certificate.
1.4	Reducing to the guaranteed sum of: R _____	From the day after the date of issue of the last Defects Certificate and up to and including the day on which there are no amounts due by either Party to the other.

1.5 Thereafter this demand guarantee shall lapse.

2 The terms *Employer*, *Contractor*, *works*, Price for Work Done to Date, Completion, Defects Certificate and Party have the meaning given to them by the *conditions of contract* stated in the Contract Data for the afore said Contract.

3 The *Employer* shall have the absolute right to arrange his affairs with the *Contractor* in any manner which the *Employer* deems fit and the Guarantor shall not have the right to claim his release on account

of any conduct alleged to be prejudicial to the Guarantor. Without derogating from the foregoing, any compromise, extension of the Completion Date, indulgence, release or variation of the *Contractor's* obligation shall not affect the validity of this demand guarantee.

4 The Guarantor chooses domicilium citandi et executandi for all purposes in connection herewith at the address appearing above.

5 This Reducing Value Guarantee is neither negotiable nor transferable and is governed by the laws of the Republic of South Africa, subject to the jurisdiction of the courts of the Republic of South Africa.

6 The *Employer* returns this Guarantee to the Guarantor when it has lapsed in terms of clause 1 above or on payment in full thereof whichever is the earlier.

Signed at ..... on this ..... day of ..... 20 .....

Guarantor: .....

Representative	Representative
.....	.....
Name (printed)	Name (printed)
.....	.....
Capacity	Capacity
.....	.....
As Witness	As Witness
Guarantor's stamp or seal	.....

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT

Reference no.: **MISA/RBWTW/FS/031/2026/27**

APPOINTMENT OF A CONTRACTOR FOR THE REFURBISHMENT OF BETHLEHEM WASTEWATER TREATMENT WORKS.

PART C2: PRICING DATA

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PART C2: Pricing Data

C2.1 PRICING INSTRUCTIONS

1 The 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 Bidder 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 Project Manager 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 Project Specifications. 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 Quantities. 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 All payments are subject to re-measurement, only quantities which have been measured as completed, in terms of the Scope of Work and Specifications, will be paid. Unless stated to the contrary, items are measured net in accordance with the Drawings without any allowance having been made for waste. The final design drawings and accompanying construction bill of quantities provided by the contractor and design engineer, will be approved by the assigned MISA project manager and will be required to facilitate implementation of the C.2.2 Schedule of quantities.

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 project specifications. 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 Bidder 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 Bidder 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 Contingencies allowed for in this schedule of quantities shall be utilised at the discretion of the Employer represented by the Acting Chief Director: Infrastructure Delivery, Maintenance and Stakeholder Coordination

9 Provisional Sums in the schedule of quantities shall be utilised at the discretion of the Project Manager. In addition, provisional sums may be omitted entirely by the Project Manager if so required.

10 Those parts of the works to be constructed using labor-intensive methods **have been marked in the schedule of quantities with the letters LI in a separate column** filled in against every item so designated. The works, or parts of the works so designated are to be constructed using labor-intensive methods only. The use of plant to provide such works, other than plant specifically provided for in the scope of work, is a variation to the contract. The items marked with the letters LI are not necessarily an exhaustive list of all the activities which must be done by hand, and this clause does not over-ride any of the requirements in the generic labour intensive specification in the Scope of Works.

11 Where minimum labour intensity is specified by the design the contractor is expected to use his/her initiative to identify additional activities that can be done labour intensively in order to comply with the set minimum labour intensity target.

12 . Payment for items which are designated to be constructed labour-intensively (either in this schedule or in the Scope of Works) will not be made unless they are constructed using labor-intensive methods. Any unauthorised use of plant to carry out work which was to be done labour-intensively will not be condoned and any works so constructed will not be certified for payment.

13 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
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

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

15 All items in the Bill of Quantities include all the resources, materials, tools and equipment as well as labour required to execute the work to completion. Where the Scope of Work requires detailed drawings and designs from the Contractor or other information to be provided, all costs associated therewith are deemed to have been provided for and included in the unit rates and sum amounts tendered under such items.

mm	=	millimetre
m	=	metre
km	=	kilometre
km-pass	=	kilometre-pass
m^2	=	square metre
m^2-pass	=	square metre-pass
LV	=	Low voltage
MV	=	Medium voltage
ha	=	hectare
m^3	=	cubic metre
m^3-km	=	cubic metre-kilometre
kW	=	kilowatt
kN	=	kilonewton
kg	=	kilogram
t	=	ton (1 000 kg)
%	=	per cent
MN	=	meganewton
MN-m	=	meganewton-metre
PC Sum	=	Prime Cost Sum
Prov Sum	=	Provisional Sum

C2.2 SCHEDULE OF QUANTITIES

The Bill of Quantities is structured as outline below. Where there are gaps and omissions in specifications and/or BOQ the applicable Standard shall apply.

Where the Scope of Work requires detailed drawings and designs or other information to be provided, all costs associated therewith are deemed to have been provided for and included in the unit rates and sum amounts tendered under such items.

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT

REFURBISHMENT OF BETHLEHEM WWTW

SECTION A: PRELIMINARY AND GENERAL

Item	Payment	Description	Unit	Qty	Rate	Amount
1		**SECTION 1: PRELIMINARY AND GENERAL**				
1,1	SABS 1200 A	FIXED COST ITEMS				
1.1.1	8.3.1	Contractual Requirements	Sum	1,00		
	SABS 1200 AB	Establish facilities on site				
	8.3.2.1	a) Facilities for Engineer				
1.1.2	PSAB 1	Survey equipment	Sum	1,00		
		Resident Engineer: Accommodation	Prov Sum	1,00	50 000,00	50 000,00
		As-built data collection by professional surveyor	Prov Sum	1,00	100 000,00	100 000,00
1.1.3		One Contract Notice Board	Sum	1,00		
	8.3.2.2	b) Facilities for Contractor				
1.1.4		Offices and stores, workshop, housing, ablution-and latrine facilities, plant and tools	Sum	1,00		
1.1.5		Water supply, electrical power, reticulation of water and access to site	Sum	1,00		
1.1.6	PS 10	Conformity with RDP requirements	Sum	1,00		
1.1.7	8.3.3	Additional Fixed Cost liabilities (particulars to be supplied)				
		i)	Sum	1,00		
		ii)	Sum	1,00		
		iii)	Sum	1,00		
1.1.8	8.3.4	Removal of site facilities	Sum	1,00		
1.1.9		Allowance for OHS and Environmental management	Prov Sum	1,00	120 000,00	120 000,00
1.1.10		Allowance for Accredited Training	Prov Sum	1,00	50 000,00	50 000,00
		Allowance for Institutional and Social Development (ISD)	Prov Sum	1,00	150 000,00	150 000,00
		Factory inspections and performance testing of machinery as advised by the engineer	Prov Sum	1,00	350 000,00	350 000,00
1,2	8.4	TIME RELATED ITEMS				
1.2.1	8.4.1	Contractual Requirements	Sum	1,00		
	8.4.2	Operate and maintain facilities on site				
	8.4.2.1	a) Facilities for Engineer for duration of construction (SABS 1200 AB)				
1.2.2	PSAB 1	Survey equipment and survey assistant	Sum	1,00		
1.2.3	PSAB 1	One Contract Notice Board	Sum	1,00		
Total Carried Forward						

Item	Payment	Description	Unit	Qty	Rate	Amount
Brought Forward						
	8.4.2.2	b) Facilities for Contractor for duration of construction				
1.2.4		Offices and stores, workshop, housing, ablution-and latrine facilities, plant and equipment	Sum	1,00		
1.2.5		Water supply, electrical power, reticulation of water and access to site	Sum	1,00		
1.2.6	8.4.3	Construction Supervision for the duration of the contract	Sum	1,00		
1.2.7	8.4.4	Company and head office overhead costs	Sum	1,00		
1.2.8		Allow for Security for the duration of the project	Sum	1,00		
1.2.9	8.4.5	Additional Time Related Items (particulars to be provided)	Sum	1,00		
		i)	Sum	1,00		
		ii)	Sum	1,00		
		iii)	Sum	1,00		
1.2.10		Allowance for WULA, EIA and Environmental management	Prov Sum	1,00	60 000,00	60 000,00
1,3		TEMPORARY WORK				
1.3.1	8.8.1	Construction and maintenance of all access roads and work for the duration of the contract	Prov Sum	1,00	372 000,00	372 000,00
1,4		CONTROL TESTING				
1.4.1		Preliminary Sum allowed for laboratory tests by an independent laboratory when required by the Engineer	Prov Sum	1,00	45 000,00	45 000,00
1.4.2		Percentage add on to Item 1.5.1 for overheads, administration and profit	%			
1,5		CLO for duration of contract	Prov Sum	1,00	75 000,00	75 000,00
1,6		Project steering committee (PSC), maximum of five (5) members.	Prov Sum	1.00	30 000,00	30 000,00
1,6,1		Allow for in-service training	Prov Sum	1,00	81 900,00	81 900,00
1,6.2		Preliminary Sum allowed for laboratory tests by an independent laboratory when required by the Engineer	Prov Sum	1,00	15 000,00	15 000,00
1,7		Percentage add on to Item 1.5and 1,6 for overheads, administration and profit	%			
TOTAL CARRIED FORWARD TO SUMMARY						

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT
REFURBISHMENT OF BETHLEHEM WWTW

SECTION B: BIOFILTER SYSTEM

Item	Description	Unit	Qty	Rate	Amount
2	**Biofilter System**				
2.1	**Humus Tank Valves**				
2.1.1	Remove existing corroded DN150 gate valves at humus tank.	No	4		
2.1.2	Supply and install new DN150 mm resilient seated gate valves, complete with flanges, gaskets, bolts and corrosion protection.	No	4		
2.2	**Biofilter Mechanism System**				
2.2.1	Supply, install, test and commission complete new biofilter distribution mechanism system including central column, rotary distributor arms, nozzles/orifices, bearings, drive mechanism where applicable, support steelwork and corrosion protection.	Sum	1		
2.3	**Digestor Cleaning**				
2.3.1	Clean digestor including isolation, confined-space controls, sludge pumping, vacuum tanker removal, washdown, disposal and final inspection. Refer to dwg number KES-WW-DB-OFD-008	No	2		
TOTAL CARRIED FORWARD TO SUMMARY					

Item	Description	Unit	Qty	Rate	Amount
3	**EMERGENCY OVERFLOW AND BALANCING SYSTEM** **CIVIL, STRUCTURAL, MECHANICAL, ELECTRICAL AND CONTROL WORKS**				
3.1	**SITE CLEARANCE, EARTHWORKS AND 16 ML BALANCING DAM**				
3.1.1	Clear site within the balancing-dam footprint and associated working areas; remove vegetation and dispose off site. (refer to drawing no. KES-WW-DB-OFD-008)	m²	7 000,00		
3.1.2	Bulk excavation and shaping of 16 000m³ emergency balancing dam, to a maximum overall depth of 4.5 m, including side slopes and floor grading to low-level outlet.	m³	20 000,00		
3.1.3	Extra-over for excavation in hard material/rock, as directed by the Engineer.	m³	300,00		
3.1.4	Trim, moisture-condition and compact dam subgrade to specified density before lining.	m²	7 000,00		
3.1.5	Supply, place and compact selected G5 material for formation correction, berms and local filling.	m³	800,00		
3.1.6	Form geomembrane anchor trenches around dam perimeter, including excavation and backfilling.	m	350,00		
3.1.7	Supply and install protective geotextile underlay to dam floor and side slopes, complete.	m²	7 000,00		
3.1.8	Supply and install 1.5 mm wastewater-compatible PVC geomembrane lining, including welded seams, penetrations, anchorage and testing.	m²	7 000,00		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
3.1.9	Provide clean storm water diversion berms/channels around balancing dam to prevent storm water ingress.	m	300,00		
3.1.10	Reinforced concrete apron, 1.0 m wide around the entire perimeter of the emergency overflow/balancing dam, 150 mm thick, 30 MPa concrete, laid to falls away from the dam and complete with construction joints.	m³	52,50		
3.1.11	High-tensile reinforcement steel to the 1.0 m wide reinforced-concrete apron, including cutting, bending, fixing, chairs and tying wire.	t	5,25		
3.1.12	Dealing with water	Sum	1,00		
3.2	**EMERGENCY GRAVITY DIVERSION AND SCREENING**				
3.2.1	Construct reinforced concrete diversion/receiving structure at existing inlet works, including tie-in and flow-control provisions.	m³	2,00		
3.2.2	Construct reinforced-concrete emergency inlet/screen channel, nominal 1.0 m wide by 1.0m, including transitions and freeboard.	m³	3,00		
3.2.3	High-tensile reinforcement steel to diversion and screening structures.	t	7,00		
3.2.4	Supply and install manually cleaned stainless-steel coarse bar screen with approximately 10 mm clear spacing, complete with support frame.	No	1,00		
3.2.5	Supply and install safe screen-cleaning/access platform, grating, toe plates and corrosion-resistant handrails.	Sum	1,00		
3.2.6	Supply and install DN1000 gravity diversion main for raw sewage from existing inlet works to balancing dam, including bedding, joints and fittings.	m	150,00		
3.2.7	Inspection/cleaning access structures on DN1000 gravity main at changes in direction and critical points.	No	3,00		
3.2.8	Testing, cleaning and commissioning of gravity diversion system.	No	1,00		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
3.3	**LOW-LEVEL OUTLET AND SHALLOW SUCTION SUMP**				
3.3.1	Excavate for elongated shallow suction sump and connecting works; sump depth shall not exceed 4.5 m below local formation level.	m³	20,00		
3.3.2	Reinforced-concrete base, walls and benching to elongated suction sump, designed for Heavy-Duty, Solid Handling, Self-Priming Centrifugal Sewage Pump.	m³	10,00		
3.3.3	High-tensile reinforcement steel to suction sump.	t	1,00		
3.3.4	Water stops, construction joints and watertight penetrations to suction sump and low-level connection.	m	20,00		
3.3.5	Supply and install approximately DN1000 low-level gravity connection from balancing dam to suction sump, including geomembrane penetration detail.	m	20,00		
3.3.6	Access covers, safety handrails and confined-space provisions to suction sump.	Sum	1,00		
3.4	**RETURN PUMP STATION – 3 × Heavy-Duty, Solid Handling, Self-Priming Centrifugal Sewage Pump (2 DUTY + 1 STANDBY)**				
3.4.1	Supply Heavy-Duty, Solid Handling, Self-Priming Centrifugal Sewage Pump with duty of 120l/s at 12m TDH and 55 kW motor complete with pump control panel, variable speed control, pump protection and auto greasing.	No	3,00		
3.4.2	Install, align, anchor, test and commission complete pump units.	No	3,00		
3.4.3	Supply and install anti-vibration mounts and pump base arrangements.	No	3,00		
3.4.4	DN400 Independent suction pipework from common sump to each pump, including long-radius bends, flanges and supports.	No	3,00		
3.4.5	DN350 Pump discharge branches complete with non-return valves, isolation valves, dismantling joints and fittings.	No	3,00		
3.4.6	Common discharge manifold and downstream main isolation valve, complete maximum size of 100mmm	No	1,00		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
3.4.8	Construct platform including foundations, floor drainage/wash-down sump. (refer to dwr no. KES-WW-DB-OFD-010)	Sum	1,00		
3.4.9	Emergency Pump station Dewatering submersible pump with duty of 10l/s and 5m TDH complete with DN80 discharge piping, valves hangers and brackets	Sum	1,00		
3.5.10	Supply and Install 2 Tonne SWL Structural Steel monorail beam ,complete with hangers ,supports and associated fittings	Item	1.00		
3.5.11	Supply and Install 2 Tonne electric chain hoist complete with lifting chains, hooks, limit switches, pendant controls and emergency stops.	Item	1.00		
3.5.12	Load test, inspect and certify 2T Monorail and hoist after installation.	Item	1.00		
3.5	**ELECTRICAL, INSTRUMENTATION and PLC**				
3.5.1	Design, manufacture, supply and install dedicated MCC for emergency return pump station, with suitable incomer, protection and spare capacity.	Sum	1,00		
3.5.2	Supply and install 55 kW feeder with motor protection and local/remote control for each pump.	No	3,00		
3.5.3	Supply and install power and control cabling between MCC and pump station equipment, including terminations.	m	300,00		
3.5.4	Supply and install HDG cable ladder/tray with lockable anti-theft covers. To SANS 61537, galvanised to SANS 121, bonded to earth.	m	300,00		
3.5.5	Continuous level transmitter for suction sump with high, low and low-low alarm functions.	No	1,00		
3.5.6	Balancing-dam level measurement and high-high emergency alarm instrumentation.	No	1,00		
3.5.7	Flow measurement on return pumping system.	No	1,00		
3.5.8	PLC processor, I/O, communications hardware and integration with WWTW control system.	Sum	1,00		

3.5.9	Develop pump sequencing, 2D+1S duty rotation, permissive, alarms, trends and treatment-capacity interlocks.	Sum	1,00		
3.5.10	Telemetry provision and future SCADA integration interface.	Sum	1,00		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
3.5.11	Area lighting, emergency lighting, safety signage and hazard warning signs. Lighting to SANS 10114-1, emergency lighting to SANS 10114-2, luminaires to SANS 60598, signs to SANS 1186.	Sum	1,00		
3.6	**TESTING, COMMISSIONING AND HANDOVER**				
3.6.1	Integrated wet commissioning of diversion, balancing, sump, and return pumping, MCC, PLC and instrumentation systems.	Sum	1,00		
3.6.2	O and M manuals, as-built information, operator training and commissioning records.	Sum	1,00		
TOTAL CARRIED FORWARD TO SUMMARY					

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT

REFURBISHMENT OF BETHLEHEM WWTW

SECTION D: OLD REACTOR

Item	Description	Unit	Qty	Rate	Amount
4	**OLD REACTOR**				
4.1	**DISMANTLING, REMOVAL AND STORAGE OF EXISTING 37 kW VERTICAL SURFACE AERATORS**				
4.1.1	Isolate, lock-out and tag-out all electrical and mechanical systems associated with existing 37kw low speed vertical surface aerators	No	6		
4.1.2	Dismantle and remove complete vertical aerator systems including electric motors, gearboxes, flexible couplings, hollow shafts, impellers, baseplates, anti-vibration pads, anchor bolts, support brackets and associated hardware.	No	6		
4,1,3	Load, transport, offload, label and store dismantled equipment at Employer's designated municipal storage facility.	No	6		
4.2	**DISMANTLING, REMOVAL AND STORAGE OF EXISTING 37 kW HORIZONTAL BRUSH AERATORS**				
4.2.1	Isolate, lock-out and tag-out all electrical and mechanical systems associated with existing low speed Horizontal Brush aerators.	No	2		
4.2.2	Dismantle and remove complete horizontal brush aerator systems including motors, gearboxes, rotor shafts, bearings, splashguards, support frames and anchor systems.	No	2		
4.2.3	Transport and store dismantled equipment at municipal storage facility.	No	2		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
4.3	**DISMANTLING, REMOVAL AND STORAGE OF EXISTING 5,5 kW MIXERS**				
4.3.1	Isolate, lock-out and tag-out all electrical and mechanical systems associated with existing mixers.	No	6		
4.3.2	Dismantle and remove complete mixer assemblies including motors, gearboxes, shafts, impellers, baseplates, supports and anchor bolts.	No	6		
4.3.3	Transport and store dismantled equipment at municipal storage facility.	No	6		
4.4	**STRUCTURAL REHABILITATION WORKS**				
4.4.1	Break out and remove defective, cracked and delaminated concrete from 55kw aerator support platform.	m^3	5		
4.4.2	Clean exposed reinforcement and treat corroded steel using approved anti-corrosion system.	m^2	20		
4.4.3	Supply and install replacement reinforcement bars where required.	kg	400		
4.4.4	Apply epoxy-bonding agent to prepared surfaces.	m^2	20		
4.4.5	Repair concrete using 50 MPa structural repair mortar.	m^3	5		
4.4.6	Supply and place non-shrink grout beneath baseplates.	m^3	3		
4.4.7	Supply and install heavy-duty anti-vibration pads beneath aerator baseplates.	No	2		
4.4.8	Re-establish platform level and reinstate anchor bolt systems.	Sum	1		
4.4.9	Break out damaged concrete at old reactor, clean reinforcement, apply bonding agent, repair with 35 MPa concrete, finish and cure.	Sum	1		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
4.5	**SUPPLY AND INSTALLATION OF 37 kW LOW SPEED VERTICAL AERATORS**				
4.5.1	Supply complete low speed vertical surface aerator including 37 kW motor, control Panel, gearbox, hollow shaft, anti-ragging 10-blade hydrofoil impeller, flexible coupling, galvanised adjustable baseplate, rain canopy, stainless steel fasteners and anchor bolts.	No	6		
4.5.2	Install complete aerator including lifting, positioning, levelling, alignment, grouting and tightening.	No	6		
4.5.3	Dynamic balancing and vibration analysis.	No	6		
4.5.4	Testing and commissioning.	No	6		
4.6	**SUPPLY AND INSTALLATION OF 55 kW LOW SPEED VERTICAL AERATORS**				
4.6.1	Supply complete low speed vertical surface aerator including 55 kW motor, control panel, gearbox, hollow shaft, anti-ragging 10-blade hydrofoil impeller, flexible coupling, galvanised adjustable baseplate, rain canopy, stainless steel fasteners and anchor bolts.	No	2		
4.6.2	Install complete brush aerator including alignment, levelling and anchoring.	No	2		
4.6.3	Dynamic balancing and vibration analysis.	No	2		
4.6.4	Testing and commissioning.	No	2		
4.7	**SUPPLY AND INSTALLATION OF 37 kW HORIZONTAL BRUSH AERATORS**				
4.7.1	Supply complete horizontal brush aerator system including 37kW motor, control panel, industrial gearbox, stainless steel shaft, heavy duty bearings, splash guards, support frame and anchor system.	No	2		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
4.7.2	Install complete brush aerator including alignment, levelling and anchoring.	No	2		
4.7.3	Dynamic balancing and vibration analysis.	No	2		
4.7.4	Testing and commissioning.	No	2		
4.8	**SUPPLY AND INSTALLATION OF 5.5 kW MIXERS**				
4.8.1	Supply complete vertical shaft mixer including 5.5kW motor, control panel, gearbox, 100 mm shaft, 1630 mm curved blade turbine impeller, painted steel baseplate and all supports.	No	6		
4.8.2	Install complete mixer including levelling, alignment and anchoring.	No	6		
4.8.3	Dynamic balancing and vibration analysis.	No	6		
4.8.4	Testing and commissioning.	No	6		
4.9	**Refurbishment of RAS Pumps**				
4.9.1	Decommission,disconnect,dismantle,remove and cart away exiting RAS Pumpset,complete with motor,couplings,pulleys,V-Belts,Isolating valves,air release valves, non-return and associated supports and fittings.	No	2		
4.9.2	Supply and install new heavy duty, solid handling,self priming RAS Pump at duty 110l/s at 12m TDH with variable speed control complete with new electric Motor,V-Belts ,baseplate,backplate and wear plates,coupling and associated accessories	No	2		
4.9.3	Supply and install new automatic air release valve complete with isolating valves and fittings	No	2		
4.9.4	Supply and Install DN350 Full bore resilient seated wedge gate Suction Isolation valve	No	2		
4.9.5	Supply and Install DN350 Suction Side Piping including flanges fittings and supports	m	15		
4.9.6	Supply and Install DN300 new Discharge resilient seated wedge gate Isolation valves	No	2		

4.9.7	Supply and Install DN300 piping and supports	m	20		
4.9.8	Supply and DN300 Install new non-return valves	No	2		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
4.10	**Refurbishment of WAS Pumps**				
4.10.1	Dismantle and remove motors, rotating elements, back weir plates, V-belts, pulleys, air release valves, non-return valves, supports and anchor bolts.	No	2		
4.10.2	Refurbish the rotating assembly on the existing pumpT4A-B-4 Self Priming Centrifugal Pump including replacement of worn components,reassembly,alignment and testing	No	2		
4.10.3	Replace back plate with wear plates	No	2		
4.10.4	Replace the Motor V belts	N0	4		
4.10.5	Replace the pulleys to speed up the motor	No	4		
4.10.6	Supply and install new air release valves	No	2		
4.10.7	Replace non-return valves	No	2		
4.10.8	Replace 3kw pump motor complete	No	2		
4.10.9	Pipe work refurbishment	Sum	1		
4.11	**Refurbishment of WAS Pump Station To Green Lands**				
4.11.1	Dismantle and remove motors, rotating elements, back weir plates, V-belts, pulleys, air release valves, non-return valves, supports and anchor bolts.	No	2		
4.11.2	Refurbish the rotating assembly on the existing pump V6A-B Self Priming Centrifugal Pump including replacement of worn components,reassembly,alignment and testing	No	2		
4.11.3	Replace existing back plate with wear plates	No	2		
4.11.4	Replace existing set of V belts	N0	4		
4.11.5	Replace pulleys to speed up the motor	No	4		
4.11.6	Replace air release valves	No	2		
4.11.7	Supply and Install DN300 non-return valves	No	2		

4.11.8	Replace 37kw pump motor	No	2		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
4.11.9	Refurbish DN300 WAS Pipework	Sum	1		
4.11.10	Supply and Install Emergency Dewatering submersible pump with duty of 10l/s and 5m TDH complete with DN80 discharge piping, valves hangers and brackets	Sum	1,00		
4.12	**Sluice Gate Valves**				
4.12.1	Complete refurbishment of sluice gate valve between Anaerobic basin and Aeration basin	No	3		
4.13	**Splitter Box Isolation Valve Refurbishment**				
4.13.1	Refurbish existing new and old reactor isolation valves at splitter box, including cleaning, dismantling, inspection, replacement of seals, greasing, reassembly and testing.(Bio reactor)	No	2		
4.13.2	Replace damaged/worn rising spindle shaft, including spindle nut, hand wheel and guides.	No	2		
4.14	**Reactor Outlet Gates to Clarifiers**				
4.14.1	Refurbish stainless steel outlet gate assemblies, 316 stainless steel frame and door, rising spindle, resilient EPDM seal, wall-mounted frame, chemical anchors and watertight installation.	No	2		
4.14.2	Test gates for smooth operation, full closure and water tightness.	No	2		
4.15	**ELECTRICAL INSTALLATIONS, MCC, PLC AND SCADA**				
4.15.1	**DESIGN, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF A NEW MOTOR CONTROL CENTRE (MCC)**				
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
4.15.1.1	Design, manufacture, supply, install, test and commission a complete floor standing Form 4 Type 2 Motor Control Centre (MCC) complete with 1250A Air Circuit Breaker incomer, 65 kA fault rating, Type 1 and Type 2 surge protection, 1250 A lockable isolator, copper busbar system, multifunction energy analyser, harmonic analyser, anti-condensation heaters, thermostatically controlled ventilation fans, internal LED lighting, lockable doors, door interlocks, terminal blocks, earth bar, neutral bar, 34 feeder spaces and 25% future spare capacity. Assembly to be design-verified to SANS 61439-1 and SANS 61439-2, Form 4b internal separation, Type 2 coordination to SANS 60947-4-1, minimum IP54 to SANS 60529.	sum	1		
4.15.2	**MOTOR FEEDERS**				
4.15.2.1	Supply and install complete 5.5 kW mixer motor feeder including VSD, MCCB, overload protection, selector switch and PLC interface terminals. VSD to SANS 61800-3 and SANS 61800-5-1, with input reactor/harmonic filter and output filter where required for the cable length.	No	8		
4.15.2.2	Supply and install complete 37 kW motor feeder including VSD, MCCB, overload protection, selector switch and PLC interface terminals. VSD to SANS 61800-3 and SANS 61800-5-1, with input reactor/harmonic filter and output filter where required for the cable length.	No	12		
4.15.2.3	Supply and install complete 55 kW motor feeder including VSD, MCCB, overload protection, selector switch and PLC interface terminals. VSD to SANS 61800-3 and SANS 61800-5-1, with input reactor/harmonic filter and output filter where required for the cable length.	No	2		
4.15.2.4	Supply and install complete 3 kW WAS pump feeder including MCCB, overload protection and PLC interface terminals.	No	2		
4.15.2.5	Supply and install complete 0.5 kW clarifier drive feeder including MCCB, overload protection and PLC interface terminals.	No	2		
4.15.2.6	Supply and install complete 1.5 kW sump pump feeder including MCCB, overload protection and PLC interface terminals.	No	1		

4.15.2.7	Supply and install six spare motor feeder compartments.	No	6		
4.15.3	**POWER CABLE INSTALLATIONS**				
4.15.3.1	Supply, install, gland, terminate, identify, test and commission 4 Core x 35 mm² Cu/PVX/SWA/PVC armoured power cable between MCC and all 37 kW motors including vertical aerators, brush aerators, RAS pumps and WAS to Green Lands pumps. Cable to SANS 1507-4, installed to SANS 10198 and SANS 10142-1.	m	15000		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
4.15.3.2	Supply, install, gland, terminate, identify, test and commission 4 Core x 50 mm² Cu/PVC/SWA/PVC armoured power cable between MCC and all 55 kW aerators. Cable to SANS 1507-4, installed to SANS 10198 and SANS 10142-1.	m	250		
4.15.3.3	Supply, install, gland, terminate, identify, test and commission 4 Core x 6 mm² Cu/PVC/SWA/PVC armoured power cable between MCC and all mixers. Cable to SANS 1507-4, installed to SANS 10198 and SANS 10142-1.	m	10000		
4.15.3.4	Supply, install, gland, terminate, identify, test and commission 4 Core x 6 mm² Cu/PVC/SWA/PVC armoured power cable between MCC and WAS pumps. Cable to SANS 1507-4, installed to SANS 10198 and SANS 10142-1.	m	150		
4.15.3.5	Supply, install, gland, terminate, identify, test and commission 4 Core x 2.5 mm² Cu/PVC/SWA/PVC armoured power cable between MCC and clarifier drives. Cable to SANS 1507-4, installed to SANS 10198 and SANS 10142-1.	m	300		
4.15.3.6	Supply, install, gland, terminate, identify, test and commission 3 Core x 4 mm² Cu/PVC/SWA/PVC armoured power cable between MCC and sump pumps. Cable to SANS 1507-4, installed to SANS 10198 and SANS 10142-1.	m	150		
4.15.4	**CABLE MANAGEMENT SYSTEM**				
4.15.4.1	Supply and install 600 mm wide heavy duty hot dip galvanised cable ladder system complete with supports, brackets and anchor bolts. To SANS 61537, galvanised to SANS 121, bonded to earth.	m	150		
4.15.4.2	Supply and install 5 mm galvanised anti-theft lockable cable ladder cover system complete with tamper-proof fixings and hinges.	m	150		
	Electrical Supply to Clarifier Centre Columns				
	Supply and install new 200m flexible power/control cables and accessories through/along new centre columns to clarifier drive mechanisms, including glands, lugs, ferrules, cable supports and terminations.	No	2		
4.15.5	**LOCAL OPERATOR STATIONS**				

4.15.5.1	Supply and install local operator station adjacent to all aerators. IP66 to SANS 60529, complete with lockable isolator and emergency stop to SANS 60947-5-5.	No	10		
4.15.5.2	Supply and install local operator station adjacent to all mixers. IP65 to SANS 60529, complete with lockable isolator and emergency stop to SANS 60947-5-5.	No	8		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
4.15.5.3	Supply and install local operator station adjacent to all pumps. IP65 to SANS 60529, complete with lockable isolator and emergency stop to SANS 60947-5-5.	No	8		
4.15.5.4	Supply and install local operator station adjacent to clarifier drives. IP65 to SANS 60529, complete with lockable isolator and emergency stop to SANS 60947-5-5.	No	2		
4.15.6	**PLC**				
4.15.6.1	Supply, install, test and commission online dissolved oxygen sensor/transmitter system, suitable for wastewater aeration basins, complete with DO probe, transmitter, mounting bracket, sun/weather shield, cleaning accessories, calibration kit, signal cable, power supply, termination and integration to PLC.	No	2		
4.15.6.2	Supply, install, test and commission online suspended solids / MLSS meter, suitable for activated sludge process monitoring, complete with optical suspended solids probe, transmitter, mounting arrangement, cleaning accessories, calibration kit, signal cable, power supply, termination and integration to PLC.	No	2		
4.15.6.3	Supply, install, test and commission sump level switches for pump station sump/dewatering pumps, including low-level stop, high-level start and high-high alarm level switches, complete with brackets, cabling, terminations and PLC integration.	No	6		
4.15.6.4	Supply, install, test and commission settled sewage flow meter, electromagnetic type, suitable for wastewater application, complete with flow tube, transmitter, electrodes suitable for sewage, earthing rings, flanges, gaskets, bolts, cabling, power supply, signal output and integration to PLC.	No	1		
4.15.6.5	Supply and install screened instrumentation cable, minimum 2 Pair x 1.5 mm² Cu SWA/PVC, between field instruments and PLC/MCC/instrument panel, including glands, ferrules, markers, cable supports and terminations.	m	800		

4.15.6.6	Supply and install instrument power supply circuits, surge protection and isolators for DO sensors, suspended solids meters and flow meter transmitters. SPDs to SANS 61643-11 (power) and SANS 61643-21 (signal).	Sum	1		
4.15.6.7	Supply and install additional PLC analogue input modules for DO, suspended solids and flow meter signals.	No	3		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
4.15.6.8	Supply and install additional PLC digital input modules for sump level switch signals.	No	1		
4.15.6.9	Modify PLC programme to incorporate DO readings, suspended solids readings, sump level alarms, flow meter readings, pump start/stop interlocks and alarm handling.	Sum	1		
4.15.6.10	Modify SCADA to display DO, suspended solids, sump levels, pump status, settled sewage flow rate, totalised flow, alarms, trends and historical records.	Sum	1		
4.15.6.11	Configure alarm set points for low DO, high DO, high-suspended solids, low suspended solids, high sump level, high-high sump level, flow meter fault and instrument communication failure.	Sum	1		
4.15.6.12	Configure trending and reporting for DO, suspended solids, flow rate, totalised flow and sump level alarm history.	Sum	1		
4.15.6.13	Calibration, loop checking, signal verification and commissioning of all instrumentation.	Sum	1		
4.15.6.14	Supply and install PLC processor, communication modules, I/O modules and Ethernet switches.	Sum	1		
4.15.6.15	Modify PLC software to incorporate all new equipment and process interlocks.	Sum	1		
4.15.6.16	Develop overview mimic diagram and individual process screens.	Sum	1		
4.15.6.17	Configure alarm handling, event logging and trend analysis.	Sum	1		
4.15.6.18	Configure energy monitoring dashboard.	Sum	1		
4.15.6.19	Factory Acceptance Testing (FAT).	Sum	1		
4.15.6.20	Site Acceptance Testing (SAT).	Sum	1		
4.15.6.21	Electrical testing including insulation resistance, earth continuity and phase rotation. Including all SANS 10142-1 tests (earth loop impedance, RCD operation, polarity).	Sum	1		

Total Carried Forward	

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
4.15.6.22	MCC commissioning.	Sum	1		
4.15.6.23	PLC commissioning.	Sum	1		
4.15.6.24	Operator training.	Sum	1		
4.16	**BUILDING WORKS – MCC ROOM REFURBISHMENT**				
4.16.1	Provide calibration certificates, instrument datasheets, loop drawings, I/O schedule, O and M manuals and as-built drawings, Warranty certificates and submission of as-built drawings.	Sum	1		
4.16.2	Complete refurbishment of MCC room including cleaning, wall preparation, floor repairs, painting, ventilation improvements, sealing of openings and making good.	Sum	1		
4.16.3	Dismantle and remove existing damaged doors and frames.	No	5		
4.16.4	Supply and install custom-made aluminium single door, heavy-duty frame, lockset, hinges and weather seal.	No	2		
4.16.5	Supply and install custom-made aluminium double door, heavy-duty frame, lockset, hinges and weather seal.	No	3		
4.15.6.25	SCADA commissioning for Old Reactor equipment, including verification of all new tags, alarms and trends.	Sum	1		
4.15.6.26	Thermographic survey of new MCC under load, with report.	Sum	1		
4.15.6.27	Certificate of Compliance and SANS 10142-1 test report for the Old Reactor installation, issued by a registered person.	Sum	1		
4.16.6	MCC room safety equipment: insulating mats to SANS 61111, fire detection to SANS 10139, CO2 extinguishers to SANS 10105-1, emergency lighting to SANS 10114-2 and safety signs to SANS 1186.	Sum	1		
TOTAL CARRIED FORWARD TO SUMMARY					

SECTION E: NEW REACTOR

Item	Description	Unit	Qty	Rate	Amount
5	**NEW REACTOR**				
5.1	**DISMANTLING, REMOVAL AND STORAGE OF EXISTING VERTICAL SURFACE AERATORS**				
5.1.1	Isolate, lock-out and tag-out all electrical and mechanical systems associated with existing low speed vertical surface aerators.	No	6		
5.1.2	Dismantle and remove complete vertical aerator systems including electric motors, gearboxes, flexible couplings, hollow shafts, impellers, baseplates, anti-vibration pads, anchor bolts, support brackets and associated hardware.	No	6		
5.1.3	Load, transport, offload, label and store dismantled equipment at Employer's designated municipal storage facility.	No	6		
5.2	**DISMANTLING, REMOVAL AND STORAGE OF EXISTING 5,5 kW MIXERS**				
5.2.1	Isolate, lockout and tag-out all electrical and mechanical systems associated with existing mixers.	No	6		

5.2.2	Dismantle and remove complete mixer assemblies including motors, gearboxes, shafts, impellers, baseplates, supports and anchor bolts.	No	6		
5.2.3	Transport and store dismantled equipment at municipal storage facility.	No	6		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
5.3	**REFURBISHMENT AND INSTALLATION OF 37 kW LOW SPEED VERTICAL AERATORS**				
5.3.1	Complete refurbishment of a low speed vertical surface aerator including 37 kW motor, gearbox, hollow shaft, anti-ragging 10-blade hydrofoil impeller, flexible coupling, galvanised adjustable baseplate, rain canopy, stainless steel fasteners and anchor bolts.	No	6		
5.3.2	Reinstall aerator including lifting, positioning, levelling, alignment, grouting and tightening.	No	6		
5.3.3	Dynamic balancing and vibration analysis.	No	6		
5.3.4	Testing and commissioning.	No	6		
5.4	**REFURBISHMENT AND INSTALLATION OF 5.5 kW MIXERS**				
5.4.1	Complete refurbishment of 5.5 kW vertical shaft mixer including gearbox, shaft, curved blade turbine impeller, steel baseplate and all supports.	No	6		
5.4.2	Re-install complete mixer including levelling, alignment and anchoring.	No	6		
5.4.3	Dynamic balancing and vibration analysis.	No	6		
5.4.4	Testing and commissioning.	No	6		

