ENGINEERING WATER AND SANITATION

Water and Sanitation

PROCUREMENT DOCUMENT

INFRASTRUCTURE

CONTRACT No.: WS.7338

TITLE: Construction of a 10.0 Mℓ Concrete Reservoir for Adams Mission 6 in Ward 96

Volume 1 – General Clauses, Contract Data, Scope of Works and Specifications

Issued by:
ENGINEERING WATER AND SANITATION
Water and Sanitation

Date of Issue: June 2021

Document Version: 18/02/2020
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PART T1: TENDERING PROCEDURES

T1.1: TENDER NOTICE AND INVITATION TO TENDER

Tenders are hereby invited for the works for the Construction of a 10.0 Mℓ Concrete Reservoir for Adams Mission 6 in Ward 96.

(F.1.1.1) The Employer is the eThekwini Municipality as represented by Deputy Head: eThekwini Water and Sanitation Engineering: Bhavna Soni

It is estimated that tenderers should have a CIDB contractor grading designation of 7 CE (or higher).

(F.1.2) Tenders must be submitted on official tender documentation issued (in hard copy) by the eThekwini Municipality. Electronically downloaded documentation, obtainable from the National Treasury’s eTenders website.

(F.2.7) There will be NO clarification meetings

(F.2.8) Queries relating to these documents shall be addressed to the Employer’s Agent’s Representative whose contact details are: Roxanne Mans Pr. Eng. T: 031 311 8745 (t) E: Roxanne.mans@durban.gov.za

Bidders shall submit email queries related to the bid. All email queries shall be submitted by 25 June 2021. Email questions and answers shall be consolidated and posted on eTenders/Municipal website for the benefit of all tenderers by 01 July 2021.

(F.2.13) Tenders shall be delivered to City Engineers Building, 166 K.E. Masinga Road and placed in the tender box located in the ground floor foyer.

(F.2.15) Tender offers shall be delivered on or before Friday, 09 July 2021 at or before 11:00

Requirements for sealing, addressing, delivery, opening and assessment of tenders are stated in the Tender Data
PART T1: TENDERING PROCEDURES

T1.2: TENDER DATA

T1.2.1 STANDARD CONDITIONS OF TENDER


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

T1.2.2 TENDER DATA

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

F.1: GENERAL

F.1.1 The employer: The Employer for this Contract is the eThekwini Municipality as represented by: Deputy Head: eThekwini Water and Sanitation Engineering: Bhavna Soni.

F.1.2 Tender documents:

Tenders must be submitted on official tender documentation issued (in hard copy) by the eThekwini Municipality:

• Electronically downloaded documentation is obtainable from the National Treasury’s eTenders website. The entire document should be printed and suitably bound by the tenderer.

The Tender Documents issued by the Employer comprise the documents as per the INDEX of this Tender Document.:

1) This procurement document Volume 1, 2 and 3.
2) Drawings, issued separately from this document (or alternately: Bound in Section C3.4 as an Annexure).
3) “General Conditions of Contract for Construction Works – 3rd Edition 2015” issued by the South African Institution of Civil Engineering (GCC 2015). This document is obtainable separately, and Tenderers shall obtain their own copies.
4) “City of Durban Technical Specifications” hereinafter referred to as the Standard Engineering Specifications. This document is obtainable separately, and Tenderers shall obtain their own copies of the applicable Sections.
5) In addition, Tenderers are advised, in their own interest, to obtain their own copies of the following acts, regulations, and standards referred to in this document as they are essential for the Tenderer to get acquainted with the basics of construction management, the implementation of preferential construction procurement policies, and the participation of targeted enterprise and labour.

• The Construction Industry Development Board Act No 38 of 2000 and the Regulations issued in terms of the Act (July 2013).
• The Employer’s current Supply Chain Management Policy.
• Any other eThekwini Policy documents referenced in the Tender Documents.

Tenders must be submitted on official tender documentation issued (in hard copy) by the eThekwini Municipality:

F.1.4 The employer’s agent: The Employer’s agent is
• Willie Marais (PR Tech Eng)
  • Tel: 031 717 2571 (t)
  • Email: willie.marais@bigengroup.com

The employer’s agent Representative: The Employer’s agent representative is
• Roxanne Mans
  • Tel: 031 311 8745
  • Email: Roxanne.Mans@durban.gov.za

F.2: TENDERER’S OBLIGATIONS

F.2.1 Eligibility: A Tenderer will not be eligible to submit a tender if:
(a) the Tenderer does not comply with the legal requirements as stated in the Employer’s current SCM Policy;
(b) the Tenderer cannot provide proof that he is in good standing with respect to duties, taxes, levies and contributions required in terms of legislation applicable to the work in the contract;
(c) in the case of JV submissions, two or more JV entities have common directors / shareholders or common entities tendering for the same works.
(d) at the time of closing of tenders, the Tenderer is not registered on the National Treasury Central Supplier Database (CSD) as a service provider. In the case of a Joint Venture, this requirement will apply individually to each party in the Joint Venture.

F.2.1.1 Eligibility: Only those tenderers who are registered (as “Active”) with the CIDB (at time of tender closing), in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered, or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations, for a 7 CE class of construction work, are eligible to have their tenders evaluated.

Joint ventures are eligible to submit tenders provided that:
(a) Every member of the joint venture is registered (as “Active”) with the CIDB (at time of tender closing);
(b) The lead partner has a contractor grading designation in the 7 CE class of construction work and has a grading designation of not lower than one level below the required grading designation; and
(c) The combined contractor grading designation calculated in accordance with the Construction Industry Development Regulations (2013) is equal to or higher than a contractor grading designation determined in accordance with the sum tendered for a 7 CE class of construction work or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations.
Industry Development Regulations.

F.2.2.2 The cost of the tender documents: Replace this paragraph with the following:

“Documents may be obtained, free of charge, in electronic format, from the National Treasury’s eTenders website. Electronically downloaded documentation should be printed and suitably bound by the tenderer.

F.2.6 Acknowledge addenda: Add the following paragraphs to the clause:

“Addenda will be published, in electronic format, on the National Treasury’s eTenders website (see F.2.2.2 above). Tenderers are to ensure that the eTenders website is consulted for any published addenda pertaining to this tender until three days before the tender closing time as stated in the Tender Data.”

“Acknowledgement of receipt of the addenda will be by the return of the relevant completed, dated and signed portion of the addenda, to the address / fax number / email address as specified on the addenda. Failure of the tenderer to comply with the requirements of the addenda may result in the tender submission being made non-responsive.”

F.2.7 Clarification meeting: There will be NO clarification meeting

F.2.8 Clarification: Queries relating to these documents shall be addressed to the Employer’s Agent’s Representative whose contact details are: Roxanne Mans Pr.(Eng.) 031 311 8745 (t), Roxanne.mans@durban.gov.za.

Bidders shall submit email queries related to the bid. All email queries shall be submitted by 25 June 2021.

Email questions and answers shall be consolidated and posted on eTenders/Municipal website for the benefit of all tenderers by 01 July 2021.

F.2.12 Alternative tender offers: No alternative tender offers will be considered.

F.2.13 Submitting a tender offer: Hard Copy Submission

The Employer’s address for delivery of tender offers is Engineering Unit, 166 K.E. Masinga Road and placed in the tender box located in the ground floor foyer.

Hard Copy Submission: Returnable Documents to be submitted in a separate lever arch file. A scanned copy of the completed Volume 1 to be issued on a CD.

Identification details to be shown on each tender offer package are:

• Contract No. : WS.7338
• Contract Title : Construction of a 10.0 Mℓ Concrete Reservoir for Adams Mission 6 in Ward 96

Telephonic, telegraphic, telex, facsimile or e-mailed tender offers will not be accepted.

F.2.15 Closing time: The closing time for delivery of tender offers is:

• Place : City Engineers Building, 166 K.E. Masinga Road (hard copy)
• Date : Friday, 09 July 2021
• Time : 11:00

F.2.16 Tender offer validity: The Tender Offer validity period is 12 weeks (84 Days) from the closing time for submission of tenders.
F.2.20 Submit securities, bonds, policies: The tenderer is required to submit with his tender a letter of intent from an approved insurer undertaking to provide the Performance Bond to the format included in Part T2.2 of this procurement document.

F.2.23 Certificates: Refer to Part T2.1 for a listing of certificates that must be provided with the tender. All certificates must be valid at the time of tender closing.

CIDB Registration
Tenderers are to include with their submission a printout of their registration with the CIDB, obtained from the CIDB website (https://registers.cidb.org.za/PublicContractors/ContractorSearch).

The Joint Venture Grading Designation Calculator should be used when submitting as a Joint Venture (https://registers.cidb.org.za/PublicContractors/JVGradingDesignationCalc).

The date of obtaining the above printouts is to be indicated on the printout. Registration with the CIDB must be reflected as “Active” at time of tender closing.

Tax Clearance
SARS has introduced a new Tax Compliance Status System. Tenderers can submit a Tax Compliance Status PIN (TCS PIN) instead of an original Tax Clearance Certificate. This TCS PIN can be used by third parties to certify the taxpayer’s real-time compliance status.

Separate Tax Clearance Certificates / TCS PINs are required for each entity in a Joint Venture.

B-BBEE Status Level of Contribution
The Amended Construction Sector Code (Government Gazette No.41287) is applicable to the B-BBEE compliance measurement of all entities that fall within the Construction Sector.

The requirements for measurement and verification of entities are contained in the “Amended Code Series CSC000: Framework for Measuring Broad Based Black Economic Empowerment in the Construction Sector”, as published in Notice 931 of 2017, Government Gazette No.41287 of 01/12/2017.

The requirements are summarised in the following table:

<table>
<thead>
<tr>
<th>Enterprise Type</th>
<th>Total Annual Revenue (R million)</th>
<th>Ownership and Annual Turnover</th>
</tr>
</thead>
<tbody>
<tr>
<td>EME: Built Environment Professional</td>
<td>&lt; R1.8m</td>
<td>May present an affidavit OR a certificate issued by the CIPC OR authorised B-BBEE verification certificate (as below)</td>
</tr>
<tr>
<td>EME: Contractor</td>
<td>&lt; R3.0m</td>
<td></td>
</tr>
<tr>
<td>EME: Built Environment Professional</td>
<td>&lt; R6m</td>
<td>Must present an authorised B-BBEE verification certificate by a SANAS accredited Verification Agency</td>
</tr>
<tr>
<td>EME: Contractor</td>
<td>&lt; R10m</td>
<td></td>
</tr>
<tr>
<td>QSE: Built Environment Professional</td>
<td>≥ R6.0m and &lt; R25m</td>
<td></td>
</tr>
<tr>
<td>QSE: Contractor</td>
<td>&gt; R10.0m and &lt; R50m</td>
<td></td>
</tr>
<tr>
<td>Large Enterprise</td>
<td>&gt; R50m</td>
<td></td>
</tr>
</tbody>
</table>
The requirements for measurement of Joint Ventures is described in Cl.2.8 of the Amended Construction Sector Code. The compilation of a consolidated verification certificate is required.

**Central Supplier Database (CSD)**
The entities (full) Registration Report, obtained from the National Treasury Central Supplier Database, is to be included in the tender submission (https://secure.csd.gov.za).