Total Carried Forward	

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
5.5	**Refurbishment of RAS Pumps Module 2**				
5.5.1	Decommission ,remove and cart away existing RAS Pumps complete with associated pipework,fittings and brackets to the designaged site	No	2		
5.5.2	Supply and install new heavy duty, solid handling,self priming RAS Pump at duty 110l/s at 12m TDH with variable speed control complete with new electric Motor,V-Belts ,baseplate,backplate and wear plates,coupling and associated accessories	No	2		
5.5.3	Supply and install new automatic air release valve complete with isolating valves and fittings	No	2		
5.5.4	Supply and Install DN350 Full bore resilient seated wedge gate Suction Isolation valve	No	2		
5.5.5	Supply and Install DN350 Suction Side Piping including flanges fittings and supports	m	15		
5.5.6	Supply and Install DN300 new Discharge resilient seated wedge gate Isolation valves	No	2		
5.5.7	Supply and Install DN300 piping and supports	m	20		
	Supply and DN300 Install new non-return valves	No	2		
	Refurbishment of RAS Pumps Module 5				
5.5.8	Decommission ,remove and cart away existing RAS Pumps complete with associated pipework,fittings and brackets to the designaged site	No	2		
5.5.9	Supply and install new heavy duty, solid handling, self-priming RAS Pump at duty 110l/s at 12m TDH with variable speed control complete with new electric Motor,V-	No	2		

	Belts ,baseplate,backplate and wear plates, coupling and associated accessories				
5.6	**Refurbishment of WAS Pumps**				
5.6.1	Isolate, lock-out and tag-out all electrical and mechanical systems associated with existing WAS Pumps.	No	2		
5.6.2	Dismantle and remove motors, rotating elements, back weir plates, V-belts, pulleys, air release valves, non-return valves, supports and anchor bolts.	No	2		
5.6.3	Refurbish Rotating Elements of the existing pump T4 Pump	No	2		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
5.6.4	Supply and install new back plate with wear plates	No	2		
5.6.5	Supply and install new set of V belts	N0	4		
5.6.6	Supply and install new pulleys to speed up the motor	No	4		
5.6.7	Supply and install new air release valves	No	2		
5.6.8	Supply and Install new non-return valves	No	2		
5.6.9	Complete refurbishment of 3Kw Pump motor	No	2		
5.6.10	Pipe work refurbishment	Sum	1		
5.7	**Sluice Gate Valves**				
5.7.1	Complete refurbishment of sluice gate valve between Anaerobic basin and Aeration basin	No	3		
5.8	**ELECTRICAL INSTALLATIONS, MCC, PLC AND SCADA**				
5.8.1	**UPGRADE, TESTING AND COMMISSIONING OF THE EXISTING MOTOR CONTROL CENTRE (MCC)**				
5.8.1.1	Upgrade, test and commission a complete floor standing Form 4 Type 2 Motor Control Centre (MCC) complete with 1250A Air Circuit Breaker incomer, 65 kA fault rating, Type 1 and Type 2 surge protection, 1250 A lockable isolator, copper busbar system, multifunction energy analyser, harmonic analyser, anti-condensation heaters, thermostatically controlled ventilation fans, internal LED lighting, lockable doors, door interlocks, terminal blocks, earth bar, neutral bar, 34 feeder spaces and 25% future spare capacity. Assembly to be design-verified to SANS 61439-1 and SANS 61439-2, Form 4b internal separation, Type 2 coordination to SANS 60947-4-1, minimum IP54 to SANS 60529.	sum	1		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
5.8.2	**MOTOR FEEDERS**				
5.8.2.1	Supply and install complete 5.5 kW mixer motor feeder including VSD, MCCB, overload protection, selector switch and PLC interface terminals. VSD to SANS 61800-3 and SANS 61800-5-1, with input reactor/harmonic filter and output filter where required for the cable length.	No	6		
5.8.2.2	Supply and install complete 37 kW motor feeder including VSD, MCCB, overload protection, selector switch and PLC interface terminals. VSD to SANS 61800-3 and SANS 61800-5-1, with input reactor/harmonic filter and output filter where required for the cable length.	No	8		
5.8.2.3	Supply and install complete 3 kW WAS pump feeder including MCCB, overload protection and PLC interface terminals.	No	2		
5.8.2.4	Supply and install complete 0.5 kW clarifier drive feeder including MCCB, overload protection and PLC interface terminals.	No	2		
5.8.2.5	Supply and install complete 1.5 kW sump pump feeder including MCCB, overload protection and PLC interface terminals.	No	1		
5.8.2.6	Supply and install six spare motor feeder compartments.	No	6		
5.8.3	**POWER CABLE INSTALLATIONS**				
5.8.3.1	Supply, install, gland, terminate, identify, test and commission 4 Core x 35 mm² Cu/PVC/SWA/PVC armoured power cable between MCC and all 37 kW motors including vertical aerators, brush aerators, RAS pumps and WAS to Green Lands pumps. Cable to SANS 1507-4, installed to SANS 10198 and SANS 10142-1.	m	1500		
5.8.3.2	Supply, install, gland, terminate, identify, test and commission 4 Core x 6 mm² Cu/PVC/SWA/PVC armoured power cable between MCC and all mixers. Cable to SANS 1507-4, installed to SANS 10198 and SANS 10142-1.	m	1000		
5.8.3.3	Supply, install, gland, terminate, identify, test and commission 4 Core x 6 mm² Cu/PVC/SWA/PVC armoured power cable between MCC and WAS pumps. Cable to SANS 1507-4, installed to SANS 10198 and SANS 10142-1.	m	150		

Total Carried Forward	

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
5.8.3.4	Supply, install, gland, terminate, identify, test and commission 4 Core x 2.5 mm² Cu/PVC/SWA/PVC armoured power cable between MCC and clarifier drives. Cable to SANS 1507-4, installed to SANS 10198 and SANS 10142-1.	m	300		
5.8.3.5	Supply, install, gland, terminate, identify, test and commission 3 Core x 4 mm² Cu/PVC/SWA/PVC armoured power cable between MCC and sump pumps. Cable to SANS 1507-4, installed to SANS 10198 and SANS 10142-1.	m	150		
5.8.4	**CABLE MANAGEMENT SYSTEM**				
5.8.4.1	Supply and install 600 mm wide heavy duty hot dip galvanised cable ladder system complete with supports, brackets and anchor bolts. To SANS 61537, galvanised to SANS 121, bonded to earth.	m	300		
5.8.4.2	Supply and install 5 mm galvanised anti-theft lockable cable ladder cover system complete with tamper-proof fixings and hinges.	m	300		
5.8.5	**LOCAL OPERATOR STATIONS**				
5.8.5.1	Supply and install local operator station adjacent to all aerators. IP65 to SANS 60529, complete with lockable isolator and emergency stop to SANS 60947-5-5.	No	6		
5.8.5.2	Supply and install local operator station adjacent to all mixers. IP65 to SANS 60529, complete with lockable isolator and emergency stop to SANS 60947-5-5.	No	6		
5.8.5.3	Supply and install local operator station adjacent to all pumps. IP65 to SANS 60529, complete with lockable isolator and emergency stop to SANS 60947-5-5.	No	4		
5.8.5.4	Supply and install local operator station adjacent to clarifier drives. IP65 to SANS 60529, complete with lockable isolator and emergency stop to SANS 60947-5-5.	No	2		
5.8.6	**PLC AND SCADA**				
5.8.6.1	Supply, install, test and commission online dissolved oxygen sensor/transmitter system, suitable for wastewater aeration basins, complete with DO probe, transmitter, mounting bracket, sun/weather shield, cleaning accessories, calibration kit, signal cable, power supply, termination and integration to PLC/SCADA.	No	2		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
5.8.6.2	Supply, install, test and commission online suspended solids / MLSS meter, suitable for activated sludge process monitoring, complete with optical suspended solids probe, transmitter, mounting arrangement, cleaning accessories, calibration kit, signal cable, power supply, termination and integration to PLC/SCADA.	No	2		
5.8.6.3	Supply, install, test and commission sump level switches for pump station sump/dewatering pumps, including low-level stop, high-level start and high-high alarm level switches, complete with brackets, cabling, terminations and PLC/SCADA integration.	No	6		
5.8.6.4	Supply, install, test and commission settled sewage flow meter, electromagnetic type, suitable for wastewater application, complete with flow tube, transmitter, electrodes suitable for sewage, earthing rings, flanges, gaskets, bolts, cabling, power supply, signal output and integration to PLC/SCADA.	No	1		
5.8.6.5	Supply and install screened instrumentation cable, minimum 2 Pair x 1.5 mm² Cu SWA/PVC, between field instruments and PLC/MCC/instrument panel, including glands, ferrules, markers, cable supports and terminations.	m	800		
5.8.6.6	Supply and install instrument power supply circuits, surge protection and isolators for DO sensors, suspended solids meters and flow meter transmitters. SPDs to SANS 61643-11 (power) and SANS 61643-21 (signal).	Sum	1		
5.8.6.7	Supply and install additional PLC analogue input modules for DO, suspended solids and flow meter signals.	No	3		
5.8.6.8	Supply and install additional PLC digital input modules for sump level switch signals.	No	1		
5.8.6.9	Modify PLC programme to incorporate DO readings, suspended solids readings, sump level alarms, flow meter readings, pump start/stop interlocks and alarm handling.	Sum	1		

Total Carried Forward	

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
5.8.6.10	Modify SCADA to display DO, suspended solids, sump levels, pump status, settled sewage flow rate, totalised flow, alarms, trends and historical records.	Sum	1		
5.8.6.11	Configure SCADA alarm set points for low DO, high DO, high suspended solids, low suspended solids, high sump level, high-high sump level, flow meter fault and instrument communication failure.	Sum	1		
5.8.6.12	Configure SCADA trending and reporting for DO, suspended solids, flow rate, totalised flow and sump level alarm history.	Sum	1		
5.8.6.13	Calibration, loop checking, signal verification and commissioning of all instrumentation.	Sum	1		
5.8.6.14	Supply and install PLC processor, communication modules, I/O modules and Ethernet switches.	Sum	1		
5.8.6.15	Modify PLC software to incorporate all new equipment and process interlocks.	Sum	1		
5.8.6.16	Develop SCADA overview mimic diagram and individual process screens.	Sum	1		
5.8.6.17	Configure alarm handling, event logging and trend analysis.	Sum	1		
5.8.6.18	Configure energy monitoring dashboard.	Sum	1		
5.8.6.19	Factory Acceptance Testing (FAT).	Sum	1		
5.8.6.20	Site Acceptance Testing (SAT).	Sum	1		
5.8.6.21	Electrical testing including insulation resistance, earth continuity and phase rotation. Including all SANS 10142-1 tests (earth loop impedance, RCD operation, polarity).	Sum	1		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
5.8.6.22	MCC commissioning.	Sum	1		
5.8.6.23	PLC commissioning.	Sum	1		
5.8.6.24	SCADA commissioning.	Sum	1		
5.8.6.25	Provide calibration certificates, instrument datasheets, loop drawings, I/O schedule, O and M manuals and as-built drawings, Warranty certificates and submission of as-built drawings.	Sum	1		
5.8.6.26	Thermographic survey of upgraded MCC under load, with report.	Sum	1		
5.8.6.27	Certificate of Compliance and SANS 10142-1 test report for the New Reactor and emergency pump station installations, issued by a registered person.	Sum	1		
5.9	**SITE-WIDE ELECTRICAL AND STATUTORY ITEMS (ADDED – SANS REVIEW)**				
5.9.1	Electrical design report: single-line diagrams, load schedule, fault-level, protection discrimination, cable sizing and volt-drop calculations to SANS 10142-1, harmonic study to NRS 048-2.	Sum	1		
5.9.2	Supply, install, test and commission 1,250 kVA, 400 V standby diesel generator to SANS 8528 (class G2), acoustic canopy, bonded integral fuel tank (110%) and AMF panel, as specified in clause 3.4.5.21.	Sum	1		
5.9.3	Automatic transfer switchgear to SANS 60947-6-1, 35 MPa plinth, generator power and control cabling, earthing to SANS 10292, SCADA signals and load testing.	Sum	1		
5.9.4	Supply, install, load-test and certify 1,000 kg electric hoist for biological reactors, IP65 pendant with emergency stop, to Driven Machinery Regulations.	No	TBC		

5.9.5	Power cable from MCC to reactor hoists including isolator and terminations (average 60 m per hoist).	m	TBC		
5.9.6	Supply, install, load-test and certify 1,500 kg corrosion-protected electric hoist in chlorine room.	No	1		
5.9.7	Power cable to chlorine room hoist including isolator and terminations.	m	30		
5.9.8	Refurbish, recalibrate and recommission existing ultrasonic outflow meter, with calibration certificate and loop drawing.	Sum	1		
5.9.9	Lightning risk assessment to SANS 62305-2 and lightning protection / surge protection measures to SANS 62305-3, SANS 62305-4 and SANS 10313.	Sum	1		
5.9.10	Site earth electrode system and equipotential bonding to SANS 10199, SANS 10292 and SANS 10142-1, including earth resistance test report.	Sum	1		
5.9.11	Hazardous area classification to SANS 10108 / SANS 60079-10-1 for sumps, wet wells, inlet works and digesters, and provision of IA-certified Ex equipment where required.	Sum	1		
5.9.12	Supply and install IP65 slip-ring assemblies at clarifier centre columns for bridge drive power and control.	No	4		
TOTAL CARRIED FORWARD TO SUMMARY					

Item	Description	Unit	Qty	Rate	Amount
6	**CLARIFIERS** **MECHANICAL WORKS** **SUPPLY, DELIVERY, INSTALLATION, TESTING AND COMMISSIONING OF CLARIFIER DRIVE SYSTEMS AND CLARIFIER CLEANING WORKS** **CLEANING OF CLARIFIERS AND REMOVAL OF ACCUMULATED SLUDG** **Clarifier Isolation and Preparation**				
6.1 **6.1.1**					
6.1.1.1	Isolate existing clarifier and implement temporary flow diversion arrangements including all temporary works required to safely execute the cleaning operation.	No	4		
6.1.2	**Sludge Removal**				
6.1.2.1	Clear and remove all forms of vegetation,dewater and desludge existing structures from clarifiers to sludge drying beds.This shall include removal of all accumulated sludge,debris and deposited materials and transferring to allocated disposals areas.Rate shall include all pumping equipment, temporary hosework,labour,transportation and disposal materials	m3	2166		
6.1.3	**Sludge Removal Using Vacuum Truck**				
6.1.3.1	Supply and operate vacuum tanker trucks to remove residual sludge deposits, grit, floating matter and debris from clarifier floors and s, including transportation and disposal at approved municipal disposal facilities.	m3	2166		
6.1.4	**Pressure Cleaning**				

6.1.4.1	High pressure cleaning of clarifier walls, launders, scum boxes, weirs, inlet chambers and floor slabs to remove all biological growth, sludge residue and debris.el bars	Sum	1		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
6.1.5	**Clarifier Inspection**				
6.1.5.1	Undertake detailed visual inspection of clarifier floors, walls, centre columns, bridge supports, scum boxes, weirs and existing anchor bolt systems and submit inspection report to Engineer.	No	4		
6.2	**SUPPLY, DELIVERY, INSTALLATION, TESTING AND COMMISSIONING OF CLARIFIER DRIVE ASSEMBLIES**				
6.2.1	**Supply of Clarifier Drive Assemblies**				
6.2.1.1	Supply complete clarifier geared motor assembly suitable for continuous operation under wastewater treatment conditions. The unit shall comprise heavy-duty geared motor, gearbox, drive shaft, coupling, torque arm, mounting frame, anchor bolts and all accessories required for a complete installation.	No	4		
6.2.2	**Gearbox Assemblies**				
6.2.2.1	Supply heavy-duty industrial gearbox complete with lubrication system, bearings and seals.	No	4		
6.2.3	**Mechanical Installation**				
6.2.3.1	Install complete clarifier drive assembly including lifting, positioning, alignment, levelling and securing to existing bridge structures.	No	4		
6.2.3.2	Supply and install flexible couplings, torque arms, support brackets and all associated mounting hardware.	No	4		

6.2.3.3	Laser alignment of gearboxes, couplings, drive shafts, and adjustment to manufacturer's tolerances.	No	4		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
6.2.3.4	Prepare surfaces and apply approved corrosion protection system to all exposed carbon steel components.	Sum	1		
6.2.3.5	Undertake mechanical testing, dry run testing, vibration analysis, temperature monitoring and final commissioning of all clarifier drive assemblies.	No	4		
6.2.4	**Unblocking of Feed Pipes from Old Reactor to Clarifiers**				
6.2.4.1	Unblock existing feed pipe from old reactor to clarifier using high-pressure jetting, root cutting, rodding, vacuum extraction and CCTV verification.	No	2		
6.2.4.2	Provide CCTV inspection report before and after cleaning, including blockage location, pipe condition and recommendations.	Sum	1		
6.2.5	**Replacement of Corroded Clarifier Centre Columns for Old Clarifiers**				
6.2.5.1	New centre column to be fabricated from Grade 316 stainless steel, minimum wall thickness 8 mm, complete with base flange, top flange, sludge withdrawal ports, cable support brackets, internal/external stiffeners, access covers, lifting lugs, anchor bolts and all connection fittings. Final dimensions to match existing clarifier bridge and mechanism.	No	2		
6.2.5.2	Mobilise mobile crane, lifting team and rigging equipment for safe removal of clarifier bridge.	No	2		
6.2.5.3	Dismantle, lift and temporarily place clarifier bridge structure clear of centre column.	No	2		

6.2.5.4	Remove existing corroded centre column, including cutting, unbolting, lifting and disposal to municipal scrap/storage area.	No	2		
6.2.5.5	Supply and install new 316 stainless steel centre column complete with flanges, anchor bolts, gaskets, sludge ports and cable access provisions.	No	2		
Total Carried Forward					

Item	Description	Unit	Qty	Rate	Amount
Brought Forward					
6.2.5.6	Reinstall clarifier bridge, align, level and secure to new centre column and peripheral supports.	No	2		
6.2.5.7	Test rotation, bridge alignment and mechanical clearances.	No	2		
6.2.6	**Clarifier Bridge Refurbishment**				
6.2.6.1	Refurbish clarifier bridge including cleaning, corrosion removal, replacement of worn bolts, local steel repairs, painting/coating and mechanical inspection.	No	4		
6.2.6.2	Supply and install new clarifier bridge drive wheels, guide wheels and bearings to match existing mechanism.	Set	4		
6.2.6.3	Supply and apply corrosion protection coating system to bridge steelwork.	No	4		
6.2.7	**Sludge Withdrawal Holes at Clarifiers Centre Column**				
6.2.7.1	Drill/core DN300 three additional sludge withdrawal holes through each centre column/base arrangement for withdrawal to RAS pump station sump, including stainless steel sleeves, sealing and corrosion protection.	No	12		
TOTAL CARRIED FORWARD TO SUMMARY					

SUMMARY OF BILL OF QUANTITY (BOQ)

Bill No.	Description	Amount (R)
1	PRELIMINARY AND GENERAL	
2	SCHEDULE 2: BIOFILTER SYSTEM	
3	SCHEDULE 3: EMERGENCY SEWER OVERFLOW DAM	
4	SCHEDULE 4: OLD REACTOR	
5	SCHEDULE 5: NEW REACTOR	
6	SCHEDULE 6: CLARIFIERS	
SUB TOTAL		
10% CONTINGENCIES		
SUB TOTAL		
15% VAT		
Total Amount of Tender Carried Forward to Form of Offer and Acceptance		

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed : _____ Date: _____

Name : _____

Enterprise Name : _____

Position : _____

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT

Reference no.: **MISA/RBWTW/FS/031/2026/27**

APPOINTMENT OF A CONTRACTOR FOR THE REFURBISHMENT OF BETHLEHEM WASTEWATER TREATMENT WORKS.

PART C3: SCOPE OF WORK

PART C3: SCOPE OF WORK

C3.1 DESCRIPTION OF THE WORKS AND SERVICES

3.1.1. EMPLOYER'S OBJECTIVES

The Municipal Infrastructure Support Agent (MISA), in collaboration with Dihlabeng Local Municipality, intends to appoint a suitably qualified and experienced contractor for the repair, refurbishment, replacement, installation, testing and commissioning of civil, structural, mechanical, and electrical and control infrastructure at the Bethlehem Wastewater Treatment Works (WWTW), Free State Province.

The principal objective of the project is to restore the functionality, reliability and operational resilience of the Bethlehem WWTW through the rehabilitation of critical wastewater treatment infrastructure that is currently defective, deteriorated, unreliable and non-operational.

The refurbishment works are intended to:

- restore the functionality of the existing activated sludge treatment processes;
- reinstate reliable aeration and mixing within the old and new activated sludge reactors;
- rehabilitate the secondary clarifiers and associated sludge withdrawal systems;
- restore the Return Activated Sludge (RAS) and Waste Activated Sludge (WAS) systems;
- refurbish the biofilter and associated humus tank infrastructure;
- improve emergency management of excessive incoming wastewater flows through the provision of a 16 000m^3 emergency overflow/balancing facility and associated return pumping system;
- rehabilitate and upgrade electrical reticulation, Motor Control Centres (MCCs), cables, controls and instrumentation;
- improve operational monitoring and process control through PLC-based automation and instrumentation;
- undertake the required civil and structural rehabilitation works associated with the mechanical and electrical installations;
- improve the safety, maintainability and reliability of the treatment works; and
- Reduce the risk of untreated or inadequately treated wastewater being discharged into the receiving environment.

The completed works shall provide Dihlabeng Local Municipality with rehabilitated wastewater treatment infrastructure capable of supporting reliable and sustainable wastewater treatment operations.

3.1.2. BACKGROUND

The Bethlehem Wastewater Treatment Works is an existing municipal wastewater treatment facility serving Bethlehem and Bohlokong within Dihlabeng Local Municipality in the Free State Province. The works has a historical treatment capacity of approximately 25.6 ML/day and comprises several treatment modules incorporating activated sludge reactors, secondary clarifiers, and biological filters, humus tanks, sequencing batch reactors, sludge handling facilities and final effluent disinfection infrastructure.

Condition assessments undertaken at the treatment works identified significant deterioration and failure of critical process, mechanical, electrical and control infrastructure. Several components of the treatment process are either non-operational or operating with substantially reduced reliability. The identified deficiencies include deteriorated and failed aerators and mixers, defective recycle pumping systems, deteriorated clarifier mechanisms and centre columns, unreliable RAS and WAS systems, ageing electrical infrastructure, damaged cables, deteriorated MCCs, limited process instrumentation and deficiencies within the biofilter and sludge-handling systems.

The condition of these systems has adversely affected the ability of the works to operate consistently at its intended treatment performance and has reduced operational redundancy. The refurbishment is therefore required to restore the major treatment processes and reduce the environmental and operational risks associated with equipment failure and uncontrolled wastewater flows.

The works under this contract comprise an integrated programme of civil, structural, mechanical, electrical, instrumentation and control refurbishment. The principal works include, but are not necessarily limited to:

- construction of a 16 000m^3 emergency sewer overflow/balancing facility, including a 10 mm open spacing manual screen, grit and debris interception arrangements and associated civil works;
- provision of an emergency return pump station incorporating three Hheavy-Duty, Solid Handling, Self-Priming Centrifugal Sewage Pumps with 55 kW motors configured as two duty and one standby (2D + 1S), together with associated pipework, valves, electrical equipment, level control and instrumentation;
- refurbishment of the old activated sludge reactor, including replacement of defective aerators and mixers and rehabilitation of associated gates, electrical systems and controls;
- refurbishment of the new activated sludge reactor, including rehabilitation of aeration and mixing equipment, electrical supply, MCCs, controls and removal of accumulated grit and solids;
- cleaning and refurbishment of the existing secondary clarifiers;

- replacement of deteriorated clarifier centre columns with Grade 316 stainless-steel centre columns, where specified;
- refurbishment and reinstatement of the clarifier bridge mechanisms;
- refurbishment and reinstatement of the RAS and WAS pumping systems, including associated valves and pipework;
- cleaning and unblocking of process pipelines between the activated sludge reactors and clarifiers;
- cleaning and rehabilitation of sludge digesters;
- refurbishment of the biological filter system, including the distributor mechanism and associated equipment;
- replacement of defective/corroded valves associated with the humus tanks;
- installation and refurbishment of MCCs, power distribution equipment, power and control cables and local control stations;
- provision of instrumentation, level monitoring, flow measurement and PLC-based process control;
- structural concrete repairs and rehabilitation associated with equipment support structures;
- installation of the required access, handrails, lifting arrangements, lighting and other occupational health and safety infrastructure; and
- testing, commissioning, process reinstatement, operator familiarisation/training and submission of the required operation and maintenance documentation and as-built information.

The supply, manufacture where applicable, delivery to site, off-loading, storage, installation, construction, testing and commissioning of all plant, equipment and materials necessary for the proper completion and operation of the works shall form part of this Contract. Unless specifically identified for refurbishment or reuse, all equipment and materials supplied under the Contract shall be new, unused and suitable for operation in a municipal wastewater treatment environment.

The Bethlehem WWTW is an operational municipal wastewater treatment facility and wastewater inflow to the works will continue throughout the construction period. The Contractor shall therefore plan, sequence and execute the works so that the maximum practicable treatment capacity remains available throughout construction. No existing process unit, pipeline, pump, electrical supply or other operational infrastructure shall be isolated or taken out of service without prior approval of the Employer’s Representative and coordination with Dihlabeng Local Municipality's operational personnel.

Temporary bypass arrangements, temporary pumping, controlled isolation, staged refurbishment and other measures required to maintain wastewater conveyance and treatment during construction shall be incorporated into the Contractor's methodology. The Contractor shall take particular precautions to prevent uncontrolled sewage overflows, pollution of the receiving environment and damage to existing infrastructure.

The Contractor shall recognise that the works involve construction and refurbishment within an operating wastewater treatment environment containing raw sewage, biological wastewater, sludge, confined spaces, electrical installations and rotating mechanical equipment. Appropriate occupational health and safety procedures, environmental controls, confined-space procedures, lock-out and isolation procedures and wastewater management measures shall therefore be implemented throughout the Contract.

The standard of workmanship shall be of the highest engineering quality, and all work shall be undertaken by suitably qualified, competent and experienced personnel. Mechanical, electrical, civil, structural, instrumentation and commissioning activities shall comply with the Contract specifications, approved drawings, applicable South African standards, manufacturers' requirements and instructions issued by the Employer's Representative.

The refurbishment of the Bethlehem WWTW is expected to substantially improve the reliability, maintainability and operational performance of the treatment works, restore critical treatment processes and reduce the risk of non-compliant final effluent and pollution of the receiving environment. The works will consequently contribute to the sustainable provision of wastewater sanitation services to the communities of Bethlehem and Bohlokong.

3.1.3. LOCATION OF WORKS AND BENEFICIARIES

The works are located at the existing Bethlehem Wastewater Treatment Works, within the jurisdiction of Dihlabeng Local Municipality, Thabo Mofutsanyane District, Free State Province.

The treatment works serves the urban areas and communities of Bethlehem and Bohlokong. The works is situated approximately 3 km north of the Bethlehem Central Business District and discharges treated final effluent to the receiving water environment associated with the Jordaan River system.

The Contractor shall familiarise itself with the site, existing access arrangements, operating process units, underground and above ground services, existing pipelines, electrical infrastructure, structures and all constraints associated with carrying out construction within an operational wastewater treatment facility.

Description	Project Information
Project	Refurbishment of Bethlehem Wastewater Treatment Works
Tender Number	MISA/RBWTW/FS/031/2026/27
Employer	Municipal Infrastructure Support Agent (MISA)
Beneficiary Municipality	Dihlabeng Local Municipality
District	Thabo Mofutsanyane District Municipality
Province	Free State

Town/Beneficiary Areas	Bethlehem and Bohlokong
Infrastructure	Bethlehem Wastewater Treatment Works
Historical Treatment Capacity	Approximately 25.6 ML/day
Current Observed Inflow	Approximately 20 ML/day
Beneficiaries	Residents, businesses, institutions and other wastewater service users within Bethlehem and Bohlokong
Approximate WWTW Coordinates	28°15′06″ S, 28°18′45″ E
Approximate Elevation	1,640 m above mean sea level

The refurbishment is therefore not the construction of an isolated new treatment facility but the rehabilitation and functional reinstatement of critical infrastructure within an existing operational WWTW. The Contractor's construction methodology, programme, temporary works and commissioning strategy shall reflect this requirement at all times.

3.1.4. TIME FRAMES

The estimated timeframe for completion of all the activities as described herein the C3: Scope of work is 8 months.

3.1.5. SOCIO ECONOMIC BENEFITS

It is envisaged that this project will create temporary jobs as per the table below:

Type	No
Work Opportunities	
SMME developed and supported	

3.2.1. OVERVIEW OF WORKS

The Works comprise the refurbishment, rehabilitation, replacement, installation, testing and commissioning of existing civil, structural, mechanical, electrical, instrumentation and control infrastructure at the Bethlehem Wastewater Treatment Works (WWTW).

The project is primarily intended to restore the operational reliability and treatment performance of the existing wastewater treatment processes through refurbishment of the old and new activated sludge reactors, secondary clarifiers, biological filters, humus tanks, sludge handling systems, recycle pumping systems, electrical installations and associated process infrastructure.

The Works further include the construction of a 16 ML/day emergency overflow/balancing facility, together with screening, grit and debris interception, associated gravity and rising mains, an emergency return pump station, valves, chambers, electrical supply, MCCs, instrumentation and controls. The emergency overflow/balancing facility shall be configured as a longer and shallower structure with a maximum depth of 4.0 m, including a 1.0 m wide reinforced-concrete apron around its entire perimeter.

The Works shall include replacement and refurbishment of existing aerators and mixers; refurbishment of secondary clarifier mechanisms; reinstatement of RAS and WAS pumping; cleaning and rehabilitation of digesters; refurbishment of the biofilter distributor and humus tank equipment; installation of new process pumps and pipelines; rehabilitation of structural concrete; replacement and upgrading of MCCs, power and control cabling; installation of PLC-based control and process instrumentation; and all ancillary works necessary to provide a complete and functional installation.

The Bethlehem WWTW shall remain operational as far as reasonably practicable throughout the construction period. The Contractor shall therefore execute the Works in a planned and phased manner, including controlled process isolation, temporary bypass arrangements and coordination with the Municipality's operational personnel.

All equipment supplied under the Contract shall be suitable for continuous operation in a municipal wastewater treatment environment. The Works shall include all necessary testing, commissioning, performance verification, operator training, preparation of as-built documentation, operation and maintenance manuals and final handover.

3.2.1. EXTENT OF THE WORKS AND SERVICES

The extent of the Works and Services shall include, but shall not necessarily be limited to, the following:

- Compliance with the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) and applicable Construction Regulations, including preparation and implementation of the Contractor's site-specific Health and Safety Plan, risk assessments, safe work procedures, confined-space procedures, isolation and lock-out procedures, environmental controls and all other statutory requirements for the duration of the Contract.
- Establishment, operation and de-establishment of the construction site, including all temporary facilities, security, temporary services, access arrangements, storage areas, barricading, signage and protection of existing municipal infrastructure.
- Provision of all contract management, supervision, programme management, time-related obligations, quality management, environmental management, community liaison and coordination required for successful execution of the Works.

- Preparation and submission of construction methodologies, work programmes, equipment data sheets, shop drawings, method statements, commissioning procedures, quality documentation, test certificates, as-built drawings, operating and maintenance manuals and other documentation required under the Contract.
- Coordination of all construction activities with Dihlabeng Local Municipality to ensure that wastewater inflows are continuously managed and that the maximum practicable treatment capacity remains available during construction.
- Provision of temporary works, temporary pumping, bypass pumping and controlled process isolation where required to enable refurbishment activities without causing uncontrolled sewage overflows or unacceptable interruption of wastewater treatment.

Schedule of Mechanical Equipment

The table below identifies the mechanical equipment forming part of the scope of work for the Refurbishment of the treatment work. The schedule shall be read in conjunction with the technical specifications, construction drawings and bill of quantities

Item	Process Area	Mechanical Equipment	Quantity
1.01	Inlet Works	Mechanically Cleaned Inlet Screens	2
1.02	Inlet Works	Manual Bypass Screen	1
1.03	Inlet Works	Screenings Screw Compactor	1
1.04	Inlet Works	Grit Removal Air-Lift Equipment	1
1.05	Inlet Works	Grit Classifier	2
1.06	Raw Sewage Pumping Stations	PS1 – SBR Feed Pumps	2
1.07	Raw Sewage Pumping Stations	PS2 – Equalising Dam Return Pumps/Biofilter Feed pumps	2
1.08	Raw Sewage Pumping Stations	PS3 – Activated Sludge Reactor Feed Pumps	4
1.09	Primary Settling Tanks	Primary Sludge Transfer Pumps	2
1.1	Primary Settling Tanks	PST Bridge	2
1.11	Biological Filters and Humus Tanks	Trickling Biofilter Column Complete	2
1.12	Sequencing Batch Reactors – Modules 3 and 4	SBR Equipment Complete	2
1.13	Activated Sludge Reactors	Module 2 – Vertical Shaft Surface Aerators	6

1.14	Activated Sludge Reactors	Module 2 – Horizontal Aerators	2
1.15	Activated Sludge Reactors	Module 2 – Reactor Mixers	8
1.16	Activated Sludge Reactors	Module 5 – Vertical Shaft Surface Aerators	6
1.17	Activated Sludge Reactors	Module 5 – Reactor Mixers	6
1.18	Secondary Clarifiers	Clarifier Bridge	2
1.19	Return Activated Sludge (RAS) System	Module 2 – Return Activated Sludge Pumps	2
1.2	Return Activated Sludge (RAS) System	Module 5 – Return Activated Sludge Pumps	2
1.21	Waste Activated Sludge (WAS) System	Module 2 – Waste Activated Sludge Pumps	2
1.22	Waste Activated Sludge (WAS) System	Module 5 – Waste Activated Sludge Pumps	2
1.23	Anaerobic Digestion System	Anaerobic Digester Sludge Circulation Pumps	8
1.24	Emergency Sewage Storage and Return Pumping	Emergency Sewage Return Pumps	3
1.25	Emergency Sewage Storage and Return Pumping	Emergency Inlet Manual Screen	1

Emergency Overflow/ Balancing Facility and Associated Works

- Construction of a 16 ML/day emergency overflow/balancing facility, configured within the available site area as a longer and shallower facility with a maximum depth of 4.5 m.
- Excavation, earthworks, shaping, compaction and disposal or reuse of excavated material associated with construction of the emergency overflow/balancing facility.
- Construction of the required inlet, outlet, overflow, screening, access and associated hydraulic structures.
- Construction of a 1.0 m wide reinforced-concrete apron around the entire perimeter of the emergency overflow/balancing facility.
- Provision of a 10 mm manual screen and facilities for interception and removal of screenings, grit, sand and debris before wastewater enters the facility.
- Construction and installation of the gravity pipeline arrangement from the inlet works to the emergency overflow/balancing facility. The balancing facility shall be excavated to the required formation level to provide the necessary hydraulic gradient for gravity conveyance from the inlet works, taking account of the existing treatment works levels.

- Construction of an emergency return pump station serving the emergency overflow/balancing facility.
- Supply, installation, testing and commissioning of three Heavy-Duty, Solid Handling, Self-Priming Centrifugal Sewage Pump fitted with approximately 55 kW motors, configured as two duty and one standby (2D + 1S).

Supply, Delivery, Installation, Testing and Commissioning of Heavy-Duty Self-Priming Centrifugal Sewage Pump Sets

Supply, deliver, offload, install, align, test and commission three (3) complete heavy-duty, horizontal, self-priming, solids-handling centrifugal sewage pump sets, each designed to deliver a minimum of 150 l/s at 12 m total dynamic head.

Each pump shall have a nominal 400mm suction and 350 mm discharge connection, or an approved alternative connection arrangement, and shall be capable of passing spherical solids of at least 76 mm diameter.

The pumps shall be suitable for above-ground dry installation and continuous or intermittent operation while handling untreated municipal wastewater containing grit, suspended solids and fibrous material.

Each pump set shall include a heavy-duty cast iron casing, non-clogging impeller, replaceable wear components, corrosion-resistant shaft, mechanical seal, bearings, suitably rated 400 V three-phase electric motor, transmission arrangement, rigid steel baseplate, mechanical guards, anchor bolts and all necessary accessories.

The complete pumping installation shall comprise two duty pumps and one standby pump, providing a combined firm pumping capacity of 300 l/s at the approved operating conditions.

The rate shall include factory testing, delivery, installation, alignment, integration with the specified electrical and control systems, site commissioning, operating documentation, training and all associated works required to provide a complete and operational pumping installation.

The Contractor shall submit certified hydraulic performance curves, motor power calculations, NPSH assessments, equipment data sheets and general arrangement drawings for approval before procurement.

- Supply and installation of associated suction and discharge pipework, bends, fittings, dismantling joints, non-return valves, isolation valves, supports, chambers and all ancillary mechanical equipment required for a complete pumping installation.
- Installation of the emergency return rising main from the overflow/balancing facility to the designated treatment process, including all associated fittings, valves, thrust restraint, chambers, bedding, backfilling and connections.

Activated Sludge Reactors and Aeration Systems

- Dismantling and removal of existing defective or redundant aeration equipment, including motors, gearboxes, shafts and associated equipment, and transportation to the designated municipal storage area where required.
- Supply, installation, testing and commissioning of six (6) 5m/s slow-speed vertical aerators rated at approximately 37 kW at 45rpm each.
- Supply, installation, testing and commissioning of two (2) 5m/s slow-speed vertical aerators rated at approximately 55 kW at 37rpm each.
- Dismantling and removal or storage of existing defective horizontal brush aerators as specified.
- Supply, installation, testing and commissioning of two (2) horizontal brush aerators rated at approximately 37 kW each.
- Dismantling and removal or storage of existing defective mixers.
- Supply, installation, testing and commissioning of new 5.5 kW mixers, including motors, mounting arrangements, supports, cabling and controls.
- Refurbishment of the old and new activated sludge reactor systems, including all associated mechanical, electrical and control equipment included in the Contract.
- Removal of accumulated grit, sludge and debris where required to permit inspection, refurbishment and reinstatement of process equipment.
- Cleaning and unblocking of existing process pipelines, including the feed pipelines between the old reactor and its associated secondary clarifiers.

Secondary Clarifiers

General

The Contractor shall undertake the complete mechanical, structural and associated electrical refurbishment of the existing secondary clarifiers at Bethlehem Wastewater Treatment Works (WWTW).

The purpose of the refurbishment is to restore the clarifiers to a safe, reliable and fully operational condition, ensuring effective separation of activated sludge from treated wastewater, continuous sludge collection, efficient sludge withdrawal and satisfactory operation of the rotating bridge mechanisms.

The refurbishment shall include inspection, dismantling, cleaning, repair, replacement, installation, alignment, corrosion protection, testing and commissioning of the existing clarifier components as specified herein and indicated on the approved drawings and Bill of Quantities.