Separate CSD Registration Reports are required for each entity in a Joint Venture.

### F.3: THE EMPLOYER'S UNDERTAKINGS

**F.3.1.1 Respond to requests from the tenderer:** Replace the words “five working days” with “three working days”.

**F.3.2 Issue addenda:** Add the following paragraph: “Addenda will be published, in electronic format, on the National Treasury’s eTenders website.

**F.3.4 Opening of Tender Submissions:** Tenders will be opened immediately after the closing time for tenders. The public reading of tenders will take place in the SCM Boardroom, 6th Floor, Engineering Unit Building, 166 KE Masinga Road, Durban.

**F.3.11 Evaluation of Tender Offers:** The procedure for evaluation of responsive Tender Offers will be in accordance with the Employer’s current SCM Policy, the Preferential Procurement Policy Framework Act (5 of 2000), and the Preferential Procurement Policy Framework Act Regulations (January 2017).

The financial offer will be reduced to a comparative basis using the Tender Assessment Schedule.

The procedure for the evaluation of responsive tenders is **Method 2** (Price and Preference with functionality).

The 80/20 preference points system will be used where the financial value (incl. VAT) of one or more responsive tender offers have a value that equals or is less than R 50,000,000. The Formula used to calculate the **Price Points**, and the **Preference Points** that will be allocated, will be according to the specified PPPFA Regulations.

**F.3.11.9 The Functionality criteria (and sub-criteria if applicable) and maximum score in respect of each of the criteria are as follows:**

The Functionality criteria (and sub-criteria if applicable) and maximum score in respect of each of the criteria are as follows:

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<th>Functionality criteria (Sub Criteria)</th>
<th>Maximum Points Score</th>
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<tr>
<td>Experience of Tendering Firm (R.C. Water Retaining Structures)</td>
<td>30</td>
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<tr>
<td>Qualifications and experience of key personnel</td>
<td>40</td>
</tr>
<tr>
<td>Preliminary programme</td>
<td>15</td>
</tr>
<tr>
<td>Quality Assurance Plan</td>
<td>15</td>
</tr>
</tbody>
</table>

**Maximum possible score for Functionality (Ms)** 100

Functionality shall be scored in accordance with the following schedules which are found in Part T2.2: Returnable Schedules:
And shall be scored by not less than three evaluators and the scores of each of the evaluators will be averaged, weighted and then totaled to obtain the final score for Functionality.

The minimum number of evaluation points for Functionality is 60. Only those tenderers who achieve the minimum number of Functionality evaluation points (or greater) will be eligible to have their tenders further evaluated.

**EVALUATION SCHEDULE**

Functionality shall be scored in accordance with the schedules below. The threshold for this contract is 60%. Failure to meet the threshold and where applicable, the minimum scoring requirements for the various quality criteria, will lead to disqualification of the tender.

The prompts for judgement and the required returnable schedules for each of the evaluation criteria are listed in below.

Functionality shall be scored by not less than three evaluators and the scores of each of the evaluators will be averaged, weighted and then totaled to obtain the final score for Functionality.

**Evaluation Criteria for Functionality**

**Experience of Tendering Firm (R.C. Water Retaining Structures) 30 points**

a) Tendering Firm's experience with reference to the present day value (excluding VAT) of successfully completed contracts over the last 15 years involving the construction of reinforced concrete water retaining structures equal or greater than 10Mℓ:

2 points per R 7.5 million present day rand value of each contract up to a maximum of: 30 points

<table>
<thead>
<tr>
<th>Rand Value of Completed Contracts</th>
<th>Number of points awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>R0 to R7.4 Million</td>
<td>0</td>
</tr>
<tr>
<td>R7.5 to R14.9 Million</td>
<td>2</td>
</tr>
<tr>
<td>R15 to R22.4 Million</td>
<td>4</td>
</tr>
<tr>
<td>R22.5 to R29.9 Million</td>
<td>6</td>
</tr>
<tr>
<td>R30 to R37.4 Million</td>
<td>8</td>
</tr>
<tr>
<td>R37.5 to R44.9 Million</td>
<td>10</td>
</tr>
<tr>
<td>R45 to R52.4 Million</td>
<td>12</td>
</tr>
<tr>
<td>R52.5 to R59.9 Million</td>
<td>14</td>
</tr>
<tr>
<td>R60 to R67.4 Million</td>
<td>16</td>
</tr>
<tr>
<td>R67.5 to R74.9 Million</td>
<td>18</td>
</tr>
<tr>
<td>R75 to R82.4 Million</td>
<td>20</td>
</tr>
<tr>
<td>R82.5 to R89.9 Million</td>
<td>22</td>
</tr>
<tr>
<td>R90 to R97.4 Million</td>
<td>24</td>
</tr>
<tr>
<td>R97.5 to R104.9 Million</td>
<td>26</td>
</tr>
<tr>
<td>R105 to R112.4 Million</td>
<td>28</td>
</tr>
<tr>
<td>R112.5 Million and above</td>
<td>30</td>
</tr>
</tbody>
</table>

**Note:** An escalation factor of 7.5% per annum will be applied (by the Engineer) to projects in order to determine present day value.
Qualifications & Experience of Key Personnel to be employed on the Contract  40 points

1. Contract Manager…………………………………………………………………………………………. 10 points

Qualifications and Registrations:

Minimum 5 years relevant experience and a Degree or NHD/S4 in civil engineering  5 points

Specific Experience:

Experience in the position of Contract Site Project Manager on contracts for the construction of reinforced concrete water retaining structures equal or greater than 10Mℓ, from start to full completion and hand over.

1 point per contract up to a maximum of:  5 points

<table>
<thead>
<tr>
<th>Completed Contracts</th>
<th>Number of points awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
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<tr>
<td>2</td>
<td>2</td>
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<tr>
<td>3</td>
<td>3</td>
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<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

2. Site Agent………………………………………………………………………………………………… 14 points

Qualifications and Registrations:

Minimum 5 years relevant experience and a Degree or NHD/S4 in civil engineering 4 points

Experience in the position of Contract Site Project Manager on contracts for the construction of reinforced concrete water retaining structures equal or greater than 10Mℓ, from start to full completion and hand over.

Points allocation as per table below maximum of:  14 points

<table>
<thead>
<tr>
<th>Completed Contracts</th>
<th>Number of points awarded</th>
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</thead>
<tbody>
<tr>
<td>0</td>
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<tr>
<td>1</td>
<td>2</td>
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<td>5</td>
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<tr>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
</tr>
</tbody>
</table>

3. Concrete (Lead) Foreman ………………………………………………………………………………….  8 points

Specific Experience:
Experience in the position of Concrete Lead Foreman (Minimum 5 years relevant experience) on contracts for the construction of reinforced concrete water retaining structures equal or greater than 10Mt, from start to full completion and hand over.

2 points per structure up to a maximum of: 8 points

<table>
<thead>
<tr>
<th>Completed Contracts</th>
<th>Number of points awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
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<td>2</td>
<td>4</td>
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<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

4. **Civils (Lead) Foreman** …………………………………………………………………… 8 points

Specific Experience:

*Experience in the position of Civils Lead Foreman* (Minimum 5 years relevant experience) on contracts involving the construction of concrete water retaining structures, pump stations, pressure pipelines and stormwater systems.

2 points per contract up to a maximum of: 8 points

<table>
<thead>
<tr>
<th>Completed Contracts</th>
<th>Number of points awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
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<tr>
<td>1</td>
<td>2</td>
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<td>4</td>
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<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
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</tbody>
</table>

**Preliminary Programme**………………………………………………………… 15 points

Adequacy and completeness of tenderer’s preliminary programme, indicating all construction activities, resources (i.e. labour and plant), cash flows and critical path.

*Inadequate* (Not submitted) 0 points

*Poor* (Programme is inadequate and / or is considered unrealistic and does not achieve the required completion date.) 5 points

*Satisfactory* (Programme is considered realistic and includes the main components and sub-components and compliance with the completion date.) 10 points

*Good* (Programme is considered realistic and includes the main components and subcomponents and linkages and compliance with the completion date) 15 points
Quality Assurance Plan  15 points

a) Contractor has no documented Q.A. Plan  0 Points
b) Contractor has own documented Q.A. plan of an acceptable standard  7.5 Points
   Points
c) Contractor has ISO 9001 certificate.  15 Points

MAXIMUM SCORE FOR TENDER EVALUATION  =  100 points

THRESHOLD FOR FUNCTIONALITY  =  60%
F.3.13 Acceptance of tender offer: In addition to the requirements of Clause F.3.13 of the Standard Conditions of Tender, tender offers will only be accepted if:

(a) The tenderer submits an original valid Tax Clearance Certificate issued by the South African Revenue Services or has made arrangements to meet outstanding tax obligations;
(b) The tenderer is registered, and “Active”, with the Construction Industry Development Board, at time of tender closing, in an appropriate contractor grading designation;
(c) The tenderer or any of its directors/shareholders is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector;
(d) The tenderer has not:
   • Abused the Employer’s Supply Chain Management System; or
   • Failed to perform on any previous contract and has been given a written notice to this effect;
(e) The tenderer has completed the Compulsory Enterprise Questionnaire and there are no conflicts of interest which may impact on the tenderer’s ability to perform the contract in the best interests of the employer or potentially compromise the tender process;
(f) The tenderer is registered and in good standing with the compensation fund or with a licensed compensation insurer;
(g) The employer is reasonably satisfied that the tenderer has in terms of the Construction Regulations, 2014, issued in terms of the Occupational Health and Safety Act, 1993, the necessary competencies and resources to carry out the work safely.

F.3.15 Complete adjudicator’s contract: Refer to the General Conditions of Contract and the Contract Data.

F.3.17 Copies of contract: The number of paper copies of the signed contract to be provided by the Employer is ONE (1).

The amended conditions of tender are:

F.2.6 Acknowledge addenda

Add the following paragraphs to the clause:
“Acknowledgement of receipt will be by the return of the relevant completed and signed portion of the addenda, to the address / fax number / email address as specified on the addenda. Failure of the tenderer to comply with the requirements of the addenda may result in the tender submission being made non-responsive.”
The additional conditions of tender are:

**ACT.1 Appeals process**

In terms of Regulation 49 of the Municipal Supply Chain Management Regulations persons aggrieved by decisions or actions taken by the Municipality, may lodge an appeal within 14 days of the decision or action, in writing to the Municipality. All appeals (clearly setting out the reasons for the appeal) and queries with regard to the decision of award are to be directed to:

The City Manager  
**Attention: Ms S. Pillay; e-mail: Simone.Pillay@durban.gov.za**  
P O Box 1394  
DURBAN, 4000

**ACT.2 Prohibition on awards to persons in the service of the state**

Clause 44 of the Supply Chain Management Regulations states that the Municipality or Municipal Entity may not make any award to a person:

(a) Who is in the service of the State;  
(b) If that person is not a natural person, of which a director, manager, principal shareholder or stakeholder is a person in the service of the state; or  
(c) Who is an advisor or consultant contracted with the municipality or a municipal entity.

Should a contract be awarded, and it is subsequently established that Clause 44 has been breached, the Employer shall have the right to terminate the contract with immediate effect.