The works shall be undertaken while maintaining the operational continuity of the wastewater treatment facility.

Extent of Refurbishment

The refurbishment shall include, but shall not necessarily be limited to, the following:

- Isolation and decommissioning of the designated clarifier.

- Removal of accumulated sludge, grit and debris.
- High-pressure cleaning of the clarifier.
- Inspection and assessment of the existing reinforced concrete structure.
- Removal of corroded centre columns and associated components.
- Supply and installation of new stainless steel centre columns.
- Refurbishment of the existing rotating bridge structures.
- Replacement or refurbishment of the clarifier drive mechanisms.
- Replacement of worn drive wheels, guide wheels and bearings.
- Refurbishment of sludge scraper arms and scraper blades.
- Refurbishment of sludge withdrawal systems.
- Cleaning and unblocking of sludge and feed pipelines.
- Modification of sludge withdrawal openings where specified.
- Refurbishment of peripheral weirs, scum baffles and associated components where scheduled.
- Repair of damaged concrete and equipment anchorage.
- Surface preparation and corrosion protection.
- Replacement of defective electrical cables, local controls and motor protection equipment where scheduled.
- Reinstallation and precision alignment of mechanical equipment.
- Dry and wet commissioning, performance verification and handover.

The Contractor shall verify the dimensions and mechanical configuration of each clarifier before manufacturing or ordering replacement components.

Existing Clarifier Arrangement

General Description

The Bethlehem WWTW incorporates circular secondary clarifiers used for separating activated sludge from treated wastewater.

The existing clarifiers have nominal diameters of approximately 18.5 m and 19.5 m, depending on the particular unit.

The Contractor shall undertake a detailed site survey to confirm the dimensions and existing mechanical configuration of each clarifier included in the refurbishment contract.

Existing Equipment

The existing clarifiers generally comprise:

- Circular reinforced concrete tanks.
- Central feed and sludge withdrawal arrangements.
- Rotating bridge structures.
- Peripheral bridge support and drive wheels.
- Electric geared motor drive systems.
- Sludge scraper arms and scraper blades.
- Central sludge collection and withdrawal arrangements.

- Peripheral effluent collection launders and weirs.
- Scum baffles and associated scum removal arrangements.
- Electrical power and control systems.

The Contractor shall not assume that all clarifiers are mechanically identical.

Initial Inspection and Condition Assessment

General

Before commencing refurbishment, the Contractor shall conduct a comprehensive condition assessment of each designated clarifier.

The assessment shall establish the condition of all existing components and identify any defects that could affect safe operation, mechanical performance or the effectiveness of sludge removal.

Inspection Requirements

The inspection shall include:

Structural components

- Reinforced concrete tank walls.
- Tank floor and sludge collection zones.
- Central concrete supports and foundations.
- Bridge support points.
- Peripheral running surfaces.
- Existing anchor bolts and embedded plates.
- Concrete cracking, spalling and reinforcement corrosion.

Mechanical components

- Rotating bridge structural members.
- Centre columns.
- Drive assemblies.
- Gearboxes and electric motors.
- Drive wheels and guide wheels.
- Bearings and shafts.
- Sludge scraper arms.
- Scraper blades.
- Sludge withdrawal pipes.
- Scum removal equipment.
- Existing valves and mechanical connections.

Electrical components

- Motor supply cables.
- Local isolators.
- Motor starters.
- Protection devices.
- Cable routing arrangements.
- Electrical Earthing and bonding.

- Control and fault indication.

Condition Assessment Report

The Contractor shall submit a condition assessment report containing:

- Identification of the clarifier inspected.
- Photographic records of existing conditions.
- Measurements of critical components.
- Identification of structural and mechanical defects.
- Assessment of corrosion and deterioration.
- Components proposed for refurbishment.
- Components requiring replacement.
- Proposed repair methodology.
- Required lifting and access arrangements.
- Recommendations for ensuring reliable long-term operation.

The Contractor shall obtain approval before proceeding with repairs or replacement works that are not already defined in the approved scope.

Isolation, Dewatering and Cleaning

Clarifier Isolation

The Contractor shall isolate the designated clarifier from the incoming wastewater and sludge systems before commencing refurbishment.

Isolation shall include the relevant inlet and outlet arrangements, sludge withdrawal connections and electrical equipment.

The Contractor shall coordinate all isolation activities with the Municipality's operational personnel.

Sludge Removal

The Contractor shall provide suitable temporary sludge pumps, hoses and associated equipment for removing accumulated sludge.

Pumps shall be capable of handling activated sludge containing grit and suspended solids.

Sludge shall be conveyed to the designated sludge handling facility or another approved receiving point.

Vacuum Tanker Operations

Vacuum tanker trucks shall be provided where required to remove residual sludge, grit and settled debris.

The Contractor shall ensure that tankers are suitable for sewage sludge handling and that removed material is transported to an approved receiving or disposal facility.

High-Pressure Cleaning

The clarifier shall be thoroughly cleaned using high-pressure water jetting and other suitable cleaning methods.

Cleaning shall include:

- Tank floor.
- Tank walls.
- Central column and feed arrangement.
- Sludge withdrawal openings.
- Sludge scraper assemblies.
- Peripheral launders.
- Effluent weirs.
- Scum baffles.
- Bridge support surfaces.
- Associated pipework.

Cleaning pressures shall be selected to avoid damage to concrete, protective coatings, seals and retained mechanical equipment.

Final Cleaning Inspection

After cleaning, the Contractor shall arrange an inspection with the Engineer.

The clarifier shall not proceed to structural or mechanical refurbishment until the relevant surfaces and components are sufficiently clean for inspection.

Removal of Existing Rotating Bridge Assembly

General

The Contractor shall carefully dismantle and remove the existing rotating bridge assembly where required to facilitate replacement of the centre column and refurbishment of the mechanical components.

Lifting Methodology

The Contractor shall submit a detailed lifting method statement before bridge removal.

The method statement shall include:

- Estimated mass of the bridge assembly.
- Position of lifting points.
- Crane selection and lifting capacity.
- Rigging arrangements.
- Crane positioning and ground-bearing assessment.
- Temporary supports.
- Sequence of dismantling.
- Protection of existing structures.
- Personnel safety arrangements.

Mobile Crane

A mobile crane of suitable capacity shall be provided for the removal and subsequent reinstatement of the bridge assembly.

All lifting equipment shall have valid inspection and certification records.

Lifting operations shall be supervised by competent personnel.

Temporary Storage

Removed bridge assemblies shall be placed on suitable temporary supports.

The supports shall prevent bending, twisting or damage to the structural members.

Components shall be identified and protected against damage during storage.

Replacement of Existing Centre Columns

General

The Contractor shall remove the existing deteriorated or corroded centre columns and replace them with new fabricated stainless steel centre columns.

The replacement columns shall be compatible with the existing clarifier structure, rotating bridge arrangement and sludge withdrawal system.

Material Specification

The replacement centre columns shall be manufactured from Grade 316 stainless steel, with a minimum nominal wall thickness of 8 mm, subject to structural verification and approved fabrication drawings.

The material shall be suitable for continuous exposure to municipal wastewater and activated sludge.

The Contractor shall provide material certificates confirming the stainless steel grade and plate or pipe thickness.

Design Requirements

The centre columns shall be designed to accommodate:

- Static loading from supported equipment.
- Operating loads from the rotating bridge.
- Mechanical torque and associated reactions.
- Hydraulic loading.
- Sludge withdrawal requirements.
- Vibration and fatigue effects.
- Maintenance and lifting loads where applicable.

The final dimensions and wall thickness shall be verified by the responsible designer.

Fabrication

Centre columns shall be fabricated using approved stainless steel welding procedures.

Fabrication shall include:

1. Main column shell.
2. Base flange.
3. Top connection flange.
4. Sludge withdrawal openings.
5. Required pipe connections.
6. Support brackets.
7. Fixing arrangements.
8. Necessary stiffeners and reinforcement.

Welds shall be continuous and suitable for the required structural and hydraulic duty.

Welding Requirements

Welding shall be undertaken by qualified welders using procedures appropriate for Grade 316 stainless steel.

Welded joints shall be inspected for defects.

Where specified by the approved inspection plan, non-destructive testing shall be undertaken.

Welded surfaces shall be cleaned, pickled or passivated as appropriate to restore corrosion resistance.

Removal of Existing Centre Columns

The Contractor shall carefully remove existing centre columns without damaging retained concrete foundations or adjacent mechanical components.

Existing anchor bolts, flanges and connections shall be inspected.

Defective anchor arrangements shall be repaired or replaced as specified.

Installation

New centre columns shall be installed vertically and aligned with the clarifier's rotational axis.

The Contractor shall verify:

- Centre column verticality.
- Base flange alignment.
- Top connection alignment.
- Anchor bolt positioning.
- Sludge withdrawal pipe alignment.
- Bridge mounting compatibility.

Final alignment measurements shall be recorded.

Testing

The installed centre column shall be inspected for dimensional accuracy, structural stability and connection integrity.

Sludge withdrawal connections shall be tested for leakage where applicable.

Refurbishment of Rotating Clarifier Bridges

General

Existing rotating bridge assemblies shall be refurbished to restore structural integrity and reliable rotational operation.

Structural Inspection

The Contractor shall inspect all bridge members for:

- Corrosion.
- Loss of section thickness.
- Cracks.
- Fatigue damage.
- Deformation.
- Defective welded joints.
- Loose or missing fasteners.
- Damaged connections.

Structural Repairs

Defective structural members shall be repaired or replaced in accordance with approved structural details.

Where steel members have experienced significant section loss, the Contractor shall submit proposed repair details for approval.

Surface Preparation

All carbon steel surfaces requiring recoating shall be prepared using an approved method suitable for the specified protective coating system.

Where abrasive blasting is specified, the surface preparation grade and surface profile shall comply with the coating manufacturer's requirements.

Corrosion Protection

The bridge shall receive an approved multi-coat corrosion protection system suitable for the wastewater treatment environment.

The coating system shall include compatible primer, intermediate and finishing coats as required.

The Contractor shall submit coating data sheets and demonstrate compliance with the specified dry-film thickness.

Bridge Reinstallation

Following refurbishment, the bridge shall be reinstalled using approved lifting procedures.

The Contractor shall verify:

- Correct bridge elevation.
- Central alignment.
- Peripheral wheel contact.
- Structural clearances.
- Correct connection to the centre column.
- Unrestricted rotational movement.

Refurbishment and Replacement of Clarifier Drive Mechanisms

General

The Contractor shall refurbish or replace existing clarifier drive mechanisms as scheduled.

The drive system shall provide reliable continuous rotation of the bridge under normal sludge loading conditions.

Drive Motor

The drive motor shall be suitable for continuous industrial operation.

Where the existing nominal motor rating is approximately 0.5 kW, the Contractor shall verify that the selected motor and gearbox combination provides adequate operating torque for the clarifier mechanism.

Motor selection shall be based on actual mechanical loading and not solely on the rating of the existing motor.

Gearbox

The gearbox shall be selected to provide the required output speed and torque.

It shall be suitable for continuous operation and the anticipated mechanical loading.

The gearbox shall include appropriate bearings, seals and lubrication arrangements.

Drive Assembly

The complete drive assembly shall include:

- Electric motor.
- Reduction gearbox.
- Drive shaft.
- Flexible or rigid coupling as appropriate.
- Mounting base.
- Bearings.
- Mechanical guards.
- Required fixing components.

Drive Wheel Replacement

Existing worn or damaged drive wheels shall be replaced with new wheels compatible with the clarifier's peripheral running surface.

The Contractor shall verify wheel diameter, profile, material, load capacity and mounting dimensions before procurement.

Guide Wheels

Guide wheels shall be inspected and replaced where defective.

The guide arrangement shall maintain the correct bridge position without imposing excessive lateral forces.

Bearings

New bearings shall be installed where scheduled.

Bearings shall be suitable for the operating loads, rotational speeds and environmental conditions.

Bearing housings shall be correctly aligned and secured.

Alignment

The drive motor, gearbox, drive shaft and wheels shall be aligned in accordance with the manufacturer's requirements.

The Contractor shall ensure that the bridge rotates without binding, excessive vibration or abnormal mechanical loading.

Overload Protection

The drive system shall incorporate suitable overload protection.

Where torque-limiting devices or overload switches are provided, they shall be tested during commissioning.

Sludge Scraper Arms and Blades

General

The Contractor shall inspect and refurbish the sludge scraper arms and blades.

The system shall collect settled sludge from the clarifier floor and direct it towards the designated sludge withdrawal arrangement.

Scraper Arm Inspection

Scraper arms shall be inspected for corrosion, deformation, loose connections and mechanical damage.

Defective components shall be repaired or replaced.

Scraper Blades

Existing scraper blades shall be inspected for wear and damage.

Replacement blades shall be compatible with the existing scraper system and suitable for wastewater service.

Blade Adjustment

Scraper blades shall be adjusted to maintain the required clearance from the clarifier floor.

The Contractor shall verify the floor profile and ensure that the blades do not scrape or damage the concrete surface.

Functional Testing

The scraper system shall be observed during bridge rotation to verify correct operation and absence of mechanical interference.

Sludge Withdrawal System

General

The Contractor shall inspect, clean, refurbish and modify the sludge withdrawal system as scheduled.

Existing Sludge Withdrawal Openings

Existing withdrawal openings shall be inspected for blockage, corrosion and structural deterioration.

Blocked openings shall be cleaned using suitable methods.

Additional Sludge Withdrawal Openings

Where scheduled, the Contractor shall provide three additional sludge withdrawal openings at each designated centre-column/base arrangement.

The location and diameter of each opening shall be confirmed on approved drawings before drilling or fabrication.

Drilling and Coring

Drilling or coring shall be undertaken using suitable equipment.

The Contractor shall avoid damaging existing reinforcement and structural components.

Where openings penetrate concrete, the structural implications shall be assessed and approved.

Stainless Steel Sleeves

Where required, stainless steel sleeves shall be installed to provide durable and watertight connections.

Sleeves shall be compatible with the centre column and associated pipework.

Sealing

Penetrations shall be sealed using approved wastewater-resistant sealing systems.

The completed connections shall be inspected and tested for leakage.

Sludge Withdrawal Testing

The Contractor shall demonstrate satisfactory sludge withdrawal through the refurbished system during wet commissioning.

Cleaning and Unblocking of Existing Feed Pipelines

General

Existing clarifier feed pipelines shall be cleaned and unblocked where scheduled.

Cleaning Methods

Cleaning may include:

- High-pressure water jetting.
- Mechanical rodding.
- Removal of accumulated solids.
- Vacuum extraction.
- Removal of roots or other obstructions.
- CCTV inspection where specified.

Protection of Existing Pipelines

Cleaning methods shall be selected to prevent damage to existing pipes, joints and structures.

The Contractor shall report any evidence of collapsed pipes, severe corrosion or structural defects.

Verification

The Contractor shall verify that the pipeline is free from significant obstruction and capable of conveying the required flow.

Refurbishment of Effluent Weirs and Scum Removal Arrangements

Effluent Weirs

Where included in the scheduled works, existing effluent weirs shall be cleaned and inspected.

Damaged or misaligned weir plates shall be repaired or replaced.

The weirs shall be adjusted to achieve uniform effluent collection around the clarifier perimeter.

Scum Baffles

Scum baffles shall be inspected for corrosion, deformation and damaged supports.

Defective sections shall be repaired or replaced where scheduled.

Scum Removal Equipment

Existing scum removal mechanisms shall be inspected and refurbished where specified.

The completed system shall provide reliable removal of floating material without excessive carryover into the effluent launders.

Civil and Structural Repairs

General

Concrete repairs shall be undertaken where deterioration affects the integrity, durability or operation of the clarifier.

Concrete Defects

The Contractor shall inspect for:

- Cracking.
- Spalling.
- Delamination.
- Exposed reinforcement.
- Reinforcement corrosion.
- Joint deterioration.
- Leakage.
- Damage around equipment anchors.

Concrete Repair Procedure

Defective concrete shall be removed to sound material.

Exposed reinforcement shall be cleaned and assessed.

Replacement reinforcement shall be installed where required by the approved structural repair design.

Repair mortar or concrete shall be compatible with the existing structure and wastewater exposure.

Equipment Anchors

Existing anchor bolts shall be inspected for corrosion, looseness and damage.

Replacement anchors shall be designed for the applicable mechanical loads.

Water tightness

Repaired structural joints and penetrations shall be tested for leakage where applicable.

Electrical Refurbishment

General

Electrical refurbishment shall include the scheduled repairs and replacement of power supply and control components associated with the clarifier drives.

Electric Motors

Motors shall be inspected and tested.

Testing shall include insulation resistance, winding condition where appropriate, bearing condition, rotation and operating current.

Electrical Cables

Defective cables shall be replaced using cables suitable for the installation environment.

Cable routing shall accommodate the movement of the rotating bridge.

Local Isolators

Suitable local electrical isolation facilities shall be provided.

Isolators shall be clearly labelled and accessible.

Motor Protection

Motor protection shall include overload and short-circuit protection and other protective functions required by the approved electrical design.

Control System

Where scheduled, the clarifier drive shall be integrated with the existing MCC or PLC control system.

The control system shall provide the specified operating status, fault indication and control functions.

Earthing

All relevant metallic structures and electrical equipment shall be bonded and earthed in accordance with the approved electrical design.

Electrical Testing

Electrical installations shall be inspected and tested before energisation.

The required electrical test records and certificates shall be submitted.

Mechanical Installation and Alignment

General

All refurbished mechanical components shall be installed to the manufacturer's tolerances and approved drawings.

Alignment Requirements

The Contractor shall verify:

- Centre column verticality.
- Bridge alignment.
- Gearbox alignment.
- Drive wheel position.
- Guide wheel position.
- Scraper blade clearance.
- Shaft and coupling alignment.
- Mechanical clearances.

Fasteners

All fasteners shall be suitable for the applicable loads and corrosive environment.

Fasteners shall be tightened to the specified torque.

Lubrication

Bearings and gearboxes shall be lubricated using approved products.

Lubrication points shall be accessible for maintenance.

Testing and Commissioning

General

The Contractor shall undertake complete testing and commissioning of each refurbished clarifier.

Testing shall be witnessed by the Engineer or designated representative where required by the approved inspection and test plan.

Pre-Commissioning Inspection

The Contractor shall verify:

1. Completion of mechanical installation.
2. Completion of structural repairs.
3. Correct equipment alignment.
4. Correct lubrication.

5. Tightness of fasteners.
6. Correct electrical connections.
7. Operation of safety devices.
8. Completion of corrosion protection.
9. Removal of construction debris.
10. Availability of operating instructions.

Dry Commissioning

Where mechanically permissible, the clarifier shall be operated without wastewater to verify rotational movement and mechanical operation.

The Contractor shall ensure that dry running does not damage equipment requiring lubrication, submergence or other operating conditions.

Bridge Rotation Test

The bridge shall be operated through sufficient complete revolutions to verify reliable operation.

The Contractor shall monitor:

- Motor current.
- Gearbox temperature.
- Mechanical vibration.
- Wheel movement.
- Scraper clearance.
- Abnormal noise.
- Mechanical interference.
- Drive stability.

Wet Commissioning

The clarifier shall be filled and returned to service under controlled conditions.

The Contractor shall verify:

- Correct hydraulic flow distribution.
- Stable bridge rotation.
- Satisfactory sludge collection.
- Effective sludge withdrawal.
- Correct operation of the scum removal system.
- Uniform effluent discharge over the weirs.
- Absence of significant leakage.
- Correct electrical and control operation.

Performance Verification

The Contractor shall demonstrate that the refurbished clarifier operates reliably under representative plant conditions.

Performance acceptance shall be based on the approved design and commissioning criteria, including mechanical reliability, sludge withdrawal and effluent collection.

The Contractor shall not be held to an undefined effluent-quality guarantee that depends on upstream biological treatment performance unless such a guarantee is expressly specified in the Contract.

Quality Assurance and Inspection

Inspection and Test Plan

The Contractor shall submit an inspection and test plan identifying the required inspections, tests, acceptance criteria and hold points.

Mandatory Inspection Stages

The inspection plan shall include:

- Initial condition assessment.
- Completion of sludge removal and cleaning.
- Inspection of the existing centre-column foundation.
- Inspection of fabricated stainless steel centre columns.
- Inspection of structural bridge repairs.
- Inspection of corrosion protection.
- Inspection of installed drive assemblies.
- Mechanical alignment.
- Electrical testing.
- Dry commissioning.
- Wet commissioning.
- Final acceptance inspection.

Non-Conforming Work

Any work that fails to meet the approved specifications shall be corrected and retested.

The Contractor shall maintain records of all non-conformances and corrective actions.

Occupational Health and Safety

General

The Contractor shall comply with applicable occupational health and safety legislation and the approved project-specific Health and Safety Plan.

Confined Spaces

Clarifier entry shall be controlled through an approved confined-space entry procedure where the work area meets the applicable confined-space criteria.

Atmospheric testing, ventilation, isolation and rescue arrangements shall be provided as required.

Lifting Operations

All crane and lifting operations shall be undertaken using approved lifting plans and certified equipment.

Working at Heights

Personnel working on clarifier bridges, platforms and elevated structures shall be protected against falls.

Biological Hazards

Personnel shall be provided with suitable protective equipment and hygiene facilities for wastewater exposure.

Electrical Safety

Electrical isolation and lockout procedures shall be implemented before work on electrical equipment.

Environmental Management

The Contractor shall prevent uncontrolled discharge of sludge, wastewater, oils, lubricants and other contaminants.

Waste materials shall be segregated and disposed of at approved facilities.

Temporary sludge handling and cleaning activities shall be undertaken using arrangements that prevent contamination of adjacent land and storm water systems.

Documentation and Handover

Operation and Maintenance Manuals

The Contractor shall provide complete O and M documentation for all refurbished or replacement equipment.

As-Built Drawings

As-built drawings shall identify the final configuration of the refurbished clarifier, including replacement centre columns, sludge withdrawal modifications, electrical arrangements and mechanical components.

Test Certificates

The Contractor shall submit:

- Material certificates for stainless steel components.
- Welding inspection records.
- Mechanical alignment records.
- Electrical test reports.
- Coating inspection records.
- Equipment commissioning reports.
- Relevant lifting equipment certification.
- Manufacturer's warranties.

Operator Training

The Contractor shall provide practical training covering operation, routine maintenance, lubrication, troubleshooting, safe isolation and emergency procedures.

Final Acceptance

The refurbished clarifier shall be accepted only after successful completion of the required inspections, testing, commissioning and documentation.

Measurement and Payment

Measurement and payment shall be in accordance with the approved BOQ and Conditions of Contract.

Where activities are separately scheduled, they shall be measured under the corresponding payment provisions.

The Contractor shall not be entitled to separate payment for incidental work already included in an applicable BOQ rate.

Any additional work arising from previously concealed defects shall be dealt with through the contractual instruction and compensation-event procedures before execution, except where immediate action is necessary to address an emergency under the Contract.

RAS, WAS and Sludge Handling Systems

- Refurbishment and reinstatement of the existing Return Activated Sludge (RAS) and Waste Activated Sludge (WAS) pumping systems.
- Supply, installation, testing and commissioning of 37 kW RAS pumps, together with associated pipework, valves, electrical equipment and controls, as scheduled in the Bill of Quantities.
- Supply, installation, testing and commissioning of 3 kW WAS pumps and associated equipment as specified.
- Supply, installation, testing and commissioning of 37 kW WAS pumps serving the Green Lands/sludge handling system, where specified.
- Cleaning and rehabilitation of the existing sludge digesters, including removal of accumulated sludge, grit and debris necessary for the refurbishment works.
- Refurbishment and reinstatement of sludge transfer infrastructure and connections to the existing sludge drying beds.

Biological Filters and Humus Tanks

- Refurbishment of the existing biological filter system and associated mechanical equipment.

- Inspection, repair and refurbishment of the biological filter distributor mechanisms and associated rotating equipment where included in the Contract.
- Refurbishment of the existing humus tanks and associated equipment.
- Removal and replacement of defective or corroded humus tank valves and associated fittings.
- Cleaning, unblocking and reinstatement of associated process pipelines where required.

Process Pumps and Pipelines

- Supply, installation, testing and commissioning of the process pumping equipment identified in the Contract, including pumps of the specified duty.
- Installation of new process pipelines required for conveyance of wastewater between the inlet pump stations, activated sludge reactors, SBR system and associated process units, as indicated on the Contract Drawings.
- Installation of the specified steel and mPVC pipelines, including excavation, bedding, laying, jointing, backfilling, compaction, thrust restraint, fittings and connections to existing infrastructure.
- Construction of valve chambers and installation of isolation and non-return valves necessary for safe operation and maintenance of the new pipelines.
- Identification, protection and support of existing underground and above-ground municipal services affected by the Works.

Electrical, MCC, Instrumentation and Control Works

- Removal, refurbishment or replacement of existing defective electrical installations associated with the equipment included under the Contract.
- Supply, installation, testing and commissioning of new Motor Control Centres (MCCs) for the new and refurbished aerators, mixers, pumps and other process equipment.
- Provision of motor starters, protection devices, isolators, surge protection, control equipment and all necessary MCC components appropriate to the respective motor ratings.
- Supply and installation of all required power and control cables from the MCCs to the respective equipment, including cable terminations, glands, ferrules, labels, joints and accessories.

- Supply and installation of suitably sized cable trays, supports and protective systems, including lockable covers where specified.
- Installation of local control stations and remote start/stop controls for aerators, mixers, pumps and other equipment as required.
- Supply, installation, testing and commissioning of a PLC-based process control system, including integration of the equipment included under this Contract.
- Provision of process instrumentation, including dissolved oxygen sensors, suspended solids measurement, sump and pump-station level instrumentation, flow measurement and other instruments specified in the Drawings and Bill of Quantities.
- Provision of high-level and low-level controls and appropriate pump interlocks for pump stations and sumps.
- Testing of all electrical installations, including insulation resistance, earth continuity, protection settings, phase rotation, motor rotation, functional testing and verification of control logic before commissioning.

Civil and Structural Rehabilitation

- Execution of all civil and structural works required to support the mechanical and electrical refurbishment.
- Breakout and removal of defective concrete at identified equipment support structures and aerator platforms.
- Cleaning and treatment of exposed reinforcement and replacement or supplementation of reinforcement where required.
- Application of approved bonding agents and repair materials.
- Structural repair using specified high-strength repair mortar and non-shrink grout.
- Construction and modification of equipment plinths, bases, supports, chambers, access structures and other reinforced-concrete works required for the new equipment.
- Provision or refurbishment of access platforms, walkways, ladders, handrails, guards and other safety-related infrastructure required for safe operation and maintenance.

Testing, Commissioning and Handover

- Pre-commissioning inspection and testing of all refurbished and newly installed civil, mechanical, electrical, instrumentation and control systems.
- Dry and wet commissioning of pumps, aerators, mixers, clarifier drives, valves, instrumentation, MCCs, PLC controls and associated process equipment.
- Integration and functional testing of mechanical, electrical and control systems to demonstrate safe, reliable and coordinated operation.
- Rectification of all defects identified during testing and commissioning prior to Practical Completion.

- Demonstration of equipment operation and provision of appropriate training and familiarisation to Dihlabeng Local Municipality's operating and maintenance personnel.
- Submission of complete operation and maintenance manuals, equipment schedules, OEM documentation, warranties, commissioning records, test certificates, PLC documentation, approved shop drawings and as-built drawings.
- Final cleaning of the Works, removal of temporary works, construction waste, redundant materials and equipment, and reinstatement of areas affected by construction.
- Handover of a fully refurbished, tested, commissioned and operational wastewater treatment installation in accordance with the Contract Documents, approved drawings, specifications and Bill of Quantities.

The above scope shall be read together with the Contract Drawings, Technical Specifications and Bill of Quantities. The Contractor shall provide all labour, supervision, plant, equipment, materials, temporary works and incidental items necessary to complete the Works, whether or not every minor component required for a complete and operational installation is individually described above.

3.3 PROJECT STAGES AND DELIVERABLES

3.4.1 Project Stages

The project stages are as follows:

a) Appointment of the Contractor by the Client
b) Submission of contractual obligations by the Contractor (performance bond etc)
c) Signing of the Contact document between the Contractor and the Client
d) Site Handover to the Contractor by the Client
e) Site Establishment by the Contractor
f) Construction works by the Contractor
g) Snag listing
h) Testing and commissioning of all civil works constructions, refurbished and installed mechanical and electrical equipment.
i) Issuing of practical completion certificate to the Contractor by the Client
j) Issuing of completion certificate to the Contractor by the Client
k) Site de-establishment by the Contractor.

The successful tenderer will be requested to deliver the following:

3.4.2 Project Deliverables

a) All Contractual Obligations
b) Signed Contract
c) Project Implementation plan
d) Site assessment report
e) Quality Control Plan (QCP)
f) Monthly Progress Reports
g) Monthly Site Meetings Agenda, Minutes and Arrange Site Visits for Relevant Stakeholders
h) Supply, deliver, replace and commission mechanical and electrical works.
i) Service and commission electrical and mechanical works.
j) Test results and certificates for installed equipment
k) As-built drawings including locality drawings.
l) Surveys and other required studies
m) Fully functional plant with all installed and serviced equipment commissioned.
n) Warranty and guarantee certificates for installed infrastructure.
o) Health and Safety (OHSA, 2003) and Environmental Management (NEMA, 2003) related documentation and project records.
p) Close Out Report, O and M Manual.

3.4.5. SPECIFICATIONS

3.4.5.1. General

The Works comprise the refurbishment, replacement, installation, testing and commissioning of civil, structural, mechanical, electrical, instrumentation and control infrastructure at the Bethlehem Wastewater Treatment Works.

All equipment supplied under this Contract shall be new, unused and suitable for continuous wastewater-treatment duty, except where the Bill of Quantities specifically requires refurbishment of existing equipment.

The Contractor shall verify all dimensions, levels, existing services, equipment interfaces, cable routes, pipe routes and connection points on site before manufacture or procurement.

No discrepancy between the drawings, BOQ, specification or actual site conditions shall be resolved by assumption. Any discrepancy shall immediately be referred to the Engineer for instruction.

Equipment shall be selected for:

- continuous operation in a wastewater environment;
- high humidity and corrosive atmospheric conditions;
- ease of operation and maintenance;
- availability of spares and technical support in South Africa;
- interchangeability of commonly replaced components wherever practical;
- safe isolation and maintenance;
- minimum whole-life operating cost; and
- compatibility with the existing and proposed electrical and process infrastructure.

The project includes new MCCs, refurbishment of existing MCCs, and replacement of damaged power and control cables, instrumentation, local control stations and PLC-based control.

3.4.5.2. Preliminaries and General Requirements

The Contractor shall provide all temporary and permanent resources necessary for execution of the Works, including site establishment, supervision, security, temporary services, health and safety facilities, environmental controls, temporary access, lifting equipment, bypass arrangements and protection of existing municipal infrastructure.

The Contractor shall prepare and submit, where applicable:

- construction programme;
- project-specific Health and Safety Plan;
- Environmental Management Plan implementation procedures;
- quality control plan;
- inspection and test plans;
- construction method statements;
- bypass and temporary pumping method statements;
- lifting plans;
- confined-space procedures;
- electrical switching and isolation procedures;
- commissioning plan;
- equipment schedules;
- shop drawings;
- manufacturer's data sheets;
- factory test certificates;

- material certificates;
- commissioning certificates;
- training programme;
- operation and maintenance manuals; and
- As-built drawings.

The treatment works shall remain operational as far as reasonably practicable throughout construction. Shutdowns shall therefore be coordinated with the Employer and Engineer and shall not proceed without written authorisation.

The Contractor shall sequence the works so that treatment capacity is not unnecessarily compromised.

3.4.5.2.1. Contractual establishment and obligations

The Contractor shall undertake all contractual establishment activities, including provision of guarantees, insurances, statutory registrations, permits, notifications, project administration and other obligations required by the Conditions of Contract.

Fixed-charge obligations shall include initial establishment and mobilisation, while time-related obligations shall include continued administration, supervision and maintenance of the site establishment for the construction period.

3.4.5.2.2. Engineer's facilities

The Contractor shall provide and maintain the Engineer's facilities as scheduled, including:

Project name board: Supply and erect the project identification board to the approved drawing and Employer's requirements. The board shall be mounted on durable, adequately founded supports, positioned for visibility and maintained in a clean and legible condition throughout construction.

Office accommodation: Provide suitable, secure, weatherproof office accommodation, including appropriate furniture, lighting, ventilation, electrical outlets, and access and cleaning arrangements. The office shall remain functional throughout the required period.

Mobile communication devices: Provide the specified communication equipment, activation, and connectivity and associated accessories, subject to the Engineer's approval and the contract's ownership and handover provisions.

Laptop computer and printer: Supply equipment meeting the approved hardware and software specifications, including operating systems, required applications, printer consumables, configuration and technical support. Ownership and handover shall follow the contract requirements.

Carports: Construct or install suitable vehicle shelters with stable foundations, adequate vehicle clearances and appropriate storm water drainage.

Survey equipment: Provide the required calibrated surveying equipment, accessories and competent operators. Maintain calibration records and ensure equipment remains available when required.

Percentage mark-ups shall apply only to the expressly identified underlying expenditure and shall not be duplicated elsewhere.

3.4.5.2.3. Contractor's facilities

The Contractor shall establish and maintain offices, storage sheds, workshops, laboratories where required, ablutions, toilets, personnel welfare facilities, tool stores and secure equipment compounds.

Facilities shall include suitable water supply, electricity, communications, lighting, ventilation, fire protection, waste collection and site drainage.

Chemical products, fuels, oils and hazardous substances shall be stored in suitably labelled and bonded areas with spill-response equipment.

3.4.5.2.4. Health and safety

Before commencing work, the Contractor shall prepare a project-specific health and safety file, risk assessments, safe work procedures and emergency response plan.

The health and safety arrangements shall specifically address:

- Working in and around operational sewage treatment units.
- Exposure to pathogens, aerosols and potentially hazardous gases.
- Confined-space entry into digesters, chambers, sumps and tanks.
- Electrical isolation and lockout/tag out.
- Lifting operations involving aerators, mixers, clarifier bridges and pumps.
- Work at height, open tanks and unprotected water edges.
- Excavations, buried services and unstable ground.

- Hot work, welding and cutting.
- Handling and disposal of sewage sludge.
- Operation of construction machinery.
- Emergency rescue and evacuation.

All personnel shall receive induction and task-specific training. Appropriate personal protective equipment shall be provided, maintained and used.

Where communicable-disease controls are required by the contract or applicable law, the Contractor shall incorporate them into the health and safety arrangements.

The health and safety file shall be updated throughout construction and handed over on completion, including statutory appointments, inspection registers, incident records, permits, training records and completion certificates.

3.4.5.2.5. Construction supervision and time-related obligations

The Contractor shall provide competent construction management, site supervision, discipline-specific artisans, quality personnel and health and safety supervision for the full duration of the works.

Time-related obligations shall include maintaining the site establishment, site security, sanitation, communications, environmental controls, temporary services, access arrangements, site administration and head-office support.

Any extension of time or adjustment of time-related charges shall be governed by the Conditions of Contract.

3.4.5.2.6. Existing services

Before excavation or demolition, the Contractor shall obtain available service drawings, inspect the site, locate services and undertake trial excavations where necessary.

Existing water mains, sewer lines, electrical cables, control cables, communication infrastructure and process pipelines shall be protected against damage.

No service shall be disconnected, relocated or altered without written authorisation.

Where service relocation is required, the Contractor shall submit a method statement, provide temporary continuity arrangements and coordinate shutdowns with the Municipality.

3.4.5.2.7. Surface water and groundwater control

The Contractor shall keep all work areas, excavations, trenches and foundations sufficiently dry to permit safe and satisfactory construction.

Temporary diversion drains, bunds, sumps, pumps and discharge arrangements shall be provided as necessary.

Dewatering shall not cause instability, erosion, settlement, pollution or damage to adjacent structures.

3.4.5.2.8. Access road maintenance

Existing access roads used by construction traffic shall be maintained in a safe and trafficable condition.

The Contractor shall repair construction-related damage, control dust and mud, maintain drainage, provide traffic signs and keep access available for municipal operations and emergency vehicles.

3.4.5.2.9. Day works

Day works shall be undertaken only when authorised in writing by the Engineer.

The Contractor shall provide appropriately qualified labour and the scheduled construction plant, including tipper trucks, light delivery vehicles, water tankers, loaders, crane trucks, vacuum tankers, excavators, tractor-loader-backhoes, rollers, plate compactors, rammers, concrete mixers, compressors and dewatering pumps.

Plant shall be mechanically sound, licensed where applicable and operated by competent personnel.

Day work records shall identify personnel, plant type, working hours, materials, location, activity and authorising instruction. Records shall be submitted for verification in accordance with the contract.

3.4.5.2.10. Materials, testing and provisional sums

Materials procured under instructed day works shall be supported by delivery notes, invoices and evidence of incorporation into the works.

Independent testing shall be carried out by suitably competent laboratories where required. Testing may include soil density, concrete strength, reinforcement, welding, coating thickness, electrical performance and equipment commissioning.

Provisional sums shall be expended only following written instruction. Contractor's mark-ups shall be limited to the allowances expressly provided in the contract.

3.4.5.3 Site clearance, demolition and preparation

3.4.5.3.1. Clearing and grubbing

The Contractor shall clear vegetation, grass, shrubs, roots, stumps, rubbish and other obstructions from designated construction areas.

Clearing shall extend only to approved limits. Trees and vegetation identified for retention shall be protected.

Organic material shall not be incorporated into engineered fills or pipe bedding.

3.4.5.3.2. Removal of fences and hedges

Existing fences, posts, gates, wire mesh and hedges obstructing construction shall be carefully removed.

Reusable materials shall be cleaned, sorted, labelled and delivered to the Employer's designated storage area. Unusable materials shall be disposed of lawfully.

Temporary fencing or barriers shall be installed wherever removal compromises site security or public safety.

3.4.5.3.3. Demolition of structures

Demolition shall include the controlled breaking and removal of designated concrete foundations, slabs, walls, brickwork, manholes and associated structures.

Before demolition, the Contractor shall verify the structural stability of adjacent infrastructure and isolate all affected services.

Demolition shall be carried out using methods that prevent damage to structures intended to remain.

Exposed reinforcement shall be cut back or protected as directed, and retained surfaces shall be repaired to a sound condition.

3.4.5.3.4. Removal of existing pipes and cables

Existing pipes and cables, including those within the scheduled 50-500 mm pipe-diameter range, shall be positively identified and isolated before removal.

Removal shall include cutting, dismantling, lifting, handling, transport and disposal or delivery to municipal storage as directed.

Open pipe ends shall be temporarily sealed to prevent uncontrolled discharge or entry of debris.

3.4.5.3.5. Disposal of demolition waste

All waste shall be classified, separated and transported to an appropriately authorised disposal or recovery facility approved by the Engineer.