**ACT.3 Code of Conduct and Local Labour**

The Tenderers shall make themselves familiar with the requirements of the following policies that are available on web address: ftp://ftp.durban.gov.za/cesu/StdContractDocs/:

- Code of Conduct;  
- The Use of CLOs and Local Labour.

**ACT.4 Pre-qualification criteria for preferential procurement**

For Contracts below R30m if an organ of state decides to apply pre-qualifying criteria to advance certain designated groups, that organ of state must advertise the tender with a specific tendering condition that only one or more of the following tenderers may respond:

(a) a tenderer having a stipulated minimum B-BBEE status level of contributor;
(b) an EME or QSE;
(c) a tenderer subcontracting a minimum of 30% to:
   (i) an EME or QSE which is at least 51% owned by black people;
   (ii) an EME or QSE which is at least 51% owned by black people who are youth;
   (iii) an EME or QSE which is at least 51% owned by black people who are women;
   (iv) an EME or QSE which is at least 51% owned by black people with disabilities;
   (v) an EME or QSE which is 51% owned by black people living in rural or underdeveloped areas or townships;
   (vi) a cooperative which is at least 51% owned by black people;
   (vii) an EME or QSE which is at least 51% owned by black people who are military veterans;
   (viii) an EME or QSE.
A tender that fails to meet any pre-qualifying criteria stipulated in the tender documents is an unacceptable tender.

**ACT.5 Subcontracting as Condition of Tender**

For contracts above R30m, the 2017 PPPFA Regulations require organs of State to identify tenders, where it is feasible, to subcontract a minimum of 30% of the value of the contract to the following designated groups:

(a) an EME or QSE;
(b) an EME or QSE which is at least 51% owned by black people;
(c) an EME or QSE which is at least 51% owned by black people who are youth;
(d) an EME or QSE which is at least 51% owned by black people who are women;
(e) an EME or QSE which is at least 51% owned by black people with disabilities;
(f) an EME or QSE which is 51% owned by black people living in rural or underdeveloped areas or townships;
(g) a cooperative which is at least 51% owned by black people;
(h) an EME or QSE which is at least 51% owned by black people who are military veterans; or
(i) more than one of the categories referred to in paragraphs (a) to (h).

In addition to the above, the eThekwini Municipal Council has adopted a framework for empowerment strategies for contracts between R5m and R30m.

Thus in light of the above, the eThekwini Municipality Water and Sanitation Unit has identified items and processes within the scope of work of this contract that can be subcontracted to the above listed designated groups, resulting in a requirement of a 30% contract participation goal (CPG) being applicable to this contract.

The contractor is to ensure priority be given to EMEs and QSEs that fall within Ward 57 first, thereafter the surrounding wards will be given priority and finally the whole municipality as a whole, depending on skills availability in the area being considered.

The CPG contractor needs to be actively registered and listed in the Mafukuzela Database. The database is obtainable from Nomthandazo Mdletshe the Mafukuzela Database Administrator. Email:

Nomthandazo.Mdletshe@durban.gov.za

The CPG contractor needs to have all the necessary qualifications and / or certificate to carry out the required work under this contract.

**ACT.6 Submission of Annual Financial Statement**

It is a compulsory requirement for all Tenderer’s to submit their Annual Financial Statement as part of the returnable documents, in line with MBD 5: DECLARATION FOR PROCUREMENT ABOVE R10 MILLION.
PART T2: RETURNABLE DOCUMENTS
T2.1: LIST OF RETURNABLE DOCUMENTS

T2.1.1 General

The Tender Document must be submitted as a whole. All forms must be properly completed as required, and the document shall not be taken apart or altered in any way whatsoever.

The Tenderer is required to complete each and every Schedule and Form listed below to the best of his ability as the evaluation of tenders and the eventual contract will be based on the information provided by the Tenderer. Failure of a Tenderer to complete the Schedules and Forms to the satisfaction of the Employer will inevitably prejudice the tender and may lead to rejection on the grounds that the tender is not responsive.

T2.1.2 Returnable Schedules, Forms and Certificates

Company Specific

Certificate of Attendance at Clarification Meeting 19
Certificate of Authority 20
Declaration of Municipal Fees 21
Compulsory Enterprise Questionnaire 22
Tax Compliance Status PIN / Tax Clearance Certificate 24
B-BBEE Status Level of Contribution 25
Verification of CIDB Registration and Status 26
CSD Registration Report 27

Consolidated MBD Documents 28

MBD2: Tax Clearance Certificate Requirements 30
MBD4: Declaration of Interest 30
MBD5: Declaration for Procurement above R10 Million (if applicable) 31
MBD6.1: Preference Points Claim Form ITO the Preferential Regulations 31
MBD6.2: Declaration Certificate for Local Production and Content (if applicable) 31
MBD8: Declaration of Bidder’s Past SCM Practices 33
MBD9: Certificate of Independent Bid Determination 34

Technical and Evaluation

Experience of Tenderer 36
Key Personnel 38
Proposed Organisation and Staffing 30
Experience of Key Personnel 39
Qualifications and Experience of Key Personnel: Contract Manager 40
Qualifications and Experience of Key Personnel: Site Agent 42
Qualifications and Experience of Key Personnel: Concrete Foreman 43
Qualifications and Experience of Key Personnel: Civils Foreman 44
Preliminary Programme 48
Plant and Equipment 52
Schedule of Proposed Subcontractors 54
Contractor's Health and Safety Declaration 55
Construction Approach, Methodology, and Quality Assurance Plan 52
Tenderers Financial Planning 54

Contractual

Joint Venture Agreements (if applicable) 62
Record of Addenda to Tender Documents 61
Contract Participation Goals 59
Amendments, Qualifications and Alternatives 64
Performance Guarantee 70
Form of Offer 65
Contract Data 68
Pricing assumptions/Instructions 78
Bill of Quantities 80
T2.1.3  Preferential Procurement Schedules and Affidavits

In the event of the Tenderer not being registered with the eThekwini Municipality, the following must be completed and submitted prior to the submission of tenders:

- Application for Registration on the eThekwini Municipality Procurement Database.
- Application for Targeted Enterprise Status.