The Contractor shall provide disposal receipts or waste manifests when requested.

No construction debris, sludge or contaminated material shall be buried on site without specific lawful authorisation.

3.4.5.3.6. Top soiling

Topsoil shall be stripped from designated areas, stockpiled separately and protected against erosion and contamination.

Following completion of construction, approved topsoil shall be spread to the specified thickness over disturbed areas, graded to prevent ponding and prepared for reinstatement or revegetation.

3.4.5.4. Emergency overflow and balancing system

3.4.5.4.1. General description

The emergency overflow and balancing system shall provide temporary storage of incoming wastewater during treatment-process interruptions, hydraulic surges or other operating conditions requiring controlled diversion.

The system shall comprise a nominal 16 000m^3 balancing dam, gravity diversion arrangements with a difference of around 0,9m in height between inlet works and balancing dam, screening facilities, a low-level outlet, shallow suction sump, sewage return pump station, discharge pipeline, electrical equipment, instrumentation and automatic controls.

The Contractor shall ensure that the completed system is hydraulically integrated with the existing inlet works and can be operated without causing uncontrolled wastewater discharge.

3.4.5.4.2. Design verification and setting out

The BOQ identifies an approximate balancing dam footprint of 40 m × 135 m and a maximum overall excavation depth of 4.0 m.

The stated footprint and depth do not, by themselves, establish a usable storage volume of 16 ML. Even a rectangular excavation with vertical sides and these nominal dimensions would provide only 21,600 m^3 of gross geometric volume before accounting for side slopes, freeboard, operating levels and other losses.

Before construction, the Engineer shall approve a detailed stage–storage relationship demonstrating the required effective storage capacity.

The verification shall include:

- Existing ground levels and available land.
- Dam floor level and maximum excavation depth.

- Side-slope geometry and stability.
- Normal maximum operating water level.
- Required freeboard.
- Low-level outlet and sump geometry.
- Inlet and outlet hydraulic levels.
- Allowance for sediment accumulation where specified.
- Liner anchorage and perimeter access requirements.

The Contractor shall not alter the approved dam geometry without written instruction.

3.4.5.4.3. Bulk excavation

The Contractor shall excavate the dam to the approved lines, levels and slopes.

Excavation shall include removal of soil, shaping of the floor and side slopes, formation of berms and access areas, loading, haulage and disposal or reuse of suitable excavated material.

Excavation methods shall prevent instability and damage to nearby structures, pipelines and services.

The Contractor shall continuously assess ground conditions and notify the Engineer of unexpected weak ground, seepage, rock or other conditions affecting the approved design.

3.4.5.4.4. Excavation in hard material

Hard material and rock excavation shall be undertaken only where encountered and confirmed in accordance with the contract's classification and measurement requirements.

The Contractor shall submit an appropriate excavation method statement, including controls for vibration, flying debris and protection of nearby infrastructure.

Blasting shall not be permitted without the required approvals and an accepted blasting plan.

3.4.5.4.5. Subgrade preparation and compaction

Following excavation, the dam floor and side slopes shall be trimmed to smooth, uniform surfaces.

Loose material, roots, sharp stones and other objects capable of damaging the liner shall be removed.

The subgrade shall be moisture-conditioned and compacted to the density specified in the approved design and applicable earthworks requirements.

Soft or unsuitable areas shall be excavated and replaced with approved material.

The Engineer shall inspect and accept the formation before protective geotextile or geomembrane installation.

3.4.5.4.6. Selected G5 material

Selected G5 material shall be supplied, placed and compacted where required for formation correction, local filling, berm construction and other approved earthworks.

Material shall comply with the specified grading and quality requirements.

Placement shall be undertaken in controlled layers, with moisture conditioning and compaction testing.

No material containing sharp objects or oversized particles shall be placed directly against the geomembrane protection system.

3.4.5.4.7. Geomembrane anchor trenches

Anchor trenches shall be excavated around the perimeter of the dam to the approved dimensions.

The trench arrangement shall provide adequate resistance to liner pullout, wind uplift and movement associated with operating water levels.

The liner shall be placed into the anchor trenches without excessive tension or sharp folds.

Backfilling shall use approved material compacted carefully to avoid puncturing or displacing the liner.

3.4.5.4.8. Protective geotextile underlay

The Contractor shall supply and install a protective geotextile over the accepted dam formation.

The geotextile shall be suitable for use beneath a wastewater containment geomembrane and shall provide adequate puncture protection.

The material shall be supplied in rolls with manufacturer's identification and technical certification.

Installation shall ensure continuous coverage of the dam floor and slopes, including overlaps, transitions and protection around penetrations.

The geotextile shall be free of tears, excessive wrinkles and contamination before the geomembrane is installed.

3.4.5.4.9. PVC geomembrane lining

The Contractor shall supply and install a minimum 1.5 mm thick PVC geomembrane suitable for continuous contact with municipal wastewater.

The geomembrane shall have documented resistance to chemical exposure, biological degradation, weathering and the anticipated operating conditions.

The Contractor shall submit manufacturer's test certificates covering thickness, tensile properties, elongation, tear resistance, puncture resistance and durability.

Installation shall include:

1. Preparation and inspection of the underlying geotextile.
2. Placement of geomembrane panels in accordance with an approved layout.
3. Allowance for thermal movement and settlement.
4. Welding of adjoining sheets using an approved method.
5. Trial welds before production welding.
6. Inspection and testing of seams.
7. Repair of defects, punctures and failed welds.
8. Formation of watertight pipe penetrations.
9. Installation and securing within anchor trenches.
10. Final integrity inspection and certification.

All seams shall be tested using a suitable method for the selected welding system. Test records shall identify seam locations, test results and repairs.

No wastewater shall be introduced until the liner installation has been accepted.

3.4.5.4.10. Storm water diversion

Clean storm water shall be diverted away from the balancing dam by suitably graded berms and channels.

The diversion system shall prevent unnecessary storm water entry, erosion of the dam perimeter and damage to the liner anchorage.

Channels and berms shall be shaped to discharge storm water safely without causing flooding or erosion of adjacent infrastructure.

3.4.5.4.11. Reinforced concrete perimeter apron

A reinforced concrete apron shall be constructed around the dam perimeter.

The apron shall be 1.0 m wide and 150 mm thick, using 30 MPa concrete, unless amended by the approved structural drawings.

The apron shall be laid to falls away from the dam to prevent surface water entering the containment area.

Construction shall include excavation and formation preparation, formwork, concrete placement, compaction, finishing, curing and provision of movement or construction joints.

The apron shall be finished to provide a durable, slip-resistant maintenance surface.

3.4.5.4.12. Reinforcement to concrete apron

High-tensile reinforcement steel shall comply with the approved reinforcement schedule.

Bars shall be cut, bent, positioned and securely fixed using approved chairs and spacers to maintain the specified concrete cover.

Reinforcement shall be free of loose rust, oil, mud and other substances that impair bonding.

The Engineer shall inspect reinforcement and formwork before concrete placement.

3.4.5.5. Emergency gravity diversion and screening

3.4.5.5.1. Diversion structure at existing inlet works

A reinforced concrete receiving and diversion structure shall be constructed at the existing inlet works.

The structure shall allow wastewater to be diverted to the emergency balancing system under controlled operating conditions.

The Contractor shall verify existing invert levels, hydraulic conditions and available connection points before construction.

The structure shall include suitable flow-control provisions, watertight pipe penetrations, access arrangements and connections to the existing works.

All tie-ins shall be undertaken during approved shutdown windows.

3.4.5.5.2. Emergency inlet and screen channel

The emergency inlet channel shall be constructed from reinforced concrete, with a nominal internal width of 1.0 m, subject to the approved hydraulic design.

The channel shall include suitable inlet and outlet transitions, adequate freeboard, a stable floor gradient and provisions for access and cleaning.

Concrete surfaces exposed to sewage shall be dense, durable and suitably finished to minimise debris accumulation.

3.4.5.5.3. Reinforcement and water-retaining concrete

Reinforcement to the diversion structure and screen channel shall be installed in accordance with approved structural drawings.

Concrete shall be designed and constructed for wastewater exposure and the anticipated hydraulic and structural loads.

Construction joints and penetrations shall be detailed to prevent leakage.

Where water stops are required, they shall be continuous, securely fixed and compatible with the joint arrangement.

3.4.5.5.4. Stainless steel manual bar screen

A manually cleaned coarse bar screen shall be installed in the emergency screening channel.

The screen shall have approximately 10 mm clear bar spacing and shall be manufactured from stainless steel suitable for wastewater exposure.

The screen shall comprise rigid bars, supporting frame, anchorage and lifting or removal arrangements where required.

The screen shall withstand the anticipated hydraulic loading and accumulated screenings without unacceptable deformation.

The Contractor shall provide a suitable manual cleaning rake and arrangements for safe collection and removal of screenings.

3.4.5.5.5. Access platform, grating and handrails

The screen-cleaning platform shall provide safe access for operators.

The platform shall incorporate corrosion-resistant structural supports, non-slip grating, toe plates and handrails.

Grating shall be removable where necessary for maintenance and shall be securely fixed against displacement.

The platform and associated structural elements shall be designed for the applicable operational and maintenance loads.

3.4.5.5.6. DN1000 gravity diversion pipeline

The Contractor shall supply and install a nominal DN1000 gravity sewer pipeline connecting the diversion structure to the balancing dam.

The pipe material and stiffness or pressure classification shall comply with the approved pipeline design and procurement specification.

The works shall include trench excavation, bedding, pipe laying, jointing, fittings, alignment, backfilling and testing.

The pipeline shall be installed to the approved gradient and invert levels to ensure gravity conveyance.

All changes in direction and connections shall be constructed to minimise hydraulic losses and the risk of blockage.

3.4.5.5.7. Inspection and cleaning access

Inspection and cleaning access structures shall be provided at designated changes in direction and other critical locations.

Structures shall be watertight and suitable for the applicable burial depth, groundwater conditions and maintenance requirements.

Access openings shall be fitted with appropriate covers and lifting arrangements.

3.4.5.5.8. Testing and commissioning

Before commissioning, the diversion pipeline and associated structures shall be cleaned and inspected.

The Contractor shall verify invert levels, flow direction, joint integrity and operation of the diversion controls.

A controlled wet test shall demonstrate that wastewater can enter the balancing dam without unacceptable leakage, surcharge or uncontrolled overflow.

3.4.5.6. Low-level outlet and suction sump

3.4.5.6.1. Excavation and formation

The Contractor shall excavate for the elongated suction sump and connecting works.

The sump excavation depth shall not exceed 4.0 m below local formation level, as specified, unless the Engineer issues a revised approved design.

Excavations shall be adequately supported and dewatered.

The formation shall be inspected before blinding or structural concrete is placed.

3.4.5.6.2. Reinforced concrete suction sump

The sump shall be constructed from reinforced concrete designed to withstand groundwater pressure, wastewater pressure, and soil loading and operational loads.

The internal arrangement shall accommodate three independent suction branches serving the return pumps.

The sump floor shall be benched and graded to minimise stagnant zones and solids accumulation.

The sump shall provide sufficient hydraulic submergence and approach conditions to minimise vortex formation and air entrainment.

3.4.5.6.3. Reinforcement, joints and water stops

Reinforcement shall be installed to the approved bar bending schedules.

Water stops shall be provided at specified construction and movement joints.

Pipe penetrations shall incorporate suitable puddle flanges, sealing systems or other approved watertight details.

All joints shall be inspected before concrete placement or concealment.

3.4.5.6.4. DN1000 low-level connection

An approximately DN1000 gravity connection shall convey wastewater from the balancing dam to the suction sump.

The connection shall incorporate a watertight transition through the geomembrane lining.

The penetration detail shall prevent leakage behind the liner and accommodate differential movement between the pipe, concrete structure and earthworks.

3.4.5.6.5. Access and confined-space safety

The sump shall include access covers, handrails and suitable arrangements for inspection, cleaning and maintenance.

Access covers shall be designed for the anticipated loading and shall be secured against unauthorised entry.

Confined-space warning signs shall be installed.

Entry shall be controlled by a permit-to-work system, atmospheric testing, ventilation and rescue arrangements.

3.4.5.7. Emergency sewage return pump station

3.4.5.7.1. General arrangement

The return pump station shall comprise three Heavy-Duty, Solid Handling, Self-Priming Centrifugal Sewage Pumpself-priming centrifugal sewage pumps, arranged as two duty pumps and one standby pump.

Each pump shall be selected for an approximate duty of 150 l/s at 12 m total dynamic head, subject to the approved final hydraulic calculations and manufacturer's performance curves.

The pump installation shall be capable of transferring stored wastewater back to the existing treatment works under controlled operating conditions.

3.4.5.7.2. Pump supply

Each pump set shall include:

- Heavy-Duty, Solid Handling, Self-Priming Centrifugal Sewage Pump or the specified approved equivalent.
- Approximately 55 kW electric motor, subject to verified absorbed power and duty.
- Pump casing, impeller, shaft and bearing assemblies.
- Suitable mechanical sealing arrangements.
- Coupling and coupling guard.
- Baseplate and anchor bolts.
- Required priming and venting arrangements.
- Lubrication and maintenance accessories.
- Manufacturer's operating and maintenance documentation.

The pump shall be suitable for raw sewage containing suspended solids and grit within the manufacturer's published operating limits.

The Contractor shall submit performance curves showing flow, head, efficiency, power consumption and operating range.

3.4.5.7.3. Installation and alignment

Pumps shall be installed on approved foundations and base arrangements.

The Contractor shall verify foundation levels, anchor positions and suction/discharge alignment.

Pumps and motors shall be aligned to the manufacturer's tolerances.

Pipework shall be independently supported so that excessive loads are not transmitted to pump nozzles.

3.4.5.7.4. Anti-vibration mounting

Suitable anti-vibration mounts shall be provided where required by the approved equipment design.

Mounts shall be selected for the installed mass, operating frequency and dynamic loads.

The installation shall prevent excessive vibration transmission to the pump house and connected pipework.

3.4.5.7.5 Suction pipework

Each pump shall be provided with an independent suction pipeline connected to the common suction sump of the emergency wastewater return pumping station. The suction pipework shall be designed, manufactured, installed and tested to ensure reliable conveyance of untreated municipal wastewater containing suspended solids, grit and fibrous materials, without excessive hydraulic losses, air entrainment, sediment deposition or cavitation.

a) Suction pipe diameter and design velocity

The suction pipework shall be hydraulically designed to accommodate the specified duty flow of 150 l/s (0.150 m^3/s) per pump.

The design velocity within each suction pipeline shall preferably be maintained between 0.8 m/s and 1.5 m/s, with a target operating velocity of approximately 1.0–1.2 m/s, subject to verification of solids transport, available suction head and the pump manufacturer's requirements.

The suction velocity shall not exceed 1.5 m/s at the specified duty point, unless a higher velocity is supported by hydraulic calculations and approved by the Engineer.

For the proposed nominal 450 mm suction pipeline, assuming an actual internal diameter of 450 mm:

The calculated suction velocity of approximately 0.94 m/s is within the specified design range and is acceptable as a preliminary hydraulic design value.

The Contractor shall confirm the actual internal diameter of the selected pipe and recalculate the operating velocity before procurement.

b) Suction pipeline configuration

The suction pipeline shall incorporate the specified nominal pipe diameter, long-radius bends, and flanges, dismantling joints, supports and associated fittings.

The pipeline shall be designed to minimise friction losses, local hydraulic disturbances and the accumulation of solids.

The following requirements shall apply:

- Each pump shall have a dedicated suction connection to the common suction sump.
- Suction pipework shall be as short and direct as reasonably practicable.

- Long-radius bends shall be used wherever possible, with a preferred centreline bend radius of not less than 1.5 times the pipe diameter.
- Sudden changes in pipe diameter and unnecessary bends shall be avoided.
- Where reducers are required on horizontal suction pipelines, eccentric reducers shall be installed with the flat side uppermost to minimise air-pocket formation.
- The suction pipeline shall be adequately supported to prevent the transmission of excessive loads to the pump suction flange.
- The suction arrangement shall be designed to prevent vortex formation and air entrainment at the sump intake.
- The Contractor shall verify the minimum required suction submergence at the lowest permissible operating water level.
- The pipeline shall incorporate suitable isolation and maintenance provisions without creating unnecessary hydraulic restrictions.
- Suction piping shall be configured to minimise solids deposition during intermittent pumping. Where low-velocity sections cannot be avoided, suitable flushing or cleaning provisions shall be included.
    - Net Positive Suction Head (NPSH) requirements
    -

For preliminary design assessment, an illustrative NPSHa of 5.68 m has been calculated using assumed site conditions. This value shall not be treated as a guaranteed minimum or as a substitute for the PSP's detailed hydraulic calculations.

The final pump selection shall satisfy the required NPSH margin at the governing operating conditions and shall be submitted to the Engineer for approval before procurement.

d) Self-priming requirements

Where self-priming centrifugal sewage pumps are specified, the PSP shall verify that the selected pumps can prime and re-prime under the actual site conditions.

The PSP shall confirm:

- Maximum permissible suction lift.
- Maximum permissible priming lift.
- Suction pipeline length and diameter.
- Priming time under the specified operating conditions.
- Minimum sump operating level.
- Air evacuation requirements.
- Pump manufacturer's installation requirements.
- Available NPSH during normal operation.

The pump shall be capable of achieving the specified duty without cavitation, loss of prime, excessive vibration or unacceptable reduction in hydraulic performance.

Self-priming capability shall not be considered a substitute for compliance with the NPSH requirements.

e) Hydraulic calculations and design submissions

Before procurement and installation, the contractor shall submit a complete suction hydraulic design report for review and approval by the Engineer.

Confirmation of compliance with the specified pump duty of 150 l/s at 12 m total dynamic head.

No pump or suction pipeline shall be approved for installation until the Engineer has reviewed the hydraulic calculations and confirmed compliance with the specified requirements.

f) Inspection, testing and commissioning

Following installation, the Contractor shall inspect and test the suction pipeline for mechanical integrity, leakage and correct alignment.

During commissioning, the Contractor shall verify pump priming, suction pressure, flow rate, operating stability, vibration and the absence of observable cavitation-related operating problems.

Any deficiencies arising from incorrect suction design, installation or equipment selection shall be rectified before acceptance.

3.4.5.7.6. Discharge pipework and valves

Each pump discharge branch shall incorporate a suitable non-return valve, isolation valve, dismantling joint and required fittings.

Non-return valves shall prevent reverse flow when pumps stop.

Isolation valves shall permit maintenance without dismantling the entire manifold.

Valves shall be accessible and suitable for sewage service.

3.4.5.7.7. Common discharge manifold and return rising main

Pump discharges shall connect to a common manifold and return rising main.

The manifold shall include a downstream main isolation valve and appropriate supports, restraints and access arrangements.

The return main shall connect to the existing WWTW inlet works at the approved location.

The Contractor shall verify the hydraulic capacity of the return pipeline under the intended two-pump operating condition.

Pressure Pipework Testing

All newly installed pressure pipework associated with the emergency return pumping station at Bethlehem Wastewater Treatment Works shall be subjected to hydrostatic pressure testing before commissioning.

Testing shall comply with the applicable requirements of SANS 2001-DP2 (Medium-Pressure Pipelines), where applicable to the pipeline classification and installation, and the relevant provisions of SANS 1200 L (Medium-Pressure Pipelines) where incorporated into the Contract. The Contractor shall also comply with the pipe manufacturer's requirements and the approved project-specific testing procedure.

a) Test preparation

Before testing, the Contractor shall ensure that:

- All pipes, fittings, flanges, valves and joints have been installed and inspected.
- Pipe supports, thrust restraints and anchorages are complete and capable of resisting the test loads.
- Equipment that cannot withstand the specified test pressure has been isolated or removed.
- The pipeline has been filled gradually with clean water, and all trapped air has been expelled through suitable venting points.
- Pressure gauges are calibrated and have an appropriate measurement range.
- The test section is isolated and secured against unauthorised access.

b) Hydrostatic test pressure

The hydrostatic test pressure shall be determined in accordance with the applicable SANS requirements, the pipeline design pressure, pipe pressure class, maximum anticipated operating pressure and the pressure ratings of the installed components.

For preliminary tender purposes, the Contractor shall allow for a test pressure of 1.5 times the maximum design operating pressure, subject to confirmation against the governing SANS requirements and the rated capacity of the weakest component in the test section.

The final test pressure shall be approved by the Engineer before testing. The test pressure shall not exceed the allowable pressure of any component or cause unacceptable loading of the pipework or its restraints.

c) Test duration and procedure

The pipeline shall be pressurised gradually to the approved test pressure using a suitable hydrostatic test pump.

After stabilisation and completion of the applicable conditioning procedure, the Contractor shall undertake the specified pressure and leakage test.

For tender pricing, the Contractor shall allow for a minimum 60-minute test observation period, unless a different duration or procedure is prescribed by the applicable SANS standard for the particular pipeline material and test method.

The Contractor shall record:

- Initial and final test pressure.
- Test duration.

- Water temperature, where relevant.
- Pressure changes during the test.
- Quantity of water added to maintain pressure, where applicable.
- Visible leakage or other defects.

d) Acceptance criteria

The pipeline shall be considered acceptable only where:

- No visible leakage occurs at pipe joints, flanges, fittings or valves.
- No structural deformation, movement or failure occurs.
- Pipe supports, restraints and anchorages remain secure.
- The measured pressure loss or water make-up quantity satisfies the acceptance criteria prescribed by the applicable SANS test method.
- No other defects affecting the integrity of the pipeline are identified.

A zero-pressure-drop criterion shall not automatically be applied to every pipe material, as some pipeline materials exhibit pressure changes associated with elastic or viscoelastic behaviour.

e) Rectification and retesting

Any pipeline section failing the prescribed test shall be depressurised, inspected and repaired at the Contractor's expense where the failure is attributable to the Contractor's work.

The affected section shall be retested until the specified acceptance criteria are achieved.

f) Test records

The Contractor shall submit a hydrostatic pressure test certificate for each test section, indicating the pipeline identification, pipe material, diameter, pressure class, test pressure, test duration, measured results and acceptance status.

All testing shall be witnessed by the Engineer or the Engineer's authorised representative, where designated as a hold point in the approved Inspection and Test Plan.

No pressure pipeline shall be placed into permanent operation before successful testing and acceptance.

3.4.5.7.8. Pump platform

The pump platform shall include reinforced concrete foundations, floor slab.

The floor shall be graded towards a suitable wash-down or drainage sump.

3.4.5.7.9. Lifting beam and chain hoist

A permanent overhead lifting beam and 1-tonne electrical chain hoist shall be provided.

The beam, supports, anchors and hoist shall be designed and certified for the approved safe working load of 1-tonne.

The Contractor shall perform the required inspections and load testing and provide certification before handover.

3.4.5.7.10. Pump station MCC and VSDs

A dedicated motor control centre shall be provided for the return pump station.

The MCC shall include an appropriately rated incomer, protective devices, control equipment, motor feeders and spare capacity.

Each 55 kW pump motor shall have a suitable feeder with motor protection and local/remote control.

The pump station MCC shall comply with the MCC requirements of clause 3.4.5.12.2 (SANS 61439-1 and SANS 61439-2). The incomer rating, fault level and point of supply shall be confirmed in the approved electrical design.

3.4.5.7.11. Level and flow instrumentation

Continuous level measurement shall be installed in the suction sump.

The system shall provide high, low and low-low level indications and alarms.

The balancing dam shall have independent level measurement and a high-high emergency alarm.

A flow meter shall be installed on the return pumping system to measure transferred wastewater volumes.

Instrumentation shall be suitable for the operating environment and accessible for maintenance.

3.4.5.7.12. Pump control and sequencing

The PLC shall provide automatic pump sequencing, duty rotation and standby selection.

Control logic shall include:

- Automatic start and stop based on approved level set points.
- Duty pump alternation.
- Automatic standby pump availability.
- High-level alarms.
- Low-level and low-low-level protection.

- Pump failure detection.
- Motor overload and VSD fault monitoring.
- Emergency stop functions.
- Local and remote operating modes.
- Flow and operating-hour recording.
- Interlocks to prevent returning wastewater at a rate exceeding available treatment capacity.

The control system shall not automatically start the standby pump in a manner that defeats the approved two-duty/one-standby philosophy.

3.4.5.7.13. Telemetry and SCADA interface

The Contractor shall provide PLC communications hardware and an interface for integration with the existing WWTW control system.

3.4.5.7.14. Lighting and safety equipment

The pump station shall be provided with suitable area lighting, emergency lighting, warning signs and electrical hazard identification.

Lighting shall permit safe operation and maintenance during night-time and emergency conditions.

Illuminance levels shall comply with SANS 10114-1, emergency lighting with SANS 10114-2 and luminaires with SANS 60598 (minimum IP65 outdoors). The pump house installation shall comply with SANS 10142-1 and be covered by the Certificate of Compliance.

3.4.5.7.15. Integrated commissioning

The complete system shall undergo integrated wet commissioning.

The Contractor shall demonstrate diversion, balancing, suction sump operation, pump starting, sequencing, standby changeover, level alarms, flow measurement, MCC operation, PLC functionality and treatment-capacity interlocks.

Commissioning records shall include measured flow rates, pump operating conditions, electrical readings and control-system test results.

3.4.5.8. Rehabilitation of the existing old biological reactor

3.4.5.8.1. General

The works on the old biological reactor shall include removal of existing mechanical equipment, structural rehabilitation, installation of replacement aeration and mixing equipment, refurbishment of sludge pumping systems, replacement or refurbishment of gates and valves, installation of a new MCC, instrumentation, PLC and SCADA integration, and refurbishment of the MCC building.

All work shall be coordinated with the Municipality to maintain the required wastewater treatment operations.

3.4.5.8.2. Isolation and removal of vertical surface aerators

Before dismantling, the Contractor shall isolate and lock out all electrical and mechanical energy sources.

Existing low-speed vertical surface aerators shall be dismantled, including motors, gearboxes, flexible couplings, hollow shafts, impellers, baseplates, anti-vibration pads, fixings and associated accessories.

Equipment shall be lifted using certified lifting arrangements that prevent damage to the reactor structure.

Removed components shall be inspected, labelled and recorded.

Items designated for municipal retention shall be transported to the Employer's designated storage facility, safely offloaded and stored in an orderly manner.

3.4.5.8.3. Removal of horizontal brush aerators

Existing horizontal brush aerators shall be isolated and dismantled.

Removal shall include motors, gearboxes, rotor shafts, bearings, bearing housings, couplings, splash guards, mounting brackets and associated accessories.

The Contractor shall provide temporary supports and suitable lifting arrangements to prevent damage to the reactor walls and support structures.

All equipment shall be handled and delivered to municipal storage or disposed of as directed.

3.4.5.8.4. Removal of existing mixers

Existing 5.5 kW mixers shall be electrically isolated, dismantled and removed.

Removal shall include motors, gearboxes, shafts, impellers, support frames, baseplates, bearings, couplings and accessories.

Equipment shall be protected against damage during lifting and transport.

3.4.5.8.5. Structural rehabilitation

The Contractor shall inspect the existing concrete support structures, aerator plinths, beams, slabs, walls and equipment foundations after mechanical equipment has been removed.

Defective concrete shall be identified and marked for repair.

Repair works shall include, where applicable:

1. Removal of loose, cracked, delaminated and deteriorated concrete.
2. Cleaning and preparation of exposed concrete surfaces.
3. Exposure and inspection of corroded reinforcement.
4. Removal of corrosion products.
5. Installation of replacement reinforcement where required.
6. Application of approved reinforcement protection.
7. Reinstatement using compatible structural repair mortar or concrete.
8. Repair of cracks and damaged joints.
9. Levelling and rehabilitation of equipment mounting surfaces.
10. Installation of new anchor bolts, grout and anti-vibration pads.

Replacement reinforcement shall match the approved structural design.

Repair materials shall be suitable for the wastewater environment and compatible with the existing concrete.

Repairs shall be cured and inspected before installation of mechanical equipment.

3.4.5.8.6. Replacement 37 kW low-speed vertical surface aerators

The Contractor shall supply, install, test and commission complete 37 kW low-speed vertical surface aerator assemblies.

Each assembly shall include an electric motor, reduction gearbox, coupling, hollow shaft, impeller, support frame, mounting base, vibration isolation and associated fasteners.

The aerator shall be designed for continuous operation in activated sludge.

The Contractor shall submit:

- Manufacturer's oxygen transfer performance data.
- Impeller dimensions and operating speed.
- Motor and gearbox ratings.
- Gearbox service factor.
- Shaft and bearing details.
- Materials and corrosion protection.
- Equipment mass and support loading.
- Maintenance requirements.

The final impeller immersion and operating speed shall be determined from the approved process design and manufacturer's recommendations.

Aerators shall be installed to the approved alignment and elevation.

Commissioning shall verify rotation, current draw, vibration, gearbox temperature, operating speed, mixing performance and applicable process performance criteria.

3.4.5.8.7. Replacement 55 kW low-speed vertical surface aerators

Complete 55 kW low-speed vertical surface aerators shall be supplied and installed where scheduled.

The construction and performance requirements shall be equivalent to those specified for the 37 kW aerators, but equipment shall be rated for the specified 55 kW motor duty.

The Contractor shall confirm that the existing supporting structure can withstand the static, dynamic and operating loads.

Any required structural strengthening shall be completed before equipment installation.

The installed aerator shall operate without excessive vibration, cavitation, abnormal noise or gearbox overheating.

3.4.5.8.8. Replacement 37 kW horizontal brush aerators

The Contractor shall supply, install and commission complete 37 kW horizontal brush aerator assemblies.

Each assembly shall include a motor, gearbox, rotor shaft, brush elements, bearings, bearing housings, couplings, supports and guards.

The rotor shall be dynamically balanced and aligned.

Bearings shall be suitable for continuous-duty operation and protected against wastewater splash and corrosion.

The aerator shall be installed at the approved operating elevation and immersion depth.

Commissioning shall include verification of rotor speed, current draw, bearing temperature, vibration and satisfactory hydraulic operation.

3.4.5.8.9. Replacement 5.5 kW mixers

The Contractor shall supply and install complete 5.5 kW vertical-shaft mixer assemblies.

Each mixer shall comprise an electric motor, gearbox, shaft, impeller, support frame, bearings, seals, mounting arrangement and associated accessories.

The mixer shall be suitable for maintaining activated sludge solids in suspension under the specified operating conditions.

The final impeller diameter, rotational speed, mixing intensity and shaft arrangement shall be confirmed against the approved process design.

The Contractor shall verify the structural capacity of the supporting platform or mounting arrangement.

Commissioning shall include rotational direction, operating speed, vibration, motor loading and mixing performance.

3.4.5.9. Refurbishment of sludge pumping systems

3.4.5.9.1. General

The Contractor shall refurbish the existing RAS and WAS pumping systems serving the old and new biological reactors, including the WAS pumping arrangement conveying sludge towards the designated green-land/sludge handling area.

The refurbishment shall restore mechanical integrity, hydraulic performance, electrical reliability and maintainability.

Before dismantling, the Contractor shall inspect each pump installation and record its condition.

3.4.5.9.2. Pump dismantling and inspection

Existing pumps shall be isolated, drained and dismantled using appropriate lifting equipment.

The Contractor shall inspect the casing, impeller, shaft, bearings, wear rings, seals, gland arrangements, coupling and baseplate.

Worn or damaged components shall be identified and replaced or repaired in accordance with the approved refurbishment scope.

3.4.5.9.3. Mechanical refurbishment

Mechanical refurbishment shall include cleaning, repair or replacement of worn components, renewal of bearings and seals, reassembly, lubrication and alignment.

Pump casings and impellers shall be inspected for erosion, corrosion and excessive wear.

The Contractor shall restore the pump to a serviceable condition consistent with the manufacturer's tolerances and the approved performance requirements.

3.4.5.9.4. Motor refurbishment

The refurbishment includes motors rated at approximately 37 kW and 3 kW, as identified for the respective sludge pumping installations.

Motor refurbishment shall include inspection of stator windings, rotor, bearings, terminals, insulation, cooling arrangements and enclosure condition.

Required repairs shall include bearing replacement, winding repair or rewinding where approved, insulation treatment, cleaning and reassembly.

Each motor shall undergo insulation resistance, winding resistance and functional testing.

The Contractor shall provide a motor test report before reinstallation.

3.4.5.9.5. Pipework refurbishment

Associated suction and discharge pipework shall be inspected for blockage, corrosion, leakage and mechanical damage.

Defective sections, fittings, gaskets, bolts and supports shall be repaired or replaced as scheduled.

Pipework shall be cleaned and reassembled with suitable jointing materials.

Connections shall be aligned to prevent excessive nozzle loading.

3.4.5.9.6. Air release valves

New air-release valves shall be supplied and installed at the designated locations.

Valves shall be suitable for wastewater or sludge service and compatible with the operating pressure and pipe material.

The installation shall permit safe isolation, inspection and maintenance.

3.4.5.9.7. Pump alignment and testing

Refurbished pump and motor assemblies shall be aligned to the manufacturer's tolerances.

The Contractor shall verify:

- Correct rotation.
- Motor current and voltage.
- Pump discharge pressure.
- Flow performance where measurable.
- Bearing temperature.
- Vibration.
- Seal leakage.
- Operation of isolation and non-return valves.
- Automatic and manual control functions.

3.4.5.9.8. Automatic submersible dewatering pump

The designated WAS pump station shall receive a complete 1.5 kW single-phase automatic submersible dewatering pump.

The pump shall be supplied with suitable lifting arrangements, electrical cable, automatic level control, discharge connection and accessories.

The pump shall be suitable for the anticipated sump liquid and solids conditions.

Automatic operation shall prevent excessive water accumulation while protecting the pump against dry running.

3.4.5.10. Sluice gates, isolation valves and reactor outlet penstocks

3.4.5.10.1. Refurbishment of existing sluice gates

Existing sluice gates between the anaerobic and aeration basins shall be inspected and refurbished.

Refurbishment shall include cleaning, removal of corrosion, and inspection of the gate leaf, frame, guides, spindle, spindle nut, seals, hand wheels and fixing arrangements.

Defective components shall be repaired or replaced.

The completed gate shall move freely throughout its operating travel and provide the required level of isolation.

3.4.5.10.2. Splitter-box isolation valves

Existing isolation valves controlling flow to the old and new reactors shall be refurbished.

The works shall include dismantling, cleaning, inspection, repair of sealing surfaces, replacement of worn components and reassembly.

Damaged rising spindles, spindle nuts, hand wheels and guides shall be replaced where scheduled.

The Contractor shall demonstrate smooth opening and closing, correct valve indication and acceptable sealing performance.

3.4.5.10.3. Stainless steel reactor outlet gates

The Contractor shall design, manufacture, supply and install the specified stainless steel reactor outlet penstock assemblies.

The scheduled gate dimensions are approximately 3.0 m long × 1.0 m high, subject to verification of the existing opening and approved fabrication drawings.

Gate leaves, frames and principal wetted components shall be manufactured from Grade 316 stainless steel.

Each gate shall include a rising spindle, operating hand wheel, spindle supports, guides, seals, frame, anchors and accessories.

The assembly shall be designed for the maximum differential water pressure and operating forces.

Gate frames shall be installed square and plumb, with suitable watertight anchorage to the existing structure.

Testing shall include full-stroke operation and leakage testing under representative hydraulic conditions.

3.4.5.11. Refurbishment of the new biological reactor

3.4.5.11.1. General

The new biological reactor shall be refurbished through removal, workshop rehabilitation, reinstallation and commissioning of existing mechanical equipment, together with refurbishment of RAS/WAS pumps, valves, electrical systems and instrumentation.

Equipment intended for refurbishment shall not be replaced without the required contractual authorisation.

3.4.5.11.2. Removal of vertical aerators and mixers

Existing 37 kW vertical surface aerators and 5.5 kW mixers shall be isolated, dismantled and removed for refurbishment.

All equipment shall be labelled to preserve identification and original installation locations.

Existing mounting structures shall be inspected before reinstallation.

3.4.5.11.3. Refurbishment of 37 kW vertical aerators

Refurbishment shall include inspection and overhaul of the 37 kW motor, gearbox, hollow shaft, impeller, bearings, couplings, mounting frame and anti-vibration components.

Worn bearings, seals, gaskets and other defective components shall be replaced.

Gearboxes shall be cleaned, inspected, reassembled and filled with the approved lubricant.

Motors shall undergo electrical testing and necessary repairs.

The refurbished assembly shall be balanced, aligned and reinstalled.

3.4.5.11.4. Refurbishment of 5.5 kW mixers

The existing 5.5 kW mixers shall be refurbished, including the motor, gearbox, vertical shaft, curved-blade turbine impeller, support structure and mounting components.

The Contractor shall inspect the shaft for bending, corrosion and wear.

Impellers shall be repaired or replaced where necessary to restore their original functional condition.

The refurbished mixer shall be tested before and after installation.

3.4.5.11.5. RAS/WAS and valve refurbishment

The new reactor's RAS and WAS pumps shall be refurbished in accordance with the sludge pump specifications above, including the relevant 37 kW and 3 kW motors, air-release valves and pipework.

The existing sluice gate between the anaerobic and aeration zones shall also be refurbished and functionally tested.

2. Motor Control Centres

MCC	Scope	Key requirements
Emergency return pump station MCC	New – design, manufacture, supply, install	Dedicated MCC with suitable incomer, protection and spare capacity; 3 × 55 kW VSD feeders with motor protection and local/remote control (BOQ 3.5.2). VSDs to provide adjustable accel/decel, minimum speed and motor protection.
Old Reactor MCC	New – design, supply, install, test, commission	Floor-standing Form 4 Type 2; 1,250 A ACB incomer; 65 kA fault rating; Type 1 + Type 2 surge protection; 1,250 A lockable isolator; copper busbars; multifunction energy analyser and harmonic analyser; anti-condensation heaters; thermostatic ventilation fans; internal LED lighting; lockable doors with interlocks; earth and neutral bars; 34 feeder spaces; 25% spare capacity.
New Reactor MCC	Existing – upgrade, test, recommission	Same specification as Old Reactor MCC. Contractor to inspect enclosure, busbars, incomer, feeders, wiring, protection and earthing; replace defective/non-compliant components; verify 1,250 A rating and suitability of retained components against the electrical design.

Design responsibility: the manufacturer must verify distribution capacity, short-circuit levels, earthing arrangements and available supply before finalising the design and issue shop drawings (GA Arrangement & Wiring Diagrams). Protective devices must be coordinated with connected equipment and fault level.

3. Motor Feeders

Each feeder includes MCCB, overload protection and PLC interface terminals; VSD and selector switch where noted.

Feeder	VSD	Old Reactor (4.15.2)	New Reactor (5.8.2)	Pump Stn (3.5.2)
55 kW (aerators / T10 return pumps)	Yes	2	–	3
37 kW (aerators, brush aerators, RAS, WAS-Green Lands)	Yes	12	8	–
5.5 kW mixers	Yes	8	6	–
3 kW WAS pumps	No	2	2	–
1.5 kW sump pump	No	1	1	–
0.5 kW clarifier drives	No	2	2	–
Spare feeder compartments	–	6	6	–
Total equipped feeders		27	19	3

4. Power Cabling and Cable Management

All power cables are Cu/PVC/SWA/PVC/1000V armoured, supplied, installed, glanded, terminated, identified, tested and commissioned.

Cable	Application	Old Reactor (m)	New Reactor (m)
4C × 50 mm²	MCC to 55 kW aerators	250	–
4C × 35 mm²	MCC to 37 kW motors (aerators, brush aerators, RAS, WAS-Green Lands)	1,200	1,200
4C × 6 mm²	MCC to mixers	1000	1000
4C × 6 mm²	MCC to WAS pumps	150	150
4C × 2.5 mm²	MCC to clarifier drives	300	300
3C × 4 mm²	MCC to sump pumps	150	150
600 mm HDG heavy-duty cable ladder	With supports, brackets, anchors	150	300

Cable	Application	Old Reactor (m)	New Reactor (m)
5 mm galvanised lockable anti-theft ladder covers	Tamper-proof fixings and hinges	150	300

- **Emergency pump station:** power and control cabling MCC to pump station equipment; HDG cable ladder/tray with lockable anti-theft covers.
- **Clarifier centre columns:** new flexible power/control cables routed through new centre columns to drive mechanisms, qty 2, accommodating bridge rotation without twisting or strain.
- **Cable sizing is not guaranteed:** the specification states scheduled sizes must be checked for load current, installation method, ambient temperature, grouping, volt drop, fault withstand and protection coordination (§3.4.5.12.6).
- Armouring bonded to earth; power and instrumentation cables segregated; manufacturer pulling tension and bending radius limits observed.

5. Local Operator Stations

Location	Old Reactor	New Reactor
Aerators	10	6
Mixers	8	6
Pumps	8	4
Clarifier drives	2	2
Total	28	18

Stations to include local/remote selection, start/stop, status indication and emergency stop, in enclosures suitable for wet, corrosive conditions, integrated with MCC and PLC without bypassing safety interlocks

6. Instrumentation

Instrument	Pump Stn	Old Reactor	New Reactor
Online dissolved oxygen (DO) sensor/transmitter	–	2	2
Online suspended solids / MLSS meter	–	2	2
Sump level switches (low stop, high start, high-high alarm)	–	6	6
Electromagnetic settled-sewage flow meter	–	1	1
Continuous suction-sump level transmitter (H, L, LL alarms)	1	–	–
Balancing-dam level + high-high emergency alarm	1	–	–
Return pumping flow meter	1	–	–
Screened instrument cable 2 pr × 1.5 mm² Cu SWA/PVC (m)	–	800	800
Instrument power supplies, surge protection, isolators	–	Sum	Sum

Calibration, loop checking and signal verification of all instruments is required, with signed calibration and loop-test records. MLSS readings must be verified against laboratory results during commissioning.

7. PLC, SCADA and Telemetry

7.1 Emergency return pump station

- PLC processor, I/O and communications hardware, integrated with the WWTW control system.
- Control logic: level-based start/stop, 2 Duty + 1 standby rotation, standby availability, high/low/low-low level protection, pump failure detection, overload and VSD fault monitoring, emergency stop, local/remote modes, flow and run-hour recording.
- Interlock to prevent return flow exceeding available treatment capacity; standby must not auto-start in a way that defeats the 2D+1S philosophy.
- Telemetry provision and interface for future SCADA integration.

7.2 Old and New Reactors

- Supply and install PLC processor, communication modules, I/O modules and Ethernet switches.
- Additional PLC modules: 3 × analogue input (DO, SS, flow) and 1 × digital input (sump level switches), per reactor.
- Modify PLC programme for DO, SS, sump alarms, flow readings, pump interlocks and alarm handling; incorporate all new equipment and process interlocks.
- SCADA: display DO, SS, sump levels, pump status, flow and totalised flow, alarms, trends and history; overview mimic and process screens; alarm setpoints (low/high DO, low/high SS, high and high-high sump, flow meter fault, comms failure); event logging, trending, reporting; energy monitoring dashboard.
- Deliverables: I/O schedule for approval, documented PLC software with backups, updated mimic screens and tag documentation.

8. Lighting, Earthing, Testing and Handover

- **Lighting (3.5.11):** area lighting, emergency lighting, safety and hazard signage at the emergency pump station.
- **Earthing:** bond all MCCs, trays, motors, instruments and metallic structures; verify earth continuity and protection operation; surge protection where specified.
- **Testing:** FAT and SAT; insulation resistance, earth continuity, phase rotation, protection settings, motor rotation and control-circuit verification; MCC, PLC and SCADA commissioning; integrated wet commissioning of the pump station.
- **Isolation:** lock-out/tag-out of all electrical systems before dismantling aerators, mixers and pumps
- **Motor refurbishment:** complete refurbishment of 37 kW RAS and Green Lands WAS motors and 3 kW WAS motors .
- **MCC room (4.16):** refurbish room (cleaning, floor/wall repairs, painting, ventilation, sealing openings); replace 5 damaged doors with 2 single and 3 double custom aluminium doors.
- **Documentation:** calibration certificates, instrument datasheets, loop drawings, I/O schedule, O&M manuals, warranties, as-built drawings incl. cable routes and electrical schematics; operator training.
- **Standards cited:** OHS Act and Construction Regulations, SANS/IEC 62271, IEC 60947, IEC 61869/60044, IEC 60255, Eskom DST 34-304, DST 34-1245 (substation earthing), DSP 34-1658 (corrosion protection).

9. Generator Supply

The following electrical items are fully specified in Part C3. These should be included in the BOQ

Item	Specified requirement
1,250 kVA standby diesel generator	400 V, 3-phase, 50 Hz, acoustic weatherproof canopy, integral base fuel tank, AMF panel, ATS with anti-paralleling interlocks, 35 MPa plinth, cabling, earthing, SCADA signals (run, fault, mains fail, fuel level), load testing. Rating to be verified against site loads and VSD behaviour.
Electric hoists, biological reactors (1,000 kg)	Supply, install, load-test and certify; power cables from MCC (avg. 60 m per hoist “as identified in the BOQ”, but no such BOQ item exists). Quantity not stated.
Chlorine room electric hoist (1,500 kg)	Corrosion-protected hoist with pendant and limits; 30 m power cable with isolator; load test and certification.
Ultrasonic outflow meter refurbishment	Clean/inspect sensor, adjust bracket, verify transmitter, calibrate, loop-verify, issue calibration certificate and updated loop drawing.

3.4.5.12 Motor control and electrical distribution

3.4.5.12.1. General electrical requirements

The electrical works shall include a new MCC for the old reactor, upgrading of the existing new-reactor MCC, a dedicated emergency pump station MCC, motor feeders, VSDs, cables, cable ladders, local controls, instrumentation power supplies and associated protective systems.

The Contractor shall verify existing electrical distribution capacity, short-circuit levels, Earthing arrangements and available supply before finalising the design.

All low-voltage electrical work shall comply with the current edition of SANS 10142-1 (The wiring of premises – Part 1: Low-voltage installations), the Electrical Installation Regulations, 2009 and the Electrical Machinery Regulations, 2011, issued under the Occupational Health and Safety Act, 1993.

The installation shall be carried out under the control of a registered person in terms of the Electrical Installation Regulations, who shall issue a Certificate of Compliance (CoC) together with the SANS 10142-1 test report for every new or altered part of the installation before energisation and handover.

Before procurement, the Contractor shall submit for the Engineer's approval an electrical design report comprising single-line diagrams, a load schedule, prospective fault-level calculations, protection discrimination studies, cable sizing and voltage-drop calculations in accordance with SANS 10142-1, and a harmonic assessment of the VSD loads against NRS 048-2.

3.4.5.12.2. Old-reactor MCC

The old-reactor MCC shall be a floor-standing Form 4 Type 2 assembly, as specified in the BOQ.

The assembly shall include appropriately rated incomer equipment, busbars, motor feeders, control circuits, protection devices, metering, PLC interfaces and spare compartments.

The MCC shall be manufactured using an approved enclosure system suitable for the installation environment.

Each MCC shall be a design-verified assembly in accordance with SANS 61439-1 and SANS 61439-2. Design verification records and routine verification certificates shall be submitted for each assembly.

Internal separation shall be Form 4b in accordance with SANS 61439-2, and motor starters shall achieve Type 2 coordination in accordance with SANS 60947-4-1. The rated short-time withstand current shall be not less than 65 kA for 1 s and shall be verified against the calculated prospective fault level.

Air circuit breakers and MCCBs shall comply with SANS 60947-2, switch-disconnectors with SANS 60947-3, and contactors and motor starters with SANS 60947-4-1. The enclosure shall have a minimum degree of protection of IP54 in accordance with SANS 60529 and corrosion protection suitable for a wastewater (H2S) environment. Verification of arcing under internal fault conditions in accordance with IEC/TR 61641 is preferred.

Labelling, conductor identification and danger notices shall comply with SANS 10142-1, and safety signs with SANS 1186.

All equipment shall be clearly identified.

Internal wiring shall be neatly routed, numbered and terminated.

3.4.5.12.3. Existing new reactor MCC upgrade

The existing new-reactor MCC shall be inspected, upgraded, tested and recommissioned.

The BOQ identifies a 1,250 A MCC arrangement; the final rating and suitability of retained components shall be verified against the electrical design.

The Contractor shall inspect the existing enclosure, busbars, incomer, feeder compartments, control wiring, protection devices and earthing system.

Defective or non-compliant components within the scheduled refurbishment scope shall be replaced.

New equipment shall be mechanically and electrically compatible with retained equipment.

3.4.5.12.4. Motor feeders

The electrical installations shall include motor feeders for the scheduled equipment, including:

- 55 kW aerator motors.
- 37 kW aerator and pump motors.
- 5.5 kW mixers.
- 3 kW WAS pumps.
- 1.5 kW sump pumps.

- 0.5 kW clarifier drives.

Each feeder shall incorporate the specified protective devices, motor control equipment, terminals, indications and PLC interface.

VSDs shall be installed on feeders expressly scheduled for variable-speed operation.

Protective devices shall be selected and coordinated for the connected equipment and available fault current.

Variable speed drives shall comply with SANS 61800-2, SANS 61800-3 (EMC) and SANS 61800-5-1 (safety). Each VSD shall be fitted with an input line reactor or harmonic filter and, where required by the VSD manufacturer for the installed motor cable length, an output dv/dt or sine-wave filter. Harmonic distortion at the point of common coupling shall not exceed the limits of NRS 048-2.

New and refurbished motors shall comply with SANS 60034-1, with a minimum efficiency class of IE3 in accordance with SANS 60034-30-1 and a minimum degree of protection of IP55 to SANS 60529. VSD-fed motors shall have insulation suitable for inverter duty (IEC TS 60034-25), and motors of 37 kW and above shall be fitted w ith PTC thermistors wired to the drive.

Motor Control Centres and Motor Starting

MCC	Service	Location	Inst. kW	MD kVA	Incomer A	Form
MCC-01	Inlet Works & Pump Stations No.1/No.3	Existing MCC room, admin building	347	233	500	Form 4 Type 6
MCC-02	Old Reactor, SBR, PS2 & Biofilter System	Existing old-reactor MCC room (replace)	580	511	1000	Form 4 Type 6
MCC-03	New Reactor, Clarifiers & RAS/WAS	Existing new-reactor MCC room (refurbish/replace)	322	294	630	Form 3b Type 2
MCC-04	Disinfection & Final Effluent	Chlorine building electrical room	23	13	25	Form 3b Type 2

MCC	Service	Location	Inst. kW	MD kVA	Incomer A	Form
MCC-05	Emergency Overflow Return Pump Station (WP2)	Outdoor IP55 kiosk on plinth at EOP platform	54	32	63	Form 2b (kiosk)

Table 7-1: Motor control centres (all Phase 1)

The MCCs are type-tested to SANS 61439-2 (Form 4 Type 6 for MCC-01 and MCC-02) with digital metering, Type 1+2 SPDs, detuned APFC, 20 % equipped spare and 20 % space. Each motor has Type 2 coordinated protection, a lockable local isolator and a local control station with a PL d E-stop. DOL starters are used for small drives, soft starters for the inlet and transfer pumps, fixed-speed aerators and mixers, and VSDs for DO-trim aerators, RAS/WAS, the recycle pump and the overflow return pumps. Typical schematics are on ELE-009 to ELE-011. Rev B additions: incomer trip units have two setting groups selected by PLC-01's "on generator" signal, and MCC-02 has an equipped 100 A feeder reserved for SBR No.2.

3.4.5.12.5. Spare feeder compartments

Six spare motor feeder compartments shall be provided in each MCC where scheduled.

Spare compartments shall include the required enclosure space and busbar arrangements specified in the approved MCC design.

Any future feeder equipment not included in the scheduled spare provision shall not be assumed to form part of the Contract.

3.4.5.12.6. Power cabling

Power cables shall be copper-conductor, XLPE-insulated, steel-wire-armoured and PVC-sheathed where specified.

The scheduled cable configurations include:

Cable configuration	Application requirement
4-core × 50 mm² Cu/PVC/SWA/PVC	Designated larger motor power circuits
4-core × 35 mm² Cu/PVC/SWA/PVC	Designated motor power circuits
4-core × 6 mm² Cu/PVC/SWA/PVC	Designated smaller motor circuits
4-core × 2.5 mm² Cu/PVC/SWA/PVC	Designated auxiliary motor circuits
3-core × 4 mm² Cu/PVC/SWA/PVC	Designated single-phase/auxiliary circuits, as applicable

Cable selection shall be checked for load current, installation method, ambient temperature, grouping, voltage drop, fault withstand and protective-device coordination.

The scheduled cable sizes shall not be treated as automatically adequate without verification.

3.4.5.12.7. Cable installation and termination

Cable installation shall include routing, supports, glands, lugs, terminations, identification and testing.

Cables shall be installed without exceeding the manufacturer's permissible pulling tension or minimum bending radius.

Armouring shall be properly bonded to the earthing system.

Power and instrumentation cables shall be segregated to minimise interference.

LV power cables shall comply with SANS 1507-4 (XLPE-insulated, 600/1 000 V) and shall be selected, handled and installed in accordance with the SANS 10198 series and SANS 10142-1. Current ratings shall be derated for grouping, ambient temperature and installation method in accordance with SANS 10142-1.

Buried cables shall be laid at the depth required by SANS 10198 and SANS 10142-1 (not less than 600 mm), with cable warning tape, sleeves under roads and route markers. VSD motor cables shall be terminated with EMC cable glands providing 360° bonding of the armour at both ends.

3.4.5.12.8. Cable ladders and anti-theft covers

The Contractor shall supply and install 600 mm wide heavy-duty hot-dip galvanised cable ladders where scheduled.

Ladders shall include supports, brackets, bends, tees, couplers, fixing systems and bonding arrangements.

Cable ladders shall be adequately supported for the installed cable load.

The specified 5 mm galvanised lockable anti-theft covers shall be installed with tamper-resistant fasteners.

Covers shall permit authorised maintenance access without damaging cables.

Cable ladder and tray systems shall comply with SANS 61537, be hot-dip galvanised to SANS 121, and be electrically continuous and bonded to the earthing system

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Cabling, Containment, Earthing and Lightning Protection

LV power cables are Cu XLPE/SWA/PVC (SANS 1507-4). VSD cables are screened symmetrical, MV cables 3C 95 mm2 Cu XLPE 6.35/11 kV (SANS 1339), and instrument cables individually and overall screened. All cables are sized for current capacity with derating and for volt drop.

Sschedules every cable with live checks. MV is buried at 1.0 m and LV at 0.8 m in HDPE ducts with draw-pits; above ground, cables run on hot-dip galvanised ladder (SS316 in the chlorine area and on bridges).

A 70 mm2 bare Cu ring earth links MVSB-01, the generator yard, all MSS, the MCC rooms and buildings. Calculation C7 shows that a stand-alone substation mat in assumed 100 ohm.m soil gives about 8.5 ohm. Connecting it to the ~1.5 km ring brings the combined resistance to about 0.19 ohm, below the 1 ohm target. Lightning protection follows a SANS/IEC 62305-2 risk assessment, provisionally to LPL III for the switch room, MCC rooms, chlorine building and admin building.

3.4.5.12.9. Electrical supply to clarifier centre columns

New flexible power and control cables shall be provided to clarifier centre columns as scheduled, including the identified 200 m cable provision.

The cable arrangement shall accommodate bridge rotation, mechanical movement and maintenance access without twisting, abrasion or excessive strain.

Suitable cable-management and termination arrangements shall be provided.

Power and control supplies to rotating clarifier bridges shall be transferred through an IP65 slip-ring assembly at the centre column, rated for the drive and control circuits, with rings and brushes accessible for maintenance.

3.4.5.12.10. Local operator stations

Local operator stations shall be installed adjacent to aerators, mixers, pumps and clarifier drives.

Stations shall include the scheduled local/remote selection, start/stop functions, status indication and emergency stop facilities.

Enclosures shall be suitable for the wet, corrosive environment.

Local controls shall be integrated with the MCC and PLC without compromising safety interlocks.

Local operator station enclosures shall be Grade 316 stainless steel or UV-stabilised GRP with a minimum degree of protection of IP66 to SANS 60529. Each station shall include a lockable motor isolator so that the motor can be isolated and locked off at the equipment, and an emergency stop device complying with SANS 60947-5-5. Control circuits shall operate at 24 V DC or not more than 230 V AC.

3.4.5.12.11. Earthing and electrical protection

All exposed conductive equipment, MCCs, cable trays, motors, instruments and associated metallic structures requiring protective bonding shall be connected to the earthing system.

The Contractor shall verify earth continuity, protective-device operation and compliance with the approved earthing design.

Surge protection shall be provided where specified for electrical and instrumentation circuits.

The earthing system shall comply with SANS 10142-1 and SANS 10292, and earth electrodes shall be designed, installed and tested in accordance with SANS 10199. The Contractor shall measure and report earth electrode resistance and earth loop impedance; the target earth resistance shall be stated in the approved electrical design.

Surge protective devices shall comply with SANS 61643-11 for power circuits and SANS 61643-21 for signal and communication circuits, coordinated with the lightning protection zones.

3.4.5.12.12. Lightning protection

A lightning risk assessment shall be carried out in accordance with SANS 62305-2 for the MCC buildings, pump house and exposed process structures. Where required by the assessment, a lightning protection system shall be designed, installed and tested in accordance with SANS 62305-3 and SANS 10313, with surge protection measures in accordance with SANS 62305-4.

3.4.5.12.13. Hazardous locations

A hazardous area classification shall be carried out by a competent person in accordance with SANS 10108 and SANS 60079-10-1 for the inlet works, emergency suction sump, pump wet wells, sumps and sludge digesters, where hydrogen sulphide and methane may be present.

Electrical apparatus installed in classified zones shall be explosion-protected, carry a valid IA certificate as required by the Electrical Machinery Regulations, 2011, and be installed and inspected in accordance with SANS 60079-14 and SANS 60079-17.

3.4.5.13 Instrumentation, PLC and SCADA

3.4.5.13.1. Dissolved oxygen instrumentation

Online dissolved oxygen measurement systems shall be supplied, installed, calibrated and commissioned at the designated biological reactor locations.

Sensors shall be suitable for continuous immersion in activated sludge and resistant to fouling.

The system shall include the sensor, mounting assembly, transmitter, power supply, signal interface and accessories.

The Contractor shall demonstrate stable measurement and integration with the control system.

3.4.5.13.2 Suspended solids and MLSS instrumentation

Online-suspended solids instruments shall be suitable for measuring mixed liquor suspended solids in the activated sludge process.

The system shall include a sensor, transmitter, mounting arrangement and calibration accessories.

Installation shall allow safe sensor removal, cleaning and maintenance.

The Contractor shall verify instrument readings against representative laboratory measurements during commissioning.

3.4.5.13.3. Sump level switches

Level switches shall be installed in designated sumps for pump control and protection.

Switches shall provide the required low-level, high-level or other scheduled signals.

The installation shall minimise fouling, entanglement and false operation.

3.4.5.13.4. Electromagnetic flow meters

Electromagnetic flow meters shall be provided for the scheduled settled sewage measurement locations.

Meters shall be suitable for wastewater service and the applicable pipe diameter and operating conditions.

Installation shall comply with the manufacturer's requirements for pipe filling, earthing, flow profile and straight-pipe arrangements.

Meters shall provide the required instantaneous flow and totalised volume outputs.

3.4.5.13.5. Instrumentation cables

Screened instrumentation cables shall be provided, including the specified minimum two-pair × 1.5 mm² copper armoured cable where scheduled.

Cable screens shall be terminated in accordance with the approved instrumentation earthing philosophy.

Instrument circuits shall be protected against mechanical damage and electrical interference.

Analogue signals shall be 4–20 mA (with HART where available). Field instruments shall comply with SANS 61326-1 (EMC); submersible sensors shall be rated IP68 and outdoor transmitters IP66 to SANS 60529.

3.4.5.13.6. Instrument power supplies

Instrument power circuits shall include suitable power supplies, protective devices, isolators and surge protection.

The Contractor shall verify voltage requirements and load capacity for all connected devices.

3.4.5.13.7. PLC hardware

PLC equipment shall include the scheduled processor, power supply, analogue input modules, digital input modules, output modules, communication modules and Ethernet switches.

The hardware shall provide sufficient capacity for the installed instruments and equipment.

A complete I/O schedule shall be submitted for approval.

PLC hardware shall comply with SANS 61131-2 and be housed in a panel built to SANS 61439. A UPS shall maintain PLC, network and instrument power for not less than 30 minutes on loss of supply, with UPS status signalled to SCADA. Not less than 20% spare I/O per signal type shall be provided.

3.4.5.13.8. PLC programming

PLC programming shall implement the approved process control philosophy.

The programme shall include motor start/stop control, interlocks, alarms, equipment status, operating modes, analogue measurement, fault detection and applicable sequencing.

The Contractor shall provide documented PLC software and backup copies.

PLC software shall be written in SANS 61131-3 (IEC 61131-3) languages, shall not be password-locked against the Employer, and the full source code shall be handed over.

3.4.5.13.9. SCADA integration

The SCADA system shall be updated to display the new and refurbished equipment.

Required functionality shall include equipment status, operating commands where authorised, analogue values, alarms, trends and historical records.

The Contractor shall provide updated mimic screens and tag documentation.

PLC and SCADA networks shall be segregated from other networks, with role-based user access and password management in line with IEC 62443-3-3, and all PLC and SCADA clocks shall be synchronised to a common time source.

3.4.5.13.10. Calibration and loop testing

All instruments shall be calibrated and loop-tested.

Testing shall verify sensor operation, transmitter output, cable continuity, PLC input scaling, displayed values and alarm functions.

Signed calibration and loop-test records shall be included in the commissioning documentation.

3.4.5.13.11. MCC, PLC and SCADA commissioning

The Contractor shall conduct factory acceptance testing where applicable, followed by site acceptance testing.

Commissioning shall verify communication between field devices, MCCs, PLCs and SCADA.

All interlocks and emergency functions shall be demonstrated before the equipment is released for normal operation.

3.4.5.14 MCC room refurbishment

The existing MCC room shall be refurbished to provide a suitable environment for electrical equipment.

The works shall include cleaning, wall preparation, floor repairs, painting, ventilation improvements and associated building repairs.

The Contractor shall repair damaged surfaces and provide durable finishes suitable for an industrial electrical installation.

New custom-made aluminium single and double doors shall be supplied and installed where scheduled.

Doors shall include heavy-duty frames, hinges, locksets, handles, weather seals and suitable fixing arrangements.

The Contractor shall verify door openings and ensure adequate clearances for electrical equipment removal and maintenance.

The MCC room shall provide the working clearances in front of and behind switchgear required by SANS 10142-1, insulating mats complying with SANS 61111 in front of the MCCs, automatic fire detection to SANS 10139,

portable CO2 fire extinguishers in accordance with SANS 10105-1, emergency lighting to SANS 10114-2 and safety signs to SANS 1186. Doors to the MCC room shall open outwards.

3.4.5.15 Refurbishment of secondary clarifiers

3.4.5.15.1. General

The clarifier refurbishment shall restore sludge settling, sludge withdrawal, bridge movement and reliable mechanical operation.

The works shall include isolation, sludge removal, cleaning, inspection, refurbishment of drive assemblies, replacement of deteriorated centre columns, bridge repairs, replacement of wheels and bearings, feed-pipe unblocking and modification of sludge withdrawal arrangements.

3.4.5.15.2. Clarifier isolation

Before work commences, the Contractor shall isolate the designated clarifier from incoming wastewater and sludge return systems.

Temporary flow diversion arrangements shall be provided where necessary to maintain plant operation.

The Contractor shall verify that the clarifier can be safely drained and that adjacent treatment units will not be hydraulically overloaded.

3.4.5.15.3. Sludge removal using temporary pumps

Suitable temporary sludge pumps shall be provided to remove accumulated sludge.

Pumps, hoses and connections shall be suitable for sludge containing grit and suspended solids.

Sludge shall be conveyed to the designated sludge handling facility or drying beds, subject to the Municipality's approval.

Discharge arrangements shall prevent spillage and uncontrolled release.

3.4.5.15.4. Vacuum tanker sludge removal

Vacuum tanker trucks shall be used to remove residual sludge, grit, floating material and debris that cannot be effectively removed by temporary pumping.

Tankers shall be suitable for sewage sludge service and operated by competent personnel.

Transport and disposal shall comply with applicable environmental requirements.

3.4.5.15.5. High pressure cleaning

Clarifier floors, walls, launders, scum boxes, weirs, inlet chambers and associated surfaces shall be pressure-cleaned.

Cleaning shall remove accumulated sludge, biological growth, deposits and debris.

Water pressure shall be controlled to avoid damage to concrete, coatings, joints and mechanical equipment.

3.4.5.15.6. Condition inspection

Following cleaning, the Contractor shall inspect the clarifier structures and mechanical components.

The inspection shall include floors, walls, centre columns, bridge supports, weirs, scum boxes, anchor bolts, drive systems and sludge withdrawal arrangements.

An inspection report shall be submitted identifying defects, photographs, measurements and recommended corrective actions.

3.4.5.15.7. Clarifier drive assemblies

Complete geared motor drive assemblies shall be supplied where scheduled.

Assemblies shall be suitable for continuous operation in the wastewater environment.

Each assembly shall include the specified geared motor, drive shaft, coupling, mounting hardware and associated mechanical components.

The Contractor shall confirm the required torque, output speed and mechanical compatibility with the existing clarifier bridge.

3.4.5.15.8. Gearboxes

Gearboxes shall be heavy-duty industrial units suitable for the intended continuous operating duty.

They shall incorporate suitable bearings, seals, lubrication arrangements and corrosion protection.

The Contractor shall submit manufacturer's technical information and maintenance requirements.

3.4.5.15.9. Mechanical installation

Drive assemblies shall be lifted, positioned, levelled and secured to the existing bridge structures.

Installation shall include flexible couplings, torque arms, brackets, anchor bolts and associated hardware.

Alignment shall be undertaken using appropriate precision instruments, including laser alignment where specified.

3.4.5.15.10. Mechanical testing

The Contractor shall perform dry-running and operating tests.

Tests shall include rotation, mechanical clearance, vibration, gearbox temperature, motor loading and abnormal noise.

The bridge shall complete the required operating cycle without binding or interference.

3.4.5.15.11. Unblocking of clarifier feed pipelines

Existing feed pipelines from the old reactor to the clarifiers shall be cleaned and unblocked.

Methods may include high-pressure jetting, rodding, root cutting and vacuum extraction, as appropriate to the obstruction and pipe condition.

CCTV inspection shall be undertaken where specified to verify the removal of blockages and identify structural defects.

The Contractor shall prevent dislodged material from entering downstream equipment.

3.4.5.15.12. Replacement of centre columns

Deteriorated centre columns at the old clarifiers shall be replaced with Grade 316 stainless steel centre columns, with a specified minimum wall thickness of 8 mm, subject to approved structural verification.

Each centre column shall incorporate the required base and top flanges, sludge withdrawal ports, cable support provisions and connection details.

Fabrication drawings shall be submitted before manufacture.

Welding shall be carried out using procedures appropriate for stainless steel.

Completed welds shall be inspected and treated to restore corrosion resistance.

3.4.5.15.13. Removal and reinstatement of clarifier bridges

The Contractor shall provide a mobile crane, qualified rigging personnel and certified lifting equipment for bridge removal.

A detailed lifting plan shall identify lifting points, equipment masses, crane positioning and ground-bearing requirements.

The bridge shall be carefully dismantled, lifted and placed on suitable temporary supports.

Following centre-column replacement, the bridge shall be reinstated, levelled and aligned.

The Contractor shall verify the bridge's rotational clearance and correct load distribution.

3.4.5.15.14. Removal of existing corroded centre columns

Existing columns shall be disconnected, cut or unbolted as necessary and removed without damaging retained concrete structures.

Removed material shall be delivered to the designated municipal storage or scrap area.

Anchor positions and supporting concrete shall be inspected before new columns are installed.

3.4.5.15.15. Bridge refurbishment

Existing clarifier bridges shall be cleaned and inspected for corrosion, fatigue, deformation and defective connections.

Refurbishment shall include local steel repairs, replacement of worn bolts, corrosion removal, surface preparation and protective coating.

Structural repairs shall be undertaken to approved details.

3.4.5.15.16. Replacement of drive wheels, guide wheels and bearings

New drive wheels, guide wheels and bearings shall be supplied to suit the existing clarifier mechanism.

Components shall be selected for the anticipated operating loads and continuous rotational duty.

The Contractor shall verify dimensions and compatibility before procurement.

Bearings shall be appropriately sealed and lubricated.

3.4.5.15.17. Corrosion protection

Exposed carbon steel bridge components shall receive an approved protective coating system.

Surface preparation shall remove corrosion, loose coating and contamination.

Coatings shall be applied in accordance with the manufacturer's requirements for surface preparation, ambient conditions, film thickness and curing.

Dry-film thickness records shall be submitted.

3.4.5.15.18. Additional sludge withdrawal openings

Three additional sludge withdrawal holes shall be formed through each designated centre-column/base arrangement as scheduled.

The works shall include drilling or coring, stainless steel sleeves, sealing, making good and connection provisions.

The Contractor shall confirm that the openings do not compromise structural capacity or the intended sludge withdrawal hydraulics.

3.4.5.16 interconnecting wastewater pipelines

3.4.5.16.1. General

The pipeline works shall include installation of a new 600 mm steel sewer pipeline between the inlet pump station and splitter box, and a 400 mm modified PVC pipeline between the inlet pump station and SBR reactor.

Associated works shall include excavation, bedding, pipe supply, fittings, thrust blocks, valve chambers, isolation valves, connections, backfilling and testing.

3.4.5.16.2. Hand excavation

Trenches shall be excavated by hand where scheduled because of existing services, access restrictions or other site constraints.

The 600 mm steel pipeline trench has an indicated average depth of approximately 1.80 m and width of 1.20 m.

The 400 mm pipeline trench has an indicated average depth of approximately 1.50 m and width of 0.90 m.

These dimensions are indicative for the scheduled work and shall be reconciled with the approved drawings and actual site conditions.

The Contractor shall provide excavation support, safe access and dewatering where necessary.

3.4.5.16.3. Trench bottom preparation

Trench bottoms shall be trimmed to the required level and compacted to 93% Modified AASHTO, as specified in the BOQ.

Soft or unsuitable material shall be removed and replaced with approved material.

The trench bottom shall provide uniform support for the pipe bedding.

3.4.5.16.4. Selected pipe bedding

Approved selected bedding material shall be placed beneath, alongside and above the pipe.

The scheduled bedding shall extend to 300 mm above the pipe crown.

Material shall be free of sharp stones and other objects that could damage the pipe or coating.

Bedding shall be placed and compacted carefully around the pipe haunches.

3.4.5.16.5. DN600 steel sewer pipeline

The Contractor shall supply and install a nominal 600 mm internally cement lined and externally coated steel sewer pipeline.

The pipe shall be suitable for wastewater conveyance and the approved operating conditions.

The internal lining shall provide corrosion resistance appropriate for sewage service.

The external coating shall be suitable for buried installation and the anticipated soil conditions.

Pipe joints shall be welded, flanged or mechanically coupled as indicated by the approved drawings.

Welded joints shall be inspected and tested to the approved procedure.

Damaged coatings shall be repaired before backfilling.

3.4.5.16.6. Steel pipe fittings

The pipeline shall include the scheduled 600 mm bends, specials, flange adaptors, couplings and other fittings.

Fittings shall be compatible with the pipe material, pressure rating and jointing system.

All fittings shall be appropriately restrained and protected against corrosion.

3.4.5.16.7. DN400 mPVC pipeline

The Contractor shall supply and install the specified 400 mm modified PVC pipeline.

The Engineer must confirm the intended pressure class before procurement. The Contractor shall not substitute one classification for another without written approval.

Pipes and joints shall comply with the applicable product specification and approved pressure rating.

Installation shall follow the manufacturer's bedding, handling and jointing requirements.

3.4.5.16.8. PVC pipeline fittings

The Contractor shall provide compatible 400 mm bends, specials, flange adaptors, couplings and fittings.

Jointing shall accommodate the approved pressure rating and anticipated operating conditions.

3.4.5.16.9. Trench backfilling

Backfilling shall be undertaken using approved selected excavated material.

The BOQ specifies placement in 150 mm layers compacted to 93% Modified AASHTO.

Material shall be placed uniformly to prevent pipe displacement or damage.

Field density tests shall be undertaken at the frequency required by the approved inspection and test plan.

3.4.5.16.10 Concrete thrust blocks

Concrete thrust blocks shall be constructed at designated bends, tees, valves and other locations requiring restraint.

The specified concrete strength is 25 MPa.

Thrust blocks shall bear against suitable undisturbed ground or approved engineered support.

The Contractor shall ensure that joints requiring future maintenance remain accessible.

3.4.5.16.11. Connections to existing inlet pump station

Connections to the inlet pump station shall include controlled breaking or coring through the existing structure, installation of pipe sleeves or puddle flanges, sealing, grouting and reinstatement.

The Contractor shall prevent leakage through the connection and protect the structural integrity of the existing wall.

All connections shall be coordinated with approved plant shutdown arrangements.

3.4.5.16.12. Connections to splitter box and SBR

The new pipelines shall be connected to the existing splitter box and SBR reactor at the approved positions.

The works shall include coring, watertight penetration details, pipe alignment, sealing, grouting and making good.

The Contractor shall verify invert levels and flow compatibility before executing the connections.

3.4.5.17 Pipeline valve chambers

3.4.5.17.1. Excavation

Valve chamber excavations shall be undertaken to the approved dimensions and founding levels.

The Contractor shall provide excavation support and dewatering as necessary.

3.4.5.17.2. Blinding concrete

A 50 mm thick layer of 15 MPa blinding concrete shall be placed beneath the valve chamber foundations where specified.

The surface shall be level and suitable for reinforcement and formwork installation.

3.4.5.17.3. Reinforced concrete structures

Valve chamber base slabs, walls and roof slabs shall be constructed using 30 MPa reinforced concrete.

Concrete shall be placed, compacted and cured in accordance with the approved structural specification.

The chamber shall provide sufficient access for valve operation, removal and maintenance.

3.4.5.17.4. Reinforcement

High-tensile reinforcement shall be cut, bent and fixed to the approved bar bending schedules.

Correct concrete cover shall be maintained using suitable spacers and chairs.

3.4.5.17.5. Access covers

Heavy-duty lockable access covers shall be supplied and installed.

Covers shall be suitable for the anticipated loading and shall prevent unauthorised access.

3.4.5.17.6. Step irons, ventilation and drainage

Chambers shall include galvanised step irons, ventilation pipes and drainage sumps where scheduled.

Step irons shall be securely anchored and arranged to provide safe access.

Ventilation and drainage arrangements shall minimise hazardous atmospheric conditions and standing water.

3.4.5.17.7. DN600 isolation valves

Resilient-seated 600 mm isolation valves shall be supplied and installed on the designated pump discharge lines and main pipeline.

Valves shall be suitable for the specified pressure rating and wastewater service.

Each installation shall include flanges, gaskets, bolts, nuts, washers and corrosion protection.

3.4.5.17.8. DN400 isolation valves

Resilient-seated 400 mm isolation valves shall be supplied and installed at the scheduled locations.

The valves shall be compatible with the confirmed 400 mm pipeline pressure classification.

3.4.5.17.9. Pipeline testing

The completed pipeline systems shall undergo inspection and applicable pressure, leakage and functional testing.

Testing shall be performed using procedures appropriate to the pipe material, joint type and operating conditions.

All defects shall be repaired and retested before acceptance.

3.4.5.18 Humus tank valve replacement

3.4.5.18.1. Removal of existing valves

The Contractor shall remove the existing corroded 160 mm gate valves at the humus tanks.

Before removal, the associated pipework shall be isolated and drained.

Removal shall include loosening or cutting defective fasteners, disconnecting flanges, lifting and removing the valves, and cleaning the existing mating surfaces.

The Contractor shall protect retained pipework and structures against damage.

3.4.5.18.2. New resilient seated gate valves

New 160 mm resilient-seated gate valves shall be supplied and installed.

Valves shall be suitable for wastewater service and the approved operating pressure.

Each valve shall include the valve body, resilient sealing arrangement, operating mechanism, flanges, gaskets, bolts, nuts, washers and required accessories.

Bolts and fasteners shall be suitable for the corrosive environment.

3.4.5.18.3 Installation and testing

The Contractor shall verify flange dimensions, alignment and operating clearances before installation.

The valves shall be installed without imposing excessive stress on adjacent pipework.

Testing shall include full opening and closing, sealing performance and inspection for leakage.

3.4.5.19 Biofilter distribution mechanism

3.4.5.19.1. General

The Contractor shall supply, install, test and commission a complete new biofilter distribution mechanism.

The mechanism shall provide reliable and reasonably uniform distribution of wastewater over the biological filter media.

The Contractor shall verify the existing biofilter dimensions, central support, and hydraulic loading and distribution requirements before manufacture.

3.4.5.19.2. Central column

The new distribution mechanism shall include a central column suitable for the existing filter arrangement.

The column shall be manufactured from materials appropriate for wastewater exposure and shall withstand the operating hydraulic and mechanical loads.

The assembly shall include the required inlet connection, support arrangement, bearings, seals and fasteners.

3.4.5.19.3. Rotary distributor arms

New rotary distributor arms shall be supplied and installed.

The arms shall be designed to distribute wastewater across the filter surface.

The Contractor shall confirm the required arm length, number of arms, flow capacity and operating clearances.

The arms shall be mechanically balanced and adequately supported.

3.4.5.19.4. Distribution nozzles and orifices

Distribution nozzles or orifices shall be sized and positioned to achieve the required hydraulic distribution.