These documents are available from Room 614, 6th Floor, 166 KE Masinga Road, Durban or on the internet at www.durban.gov.za. Follow the following links: eThekwini Municipality / City Government / Administration / Administrative Clusters / Finance / Supply Chain Management / Application for the City's Accredited Supplier and Contractor's Database / Documents you need.

NOTES

(a) The information for registration as in the possession of the eThekwini Municipality will apply.
(b) It is the Tenderer's responsibility to ensure that the details as submitted to the Municipality are correct.
(c) Tenderers are to submit the above forms prior to the submission of tenders.

T2.2: RETURNABLE SCHEDULES, FORMS, AND CERTIFICATES

The returnable schedules, forms, and certificates as listed in T2.1.2 can be found on the pages 19 to 61.
CERTIFICATE OF ATTENDANCE AT CLARIFICATION MEETING / SITE INSPECTION

This is to certify that:

(tenderer name) ..............................................................................................................................

of (address) ..............................................................................................................................

was represented by the person(s) named below at the Clarification Meeting held for all tenderers, the details of which are stated in the Tender Data (F.2.7).

I / We acknowledge that the purpose of the meeting was to acquaint myself / ourselves with the site of the works and / or matters incidental to doing the work specified in the tender documents in order for me / us to take account of everything necessary when compiling our rates and prices included in the tender.

Particulars of person(s) attending the meeting:

Name: ........................................ Name: ........................................
Signature: ........................................ Signature: ........................................
Capacity: ........................................ Capacity: ........................................

Attendance of the above person(s) at the meeting is confirmed by the Employer’s Agent’s Representative, namely:

Name: ........................................
Signature: ........................................
Date: ........................................
CERTIFICATE OF AUTHORITY

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

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>CLOSE CORPORATION</th>
<th>PARTNERSHIP</th>
<th>JOINT VENTURE</th>
<th>SOLE PROPRIETOR</th>
</tr>
</thead>
</table>

Refer to Notes at the bottom of the page

I / We, the undersigned, being the Chairperson (Company), Member(s) (Close Corporation), Partners (Partnership), Sole Owner (Sole Proprietor), Lead Partner (JV), in the company / business trading as:


hereby authorise Mr/Mrs/Ms …………………………………………………………………………………………………………

acting in the capacity of ……………………………………………………………………………………………………………

to sign all documents in connection with the tender for Contract No. WS.7338 and any contract resulting from it on our behalf.

<table>
<thead>
<tr>
<th>NAME</th>
<th>ADDRESS</th>
<th>SIGNATURE</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Notes

The following documents must be attached to the back inside cover to this procurement document:

If a Company : a “Resolution of the Board” in this regard.
If a Joint Venture : a “Power of Attorney” signed by the legally authorised signatories of all the partners to the Joint venture.
DECLARATION OF MUNICIPAL FEES

I, the undersigned, do hereby declare that the Municipal fees of

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

(full name of Company / Close Corporation / partnership / sole proprietor/Joint Venture)

(hereinafter referred to as the TENDERER) are, as at the date hereunder, fully paid or an Acknowledgement of Debt has been concluded with the Municipality to pay the said charges in instalments.

The following account details relate to property of the said TENDERER:

<table>
<thead>
<tr>
<th>Account</th>
<th>Account Number: to be completed by tenderer.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidated Account No.</td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td></td>
</tr>
<tr>
<td>Rates</td>
<td></td>
</tr>
<tr>
<td>JSB Levies</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

I acknowledge that should the aforesaid Municipal charges fall into arrears, the Municipality may take such remedial action as is required, including termination of any contract, and any payments due to the Contractor by the Municipality shall be first set off against such arrears. ATTACHED, to the back inside cover of this document, please find copies of the above account’s and or agreements signed with the municipality.

- Where the TENDERER’S place of business or business interests are outside the jurisdiction of eThekwini municipality, a copy of the accounts/agreements from the relevant municipality must be attached (to the back inside cover of this document).
- Where the tenderer’s Municipal Accounts are part of their lease agreement, then a copy of the agreement, or official letter to that effect is to be attached (to the back inside cover of this document).

NAME : ................................................................. (Block Capitals)

SIGNATURE : .......................................................... DATE: .................................

(of person authorised to sign on behalf of the Tenderer)
COMPULSORY ENTERPRISE QUESTIONNAIRE

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

1) **Name of enterprise:** .................................................................

2) **VAT registration number, if any:** .................................................................

3) **CIDB registration number, if any:** .................................................................

4) **Particulars of sole proprietors and partners in partnerships**

<table>
<thead>
<tr>
<th>Full Name</th>
<th>Identity number*</th>
<th>Personal income tax number *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

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

5) **Particulars of companies and close corporations**

- **Company registration number, if applicable:** .................................................................
- **Close corporation number, if applicable:** .................................................................
- **Tax Reference number, if any:** .................................................................