They shall be accessible for inspection and cleaning.

The design shall minimise clogging and permit maintenance without extensive dismantling.

3.4.5.19.5. Bearings and drive mechanism

The mechanism shall include suitable bearings, seals and the specified rotation or drive arrangement.

Where a mechanical drive is provided, it shall include the required motor, gearbox, coupling and protection.

Where rotation is hydraulically driven, the Contractor shall demonstrate satisfactory operation over the approved flow range.

3.4.5.19.6. Installation and commissioning

The distributor shall be installed centrally and levelled to the manufacturer's tolerances.

The Contractor shall verify that the arms rotate freely without contacting the filter media, retaining walls or adjacent structures.

Commissioning shall demonstrate correct rotation, satisfactory distribution, absence of abnormal vibration and acceptable operation at the available hydraulic loading.

3.4.5.20. Cleaning of sludge digesters

3.4.5.20.1. General

The Contractor shall clean the designated sludge digester, including isolation, sludge removal, vacuum tanker operations, wash-down, waste disposal and final inspection.

The works shall be undertaken under an approved confined-space entry procedure.

3.4.5.20.2. Isolation

All inlet, outlet, sludge transfer and associated services shall be isolated before cleaning.

The Contractor shall verify that isolation arrangements prevent accidental inflow.

Electrical and mechanical equipment shall be locked out where required.

3.4.5.20.3. Atmospheric testing and ventilation

Before personnel enter the digester, atmospheric testing shall be undertaken for oxygen concentration, flammable gases and relevant toxic gases, including hydrogen sulphide.

Testing shall be undertaken by competent personnel using calibrated equipment.

Adequate ventilation shall be provided.

Atmospheric monitoring shall continue as required by the confined-space risk assessment.

3.4.5.20.4. Sludge pumping and vacuum removal

Accumulated sludge shall be removed using suitable sludge pumps and vacuum tankers.

Equipment shall be capable of handling the anticipated solids concentration and grit content.

Sludge shall be transferred to an approved receiving or disposal facility.

3.4.5.20.5. Wash-down and final cleaning

Following bulk sludge removal, the digester shall be washed down to remove residual deposits.

Wash-down shall be controlled to prevent uncontrolled discharge.

The Contractor shall remove remaining debris and accumulated grit.

3.4.5.20.6. Inspection and handover

The cleaned digester shall be inspected for structural defects, corrosion, cracks, leakage and damaged equipment.

The Contractor shall submit an inspection report with photographs and details of any defects identified.

The digester shall be handed over only after the Engineer has accepted the cleaning work.

3.4.5.21 Standby diesel generator

3.4.5.21.1. General

The Contractor shall supply, install, test and commission a complete 1,250 kVA diesel standby generator, including automatic mains failure equipment, automatic transfer switchgear, reinforced concrete plinth, cables, earthing, control interfaces and associated accessories.

The generator shall be suitable for standby operation at the WWTW.

The generating set shall comply with SANS 8528 (ISO 8528) Parts 1 to 5, with a minimum performance class of G2, and shall be rated for the standby or prime duty confirmed in the approved electrical design.

3.4.5.21.2. Generator technical requirements

The generator shall have the following scheduled nominal characteristics:

Parameter	Requirement
Rated apparent power	1,250 kVA
Output voltage	400 V
Phases	Three-phase
Frequency	50 Hz
Fuel	Diesel
Enclosure	Weatherproof acoustic canopy
Fuel storage	Integral base fuel tank
Control	Automatic mains failure and transfer system

The Contractor shall submit manufacturer's technical data confirming standby rating, permissible operating conditions, fuel consumption, alternator characteristics, engine performance and protective functions.

The generator rating shall be verified against the actual site electrical loads, motor starting requirements, VSD behaviour and load sequencing.

3.4.5.21.3. Diesel engine

The diesel engine shall be suitable for generator operation and equipped with the necessary cooling, lubrication, fuel supply, starting and protection systems.

Engine protection shall include, as applicable, low oil pressure, high coolant temperature, overspeed, starting failure and other manufacturer's standard protective functions.

3.4.5.21.4. Alternator

The alternator shall be suitable for 400 V, three-phase, 50 Hz operation.

It shall include automatic voltage regulation and suitable protection against electrical faults.

The Contractor shall confirm compatibility with the WWTW electrical distribution system.

3.4.5.21.5. Acoustic weatherproof canopy

The generator shall be housed in a weatherproof acoustic canopy suitable for outdoor installation.

The canopy shall provide access for routine inspection, maintenance and equipment servicing.

Ventilation openings shall be designed to prevent overheating while limiting rainwater entry.

The canopy shall incorporate suitable corrosion protection and lockable access doors.

Noise emissions shall comply with the applicable noise control regulations, assessed in accordance with SANS 10103.

3.4.5.21.6. Fuel tank

An integral base fuel tank shall be provided.

The tank shall include filling arrangements, fuel level indication, venting, drain provision and protection against leakage.

The Contractor shall submit the tank capacity and expected operating duration at representative loads.

The fuel tank shall be bunded or double-skinned to contain not less than 110% of the tank capacity.

3.4.5.21.7. Automatic mains failure panel

An automatic mains failure panel shall monitor the incoming electrical supply and initiate generator starting when the mains supply fails or falls outside approved operating limits.

The system shall incorporate suitable delays to prevent unnecessary starting during momentary supply disturbances.

Upon restoration of stable mains power, the system shall transfer the load back to the normal supply and permit the generator to complete its cooling-down cycle.

3.4.5.21.8. Automatic transfer switchgear

Automatic transfer switchgear shall be rated for the connected load and the available fault level.

The system shall prevent inadvertent paralleling of the generator and mains supply unless an approved synchronising arrangement is specifically provided.

Electrical and mechanical interlocks shall be installed as required.

Automatic transfer switching equipment shall comply with SANS 60947-6-1, and the changeover arrangement shall prevent back-feed into the supply authority network in accordance with SANS 10142-1.

3.4.5.21.9. Generator foundation

The generator shall be installed on a reinforced concrete plinth constructed using 35 MPa concrete.

The foundation shall include reinforcement, cable ducts, anchorage and anti-vibration arrangements.

The Contractor shall verify the generator's operating mass, dynamic loads and mounting requirements before casting.

3.4.5.21.10. Electrical cables and earthing

Generator power cables, control cables, cable trays, glands and terminations shall be supplied and installed.

Cable sizing shall be based on the verified electrical load and installation conditions.

The generator frame, canopy and associated metallic equipment shall be connected to the approved earthing system.

Generator neutral earthing shall be arranged in accordance with SANS 10292 so that earth fault protection remains effective under both mains and generator supply.

Standby Generation and ATS

Option assessment

Option	Description	Assessment
Central LV main board	Single 1 250 kVA transformer + LV main board with ATS; radial LV feeders (up to ~600 m) to MCCs	Backs up all three MSS; LV feeders stay short; Phase 1 switchgear unchanged in Phase 2

Table 6-1: Standby power configuration options

6.2 Equipment

- **GEN-01:** 1 250 kVA PRP, 0.8 pf (1 000 kW), 400 V, 50 Hz, 1 500 rpm, ISO 8528-5 class G2, brushless with PMG excitation, digital AVR (+/-1 %), acoustic canopy (<= 75 dBA at 7 m), integral 1 500 L day tank. The AMF controller has Modbus TCP to PLC-01 and the ATS controller. Rating guaranteed at 1 650 m altitude and 40 C.
- **Fuel:** 10 000 L bunded aboveground bulk tank with automatic transfer to the day tank, fill point with spill containment, and level monitoring to the PLC.

6.3 ATS operation

The transfer is open transition only, with no paralleling with the Dihlabeng supply. On mains failure (27/59/81/47 on the P1 VT for more than 3 s), P1 opens and PLC-01 holds all motors stopped. GEN-01 then starts. Q-GEN and P2 close at standstill excitation and the AVR ramps the voltage to 100 % over 10 s. This soft energisation magnetises GTX-01, the MV ring and all three MSS transformers without inrush (calculation C5). When the generator is ready, PLC-01 restores load in six blocks (calculation C4.3). After mains has been healthy for 5 min, the PLC stops motors, P2 opens and P1 closes. The interruption is about 1 s, after which the plant restarts in sequence and the generator cools down. Drawing ELE-015 shows the full sequence.

6.4 Generator-mode restrictions

- Emergency overflow return pumping is inhibited: the dam stores the overflow until mains returns, unless the operator overrides with load available.
- PS3 is limited to two duty pumps; the third is released only below 70 % generator load.
- Aerator staging is load-dependent, keeping generator load at or below 90 % of prime.
- APFC is disconnected; MSS and MCC trip units change to setting group 2.

6.5 Protection

The protection schedule on drawing ELE-014 gives indicative settings, which the contractor's protection study must confirm. On generator, the LV fault levels fall to about 4.4-5.6 kA initial (calculation C6). The second LSIG setting group lowers the short-time pick-ups so that discrimination and fault clearance are kept.

3.4.5.21.11. SCADA and telemetry integration

The generator control system shall provide the required signals to SCADA or telemetry.

Signals shall include generator running, fault, mains failure, fuel level and other scheduled operating information.

3.4.5.21.12. Generator testing and commissioning

The Contractor shall conduct mechanical and electrical inspections before starting.

Commissioning shall include:

1. Verification of fuel, lubrication and cooling systems.
2. Starting and stopping tests.
3. Voltage and frequency verification.
4. Protection and alarm testing.
5. Automatic mains failure simulation.
6. Automatic transfer and return-to-mains testing.
7. Load testing under an approved test procedure.
8. Verification of control and SCADA signals.
9. Operator training.

The Contractor shall submit signed commissioning records and manufacturer's certificates.

3.4.5.22. Electrical hoists for biological reactors

3.4.5.22.1. General

The Contractor shall supply and install complete 1,000 kg electric hoists for the designated reactor lifting operations.

Each hoist shall be suitable for the intended maintenance loads and operating environment.

3.4.5.22.2. Hoist assembly

The hoist shall include the electric lifting mechanism, load chain or other specified lifting medium, hook assembly, lifting controls, limit protection and associated accessories.

The hoist shall be clearly marked with its safe working load.

3.4.5.22.3. Support and mounting

The Contractor shall verify that the existing or proposed supporting structure is suitable for the hoist's rated load, including applicable dynamic effects.

The hoist shall not be placed into service until the supporting arrangement has been accepted.

3.4.5.22.4. Electrical supply

Power cables shall be installed from the MCC to the reactor hoists.

The BOQ identifies an average cable length of 60 m per hoist.

Installation shall include the required isolators, glands, lugs, terminations, supports and electrical protection.

Electric hoists shall comply with the Driven Machinery Regulations, 2015 and the Electrical Machinery Regulations, 2011. Pendant controls shall be rated IP65 and incorporate an emergency stop device to SANS 60947-5-5.

3.4.5.22.5. Testing and certification

Each hoist shall be inspected, load-tested and certified in accordance with applicable lifting equipment requirements.

The Contractor shall provide test certificates, operating instructions and maintenance information.

3.4.5.23 Chlorine room electrical hoist

3.4.5.23.1. General

The Contractor shall supply and install a complete 1,500 kg electric hoist in the chlorine room.

The hoist shall be suitable for the intended lifting operations and the potentially corrosive environment.

3.4.5.23.2. Equipment requirements

The hoist shall include the lifting mechanism, hook, load chain, control pendant or approved control arrangement, limit protection and accessories.

All components shall be suitably protected against corrosion.

3.4.5.23.3. Structural support

The Contractor shall verify the capacity of the supporting structure and fixing arrangements.

No lifting operations shall commence until the installation has been inspected and accepted.

3.4.5.23.4. Electrical supply

The Contractor shall install the scheduled 30 m power cable to the chlorine room hoist.

The installation shall include isolators, glands, lugs, terminations and associated supports.

The chlorine room hoist shall comply with the Driven Machinery Regulations, 2015, with corrosion-resistant electrical components and an IP65 pendant incorporating an emergency stop device to SANS 60947-5-5.

3.4.5.23.5. Testing and commissioning

The hoist shall undergo functional testing, load testing and statutory certification as applicable.

The Contractor shall provide the necessary operating instructions and maintenance records.

3.4.5.24 Refurbishment of ultrasonic outflow meter

3.4.5.24.1. General

The existing ultrasonic outflow meter shall be refurbished, recalibrated and recommissioned.

The objective is to restore reliable measurement and recording of treated wastewater discharge.

3.4.5.24.2. Sensor cleaning and inspection

The Contractor shall inspect and clean the ultrasonic sensor.

Deposits, contamination and obstructions affecting measurement shall be removed.

The sensor housing, mounting and electrical connections shall be inspected for deterioration.

3.4.5.24.3. Mounting and bracket adjustment

The sensor mounting bracket shall be adjusted or repaired as necessary to achieve the correct measurement position.

The Contractor shall verify alignment and distance to the measured surface.

3.4.5.24.4. Transmitter verification

The transmitter shall be inspected for correct configuration, power supply, output signals and display operation.

Faulty settings shall be corrected.

3.4.5.24.5. Calibration

The instrument shall undergo zero and span verification or the manufacturer's applicable calibration procedure.

Where the meter measures flow through an open channel or hydraulic structure, the Contractor shall verify that the configured level-to-flow relationship corresponds to the actual measuring structure.

3.4.5.24.6. Loop verification

The Contractor shall verify the measurement signal from the sensor through the transmitter and control system.

Displayed flow rates and totalised volumes shall be checked.

3.4.5.24.7. Calibration certificate and loop drawing

A calibration certificate shall be submitted, recording the instrument identification, test method, reference values, measured values and results.

An updated instrumentation loop drawing shall also be provided.

3.4.5.25 General testing, commissioning and quality assurance

3.4.5.25.1. Inspection and test plans

Before commencing the relevant works, the Contractor shall submit inspection and test plans for approval.

Inspection and test plans shall identify the inspection activity, applicable specification, acceptance criteria, responsible personnel and required records.

Hold points shall include, where applicable, excavation formation, reinforcement before casting, pipework before backfilling, geomembrane installation, mechanical alignment, electrical energisation and final commissioning.

3.4.5.25.2. Civil works testing

Civil works testing shall include applicable material grading, compaction, concrete strength, dimensional verification and water tightness testing.

The Contractor shall maintain a register of test results and corrective actions.

3.4.5.25.3. Mechanical works testing

Mechanical testing shall include alignment, rotation, vibration, lubrication, motor loading, operating temperatures, valve function and performance verification.

Equipment shall be tested under representative operating conditions wherever practicable.

3.4.5.25.4. Electrical testing

Electrical testing shall include insulation resistance, continuity, earthing, protection settings, phase rotation, control circuit verification and functional operation.

The Contractor shall provide the required electrical certificates and test reports.

Testing shall include all tests required by SANS 10142-1, including earth loop impedance, earth leakage (RCD) operation and polarity, and a thermographic survey of all MCCs under load. A Certificate of Compliance with the SANS 10142-1 test report shall be issued for every new or altered part of the installation before Practical Completion.

3.4.5.25.5. Instrumentation testing

Instrumentation shall be calibrated and loop-tested.

All analogue and digital signals shall be verified against the approved I/O schedules.

3.4.5.25.6. Integrated process commissioning

Integrated commissioning shall demonstrate that refurbished equipment and new infrastructure operate together in accordance with the approved process control philosophy.

The Contractor shall coordinate commissioning with the Municipality's operational personnel.

3.4.5.25.7. Defects and corrective work

Equipment or workmanship failing to meet the specified acceptance criteria shall be repaired or replaced at the Contractor's responsibility, subject to the Conditions of Contract.

Defective work shall be retested before acceptance.

3.4.5.26. Operation and maintenance documentation

3.4.5.26.1. General

The Contractor shall submit comprehensive operation and maintenance documentation for all new and refurbished equipment.

Documentation shall include:

- Equipment descriptions and technical data.
- Manufacturer's operation and maintenance instructions.
- Approved electrical and mechanical drawings.
- Pump performance curves.
- Equipment schedules.
- Recommended maintenance intervals.
- Lubrication schedules.
- Spare parts lists.
- Troubleshooting procedures.
- Safety instructions.
- Instrument calibration records.
- PLC and SCADA documentation.
- Testing and commissioning records.
- Warranty certificates.

3.4.5.26.2. As-built drawings

As-built drawings shall accurately reflect the completed installation.

Drawings shall include final equipment positions, pipe routes, invert levels, cable routes, electrical schematics, instrument locations and relevant structural details.

3.4.5.26.3. Operator training

The Contractor shall provide practical training to the Municipality's designated operators and maintenance personnel.

Training shall cover normal operation, emergency operation, routine maintenance, fault identification, safe isolation and basic troubleshooting.

Training attendance registers and materials shall be submitted.

3.4.5.26.4. Warranties

Manufacturer's warranties and contractual defects obligations shall apply as specified in the Contract.

Warranty certificates shall identify the equipment, applicable period, coverage and conditions.

3.4.5.27 Measurement and payment

3.4.5.27.1. General

Measurement and payment shall be undertaken in accordance with the BOQ, applicable standardised specifications and Conditions of Contract.

Unless expressly scheduled separately, rates shall include all materials, labour, equipment, transport, handling, installation, fixing, protection, testing and incidental work necessary to complete the described work.

3.4.5.27.2. Fixed and time-related obligations

Fixed-charge items shall be payable in accordance with the contract's payment provisions.

Time-related items shall be measured over the authorised period and subject to the contractual provisions governing extensions and adjustments.

3.4.5.27.3. Excavation and earthworks

Excavation and earthworks shall be measured in the units specified in the BOQ.

Classification of excavation material, treatment of unsuitable material, disposal distances and extra-over payments shall follow the applicable contractual measurement rules.

3.4.5.27.4. Concrete and reinforcement

Concrete shall be measured in the specified units and according to the scheduled structural components.

Reinforcement shall be measured separately where scheduled.

No additional payment shall be made for wastage, laps, supports or accessories unless the BOQ or applicable measurement rules expressly provide otherwise.

3.4.5.27.5. Mechanical equipment

Mechanical equipment shall be measured according to the scheduled supply, installation, refurbishment, testing and commissioning items.

Where these activities are separately scheduled, payment shall be allocated to the relevant completed activity.

3.4.5.27.6. Electrical equipment

Electrical equipment, cables, cable trays, instruments and control systems shall be measured according to the scheduled units.

Cable lengths shall be measured in accordance with the contract's measurement rules.

3.4.5.27.7. Testing and commissioning

Testing and commissioning shall be payable separately only where specifically scheduled.

Otherwise, the cost shall be included in the relevant work item.

3.4.5.27.8. Provisional sums and day works

Provisional sums and day works shall be payable only against the required written instructions and verified records.

No provisional expenditure shall be deemed automatically authorised merely because an allowance appears in the BOQ.

3.4.5.28. Completion and handover

The works shall not be considered ready for completion until the Contractor has demonstrated satisfactory operation of the relevant systems and submitted the required completion documentation.

The completion requirements shall include:

1. Completion of all scheduled construction and installation works.
2. Successful civil, mechanical and electrical testing.
3. Successful functional and integrated commissioning.
4. Rectification of identified defects.
5. Submission of test certificates and calibration records.
6. Submission of operation and maintenance manuals.
7. Submission of as-built drawings.
8. Completion of operator training.
9. Submission of warranties and equipment documentation.
10. Removal of temporary works and construction debris.
11. Reinstatement and cleaning of disturbed areas.
12. Handover of the completed health and safety file.

Final acceptance shall be subject to the Conditions of Contract and the Engineer's certification.

Appendix A: Motor and Feeder Schedule

Tag	Description	MCC	kW	Starter	Cable	L m	VD %	Phase
MS-201	Vertical mechanical screen No.1	MCC-01	1.5	DOL	4C2.5	45	0.98	1
MS-202	Vertical mechanical screen No.2	MCC-01	1.5	DOL	4C2.5	50	1.05	1

Tag	Description	MCC	kW	Starter	Cable	L m	VD %	Phase
CV-203	Screenings screw conveyor	MCC-01	2.2	DOL	4C2.5	55	1.42	1
CP-204	Screenings screw compactor	MCC-01	3	DOL	4C2.5	60	1.88	1
DG-205	Vortex degritter No.1 paddle drive	MCC-01	1.1	DOL	4C2.5	70	1.10	1
DG-206	Vortex degritter No.2 paddle drive	MCC-01	1.1	DOL	4C2.5	75	1.15	1
P-207	Grit pump No.1 (submersible)	MCC-01	4	DOL	4C2.5	70	2.66	1
P-208	Grit pump No.2 (submersible)	MCC-01	4	DOL	4C2.5	75	2.82	1
GC-209	Grit classifier	MCC-01	1.1	DOL	4C2.5	80	1.20	1
P-301	PS1 SBR feed pump No.1 (GR T10)	MCC-01	30	SS	4C16	40	1.73	1
P-302	PS1 SBR feed pump No.2 (GR T10)	MCC-01	30	SS	4C16	42	1.79	1
P-321	PS3 AS feed pump No.1 (GR T10)	MCC-01	55	SS	4C35	38	1.44	1
P-322	PS3 AS feed pump No.2 (GR T10)	MCC-01	55	SS	4C35	40	1.49	1
P-323	PS3 AS feed pump No.3 (GR T10)	MCC-01	55	SS	4C35	42	1.55	1
P-324	PS3 AS feed pump No.4 (GR T10)	MCC-01	55	SS	4C35	44	1.60	1
AE-401	SBR surface aerator (existing, verify)	MCC-02	37	VSD	3C25	90	2.56	1

Tag	Description	MCC	kW	Starter	Cable	L m	VD %	Phase
MX-402	SBR mixer (existing, verify)	MCC-02	5.5	SS	4C4	95	2.89	1
DC-403	SBR decanter actuator	MCC-02	0.75	DOL	4C2.5	100	1.06	1
P-404	SBR WAS pump	MCC-02	4	DOL	4C2.5	100	3.56	1
P-311	PS2 biofilter feed pump No.1 (GR T6)	MCC-02	11	SS	4C10	120	2.78	1
P-312	PS2 biofilter feed pump No.2 (GR T6)	MCC-02	11	SS	4C10	122	2.82	1
BF-501	Biofilter No.1 rotating distributor drive	MCC-02	0.75	DOL	4C2.5	150	1.43	1
BF-502	Biofilter No.2 rotating distributor drive	MCC-02	0.75	DOL	4C2.5	170	1.58	1
P-503	Primary sludge pump No.1 (existing, verify)	MCC-02	5.5	DOL	4C6	140	2.85	1
P-504	Primary sludge pump No.2 (existing, verify)	MCC-02	5.5	DOL	4C6	142	2.88	1
AE-601	Old reactor vertical aerator No.1	MCC-02	37	VSD	3C16	60	2.66	1
AE-602	Old reactor vertical aerator No.2	MCC-02	37	VSD	3C16	70	3.05	1
AE-603	Old reactor vertical aerator No.3	MCC-02	37	SS	4C16	80	3.62	1
AE-604	Old reactor vertical aerator No.4	MCC-02	37	SS	4C25	90	2.70	1
AE-605	Old reactor vertical aerator No.5	MCC-02	37	SS	4C25	100	2.96	1

Tag	Description	MCC	kW	Starter	Cable	L m	VD %	Phase
AE-606	Old reactor vertical aerator No.6	MCC-02	37	SS	4C25	110	3.22	1
AE-607	Old reactor horizontal brush aerator No.1	MCC-02	37	SS	4C25	95	2.83	1
AE-608	Old reactor horizontal brush aerator No.2	MCC-02	37	SS	4C25	105	3.09	1
AE-609	Old reactor vertical aerator 55 kW No.1	MCC-02	55	SS	4C35	115	3.49	1
AE-610	Old reactor vertical aerator 55 kW No.2	MCC-02	55	SS	4C35	125	3.77	1
MX-611	Old reactor anaerobic mixer No.1	MCC-02	5.5	SS	4C2.5	55	2.71	1
MX-612	Old reactor anaerobic mixer No.2	MCC-02	5.5	SS	4C2.5	60	2.93	1
MX-613	Old reactor anoxic mixer No.1	MCC-02	5.5	SS	4C2.5	65	3.15	1
MX-614	Old reactor anoxic mixer No.2	MCC-02	5.5	SS	4C2.5	70	3.37	1
MX-615	Old reactor anoxic mixer No.3	MCC-02	5.5	SS	4C2.5	75	3.59	1
MX-616	Old reactor anoxic mixer No.4	MCC-02	5.5	SS	4C2.5	80	3.80	1
CL-621	Old clarifier No.1 bridge drive	MCC-02	0.75	DOL	4C2.5	130	1.28	1
CL-622	Old clarifier No.2 bridge drive	MCC-02	0.75	DOL	4C2.5	150	1.43	1
P-631	Old train RAS pump No.1	MCC-02	18.5	VSD	3C16	120	2.68	1

Tag	Description	MCC	kW	Starter	Cable	L m	VD %	Phase
P-632	Old train RAS pump No.2	MCC-02	18.5	VSD	3C16	122	2.72	1
P-633	Old train WAS pump No.1	MCC-02	5.5	VSD	3C4	125	3.41	1
P-634	Old train WAS pump No.2	MCC-02	5.5	VSD	3C4	127	3.45	1
AE-701	New reactor vertical aerator No.1	MCC-03	37	VSD	3C16	55	2.47	1
AE-702	New reactor vertical aerator No.2	MCC-03	37	VSD	3C16	65	2.86	1
AE-703	New reactor vertical aerator No.3	MCC-03	37	SS	4C16	75	3.42	1
AE-704	New reactor vertical aerator No.4	MCC-03	37	SS	4C25	85	2.57	1
AE-705	New reactor vertical aerator No.5	MCC-03	37	SS	4C25	95	2.84	1
AE-706	New reactor vertical aerator No.6	MCC-03	37	SS	4C25	105	3.10	1
MX-711	New reactor anaerobic mixer No.1 (existing, verify)	MCC-03	7.5	SS	4C2.5	50	3.23	1
MX-712	New reactor anaerobic mixer No.2 (existing, verify)	MCC-03	7.5	SS	4C2.5	55	3.52	1
MX-713	New reactor anoxic mixer No.1 (existing, verify)	MCC-03	7.5	SS	4C2.5	60	3.81	1
MX-714	New reactor anoxic mixer No.2 (existing, verify)	MCC-03	7.5	SS	4C4	65	2.68	1
MX-715	New reactor anoxic mixer No.3 (existing, verify)	MCC-03	7.5	SS	4C4	70	2.86	1

Tag	Description	MCC	kW	Starter	Cable	L m	VD %	Phase
MX-716	New reactor anoxic mixer No.4 (existing, verify)	MCC-03	7.5	SS	4C4	75	3.04	1
P-717	New reactor internal (a-) recycle pump	MCC-03	15	VSD	3C6	80	3.80	1
CL-721	New clarifier No.1 bridge drive	MCC-03	0.75	DOL	4C2.5	120	1.22	1
CL-722	New clarifier No.2 bridge drive	MCC-03	0.75	DOL	4C2.5	140	1.37	1
P-731	New train RAS pump No.1	MCC-03	11	VSD	3C10	110	2.41	1
P-732	New train RAS pump No.2	MCC-03	11	VSD	3C10	112	2.45	1
P-733	New train WAS pump No.1	MCC-03	4	VSD	3C2.5	115	3.69	1
P-734	New train WAS pump No.2	MCC-03	4	VSD	3C2.5	117	3.75	1
P-801	Chlorinator injector booster pump No.1	MCC-04	5.5	DOL	4C2.5	25	2.92	1
P-802	Chlorinator injector booster pump No.2	MCC-04	5.5	DOL	4C2.5	27	3.01	1
EF-803	Chlorine room low-level extraction fan No.1	MCC-04	0.75	DOL	4C2.5	15	1.94	1
EF-804	Chlorine room low-level extraction fan No.2	MCC-04	0.75	DOL	4C2.5	18	1.96	1
HO-805	Chlorine drum electric hoist 1 500 kg + trolley	MCC-04	3	DOL	4C2.5	20	2.33	1
P-101	EOP return pump No.1 (GR T10, SC-101)	MCC-05	15	VSD	3C4	15	2.78	1

Tag	Description	MCC	kW	Starter	Cable	L m	VD %	Phase
P-102	EOP return pump No.2 (GR T10, SC-102)	MCC-05	15	VSD	3C4	17	2.91	1
P-103	EOP return pump No.3 (GR T10, SC-103)	MCC-05	15	VSD	3C4	19	3.04	1
P-104	EOP drain-pit submersible pump	MCC-05	1.1	DOL	4C2.5	20	2.00	1
XV-101	EOP dam outlet penstock actuator	MCC-05	0.75	DOL	4C2.5	35	2.06	1
HO-106	EOP monorail electric chain hoist 2 t	MCC-05	3	DOL	4C2.5	15	2.17	1
DB-01	Admin building / control room / workshop DB	MCC-01	40	MCB/MCCB	4C25	30	1.16	1
UPS-01	PLC-01 / SCADA UPS supply	MCC-01	3	MCB/MCCB	4C4	5	0.45	1
LDB-01	Inlet works area lighting DB	MCC-01	4	MCB/MCCB	4C4	60	1.37	1
LDB-02	Old reactor / biofilter area lighting & small power DB	MCC-02	8	MCB/MCCB	4C4	80	2.94	1
UPS-02	PLC-02 UPS supply	MCC-02	2	MCB/MCCB	4C4	5	0.36	1
LDB-03	New reactor area lighting & small power DB	MCC-03	6	MCB/MCCB	4C4	70	2.05	1
UPS-03	PLC-03 UPS supply	MCC-03	2	MCB/MCCB	4C4	5	0.37	1
DB-04	Chlorine building lighting, small power & heaters DB	MCC-04	6	MCB/MCCB	4C4	10	2.08	1
UPS-04	RIO-04 / analyser UPS supply	MCC-04	1.5	MCB/MCCB	4C4	5	1.86	1

Tag	Description	MCC	kW	Starter	Cable	L m	VD %	Phase
LDB-05	Canopy lighting & FIT-101 converter DB	MCC-05	3	MCB/MCCB	4C4	10	1.92	1
UPS-05	PLC-05 + HMI UPS (2 h)	MCC-05	1.5	MCB/MCCB	4C4	5	1.83	1

Appendix B: Instrument Schedule

Tag	Service	Type	Signal	PLC
LIT-210	Inlet channel level upstream of screens (screen differential)	Ultrasonic, non-contact	4-20 mA HART	PLC-01
LIT-211	Inlet channel level downstream of screens	Ultrasonic, non-contact	4-20 mA HART	PLC-01
FIT-212	Inlet flow channel 1 (AS route)	Open-channel ultrasonic (flume)	4-20 mA + pulse	PLC-01
FIT-213	Inlet flow channel 2 (SBR/biofilter route)	Open-channel ultrasonic (flume)	4-20 mA + pulse	PLC-01
LIT-301	Inlet sump level	Radar, non-contact 80 GHz	4-20 mA HART	PLC-01
LSHH-302	Inlet sump high-high	Float switch	DI (volt-free)	PLC-01
LSLL-303	Inlet sump low-low	Float switch	DI hard-wired	PLC-01
PIT-304	PS1 discharge header pressure	Pressure transmitter, diaphragm seal	4-20 mA HART	PLC-01
PIT-305	PS3 discharge header pressure	Pressure transmitter, diaphragm seal	4-20 mA HART	PLC-01
FIT-306	PS3 flow to splitter box	Electromagnetic DN500	4-20 mA + pulse	PLC-01
FIT-307	PS1 flow to SBR	Electromagnetic DN300	4-20 mA + pulse	PLC-01

Tag	Service	Type	Signal	PLC
LIT-401	SBR level	Radar, non-contact	4-20 mA HART	PLC-02
AIT-402	SBR dissolved oxygen	Optical DO	4-20 mA / Modbus	PLC-02
ZS-403	SBR decanter position (up/down)	Limit switches	DI	PLC-02
LIT-410	Balancing dam level	Radar, non-contact	4-20 mA HART	PLC-02
LSHH-411	Balancing dam high-high	Float switch	DI	PLC-02
LSLL-412	Balancing dam / PS2 sump low-low	Float switch	DI hard-wired	PLC-02
FIT-413	PS2 flow to PSTs	Electromagnetic DN200	4-20 mA + pulse	PLC-02
PIT-414	PS2 discharge pressure	Pressure transmitter, diaphragm seal	4-20 mA HART	PLC-02
SS-501	Biofilter No.1 distributor rotation	Inductive proximity	DI pulse	PLC-02
SS-502	Biofilter No.2 distributor rotation	Inductive proximity	DI pulse	PLC-02
AIT-601	Old reactor aerobic DO - zone A	Optical DO	4-20 mA / Modbus	PLC-02
AIT-602	Old reactor aerobic DO - zone B	Optical DO	4-20 mA / Modbus	PLC-02
AIT-603	Old reactor MLSS	Optical TSS	4-20 mA / Modbus	PLC-02
LIT-620	Old clarifier No.1 sludge blanket	Ultrasonic blanket	4-20 mA	PLC-02
LIT-621	Old clarifier No.2 sludge blanket	Ultrasonic blanket	4-20 mA	PLC-02

Tag	Service	Type	Signal	PLC
ZS-622	Old clarifier No.1 bridge rotation / encoder	Proximity switch	DI pulse	PLC-02
ZS-623	Old clarifier No.2 bridge rotation / encoder	Proximity switch	DI pulse	PLC-02
FIT-631	Old train RAS flow	Electromagnetic DN300	4-20 mA + pulse	PLC-02
FIT-633	Old train WAS flow	Electromagnetic DN100	4-20 mA + pulse	PLC-02
LIT-630	Old RAS sump level	Radar	4-20 mA HART	PLC-02
AIT-701	New reactor aerobic DO - zone A	Optical DO	4-20 mA / Modbus	PLC-03
AIT-702	New reactor aerobic DO - zone B	Optical DO	4-20 mA / Modbus	PLC-03
AIT-703	New reactor MLSS	Optical TSS	4-20 mA / Modbus	PLC-03
FIT-717	New reactor a-recycle flow	Electromagnetic DN400	4-20 mA	PLC-03
LIT-720	New clarifier No.1 sludge blanket	Ultrasonic blanket	4-20 mA	PLC-03
LIT-721	New clarifier No.2 sludge blanket	Ultrasonic blanket	4-20 mA	PLC-03
ZS-722	New clarifier No.1 bridge rotation / encoder	Proximity switch	DI pulse	PLC-03
ZS-723	New clarifier No.2 bridge rotation / encoder	Proximity switch	DI pulse	PLC-03
FIT-731	New train RAS flow	Electromagnetic DN250	4-20 mA + pulse	PLC-03
FIT-733	New train WAS flow	Electromagnetic DN100	4-20 mA + pulse	PLC-03

Tag	Service	Type	Signal	PLC
LIT-730	New RAS sump level	Radar	4-20 mA HART	PLC-03
FIT-801	Final effluent flow (existing ultrasonic, refurbish)	Open-channel ultrasonic	4-20 mA + pulse	RIO-04
AIT-802	Chlorine residual (free)	Amperometric / colorimetric	4-20 mA	RIO-04
AIT-803	Chlorine gas leak detector (2 heads)	Electrochemical Cl2	4-20 mA + relays	RIO-04
WIT-804	Chlorine drum weigh scale (2 drums)	Load cells	4-20 mA	RIO-04
FCV-805	Chlorinator automatic dosing valve	V-notch / motorised	AO 4-20 mA + AI fb	RIO-04
PSL-806	Injector water low pressure	Pressure switch	DI	RIO-04
LIT-101	EOP wet sump level (OFD-017)	Radar, non-contact	4-20 mA HART	PLC-05
LIT-102	EOP dam level (OFD-017)	Radar in tower	4-20 mA HART	PLC-05
LSL-101	EOP sump low (back-up stop)	Float switch	DI	PLC-05
LSLL-101	EOP sump low-low trip	Float switch	DI hard-wired	PLC-05
LSHH-101	EOP sump high-high	Float switch	DI	PLC-05
FIT-101	EOP return flow + total	Electromagnetic DN350	4-20 mA + pulse	PLC-05
PIT-101	EOP header pressure	Pressure transmitter	4-20 mA HART	PLC-05
ZSO/ZSC-101	EOP penstock position	Actuator limits	DI	PLC-05

Tag	Service	Type	Signal	PLC
LSH-104	EOP drain pit level (P-104 control)	Float	Local + DI	PLC-05
LSH-105	EOP drain pit high	Float	DI	PLC-05

3.5. LEGISLATIVE AND STATUTORY REQUIREMENTS

Tenderers must comply with all the legislation and statutory requirements pertaining to this contract being including but not limited to:

- Occupational Health and Safety Act 1993 (Act 85 of 1993) and its Regulations.
- The Constitution of the Republic of South Africa (particularly Section 24 of the Bill of Rights).
- National Environmental Management Act 1998 (Act 107 of 1998).
- Environment Conservation Act 1989 (Act 73 of 1989).
- Compensation for Occupational Injures and Diseases Act.
- SANS Standards –Contractor shall use the relative standards applicable to the project.
- DST 34-304: Distribution standard – Part 7: Generic substation design.
- International Electro technical Commission (IEC) standard switchgear for 62271-100,200; SANS 62271
- International Electrotechnical Commission (IEC) standard 60947
- IEC Standard for CTs 61869 / IEC 60044
- IEC Standard for Protection Relays IEC 60255
- DST 34-1245: Substation Earthing
- DSP 34-1658: Corrosion Protection specification for new indoor and outdoor Distribution

equipment, components, materials and structures manufactured from steel.

- Occupational Health and Safety Act, 1993 (Act 85 of 1993)
- Construction Regulations (as amended)
- Pressure Equipment Regulations (PER)
- SANS 347 – Categorization and conformity assessment of pressure equipment
- ISO 9906 – Rotodynamic pumps performance testing
- ISO 5199 / ISO 13709 – Centrifugal pumps for industrial applications
- API 610 – Centrifugal pumps
- ISO 10816 / ISO 20816 – Mechanical vibration of machines
- ISO 1940 – Balance quality requirements for rotating machinery

- ISO 11342 – Mechanical vibration and shaft alignment
- SANS 719 – Cast iron pipes, fittings and joints
- SANS 545 – Ductile iron pipes, fittings and joints
- SANS 1123 – Steel pipes
- SANS 1125 – Flanges
- ISO 7005 – Metallic flanges
- BS EN 1074 – Valves for water supply
- AWWA C200–C509 series – Water pipeline and valve standards
- ASME B31.3 / ASME B31.4 – Piping systems
- ISO 12944 – Corrosion protection of steel structures
- SANS 121 / ISO 1461 – Hot-dip galvanizing
- AWWA C210 / AWWA C213 – Coatings and linings for steel water pipelines
- SANS 241 – Drinking water quality
- ISO 9927 – Inspection of lifting equipment
- ISO 4309 – Steel wire ropes for lifting equipment
- ISO 9001 – Quality management systems
- Original Equipment Manufacturer (OEM) specifications and standards
- SANS 10142-1 – The wiring of premises, Part 1: Low-voltage installations (current edition)
- Electrical Installation Regulations, 2009; Electrical Machinery Regulations, 2011; Driven Machinery Regulations, 2015
- SANS 61439-1 and SANS 61439-2 – Low-voltage switchgear and controlgear assemblies
- SANS 60947-2, -3, -4-1, -5-5 and -6-1 – Low-voltage switchgear and controlgear
- SANS 61800-2, -3 and -5-1 – Adjustable speed electrical power drive systems
- SANS 60034-1 and SANS 60034-30-1 – Rotating electrical machines and efficiency classes
- SANS 60529 – Degrees of protection provided by enclosures (IP code)
- SANS 1507-4 – XLPE-insulated distribution cables (600/1 000 V)
- SANS 10198 (series) – Selection, handling and installation of electric power cables
- SANS 61537 – Cable tray and cable ladder systems
- SANS 10292 – Earthing of low-voltage distribution systems; SANS 10199 – Design and installation of earth electrodes
- SANS 62305-1 to -4 and SANS 10313 – Protection against lightning
- SANS 61643-11 and SANS 61643-21 – Surge protective devices
- SANS 10108, SANS 60079-10-1, SANS 60079-14 and SANS 60079-17 – Hazardous locations and explosive atmospheres
- SANS 10114-1 and SANS 10114-2 – Interior and emergency lighting; SANS 60598 – Luminaires
- SANS 61131-2 and SANS 61131-3 – Programmable controllers; SANS 61326-1 – EMC of measurement and control equipment
- SANS 8528 (ISO 8528) – Reciprocating internal combustion engine driven a.c. generating sets
- NRS 048-2 – Electricity supply: Quality of supply
- SANS 1186 – Symbolic safety signs; SANS 61111 – Insulating matting; SANS 10139 – Fire detection

and alarm systems; SANS 10105-1 – Portable fire extinguishers; SANS 10103 – Environmental noise

- Note: Eskom standards DST 34-304, DST 34-1245 and DSP 34-1658 are utility documents and are to be used for guidance only; where they conflict with the SANS documents above, the SANS documents shall prevail.

Extent of the electrical, C&I and SCADA works

1.3.1 The works include the design development, supply, delivery, installation, connection, testing, commissioning, training, documentation and maintenance during the defects liability period of the following, as detailed in the drawings, schedules and these specifications:

(a) **MV supply and substations:** 11 kV intake ring main unit with metering interface, three miniature substations (MSS-01 315 kVA, MSS-02 630 kVA, MSS-03 400 kVA), about 1 030 m of 11 kV cable forming an open ring, and liaison with Dihlabeng LM for the supply connection and notified maximum demand of 1 000 kVA.

(b) **Standby power (provisional):** 400 kVA prime-rated diesel generator set with automatic transfer switch serving the essential section of MSS-01.

(c) **Motor control centres:** five MCCs serving 77 motors (27 DOL, 33 soft starter, 17 VSD), complete with incomers, metering, surge protection, power factor correction and PLC interfacing.

(d) **Removal** of redundant MCCs, distribution boards, starters, cables and instruments, and safe disposal or return to the Employer as directed.

(e) **Cabling:** all MV, LV power, control, instrument, fibre-optic and data cables, trenching, ducts, draw-pits, cable ladders and trays, terminations and labelling.

(f) **Local isolators and local control stations** at every motor; reconnection of refurbished and new motors supplied under the mechanical works.

(g) **Process instrumentation:** 58 tagged instruments (level, flow, pressure, DO, MLSS, sludge blanket, chlorine residual, gas detection, weigh scales, switches).

(h) **PLC control system:** PLC-01 (master), PLC-02, PLC-03, RIO-04 and PLC-05 panels with UPS, local HMIs, application software, and a single-mode fibre ring network.

(i) **Plant SCADA (Separable Portion 2):** server/historian, operator and engineering workstations, firewall, remote access, alarm call-out, HMI graphics, reports and cybersecurity.

(j) **Earthing, lightning and surge protection**, area lighting, small power and emergency lighting associated with the process areas, MCC rooms and chlorine building.

(k) **Testing and commissioning**, Certificates of Compliance, training, O&M manuals, as-built documentation, spares and tools.

MCC	Service	Location	Feeders	Installed kW
MCC-01	Inlet Works & Pump Stations No.1/No.3	Existing MCC room, admin building	15	347
MCC-02	Old Reactor, SBR, PS2 & Biofilter System	Existing old-reactor MCC room (replace)	32	580
MCC-03	New Reactor, Clarifiers & RAS/WAS	Existing new-reactor MCC room (refurbish/replace)	19	322
MCC-04	Disinfection & Final Effluent	Chlorine building electrical room	5	23

MCC	Service	Location	Feeders	Installed kW
MCC-05	Emergency Overflow Return Pump Station (WP2)	Outdoor IP55 kiosk on plinth at EOP platform	6	54

Table C3.1-1: Motor control centres

C3.1.4 Separable portions and provisional items

Portion	Description	Completion basis
SP1	Main electrical and C&I works (MV/LV, MCCs, cabling, instruments, PLCs, network, lighting, earthing)	Per area handover sequence (PS-G09)
SP2	Plant SCADA hardware, software, HMI and remote access	After SP1 commissioning of PLC-01
Provisional	Standby generator and ATS; Dihlabeng connection fees; lightning protection extent following risk assessment; replacement of existing transformers if found unserviceable	Instructed by the Engineer

Table C3.1-2: Separable portions and provisional items

C3.1.5 Battery limits and interfaces

Interface	By this contract (electrical / C&I)	By others
Dihlabeng LM 11 kV supply	Intake RMU, MV ring, MSS; application documentation	Supply connection, metering CTs/VTs and meter (Dihlabeng)
Mechanical equipment	Power and control cabling to motor terminal box, LI, LCS, thermistor/leak relays, testing of rotation, commissioning with mechanical contractor	Supply and installation of pumps, aerators, mixers, screens, drives, motors (mechanical works)
Civil / structural	Cable trenches, ducts, draw-pits, plinths for MSS/generator/kiosk, cable entries (unless shown as civil)	Buildings, MCC room repairs, chambers, roads (civil works)
WP2 emergency overflow PS	MCC-05 kiosk, PLC-05, instruments per OFD-017, FO spur to PLC-01	Pumps, pipework, penstock mechanism, dam (WP2 civil/mechanical)
Chlorination equipment	Power, control and signal wiring, gas detection, analyser, interface to chlorinator	Chlorinators, vacuum regulators, drums, injector (mechanical)

Table C3.1-3: Interfaces

C3.1.6 Drawings and schedules

1.6.1 The drawings listed in Annexure D and the schedules in KES-WW-DB-ELE-CS-001 form part of the Scope of Work. Drawings are schematic and indicate the design intent; positions and route lengths shall be verified on site by the Contractor before ordering. Dimensions shall not be scaled.

C3.1.7 Site information

1.7.1 The site is at Bethlehem, Free State, at an altitude of about 1 613 m. Ambient temperatures range from about -8 C to +35 C; the area experiences high lightning activity and summer thunderstorms. All equipment shall be rated for these conditions (PS-G03).

1.7.2 Wastewater atmospheres contain hydrogen sulphide and moisture; chlorine gas is stored and dosed on site. Material selection shall resist these conditions.

1.7.3 Existing services are poorly documented. The Contractor shall locate existing cables and pipes by scanning and hand excavation before mechanical excavation.

C3.2 Engineering

C3.2.1 Employer's design

2.1.1 The Employer's design comprises the design report KES-WW-DB-RPT-ELE-001, drawings and schedules listed in Annexure D. The Engineer remains responsible for the concept, sizing basis and control philosophy.

C3.2.2 Contractor's design responsibility

2.2.1 The Contractor shall be responsible for the detail design, manufacturing design and verification listed below. Such design shall be carried out or reviewed by a person registered with ECSA (Pr Eng or Pr Tech Eng, electrical) employed or appointed by the Contractor.

Deliverable	Content	Submission
Site verification report	Nameplate survey of all retained motors; condition of existing transformers, MCCs, ducts; measured cable routes	after site handover
Protection & discrimination study	Fault levels (from Dihlabeng data), MV/LV protection settings, cable fault withstand, earth-loop impedance, arc-flash incident energy labels	Before MCC manufacture
Harmonic study	VSD harmonic contribution at PCC vs NRS 048 / IEEE 519; mitigation if required	Before VSD order
Cable sizing verification	Update of KES-WW-DB-ELE-CS-001 with measured lengths and final motor data	Before cable order
Earthing design	Soil resistivity (Wenner), earth mat design to SANS 10199 / IEEE 80 for MSS	Before MSS installation
Lightning risk assessment	SANS/IEC 62305-2 risk assessment and LPS design	Within 8 weeks
MCC & panel drawings	GA, SLD, schematics, wiring, terminal, bill of materials, nameplates	Before manufacture
Functional design specification (FDS)	Detailed control narratives, I/O list, alarm list, set points, interlock matrix, HMI screens	Before programming
Network & cybersecurity design	IP plan, VLANs, firewall rules, user roles (IEC 62443)	Before SCADA configuration
Generator sizing confirmation	Motor starting voltage-dip calculation from alternator curves	Before order (if instructed)

Table C3.2-1: Contractor's design deliverables

C3.2.3 Submittal procedure

2.3.1 Submittals shall be issued electronically (PDF plus native files where applicable) with a transmittal stating document number, revision and purpose. The Engineer will review within 10 working days and return them as: A - approved; B - approved subject to comments (proceed, resubmit); C - not approved (resubmit). Manufacture or procurement shall not start before code A or B.

2.3.2 Review by the Engineer does not relieve the Contractor of responsibility for compliance with the Scope of Work.

C3.2.4 Drawing standards

2.4.1 Drawings shall comply with SANS 10111 and graphical symbols with SANS 60617; instrument symbols with ISA 5.1. Drawings shall be produced in AutoCAD (DWG) with the Employer's title block, using the project tag and cable numbering conventions of drawing KES-WW-DB-ELE-001.

2.4.2 As-built drawings, red-lined on site during construction and kept in the site office, shall be updated and submitted in DWG and PDF before practical completion.

C3.2.5 Standardisation

2.5.1 To reduce spares holding, the Contractor shall use one manufacturer for each of: PLCs and remote I/O; soft starters; VSDs; MCCBs/MPCBs/contactors; network switches; and one manufacturer per instrument type (e.g. all radar transmitters).

C3.3 Procurement

3.1 Preferences. Procurement shall comply with the Preferential Procurement Policy Framework Act and Regulations, the Municipal Finance Management Act Supply Chain Management Regulations and the Employer's SCM policy, as stated in the Tender Data.

3.2 Local content. Where products fall within sectors designated for local production by the Department of Trade, Industry and Competition (for example electrical cables and transformers), the stipulated minimum local content thresholds apply, measured per SATS 1286. Tenderers shall declare local content in the returnable schedules and in Technical Schedules B.

3.3 Contractor grading. The tenderer shall hold the CIDB contractor grading designation stated in the Tender Data (electrical engineering works, EP class).

3.4 Electrical contractor registration. The Contractor (or its electrical subcontractor) shall be a registered electrical contractor in terms of the Electrical Installation Regulations, 2009 with the Department of Employment and Labour, and shall employ registered persons (master installation electrician for the installation including MV where applicable) to sign Certificates of Compliance.

3.5 Specialist subcontractors. PLC/SCADA systems integration, MCC manufacture and instrumentation commissioning shall be carried out by specialists with at least three completed water or wastewater projects of similar scope in the last seven years. References shall be submitted with the tender.

3.6 MCC manufacturer. MCCs shall be manufactured by a panel builder holding a licence/partnership with the original equipment manufacturer of the type-tested switchboard system offered, operating a quality system to ISO 9001.

3.7 Equivalence. Brand names in this document indicate the standard of quality only. Alternatives of equal or better quality and performance are acceptable subject to approval. The onus of proving equivalence lies with the tenderer.

3.8 Targeted labour and local enterprises. Requirements for local labour, local subcontractors and EPWP reporting are stated in the Contract Data and shall be complied with.

C3.4 Construction

C3.4.1 Applicable standards

4.1.1 All work shall comply with the following legislation and standards, the latest editions applying:

Reference	Title / application
Act 85 of 1993	Occupational Health and Safety Act and Regulations: Electrical Installation Regulations 2009; Electrical Machinery Regulations 2011; Construction Regulations 2014; General Machinery Regulations; Hazardous Chemical Agents Regulations
SANS 10142-1 / -2	The wiring of premises - Part 1 LV installations; Part 2 MV installations above 1 kV a.c. up to 22 kV
SANS 10845-1/-2/-3	Construction procurement
SANS 1921-1	Construction and management requirements for works contracts - general engineering and construction works
SANS 1029	Miniature substations
SANS 780	Distribution transformers
SANS 62271 series	High-voltage switchgear and controlgear (incl. -200 metal-enclosed, -202 prefabricated substations)
SANS 61439-1 / -2	Low-voltage switchgear and controlgear assemblies
SANS 60947 series	Low-voltage switchgear and controlgear (breakers, contactors, starters, soft starters, ATS)
SANS 556-1	Low-voltage switchgear - circuit-breakers
SANS 61800 series	Adjustable speed electrical power drive systems (incl. EMC and functional safety)
SANS 60034 series	Rotating electrical machines (incl. -30-1 efficiency classes)
SANS 1507-3 / -4	LV PVC and XLPE distribution cables (600/1000 V), 1507-3
SANS 1339	Electric cables - cross-linked polyethylene (XLPE) insulated cables for rated voltages 3.8/6.6 kV to 19/33 kV
SANS 10198 (all parts)	Selection, handling and installation of electric power cables of rating not exceeding 33 kV

Reference	Title / application
SANS 1213	Mechanical cable glands
SANS 10199	Design and installation of earth electrodes
SANS 10292	Earthing of low-voltage (LV) distribution systems
SANS 10313 / SANS 62305	Protection against lightning
SANS 61643 series	Low-voltage surge protective devices
SANS 60529	Degrees of protection provided by enclosures (IP code)
SANS 121	Hot-dip galvanized coatings on fabricated iron and steel articles
SANS 8528 series	Reciprocating internal combustion engine driven a.c. generating sets
SANS 62040 series	Uninterruptible power systems
SANS 10114-1 / -2	Interior lighting; emergency lighting
SANS 10098-1	Public lighting (area lighting guidance)
SANS 10340-1	Installation of telecommunication cables - fibre optic cable
SANS 10111	Engineering drawings
SANS 60617	Graphical symbols for diagrams
NRS 048	Electricity supply - quality of supply
IEC 61131-2 / -3	Programmable controllers - equipment, programming languages
IEC 62443-3-3	Industrial communication networks - system security requirements
IEC 62439-2	High availability automation networks - MRP
ISA 5.1 / ISA-18.2 / ISA-101	Instrumentation symbols; alarm management; HMI design
ISO 13849-1	Safety of machinery - safety-related parts of control systems
IEC 60204-1	Safety of machinery - electrical equipment of machines
IEEE 519	Harmonic control in electric power systems
Dihlabeng LM	Electricity supply by-laws and standards for connections

Table C3.4-1: Applicable legislation and standards

C3.4.2 General Technical Specifications (GS)

The General Technical Specifications below apply to all electrical, instrumentation and control works under this contract unless amended by a Particular Specification.

GS-01 General requirements

GS-01.1 Materials and equipment shall be new, of current manufacture, unused, and suitable for continuous operation in a wastewater treatment environment. Obsolete or end-of-life products (manufacturer's announced discontinuation within 5 years) shall not be offered.

GS-01.2 Equipment shall bear the SABS mark or Letter of Authority (LoA) from the NRCS where a compulsory specification applies (e.g. VC 8075 for cables, VC 8036 for plugs/sockets, VC 8055 for switches).

GS-01.3 Workmanship shall be of the highest standard, carried out by qualified and experienced personnel under continuous supervision of a competent person.

GS-01.4 All equipment shall be labelled in English with engraved traffolyte (indoor) or engraved stainless steel / UV-stable labels (outdoor), fixed with stainless steel screws or rivets. Self-adhesive labels are not acceptable.

GS-01.5 Fasteners outdoors and in process areas shall be stainless steel grade 316; dissimilar metals shall be isolated.

GS-02 Service conditions

GS-02.1 Equipment shall be rated for continuous operation at: altitude 1 650 m; ambient -10 C to +40 C (outdoor equipment in direct sun: surface temperature 60 C); relative humidity up to 95 %; corrosive atmosphere containing H2S and, in the chlorine building, chlorine traces; lightning ground flash density typical of the Free State highveld.

GS-02.2 Derating for altitude and temperature shall be applied to motors, VSDs, soft starters, transformers, generators, breakers and busbars, and shall be demonstrated in the Technical Schedules.

GS-02.3 Minimum enclosure protection: indoor switchgear IP54; outdoor equipment IP65 (IP66 for LCS and junction boxes); submerged equipment IP68. Outdoor enclosures shall be fitted with sun canopies.

GS-03 Supply characteristics

GS-03.1 MV: 11 kV, 3-phase, 50 Hz, resistance-earthed (to be confirmed by Dihlabeng LM). LV: 400/230 V, 3-phase 4-wire, 50 Hz, TN-S. Control voltage: 230 VAC; PLC I/O: 24 VDC. Voltage tolerance +/-10 %, frequency +/-2.5 %.

GS-04 Low-voltage switchgear assemblies and MCCs

GS-04.1 Assemblies shall be design-verified to SANS 61439-1/-2 (type-tested), with test certificates for temperature rise, short-circuit withstand, dielectric properties and, where specified, internal arc (IEC/TR 61641). Routine verification certificates shall be submitted for every assembly.

GS-04.2 Construction: rigid, self-supporting, 2 mm sheet steel minimum (doors 2 mm, covers 1.6 mm), powder-coated to minimum 60 microns, RAL 7032 or 7035 externally, white mounting plates. Cable entry from below via removable undrilled gland plates (non-magnetic for single-core cables).

GS-04.3 Busbars: hard-drawn high-conductivity copper, tin-plated, colour-coded red/white/blue/black, fully insulated or shrouded; current density not exceeding 1.6 A/mm2 for main busbars. Neutral full-size; separate earth bar along full length.

GS-04.4 Separation forms as specified in the PS. Each functional unit shall have its own door, interlocked with the isolating device so that the door cannot open with the device ON (defeat facility for authorised personnel only), and lockable in the OFF position.

GS-04.5 Internal wiring: flexible copper, 600/1000 V PVC or halogen-free, minimum 2.5 mm2 for power and CTs, 1.0 mm2 for control, 0.75 mm2 for signal; colour-coded (control AC red/black, DC blue, interlocks from external sources orange); ferrule-numbered both ends to the schematic; in slotted trunking with 30 % spare space.

GS-04.6 Terminals: DIN-rail screw or spring-clamp, one conductor per terminal side, grouped and labelled by function; disconnect/fuse terminals for analogue loops and CT shorting terminals; 20 % spare terminals.

GS-04.7 Indications: LED pilot lights with colours per IEC 60204-1 / IEC 60073 (green = running, amber = tripped/fault, white = supply healthy/available, blue = local mode) unless the Employer's standard differs; to be confirmed at design review before manufacture.

GS-04.8 Anti-condensation heaters with thermostat in outdoor assemblies; forced ventilation with filters sized for VSD/soft starter losses, maintaining internal temperature below 45 C.

GS-04.9 Danger and warning signs per OHS Act; arc-flash labels as determined by the protection study; mimic diagram on the front of each MCC.

GS-05 Motor starters and protection

GS-05.1 Every starter shall achieve Type 2 coordination (SANS 60947-4-1 / -4-2) between short-circuit protective device, contactor/soft starter and overload device, verified by manufacturer's coordination tables.

GS-05.2 Motor protection shall include thermal overload (class 10 unless stated), phase loss and unbalance, earth fault, and PTC thermistor where fitted. Soft starters and VSDs may provide these functions integrally.

GS-05.3 Every motor shall have a local isolator (AC-23A, lockable OFF, early-break auxiliary contact) adjacent to the motor and a local control station (LCS) with latching E-stop, start, stop, key-operated LOCAL-OFF-REMOTE selector, and run/trip indication, as shown on typical schematics ELE-009 to ELE-011.

GS-05.4 E-stop circuits shall be hard-wired, de-energise-to-trip, monitored by a safety relay achieving PL d to ISO 13849-1, and require a deliberate reset at the MCC after release.

GS-05.5 Control circuits shall be supplied via a control transformer with earthed secondary and MCB protection per MCC section. PLC interfaces shall be by interposing relays (plug-in, LED, test button).

GS-06 Soft starters

GS-06.1 Soft starters shall be three-phase controlled, with integral bypass contactor, current-limit and torque-control (pump) start/stop profiles, and comprehensive electronic motor protection. Rating shall be heavy duty (minimum 3.5 x In for 15 s, 10 starts per hour) at site conditions.

GS-06.2 Each soft starter shall communicate on the specified Ethernet protocol, reporting currents, energy, starts, thermal model and fault codes to the PLC.

GS-07 Variable speed drives

GS-07.1 VSDs shall comply with SANS 61800-2, -3 (category C2), -5-1 and -5-2 (STO). Input harmonic mitigation by DC choke or line reactor (THDi <= 40 % at drive). Harmonic compliance at the PCC shall be demonstrated by the Contractor's study.

GS-07.2 Output: motor cable screened symmetrical type; dV/dt or sine filter where cable length exceeds 50 m or the motor manufacturer requires. Motors >= 37 kW on VSD shall have an insulated non-drive-end bearing.

GS-07.3 Each VSD shall have STO wired to the E-stop safety relay, PTC input, local keypad mounted on the MCC door, hard-wired run/ready/fault and analogue speed reference/feedback, plus Ethernet communications for diagnostics.

GS-07.4 Parameter sets shall be documented, backed up to the engineering workstation and handed over. Minimum speeds and ramps shall be agreed with the mechanical supplier.

GS-08 Electric motors

GS-08.1 LV motors: SANS 60034, IE3 minimum, TEFC IP55, class F insulation with class B rise, 400 V 50 Hz, cast-iron frame for >= 11 kW in process areas, rated at site altitude. Submersible motors IP68 with seal-leak and thermal protection.

GS-08.2 Existing motors to be retained shall be inspected, insulation-resistance and polarisation-index tested, and reported on. Motors failing the tests shall be reported for refurbishment or replacement by variation order.

GS-09 Cables

GS-09.1 LV power cables: copper, SANS 1507-3 (PVC) or SANS 1507-4 (XLPE), 600/1000 V, SWA, PVC-sheathed. MV cables: SANS 1339 XLPE 6.35/11 kV, copper, screened, SWA. Instrument cables: pairs individually and overall screened, armoured. VSD cables: symmetrical screened type.

GS-09.2 Cable handling and installation shall comply with SANS 10198, including minimum bending radii, maximum pulling tension, drum handling and storage. Cable ends shall be sealed at all times before termination.

GS-09.3 Cables shall be installed in one continuous length between terminations; joints are not permitted without written approval.

GS-09.4 Segregation: MV, LV power, control, instrument/data shall be separated by at least 300 mm on trays or by earthed metal barriers, and cross at right angles.

GS-09.5 Glands: SANS 1213 brass compression glands with PVC shrouds; EMC 360-degree glands for VSD and screened cables; earth tags bonding armour to the earth bar.

GS-09.6 Terminations: compression lugs crimped with a calibrated hydraulic tool; cores identified with ferrules matching the schematic; spare cores terminated on earth bar at panel end and labelled SPARE.

GS-09.7 Cable labelling: every cable at both ends and at entry/exit of ducts and draw-pits with stainless steel or UV-stable engraved markers showing the cable number from the cable schedule.

GS-10 Cable trenches, ducts and draw-pits

GS-10.1 Trench depths to cover: MV 1.0 m, LV 0.8 m, communications 0.6 m. Bedding and blanket of 150 mm selected fine material (no stones > 6 mm), compaction to 93 % Mod AASHTO under roads and 90 % elsewhere, warning tape 300 mm above cables, route markers at 50 m and changes of direction.

GS-10.2 Ducts: HDPE or uPVC (110 mm LV/control, 160 mm MV, 50 mm FO), with a draw-wire and sealed ends; concrete-encased under roads extending 1 m beyond road edges. Minimum 1 spare duct per route.

GS-10.3 Draw-pits: precast concrete with heavy-duty lids at maximum 50 m intervals, at changes of direction and at road crossings, with drainage.

GS-10.4 Where existing services are crossed, hand excavation is required within 1 m; clearances per SANS 10198-8.

GS-11 Cable ladders, trays and supports

GS-11.1 Heavy-duty ladder or return-flanged perforated tray, hot-dip galvanised to SANS 121 (SS316 in the chlorine building and on reactor bridges), supported at maximum 1.5 m, with manufacturer's bends, tees and risers (site-fabricated bends not acceptable). 30 % spare capacity.

GS-11.2 Cables fixed with UV-stabilised cleats or stainless steel ties at 600 mm horizontal and 300 mm vertical. Lockable covers on walkways and where exposed to direct sun along long runs.

GS-12 Earthing and bonding

GS-12.1 Earthing systems shall comply with SANS 10142-1, SANS 10199 and SANS 10292. Earth electrodes: copper-bonded steel rods with exothermic welded connections; inspection pits at test points.

GS-12.2 Main earth bars at each MSS and MCC, interconnected by the site ring earth. All exposed and extraneous conductive parts bonded, including handrails, walkways, aerator bridges, cable trays (at every joint and every 20 m), pipework and fences within 2 m of electrical equipment.

GS-12.3 Instrument/PLC clean earth bars isolated from the panel structure and connected to the main earth bar at one point only.

GS-13 Lightning and surge protection

GS-13.1 Lightning protection systems to SANS 10313 / SANS 62305, following the risk assessment. Coordinated SPDs to SANS 61643: Type 1+2 at substations and MCC incomers, Type 2 at DBs and PLC panels, Type 3 and signal SPDs at field instruments with outdoor cable runs exceeding 30 m (both ends).

GS-14 Field instrumentation

GS-14.1 Instruments shall be industrial grade, from manufacturers with local calibration and service capability, with 4-20 mA HART outputs (or specified fieldbus) and local display. Calibration certificates traceable to national standards shall be supplied.

GS-14.2 Installation: on SS316 brackets or stands with sun shields; accessible from walkways without confined space entry; converters and junction boxes above the 1:100 flood level; process connections with isolation valves.

GS-14.3 Instrument tag plates (SS engraved) shall be fixed to every instrument and junction box.

GS-15 PLC systems

GS-15.1 PLCs shall be modular industrial controllers to IEC 61131-2, programmed in IEC 61131-3 languages with a standard library of function blocks (motor, VSD, valve, analogue, PID, duty/standby). Source code shall be fully commented, unlocked and handed over with licences.

GS-15.2 Each PLC panel shall have redundant 24 VDC supplies, UPS backing for 2 h, 20 % installed spare I/O wired to terminals, and 20 % spare rack space. Analogue inputs shall detect wire-break and over-range (NAMUR NE43).

GS-15.3 Process control shall continue at each PLC if network communication is lost; critical interlocks between PLCs shall have a hard-wired back-up where specified.

GS-16 Industrial networks

GS-16.1 Plant network: managed industrial Ethernet switches with ring redundancy (MRP or RSTP), single-mode fibre between buildings, Cat6 S/FTP within buildings (maximum 90 m). Fibre installation to SANS 10340-1, fusion-spliced, OTDR-tested.

GS-16.2 Cybersecurity to IEC 62443-3-3: zones and conduits, firewalled boundary, no direct internet connection to control devices, unique accounts and passwords, disabled unused ports and services, logging and back-ups.

GS-17 Lighting and small power

GS-17.1 Luminaires: LED, minimum 100 lm/W (120 lm/W floodlights), IP65 indoors in process buildings, IP66 outdoors, 4 000 K. Illuminance per SANS 10114-1 for indoor areas and as specified in PS for outdoor areas. Emergency lighting to SANS 10114-2.

GS-17.2 Socket outlets: industrial IEC 60309 type outdoors (IP67), protected by 30 mA earth leakage units.

GS-18 Painting and corrosion protection

GS-18.1 All steelwork outdoors hot-dip galvanised (SANS 121). Damaged galvanising repaired with zinc-rich paint. Enclosures outdoors SS316 or GRP with UV stabilisation, or galvanised steel powder-coated to 80 microns.

GS-19 Removal of existing installations

GS-19.1 Before removal, the Contractor shall prove de-energisation, apply lock-out, and record existing circuits. Removed equipment shall be listed and handed to the Employer or disposed of at a licensed facility as instructed; PCB-containing equipment (if any) shall be handled per hazardous waste regulations.

C3.4.3 Particular (Project) Specifications (PS)

The Particular Specifications state the project-specific requirements of this contract and take precedence over the General Technical Specifications.

PS-G General project requirements

PS-G01 **Design basis.** The works shall be executed in accordance with design report KES-WW-DB-RPT-ELE-001 and the drawings in Annexure D. Equipment ratings and quantities are listed in Annexures B and C.

PS-G02 **Tagging.** Equipment, cable and instrument tags shall follow drawing KES-WW-DB-ELE-001: area numbers 1xx EOP (WP2), 2xx inlet works, 3xx inlet sump/PS1/PS3, 4xx SBR/balancing dam/PS2, 5xx PST/biofilters, 6xx old reactor train, 7xx new reactor train, 8xx disinfection.

PS-G03 **Site conditions.** All equipment shall be rated for 1 650 m altitude and 40 C ambient without loss of specified output.

PS-G04 **Verification of existing equipment.** Items marked "verify" in Annexure B are existing; their nameplate data shall be confirmed in the site verification report (C3.2.2) before MCC manufacture. Starter sizes shall be adjusted at the tendered rates.

PS-G05 **Cable lengths.** Lengths in the cable schedule are design estimates. The Contractor shall measure routes and re-verify volt drop using the live calculation in KES-WW-DB-ELE-CS-001 before ordering; quantities are remeasurable.

PS-G06 **Inconsistency resolved.** The emergency overflow return pumps P-101 to P-103 shall be on VSDs (15 kW) per drawing OFD-017 and calculation CALC-001, superseding the soft-starter entry for that station in DDR Table 4-6.

PS-G07 **Mechanical interface.** The Contractor shall attend joint rotation checks, motor alignment witness and wet commissioning with the mechanical contractor.

PS-G08 **Dihlabeng LM.** The Contractor shall prepare the supply application documentation (SLD, load schedule, NMD 1 000 kVA, protection settings) for submission by the Employer and comply with Dihlabeng requirements for connection, testing and switching.

PS-G09 **Live plant and shutdowns.** The plant shall remain in operation. Change-overs shall be planned area by area with temporary supplies where needed, and each shutdown shall be requested 10 working days in advance with a method statement. Indicative sequence: (1) MSS-01, MCC-01, inlet works and PS3 (temporary supply to two PS3 pumps maintained); (2) MCC-05 and EOP with WP2; (3) MSS-03, MCC-03, new reactor; (4) MSS-02, MCC-02, old reactor, SBR, PS2, biofilters - only after the new reactor is fully operational; (5) MCC-04, disinfection; (6) SCADA. No more than one reactor train may be out of service at any time.

PS-G10 **Temporary works.** Temporary supplies, generator hire and temporary cabling required to keep the plant in operation during change-overs shall be priced in the preliminary and general items.

PS-E01 MV reticulation and miniature substations

Provide MSS-02 630 kVA (old reactor), MSS-03 400 kVA (new reactor), each 11 000/420 V Dyn11 ONAN with MV RMU (2 ring switches + T-off) and LV section with ACB (LSIG), multi-function meter on Modbus TCP, SPD Type 1+2 and MCCB outgoing ways per drawing

PS-E01.2 Provide intake RMU-00 to Dihlabeng LM standard with metering cubicle interface and a circuit breaker with self-powered IDMT protection on the plant feeder.

PS-E01.3 Install 3C 95 mm2 Cu XLPE 6.35/11 kV SWA cable in 160 mm ducts: MV1 RMU-00 to MSS-01 (~60 m), MV2 MSS-01 to MSS-02 (~350 m), MV3 MSS-02 to MSS-03 (~220 m), MV4 MSS-03 to RMU-00 (~400 m) with normally-open point at MSS-03. MV terminations by a jointer qualified for XLPE MV cable. Pressure-test per SANS 10198-13 (very low frequency or DC as approved).

PS-E01.4 MSS plinths (concrete, with oil containment where required by the environmental authorisation) and earth mats (target <= 1 ohm) are included.

PS-E01.5 Option: where the site verification shows existing transformers to be serviceable and of equal or greater rating, the Engineer may instruct their retention after oil testing (dielectric strength, moisture, DGA) and refurbishment, priced at the tendered provisional rates.

PS-E02 Standby generator and ATS (provisional)

PS-E02.1 Provide a 1250 kVA prime-rated (ISO 8528 PRP) 400 V diesel generator set at MSS-01, performance class G2, in an acoustic canopy (<= 75 dBA at 7 m) on a concrete plinth, with 12-hour bunded day tank, AMF controller with Modbus TCP to PLC-01 and remote start.

PS-E02.2 The set shall start a 55 kW PS3 pump on its soft starter (current limit 3.0 x FLC) with 190 kW already running, with voltage dip not exceeding 15 % and recovery within 2 s. The supplier shall submit the calculation.

PS-E02.3 Provide a 630 A 4-pole PC-class ATS (SANS 60947-6-1) with mechanical and electrical interlocking, 5 s mains-fail confirmation, 5 min mains-return stabilisation and 5 min cool-down, and status signals to PLC-01 for load shedding (drawing ELE-012).

PS-E03 Motor control centres

PS-E03.1 Provide MCC-01 to MCC-05 to SLDs ELE-004 to ELE-008 and Technical Schedule TS-04: MCC-01 and MCC-02 Form 4 Type 6 with internal-arc tested construction; MCC-03 and MCC-04 Form 3b; MCC-05 an outdoor IP55 double-walled stainless steel or galvanised-and-painted kiosk on the EOP platform per OFD-010.

PS-E03.2 Each MCC shall include: incomer MCCB/ACB with LSIG trip and shunt trip; phase-failure relay; SPD Type 1+2 with status contact; MFM (V, A, kW, kvar, kVA, pf, THD, kWh) on Modbus TCP; automatic detuned PFC (sizes per ELE-002); control transformer; managed Ethernet switch; 20 % equipped spare feeders (at least one 32 A and one 63 A) and 20 % space.

PS-E03.3 MCC-02 and MCC-03 shall be installed in the existing MCC rooms after removal of the existing boards; room refurbishment (painting, ventilation/air conditioning to keep below 35 C, lighting, cable trenches with covers) is included where shown.

PS-E03.4 Factory acceptance testing (C3.6) shall be witnessed by the Engineer at the manufacturer's works before delivery.

PS-E04 Motor starting and control

PS-E04.1 Starter types shall be as listed in Annexure B: DOL for motors <= 7.5 kW not otherwise specified; soft starters for PS1/PS2/PS3 pumps, fixed-speed aerators and all reactor mixers; VSDs for DO-trim aerators (AE-401, AE-601, AE-602, AE-701, AE-702), RAS and WAS pumps, internal recycle pump P-717 and EOP pumps P-101 to P-103.

PS-E04.2 Hard-wired low-low level trips shall be provided from LSLL-303 (PS1/PS3), LSLL-412 (PS2) and LSLL-101 (EOP pumps) into the starter safety circuits.

PS-E04.3 Reversing starters with open/closed limit inputs shall be provided for the SBR decanter DC-403 and EOP penstock XV-101.

PS-E04.4 Clarifier bridge drives shall be fed via the existing slip-ring assemblies, which shall be inspected and refurbished or replaced (including the earth track).

PS-E05 Cabling and containment

PS-E05.1 Supply and install all cables listed (Power_Cables, Control_Cables, Instrument_Cables and Network_Cables sheets). Each motor feeder comprises P1 (MCC to local isolator), P2 (local isolator to motor), C1 (12C 1.5 mm2 MCC to LCS) and, where listed, T1 (thermistor/seal-leak).

PS-E05.2 All existing redundant cables in trenches being reused shall be removed. Existing ducts may be reused only after proving by mandrel and approval by the Engineer.

PS-E05.3 On reactor walkways and clarifier bridges, cables shall be on SS316 ladder with lockable covers, mounted on the outside of handrails so as not to obstruct access.

PS-E06 Earthing and lightning protection

PS-E06.1 Install a 70 mm2 bare copper ring earth at 0.6 m depth interconnecting MSS-01/02/03, the MCC rooms, the chlorine building, the admin building and the EOP kiosk, with earth mats at each MSS (target <= 1 ohm) per drawing ELE-013.

PS-E06.2 Lightning protection: provisional LPL III for MCC rooms, the chlorine building and the admin building; air terminals on the EOP canopy; final extent per the risk assessment.

PS-E07 Lighting and small power

PS-E07.1 Area lighting: LED floodlights on HDG poles giving average 20 lux on walkways and roads and 50 lux at equipment platforms (inlet works, pump stations, reactor bridges, clarifiers, chlorine building, EOP), photocell and timer control with local override.

PS-E07.2 Indoor: 300 lux MCC rooms, 500 lux control room, 200 lux chlorine building with IP66 corrosion-resistant luminaires, and 3 h emergency lighting in these rooms.

PS-E07.3 Provide one 3-phase 32 A and two 16 A 230 V industrial socket outlets at each process area for maintenance.

PS-I01 Instrumentation

PS-I01.1 Supply, install, calibrate and commission the 58 instruments in Annexure C in accordance with the P&IDs CI-002 to CI-005, loop typicals CI-006 and Technical Schedules TS-21 to TS-29.

PS-I01.2 Electromagnetic flow meters shall be installed with the straight lengths required by the manufacturer, in chambers with drainage, with remote converters mounted above ground level on SS stands with sun shields.

PS-I01.3 The existing inlet and final effluent open-channel flow meters shall be refurbished or replaced; flumes shall be checked for dimensional compliance with ISO 4359 and a flow verification carried out by an independent method (e.g. dye dilution or temporary clamp-on meter where feasible).

PS-I01.4 DO, MLSS and sludge blanket sensors shall be mounted on retractable SS316 handrail brackets enabling removal for cleaning without entering the tank.

PS-I01.5 The chlorine gas detection system shall operate the extraction fans, beacon, siren and door warning light directly from its relays independent of the PLC, and report to RIO-04.

PS-I01.6 WP2 instruments LIT-101, LIT-102, LSL/LSLL/LSHH-101, FIT-101, PIT-101, LSH-104/105 and penstock limits shall be as specified on OFD-017 with set points as listed there.

PS-C01 PLC control system

PS-C01.1 Provide PLC-01 (master, MCC-01 room), PLC-02 (MCC-02 room), PLC-03 (MCC-03 room), RIO-04 (chlorine building, on PLC-03) and PLC-05 (EOP kiosk) to drawings CI-007 and SCA-001 and Technical Schedule TS-20, with I/O per the IO_Schedule in KES-WW-DB-ELE-CS-001 plus 20 % installed spare.