6) **Record in the service of the state**

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

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

<table>
<thead>
<tr>
<th>Name of sole proprietor, partner, director, manager, principal shareholder or stakeholder</th>
<th>Name of institution, public office, board or organ of state and position held</th>
<th>Status of service (tick appropriate column)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Current</td>
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</tbody>
</table>

Insert separate page if necessary
7) Record of spouses, children and parents in the service of the state

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

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

<table>
<thead>
<tr>
<th>Name of spouse, child or parent</th>
<th>Name of institution, public office, board or organ of state and position held</th>
<th>Status of service (tick appropriate column)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Current</td>
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<tr>
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<td>-----------</td>
</tr>
</tbody>
</table>

Insert separate page if necessary

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

i) authorizes the Employer to obtain a tax clearance certificate from the South African Revenue Services that my/our tax matters are in order;

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

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

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

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

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

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

Enterprise Name .................................................................
TAX COMPLIANCE STATUS PIN / TAX CLEARANCE CERTIFICATE

Reference is made to F.2.23 of the Conditions of Tender.

SARS has introduced a new Tax Compliance Status System. Tenderers can submit a Tax Compliance Status PIN (TCS PIN) instead of an original Tax Clearance Certificate. This TCS PIN can be used by third parties to certify the taxpayer’s real-time compliance status.

Separate Tax Clearance Certificates / TCS PINs are required for each entity in a Joint Venture.

Tenderers are to attach to this page a printout of their Tax Compliance Status PIN (TCS PIN) OR an original Tax Clearance Certificate.

NAME : ........................................................................  (Block Capitals)

SIGNATURE : .................................................................  DATE: ................................
(of person authorised to sign on behalf of the Tenderer)
B-BBEE STATUS LEVEL OF CONTRIBUTION

Reference is made to F.2.23 of the Conditions of Tender.

The Amended Construction Sector Code (Government Gazette No.41287) is applicable to the B-BBEE compliance measurement of all entities that fall within the Construction Sector.

The requirements for measurement and verification of entities are contained in the “Amended Code Series CSC000: Framework for Measuring Broad Based Black Economic Empowerment in the Construction Sector”, as published in Notice 931 of 2017, Government Gazette No.41287 of 01/12/2017.

The requirements are summarised in the following table:

<table>
<thead>
<tr>
<th>Enterprise Type</th>
<th>Total Annual Revenue (R million)</th>
<th>Ownership and Annual Turnover</th>
</tr>
</thead>
<tbody>
<tr>
<td>EME: Built Environment Professional</td>
<td>&lt; R1.8m</td>
<td>May present an affidavit OR a certificate issued by the CIPC OR authorised B-BBEE verification certificate (as below)</td>
</tr>
<tr>
<td>EME: Contractor</td>
<td>&lt; R3.0m</td>
<td></td>
</tr>
</tbody>
</table>

Reference should be made to Cl.3.6.2.4.1 of the Amended Construction Sector Code regarding the above exceptions.

The requirements for measurement of Joint Ventures is described in Cl.2.8 of the Amended Construction Sector Code. The compilation of a consolidated verification certificate is required.

Tenderers are to attach to this page an affidavit, a certificate issued by the CIPC, or an authorised B-BBEE verification certificate by a SANAS accredited Verification Agency.

NAME : ........................................................................  (Block Capitals)

SIGNATURE : ........................................................................  DATE: ................................

(of person authorised to sign on behalf of the Tenderer)
VERIFICATION OF CIDB REGISTRATION AND STATUS

Reference is made to F.2.23 of the Conditions of Tender.

Clause F.2.1.1 of the Conditions of Tender - “Eligibility”, requires a tenderer to be registered, as “Active”, with the CIDB (at time of tender closing), in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered, or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations, for a 7 CE class of construction work.

Tenderers are to attach to this page a printout of their registration with the CIDB, as obtained from the CIDB website https://registers.cidb.org.za/PublicContractors/ContractorSearch. The date of obtaining the printout is to be indicated on the printout.

The following is an example of a printout obtained from the above website.

NAME : ........................................................................  (Block Capitals)

SIGNATURE : .................................................................  DATE: .........................

(of person authorised to sign on behalf of the Tenderer)
CSD REGISTRATION REPORT

Reference is made to F.2.23 of the Conditions of Tender.

Clause F.2.1 of the Conditions of Tender - “Eligibility”, requires a tenderer to be registered at the time of tender closing on the National Treasury Central Supplier Database (CSD) as a service provider.

Tenderers are to attach to this page a printout of their CSD Registration Report, as obtained from the National Treasury’s CSD website https://secure.csd.gov.za/Account/Login. The date of obtaining the printout is to be indicated on the printout.

The following is an example of the beginning of the printout obtained from the above website.

NAME : ........................................................................ (Block Capitals)

SIGNATURE : .................................................................................. DATE: .........................

(of person authorised to sign on behalf of the Tenderer)
The CONSOLIDATED MUNICIPAL BIDDING DOCUMENTS:

The following SECTIONS are required to be completed as part of this procurement document:

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>General Enterprise Information</td>
</tr>
<tr>
<td>B</td>
<td>MBD2: Tax Clearance Certificate Requirements</td>
</tr>
<tr>
<td>C</td>
<td>MBD4: Declaration of Interest</td>
</tr>
<tr>
<td>D</td>
<td>MBD5: Declaration for Procurement Above R10 Million</td>
</tr>
<tr>
<td>E</td>
<td>MBD6.1: Preference Points Claim Form ITO the Preferential Regulations</td>
</tr>
<tr>
<td>F</td>
<td>MBD6.2: Declaration Certificate for Local Production and Content for Designated Sectors</td>
</tr>
<tr>
<td>G</td>
<td>MBD8: Declaration of Bidder’s Past SCM Practices</td>
</tr>
<tr>
<td>H</td>
<td>MBD9: Certificate of Independent Bid Determination</td>
</tr>
<tr>
<td>I</td>
<td>Confirmations, Authorities, Certifications, Acknowledgements and Signatures</td>
</tr>
</tbody>
</table>

NOTES

MBD4. MSCM Regulations: “in the service of the state” means to be:
   (a) a member of –
       (i) any municipal council;
       (ii) any provincial legislature; or
       (iii) the national Assembly or the national Council of provinces;
   (b) a member of the board of directors of any municipal enterprise;
   (c) an official of any municipality or municipal enterprise;
   (d) an employee of any national or provincial department, national or provincial public enterprise or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No.1 of 1999);
   (e) a member of the accounting authority of any national or provincial public enterprise; or
   (f) an employee of Parliament or a provincial legislature.