PS-C01.2 Each PLC panel shall have a local 10-15 inch colour HMI giving full monitoring and control of its area, so that the plant can be operated without SCADA.

PS-C01.3 Application software shall implement the control philosophy in Section 9 of the design report and drawings CI-002 to CI-005, including: screen differential/timer control; PS3 four-stage level control with rotation, standby substitution, maximum starts and float back-up; PS1 SBR fill permissive; SBR cycle control with DO trim; PS2 level control; primary sludge timers; DO cascade control with aerator staging; flow-paced RAS with blanket override; SRT-based WAS batching; flow-paced recycle; flow-paced chlorine dosing with residual trim; drum changeover; EOP interface (overflow active, return enable, flow set point) per OFD-017; sequential starting, staggered restart after power failure and generator load shedding.

PS-C01.4 Before programming, the Contractor shall submit the Functional Design Specification (FDS) for approval, developed from the design report, including the interlock and alarm matrix and all set points.

PS-C01.5 Inter-PLC critical signals (PS1 SBR fill permissive; EOP overflow active and return enable) shall have a hard-wired or GSM back-up as shown on SCA-001.

PS-C02 Communications network

PS-C02.1 Provide a single-mode fibre ring PLC-01 > PLC-02 > PLC-03 > RIO-04 > PLC-01 (FO-01 to FO-04, ~1 230 m) and spur FO-05 to PLC-05 (~280 m), 12-core OS2 armoured cable in 50 mm HDPE ducts, with patch panels and managed switches (TS-16) configured for MRP/RSTP.

PS-C02.2 Ring FO-04 shall follow a physically different route from FO-01 to FO-03 wherever practical.

PS-C02.3 Provide a GSM alarm gateway at PLC-01 and the GSM back-up modem at PLC-05 (OFD-017) with SIM contracts in the Employer's name for 12 months.

PS-C03 Plant SCADA (Separable Portion 2)

PS-C03.1 Provide the SCADA system to drawing SCA-001/002 and Technical Schedules TS-30 and TS-31 in the control room at the admin building: server/historian, operator workstation(s), engineering workstation, core switch, firewall, 4G VPN router, UPS, printer and furniture (operator desk and chair).

PS-C03.2 HMI graphics to ISA-101 high-performance principles with the screen hierarchy on SCA-002 (overview, nine area screens, faceplates, alarms, trends, reports, maintenance, user management).

PS-C03.3 Alarm management to ISA-18.2: alarm philosophy document, rationalised alarm list with priorities, SMS call-out for priority 1 alarms to a roster of at least 5 numbers with acknowledgement.

PS-C03.4 Historian: all analogue values and states logged for at least 5 years online. Reports: daily and monthly flow, volumes, energy per area, chlorine use, run-hours and starts, and a monthly DWS compliance data report.

PS-C03.5 Cybersecurity: implement the network design submitted under C3.2.2; perform and document a vulnerability scan and a cybersecurity acceptance test before handover.

PS-C03.6 Include 3 years of software maintenance/support licences from commissioning.

Annexure A: Technical Schedules A and B

Schedule A states the Employer's minimum requirements; Schedule B shall be completed by the tenderer. The Schedule A for the printed tender document. Tenderers shall complete either version and attach manufacturers' data sheets.

TS-01 Miniature substations 11/0.42 kV (3 No)

No	Description	Schedule A - Required	Schedule B - Offered
01.1	Manufacturer	State	
01.2	Model / type reference	State	
01.3	Country of manufacture	State	
01.4	Local content (SATS 1286) where designated (%)	State %	
01.5	Local agent / service centre (nearest to Bethlehem)	State	
01.6	Standard	SANS 1029, SANS 780, SANS 62271-202	

No	Description	Schedule A - Required	Schedule B - Offered
01.7	Ratings / quantity (kVA)	MSS-01 315 kVA, MSS-02 630 kVA, MSS-03 400 kVA (1 each)	
01.8	Rated voltage ratio (V)	11 000 / 420 V	
01.9	Vector group	Dyn11	
01.10	Cooling	ONAN, mineral oil to SANS 555	
01.11	Tapping range (%)	+/- 5 % in 2.5 % steps, off-load	
01.12	Impedance voltage (%)	4.0 - 5.0 %	
01.13	Losses (W)	To SANS 780 / NRS (state no-load and load losses)	
01.14	MV compartment	2 ring switches + 1 T-off (fuse-switch or CB with relay), 630 A, 20 kA 1 s	
01.15	LV compartment	ACB LSIG trip, MFM, CT metering, SPD Type 1+2, outgoing MCCBs	
01.16	Enclosure	Mild steel hot-dip galvanised + paint, IP54, vandal-resistant, lockable	
01.17	Internal arc classification	IAC AB 20 kA 1 s (MV)	
01.18	Temperature rise (K)	Top oil <= 60 K, winding <= 65 K at site altitude	
01.19	Earthing	HV and LV earth bars, separable link	

TS-02 MV ring main unit (intake RMU-00) (1 No)

No	Description	Schedule A - Required	Schedule B - Offered
02.1	Manufacturer	State	
02.2	Model / type reference	State	
02.3	Country of manufacture	State	
02.4	Local content (SATS 1286) where designated (%)	State %	
02.5	Local agent / service centre (nearest to Bethlehem)	State	
02.6	Standard	SANS 62271-200, NRS 003	

No	Description	Schedule A - Required	Schedule B - Offered
02.7	Rated voltage / insulation level (kV)	12 kV, 28 kV PF / 75 kV BIL	
02.8	Rated current busbar / ring switches (A)	630 A	
02.9	Short-time withstand (kA)	20 kA 3 s (or to Dihlabeng standard)	
02.10	Insulating medium	SF6-free (solid / air) preferred; SF6 acceptable to Dihlabeng standard	
02.11	Configuration	2 ring + 1 CB with self-powered protection relay + metering unit	
02.12	Protection relay	IDMT O/C + E/F (IEC 60255)	
02.13	Fault passage indicators	Required on ring switches	
02.14	IAC	AFL 20 kA 1 s	

TS-03 MV cables and accessories (1 030 m)

No	Description	Schedule A - Required	Schedule B - Offered
03.1	Manufacturer	State	
03.2	Model / type reference	State	
03.3	Country of manufacture	State	
03.4	Local content (SATS 1286) where designated (%)	State %	
03.5	Local agent / service centre (nearest to Bethlehem)	State	
03.6	Standard	SANS 1339, SANS 10198 (installation)	

No	Description	Schedule A - Required	Schedule B - Offered
03.7	Type	3-core 95 mm2 Cu, XLPE, 6.35/11 kV, screened, SWA, PVC	
03.8	Short-circuit rating conductor (kA)	>= 13.6 kA 1 s	
03.9	Terminations	Heat-shrink / cold-shrink, indoor & outdoor, to SANS 10198-11	
03.10	Joints	Not permitted unless approved; heat-shrink straight joints	
03.11	Approx. length (m)	1 030 m (measure on site)	

TS-04 Motor control centres MCC-01 to MCC-05 (5 No)

No	Description	Schedule A - Required	Schedule B - Offered
04.1	Manufacturer	State	
04.2	Model / type reference	State	
04.3	Country of manufacture	State	
04.4	Local content (SATS 1286) where designated (%)	State %	
04.5	Local agent / service centre (nearest to Bethlehem)	State	
04.6	Standard	SANS/IEC 61439-1 and -2, type-tested (design verification)	
04.7	Rated operational voltage (V)	400 V 3 ph + N, 50 Hz	
04.8	Rated insulation voltage (V)	1 000 V	
04.9	Busbar rated current (A)	MCC-01 630 A, MCC-02 1 250 A, MCC-03 800 A, MCC-04 63 A, MCC-05 100 A (minimum)	
04.10	Short-circuit rating Icw (kA)	50 kA 1 s (MCC-01..03), 25 kA (MCC-04/05) - confirm by study	
04.11	Form of separation	MCC-01/02 Form 4 Type 6; MCC-03/04 Form 3b; MCC-05 Form 2b	
04.12	Degree of protection	IP54 indoor; IP55 outdoor kiosk (MCC-05) with canopy	

No	Description	Schedule A - Required	Schedule B - Offered
04.13	Internal arc	IEC/TR 61641 tested, 50 kA 0.3 s (MCC-01..03)	
04.14	Construction	Floor-standing, front access, 2 mm sheet steel, powder coat RAL 7032/7035, gland plates	
04.15	Busbars	Tin-plated Cu, fully insulated / shrouded	
04.16	Starter modules	Plug-in / withdrawable, door-interlocked isolator, lockable OFF	
04.17	Spare capacity (%)	20 % equipped spare + 20 % space	
04.18	Incomer	MCCB/ACB LSIG, shunt trip, PFR, SPD T1+2, MFM (Modbus TCP)	
04.19	Internal network	Managed industrial Ethernet switch, VLAN capable	
04.20	Labelling	Engraved traffolyte, English, per cable / equipment tag	
04.21	Altitude derating (m)	Equipment rated for 1 650 m	

TS-05 Circuit breakers (ACB, MCCB, MPCB, MCB)

No	Description	Schedule A - Required	Schedule B - Offered
05.1	Manufacturer	State	
05.2	Model / type reference	State	
05.3	Country of manufacture	State	
05.4	Local content (SATS 1286) where designated (%)	State %	

No	Description	Schedule A - Required	Schedule B - Offered
05.5	Local agent / service centre (nearest to Bethlehem)	State	
05.6	Standard	SANS/IEC 60947-2, SANS 556-1, SANS/IEC 60898 (MCB)	
05.7	ACB trip unit	Electronic LSIG, communication capable	
05.8	MCCB breaking capacity Icu / Ics (kA)	>= 50 kA / 100 % Icu at 400 V (main MCCs)	
05.9	Motor circuit breakers	Magnetic-only for SS/VSD feeders; thermal-magnetic MPCB for DOL	
05.10	Type 2 coordination	Required for all motor starters (IEC 60947-4-1 / -4-2)	
05.11	Auxiliary contacts	ON/OFF + trip alarm	
05.12	Padlocking	OFF position lockable	

TS-06 Contactors and electronic motor protection relays

No		Description	Schedule A - Required	Schedule B - Offered
06.1		Manufacturer	State	
06.2		Model / type reference	State	

No		Description	Schedule A - Required	Schedule B - Offered
06.3		Country of manufacture	State	
06.4		Local content (SATS 1286) where designated (%)	State %	
06.5		Local agent / service centre (nearest to Bethlehem)	State	
06.6		Standard	SANS/IEC 60947-4-1	
06.7		Utilisation category	AC-3 (AC-4 for reversing)	
06.8		Coil voltage (V)	230 VAC 50 Hz	
06.9		Electrical endurance (ops)	>= 1 million operations at AC-3 rated current	
06.10		Protection relay functions	Thermal overload class 10, phase loss / unbalance, earth fault, PTC input, stall	
06.11		Communications	Modbus TCP or hard-wired status (state)	

TS-07 Soft starters (33 No)

No	Description	Schedule A - Required	Schedule B - Offered
07.1	Manufacturer	State	
07.2	Model / type reference	State	
07.3	Country of manufacture	State	
07.4	Local content (SATS 1286) where designated (%)	State %	
07.5	Local agent / service centre (nearest to Bethlehem)	State	
07.6	Standard	SANS/IEC 60947-4-2	
07.7	Ratings (kW)	Per motor schedule: 5.5 / 7.5 / 11 / 30 / 37 / 55 kW (33 No)	
07.8	Control	3-phase controlled thyristors, current limit and torque control, soft stop (pump control algorithm)	
07.9	Bypass	Integral bypass contactor	
07.10	Rating basis	Heavy duty: 3.5 x In for 15 s, 10 starts/h, 40 C, 1 650 m altitude	
07.11	Protection	Electronic overload, phase loss / reversal, under/over current, PTC, earth fault	
07.12	Communications	Modbus TCP: currents, kWh, starts, fault codes	
07.13	Keypad / display	Door-mounted remote keypad, English	

TS-08 Variable speed drives (17 No)

No	Description	Schedule A - Required	Schedule B - Offered
08.1	Manufacturer	State	
08.2	Model / type reference	State	
08.3	Country of manufacture	State	
08.4	Local content (SATS 1286) where designated (%)	State %	
08.5	Local agent / service centre (nearest to Bethlehem)	State	
08.6	Standard	SANS/IEC 61800-2, -3 (EMC category C2), -5-1, -5-2 (STO)	
08.7	Ratings (kW)	Per motor schedule: 4 / 5.5 / 11 / 15 / 18.5 / 37 kW (17 No)	
08.8	Duty	Variable torque (pumps/aerators), 110 % 60 s; aerators constant torque rating if required by mechanical supplier	
08.9	Input	6-pulse with DC choke or line reactor; THDi <= 40 % at drive	
08.10	Output	dV/dt filter where motor cable > 50 m	
08.11	Safe torque off	STO SIL 2 / PL d, 2 channels	
08.12	I/O	>= 4 DI, 2 AI, 1 AO, 2 relay, PTC input	
08.13	Communications	Modbus TCP / Profinet / EtherNet/IP (match PLC)	
08.14	Enclosure	IP20 inside MCC with forced ventilation, or IP54 wall-mounted	
08.15	Efficiency (%)	>= 97 % at rated load (IE2 to IEC 61800-9-2)	
08.16	Altitude	Derated / rated for 1 650 m, 40 C	

TS-09 LV induction motors (new and replacement)

No	Description	Schedule A - Required	Schedule B - Offered
09.1	Manufacturer	State	
09.2	Model / type reference	State	
09.3	Country of manufacture	State	
09.4	Local content (SATS 1286) where designated (%)	State %	
09.5	Local agent / service centre (nearest to Bethlehem)	State	
09.6	Standard	SANS/IEC 60034-1, -30-1	
09.7	Efficiency class	IE3 minimum (IE4 preferred >= 37 kW)	
09.8	Voltage / frequency	400 V, 3 ph, 50 Hz	
09.9	Enclosure	IP55 TEFC (IP68 submersible)	
09.10	Insulation / temperature rise	Class F / class B	
09.11	Thermistors	PTC in windings: >= 30 kW, all VSD, all submersible	
09.12	VSD duty motors	Inverter-duty insulation; insulated NDE bearing >= 37 kW	
09.13	Service factor	1.0 at 1 650 m altitude	
09.14	Terminal box	Oversized, rotatable, M-thread entries	

TS-10 Automatic power factor correction (4 No)

No	Description	Schedule A - Required	Schedule B - Offered
10.1	Manufacturer	State	
10.2	Model / type reference	State	
10.3	Country of manufacture	State	
10.4	Local content (SATS 1286) where designated (%)	State %	
10.5	Local agent / service centre (nearest to Bethlehem)	State	
10.6	Standard	SANS/IEC 61921, IEC 60831-1/-2	
10.7	Ratings (kvar)	MCC-01 62.5, MCC-02 150, MCC-03 87.5, MCC-05 12.5 kvar	
10.8	Detuning	7 % reactor (fr = 189 Hz)	
10.9	Capacitor voltage rating (V)	>= 525 V	
10.10	Steps	12.5 / 25 kvar, AC-6b contactors	
10.11	Controller	Target pf 0.96, THD monitoring, alarm relay, Modbus	
10.12	Generator inhibit	Disconnect on generator supply	

TS-11 Standby diesel generator set (provisional) (1 No)

No	Description	Schedule A - Required	Schedule B - Offered
11.1	Manufacturer	State	
11.2	Model / type reference	State	
11.3	Country of manufacture	State	
11.4	Local content (SATS 1286) where designated (%)	State %	
11.5	Local agent / service centre (nearest to Bethlehem)	State	
11.6	Standard	SANS/ISO 8528-1 to -5, SANS 10142-1	
11.7	Rating (kVA)	12500 kVA prime (PRP) at 0.8 pf, 400 V, 50 Hz at 1 650 m and 40 C	
11.8	Performance class	G2 (ISO 8528-5)	
11.9	Engine	Water-cooled, electronic governor, 1 500 rpm	
11.10	Alternator	Brushless, PMG excitation, class H insulation	
11.11	Motor starting (%)	Voltage dip <= 15 % starting 55 kW pump on soft starter with 190 kW running	
11.12	Fuel (h)	12 h at 75 % load day tank, bunded 110 %	
11.13	Enclosure (dBA)	Acoustic canopy <= 75 dBA at 7 m, weatherproof	
11.14	Controller	AMF, Modbus TCP to PLC-01, remote start	
11.15	Batteries	Lead-acid with smart charger	

TS-12 Automatic transfer switch (1 No)

No	Description	Schedule A - Required	Schedule B - Offered
12.1	Manufacturer	State	
12.2	Model / type reference	State	
12.3	Country of manufacture	State	
12.4	Local content (SATS 1286) where designated (%)	State %	
12.5	Local agent / service centre (nearest to Bethlehem)	State	
12.6	Standard	SANS/IEC 60947-6-1 (PC class)	
12.7	Rating (A)	630 A, 4-pole	
12.8	Interlocking	Mechanical and electrical	
12.9	Transfer	Open transition, adjustable timers	
12.10	Status contacts	Position I / II / fault to PLC	

TS-13 UPS systems (5 No)

No	Description	Schedule A - Required	Schedule B - Offered
13.1	Manufacturer	State	
13.2	Model / type reference	State	
13.3	Country of manufacture	State	
13.4	Local content (SATS 1286) where designated (%)	State %	
13.5	Local agent / service centre (nearest to Bethlehem)	State	
13.6	Standard	SANS/IEC 62040-1, -2, -3	
13.7	Topology	Online double conversion (VFI-SS-111)	
13.8	Autonomy (h)	2 h at full connected PLC/network/instrument load	

No	Description	Schedule A - Required	Schedule B - Offered
13.9	Ratings (kVA)	UPS-01 3 kVA, UPS-02/03 2 kVA, UPS-04/05 1.5 kVA (minimum - size to final load)	
13.10	Bypass	Static + manual maintenance bypass	
13.11	Batteries	VRLA 10-year design life or LiFePO4	
13.12	Alarms	On battery, battery low, fault to PLC (volt-free / Modbus)	

TS-14 LV power and control cables

No	Description	Schedule A - Required	Schedule B - Offered
14.1	Manufacturer	State	
14.2	Model / type reference	State	
14.3	Country of manufacture	State	
14.4	Local content (SATS 1286) where designated (%)	State %	
14.5	Local agent / service centre (nearest to Bethlehem)	State	
14.6	Standard	SANS 1507-3 (PVC), SANS 1507-4 (XLPE); SABS mark / VC 8075	
14.7	Conductor	Stranded copper	
14.8	Voltage rating (V)	600/1000 V	
14.9	Armour	Galvanised steel wire (SWA)	
14.10	VSD cable	Symmetrical 3C + 3 earth, overall Cu screen, XLPE, SWA	
14.11	Control cable	1.5 mm2 Cu, numbered cores, PVC/SWA/PVC	
14.12	Glands	SANS 1213 brass compression, shrouded; EMC 360 deg for VSD	
14.13	Quantities	Per cable schedule KES-WW-DB-ELE-CS-001	

TS-15 Instrumentation and communication cables

No	Description	Schedule A - Required	Schedule B - Offered
15.1	Manufacturer	State	
15.2	Model / type reference	State	
15.3	Country of manufacture	State	
15.4	Local content (SATS 1286) where designated (%)	State %	
15.5	Local agent / service centre (nearest to Bethlehem)	State	
15.6	Instrument cable	1.5 mm2 pairs, individually + overall screened, PVC/SWA/PVC (EN 50288-7)	
15.7	Fibre	12-core single-mode OS2, loose tube, gel-free, armoured / rodent protected (ITU-T G.652.D)	
15.8	Fibre installation	SANS 10340-1; fusion spliced, LC connectors, OTDR tested	
15.9	Copper data	Cat6 S/FTP LSZH (ISO/IEC 11801)	

TS-16 Industrial Ethernet switches (8 No)

No	Description	Schedule A - Required	Schedule B - Offered
16.1	Manufacturer	State	
16.2	Model / type reference	State	
16.3	Country of manufacture	State	
16.4	Local content (SATS 1286) where designated (%)	State %	
16.5	Local agent / service centre (nearest to Bethlehem)	State	

No	Description	Schedule A - Required	Schedule B - Offered
16.6	Type	Managed layer-2 industrial, DIN rail, fanless	
16.7	Ports	2 x 1 Gb SFP (SM) + >= 8 x 10/100/1000 Cu	
16.8	Redundancy (ms)	MRP (IEC 62439-2) or RSTP, < 200 ms	
16.9	Security	IEC 62443-4-2 capable, VLAN, port security, SNMPv3, RADIUS	
16.10	Power / temp	Dual 24 VDC, -10 to +60 C	

TS-17 Cable ladder, tray and support systems

No	Description	Schedule A - Required	Schedule B - Offered
17.1	Manufacturer	State	
17.2	Model / type reference	State	
17.3	Country of manufacture	State	
17.4	Local content (SATS 1286) where designated (%)	State %	
17.5	Local agent / service centre (nearest to Bethlehem)	State	
17.6	Standard	SANS 121 hot-dip galvanising (or SS316 in chlorine area)	
17.7	Type	Heavy-duty ladder / perforated tray, return flange	
17.8	Covers	Lockable lids on walkways and exposed sun runs	
17.9	Supports (m)	SS316 / HDG at <= 1.5 m centres	
17.10	Spare capacity (%)	30 %	

TS-18 Earthing, lightning protection and surge protection

No	Description	Schedule A - Required	Schedule B - Offered
18.1	Manufacturer	State	
18.2	Model / type reference	State	

No	Description	Schedule A - Required	Schedule B - Offered
18.3	Country of manufacture	State	
18.4	Local content (SATS 1286) where designated (%)	State %	
18.5	Local agent / service centre (nearest to Bethlehem)	State	
18.6	Standards	SANS 10199, SANS 10292, SANS 10313 / SANS 62305, SANS/IEC 61643	
18.7	Earth electrodes	Copper-bonded steel rods 1.5 m min., exothermic joints	
18.8	Ring earth (mm2)	70 mm2 bare Cu at 0.6 m	
18.9	SPD Type 1+2 (incomers)	Iimp >= 12.5 kA/pole (10/350), Up <= 1.5 kV, remote status	
18.10	SPD Type 2 / 3	In >= 20 kA (8/20) DBs/PLC; Type 3 and signal SPDs on loops	
18.11	Air terminals / down conductors	Per risk assessment, LPL III provisional	

TS-19 Local isolators and local control stations (77 sets)

No	Description	Schedule A - Required	Schedule B - Offered
19.1	Manufacturer	State	
19.2	Model / type reference	State	
19.3	Country of manufacture	State	
19.4	Local content (SATS 1286) where designated (%)	State %	
19.5	Local agent / service centre (nearest to Bethlehem)	State	
19.6	Isolator standard	SANS/IEC 60947-3, AC-23A, lockable OFF	
19.7	Isolator enclosure	IP65 polycarbonate / SS316, UV-stable	
19.8	Aux contact	Early-break NO/NC	

No	Description	Schedule A - Required	Schedule B - Offered
19.9	LCS enclosure	IP66 SS316 or GRP, sun canopy, stand	
19.10	LCS devices	Latching mushroom E-stop (IEC 60947-5-5), start/stop, key L-O-R, LED run/trip	

TS-20 PLC system (5 No)

No	Description	Schedule A - Required	Schedule B - Offered
20.1	Manufacturer	State	
20.2	Model / type reference	State	
20.3	Country of manufacture	State	
20.4	Local content (SATS 1286) where designated (%)	State %	
20.5	Local agent / service centre (nearest to Bethlehem)	State	
20.6	Platform	Single platform plant-wide (state); modular, IEC 61131-2	
20.7	Programming	IEC 61131-3; licences handed to Employer	
20.8	CPU	Min. 2 Ethernet ports, Modbus TCP client/server, OPC UA server, web diagnostics	
20.9	I/O (installed)	PLC-01, -02, -03, RIO-04, -05 per I/O schedule + 20 % spare	
20.10	AI cards	16-bit, HART pass-through, NAMUR NE43	
20.11	DI/DO	24 VDC; DO via interposing relays	
20.12	Local HMI (in)	10-15 in colour touch panel per PLC panel	
20.13	Power	Dual 24 VDC PSU (N+1), UPS-backed	
20.14	Panel	2000 x 800 x 600 floor-standing (PLC-01/02/03), IP54, ventilated	
20.15	Spares	1 CPU + 1 of each card type	

TS-21 Radar level transmitters (9 No)

No	Description	Schedule A - Required	Schedule B - Offered
21.1	Manufacturer	State	
21.2	Model / type reference	State	
21.3	Country of manufacture	State	
21.4	Local content (SATS 1286) where designated (%)	State %	
21.5	Local agent / service centre (nearest to Bethlehem)	State	
21.6	Principle	80 GHz FMCW non-contact radar	
21.7	Accuracy (mm)	+/- 2 mm	
21.8	Output	4-20 mA HART, 2-wire	
21.9	Enclosure	IP68, SS316 / PVDF antenna, sun shield	
21.10	Range (m)	Per instrument schedule (0-2 m to 0-6.5 m)	
21.11	Display	Local display, Bluetooth / HART configuration	

TS-22 Electromagnetic flow meters (10 No)

No	Description	Schedule A - Required	Schedule B - Offered
22.1	Manufacturer	State	
22.2	Model / type reference	State	
22.3	Country of manufacture	State	
22.4	Local content (SATS 1286) where designated (%)	State %	

No	Description	Schedule A - Required	Schedule B - Offered
22.5	Local agent / service centre (nearest to Bethlehem)	State	
22.6	Standard	OIML R49 / ISO 4064 accuracy class or better	
22.7	Accuracy (%)	+/- 0.5 % of reading	
22.8	Liner / electrodes	Hard rubber or PU / Hastelloy C	
22.9	Sensor protection	IP68 submersible, remote converter	
22.10	Sizes (DN)	DN100 - DN500 per instrument schedule	
22.11	Outputs	4-20 mA HART + pulse + status	
22.12	Power	230 VAC	
22.13	Verification	In-situ verification function and calibration certificate	

TS-23 Open-channel ultrasonic flow meters (3 No)

No	Description	Schedule A - Required	Schedule B - Offered
23.1	Manufacturer	State	
23.2	Model / type reference	State	
23.3	Country of manufacture	State	
23.4	Local content (SATS 1286) where designated (%)	State %	
23.5	Local agent / service centre (nearest to Bethlehem)	State	
23.6	Principle	Ultrasonic level on flume / weir, temperature compensated	
23.7	Accuracy	+/- 1 mm level; flow per flume standard ISO 4359	
23.8	Output	4-20 mA + pulse, data logging 12 months	
23.9	Enclosure	Sensor IP68; converter IP66 above flood level	

TS-24 Pressure transmitters (4 No)

No	Description	Schedule A - Required	Schedule B - Offered
24.1	Manufacturer	State	
24.2	Model / type reference	State	
24.3	Country of manufacture	State	
24.4	Local content (SATS 1286) where designated (%)	State %	
24.5	Local agent / service centre (nearest to Bethlehem)	State	
24.6	Type	Gauge pressure with flush diaphragm seal	
24.7	Accuracy (%)	+/- 0.1 % of span	
24.8	Output	4-20 mA HART	
24.9	Wetted parts	SS316L / Hastelloy	
24.10	Accessories	Isolation valve, gauge, SS tubing	

TS-25 Dissolved oxygen and suspended solids (MLSS) analysers (7 No)

No	Description	Schedule A - Required	Schedule B - Offered
25.1	Manufacturer	State	
25.2	Model / type reference	State	
25.3	Country of manufacture	State	
25.4	Local content (SATS 1286) where designated (%)	State %	
25.5	Local agent / service centre (nearest to Bethlehem)	State	
25.6	DO principle	Optical luminescence, no membrane	
25.7	DO range / accuracy (mg/L)	0-20 mg/L, +/- 0.1 mg/L	
25.8	TSS principle	Optical (IR scattered light)	
25.9	TSS range (g/L)	0-10 g/L	
25.10	Cleaning	Automatic (wiper / air)	

No	Description	Schedule A - Required	Schedule B - Offered
25.11	Mounting	Handrail bracket, SS316 retractable pole	
25.12	Output	4-20 mA / Modbus TCP from multi-channel controller	

TS-26 Sludge blanket monitors (4 No)

No	Description	Schedule A - Required	Schedule B - Offered
26.1	Manufacturer	State	
26.2	Model / type reference	State	
26.3	Country of manufacture	State	
26.4	Local content (SATS 1286) where designated (%)	State %	
26.5	Local agent / service centre (nearest to Bethlehem)	State	
26.6	Principle	Ultrasonic sludge blanket / interface	
26.7	Range (m)	0-5 m	
26.8	Mounting	Clarifier bridge, self-cleaning	
26.9	Output	4-20 mA	

TS-27 Chlorine residual analyser (1 No)

No	Description	Schedule A - Required	Schedule B - Offered
27.1	Manufacturer	State	
27.2	Model / type reference	State	
27.3	Country of manufacture	State	
27.4	Local content (SATS 1286) where designated (%)	State %	

No	Description	Schedule A - Required	Schedule B - Offered
27.5	Local agent / service centre (nearest to Bethlehem)	State	
27.6	Principle	Amperometric (membrane-free) or colorimetric DPD	
27.7	Range (mg/L)	0-5 mg/L free chlorine	
27.8	Accuracy	+/- 0.02 mg/L or 3 %	
27.9	Sample	Panel-mounted, sample pump / filter	
27.10	Output	4-20 mA + alarm relays	

TS-28 Chlorine gas detection (1 system)

No	Description	Schedule A - Required	Schedule B - Offered
28.1	Manufacturer	State	
28.2	Model / type reference	State	
28.3	Country of manufacture	State	
28.4	Local content (SATS 1286) where designated (%)	State %	
28.5	Local agent / service centre (nearest to Bethlehem)	State	
28.6	Standard	SANS/IEC 60079-29 style performance; electrochemical Cl2 sensor	
28.7	Range (ppm)	0-10 ppm	
28.8	Alarms	0.5 ppm warning, 1.0 ppm alarm, relays for fans / beacon / siren	
28.9	Heads	2 (drum store + dosing room), mounted at low level	
28.10	Output	4-20 mA + volt-free relays	
28.11	Calibration	Gas test kit + 1 year spare sensors	

TS-29 Float level switches (10 No)

No	Description	Schedule A - Required	Schedule B - Offered
29.1	Manufacturer	State	
29.2	Model / type reference	State	
29.3	Country of manufacture	State	
29.4	Local content (SATS 1286) where designated (%)	State %	
29.5	Local agent / service centre (nearest to Bethlehem)	State	
29.6	Type	Mechanical tilt float, no mercury	
29.7	Cable	Oil-resistant, neoprene, length to suit	
29.8	Contact	Volt-free, fail-safe (NC for low-low)	

TS-30 SCADA hardware (Separable Portion 2) (1 lot)

No	Description	Schedule A - Required	Schedule B - Offered
30.1	Manufacturer	State	
30.2	Model / type reference	State	
30.3	Country of manufacture	State	
30.4	Local content (SATS 1286) where designated (%)	State %	
30.5	Local agent / service centre (nearest to Bethlehem)	State	
30.6	Server	Industrial rack server, dual PSU, RAID 1, ECC RAM >= 32 GB	
30.7	Operator workstations	1 (+1 optional), dual 24 in monitors	
30.8	Engineering workstation	Rugged laptop with all licences	
30.9	Firewall	Next-generation, IEC 62443 zones, VPN with MFA	
30.10	Remote access router	4G/LTE industrial router, VPN	
30.11	Alarm gateway	GSM SMS gateway, 2-way acknowledge	
30.12	Back-up	NAS with nightly images	
30.13	Time server	NTP (GPS optional)	

TS-31 SCADA software (Separable Portion 2)

No	Description	Schedule A - Required	Schedule B - Offered
31.1	Manufacturer	State	
31.2	Model / type reference	State	
31.3	Country of manufacture	State	
31.4	Local content (SATS 1286) where designated (%)	State %	
31.5	Local agent / service centre (nearest to Bethlehem)	State	
31.6	Package	State (AVEVA / Ignition / WinCC / Citect or approved equal)	
31.7	Licence (tags)	>= 5 000 tags, 1 server, 3 clients, web view client	
31.8	Historian	>= 5 years on-line, 1 s - 60 s	
31.9	Alarm management	ISA-18.2 compliant, shelving, SMS integration	
31.10	HMI standard	ISA-101 high-performance graphics	
31.11	Reporting	Daily/monthly flow, energy, chemical, run-hours, DWS format	
31.12	Drivers	OPC UA / native for offered PLC	
31.13	Support (years)	3 years software maintenance included	

TS-32 Area lighting and building luminaires

No	Description	Schedule A - Required	Schedule B - Offered
32.1	Manufacturer	State	
32.2	Model / type reference	State	
32.3	Country of manufacture	State	
32.4	Local content (SATS 1286) where designated (%)	State %	
32.5	Local agent / service centre (nearest to Bethlehem)	State	

No	Description	Schedule A - Required	Schedule B - Offered
32.6	Standard	SANS/IEC 60598, SANS 10114-1, SANS 10098	
32.7	Floodlights	LED >= 120 lm/W, IP66, IK08, 4 000 K, photocell/timer	
32.8	Poles	Hot-dip galvanised, hinged/tilt where practical	
32.9	Indoor luminaires	LED IP65 vapour-proof (corrosion resistant in chlorine building)	
32.10	Emergency lighting (h)	3 h maintained/non-maintained, SANS 10114-2	

3.6. FACILITIES AND EQUIPMENT TO BE PROVIDED BY THE EMPLOYER

The Employer shall provide no facility or equipment.

3.7. FACILITIES AND EQUIPMENT TO BE PROVIDED BY THE SERVICE PROVIDER

The Contractor shall provide all equipment and facilities required to provide the services relating to successful completion of the project.

3.8. GENERAL REQUIREMENTS

3.8.1 Management requirements

The Contractor shall in providing the Works observe all statutes, by-laws and associated regulations and industry norms established in relevant South African national standards published in terms of the Standards Act of 2008 or standards recommended by relevant bodies.

3.8.2 Construction requirements

The Contractor shall only incorporate in the works materials (substances that can be incorporated into the works), products (item manufactured or processed for incorporation into the works), components (products manufactured as distinct units to serve a specific function or functions) and assemblies (set of related components attached to each other) which are:

a) Fit for their intended purpose; and

b) Capable of fulfilling required functions under intended use conditions or when in use, with planned maintenance, under the influence of environmental actions or a result of a self-ageing process for a period within industry accepted norms.

3.9 MANAGEMENT

3.9.1. General

The Contractor will be required to participate in regular progress meetings with the client and other stakeholders. During monthly progress meeting the contractor will be required to submit project progress reports against the activities of scope of works.

3.9.2 Completion strategy

a) The Contractor shall develop a completion strategy to minimise the correction of defects after Completion and to achieve Completion on or before the Completion Date. Such a strategy shall include a systematic approach to ensuring that employees and subcontractors search for defects as the work progresses, programme their work in such a manner that defects are corrected ahead of Completion and sufficient time is allowed for commissioning.

b) The completion strategy should be framed around the systematic acceptance and / or testing of materials, plant, workmanship and subsystems as the works proceed in order to address issues ahead of completion and the allocation of tasks to ensure satisfactory completion.

3.9.3 Communications

All communications with the Employer which are made in terms of the contract should be made using the standard templates provided by MISA.

3.9.4 Health and safety

The Contractor shall manage health and safety in accordance with the latest edition of the Occupational Health and Safety Specification for Construction Works Contracts.

3.9.5 Invoices

Contractor will be required to submit payment certificates to the Project Manager on 25th of each month. The payment certificates must be submitted with invoice, progress report and relevant test results.

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT

Cooperative Governance and Traditional Affairs

Reference no.: **MISA/RBWTW/FS/031/2026/27**

APPOINTMENT OF A CONTRACTOR FOR THE REFURBISHMENT OF BETHLEHEM WASTEWATER TREATMENT WORKS.

PART C4: SITE INFORMATION

C4.1 LOCALITY PLAN

The locality of the target area is shown in **Figure C4.1** below.

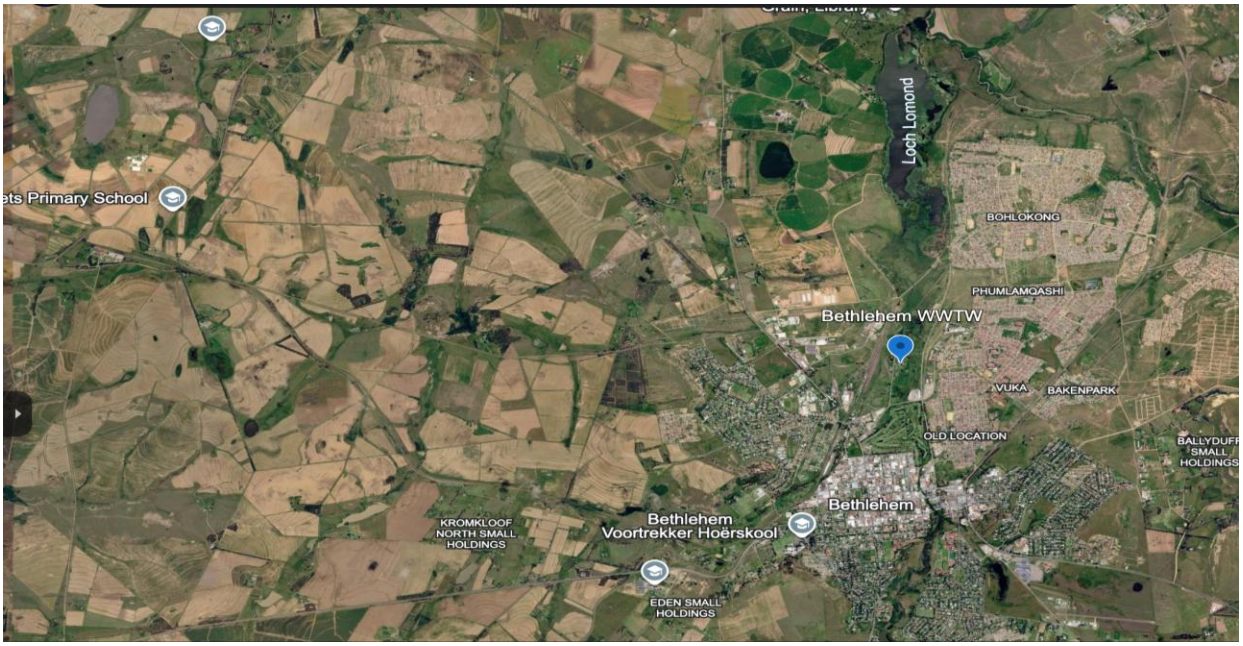

Figure C4.1: location of Bethlehem Wastewater Treatment Works