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

MBD9. Bid rigging (or collusive bidding) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or lower the quality of goods and / or services for purchasers who wish to acquire goods and / or services through a bidding process. Bid rigging is, therefore, an agreement between competitors not to compete.
## SECTION A: GENERAL ENTERPRISE INFORMATION

<table>
<thead>
<tr>
<th>Ref</th>
<th>Description</th>
<th>Complete or Circle Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Full Name of bidder or his or her representative</td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>ID Number of bidder or his or her representative</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Position occupied in the enterprise</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>Name of enterprise:</td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Tax Reference number, if any:</td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>VAT registration number, if any:</td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>CIDB registration number, if any:</td>
<td></td>
</tr>
<tr>
<td>2.4</td>
<td>Company registration number, if applicable:</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Close corporation number, if applicable:</td>
<td></td>
</tr>
<tr>
<td>2.6</td>
<td>Supplier reference number (PR), if any:</td>
<td></td>
</tr>
<tr>
<td>2.7</td>
<td>South African Revenue Service Tax Compliance Status PIN:</td>
<td></td>
</tr>
<tr>
<td>2.8</td>
<td>National Treasury Central Supplier Database registration number</td>
<td></td>
</tr>
</tbody>
</table>

The names of all directors / trustees / shareholders / members / sole proprietors / partners in partnerships, their individual identity numbers and state employee numbers must be indicated below. In the case of a joint venture, information in respect of each partnering enterprise must be completed and submitted.

<table>
<thead>
<tr>
<th>Full Name</th>
<th>Identity No.</th>
<th>State Employee No.</th>
<th>Personal income tax No. *</th>
</tr>
</thead>
<tbody>
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</table>

Use additional pages if necessary
**SECTION B: MBD 2: TAX CLEARANCE CERTIFICATE REQUIREMENTS**

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

1.0 In order to meet this requirement bidders are required to complete the TCC 001: “Application for a Tax Clearance Certificate” form and submit it to any SARS branch office nationally. The Tax Clearance Certificate Requirements are also applicable to foreign bidders / individuals who wish to submit bids.

2.0 SARS will then furnish the bidder with a Tax Clearance Certificate that will be valid for a period of 1 (one) year from the date of approval.

3.0 The original Tax Clearance Certificate must be submitted together with the bid (attached to the inside back cover of this procurement document). Failure to submit the original and valid Tax Clearance Certificate will result in the invalidation of the bid. Certified copies of the Tax Clearance Certificate will not be acceptable.

4.0 In bids where Consortia / Joint Ventures / Sub-contractors are involved, each party must submit a separate Tax Clearance Certificate.

5.0 Copies of the TCC 001: “Application for a Tax Clearance Certificate” form are available from any SARS branch office nationally or on the website [www.sars.gov.za](http://www.sars.gov.za).

6.0 Applications for the Tax Clearance Certificates may also be made via eFiling. In order to use this provision, taxpayers will need to register with SARS as eFilers through the website [www.sars.gov.za](http://www.sars.gov.za).

7.0 Notwithstanding Clauses 1.0 to 6.0 above: Since 18 April 2016, SARS has introduced a new Tax Compliance Status System (TCS). As part of this enhanced system, tenderers can now submit a Tax Compliance Status PIN instead of an original Tax Clearance Certificate (TCC). This TCS PIN can be used by third parties to certify the taxpayer’s real-time compliance status. This number, if available, is to be entered in Item 2.7 of Section A of these consolidated Municipal Bidding Documents.

For further particulars please contact your nearest SARS branch, or call the SARS Contact Centre on 0800 00 7277, or log onto SARS eFiling.

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**SECTION C: MBD 4: DECLARATION OF INTEREST**

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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Are you presently in the service of the state?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If yes, furnish particulars: ..............................................................</td>
<td></td>
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</tr>
<tr>
<td>2.0</td>
<td>Have you been in the service of the state for the past twelve months?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If yes, furnish particulars: ..............................................................</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>Do you have any relationship (family, friend, other) with persons in the service of the state and who may be involved with the evaluation and or adjudication of this bid?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If yes, furnish particulars: ..............................................................</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>Are you aware of any relationship (family, friend, other) between any other bidder and any persons in the service of the state who may be involved with the evaluation and or adjudication of this bid?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If yes, furnish particulars: ..............................................................</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>Are any of the company’s directors, trustees, managers, principle shareholders or stakeholders in service of the state?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If yes, furnish particulars: ..............................................................</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td>Are any spouse, child or parent of the company’s directors, trustees, managers, principle shareholders or stakeholders in service of the state?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If yes, furnish particulars: ..............................................................</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>Do you or any of the directors, trustees, managers, principle shareholders, or stakeholders of this company have any interest in any other related companies or business whether or not they are bidding for this contract?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If yes, furnish particulars: ..............................................................</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0</td>
<td>The names of all directors / trustees / shareholders / members / sole proprietors / partners in partnerships, their individual identity numbers and state employee numbers are indicated in SECTION A of these Consolidated Municipal Bidding documents.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SECTION D: MBD 5: DECLARATION FOR PROCUREMENT ABOVE R10 MILLION (ALL APPLICABLE TAXES INCLUDED)

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

<table>
<thead>
<tr>
<th>Ref</th>
<th>Description</th>
<th>Complete or Circle Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Are you by law required to prepare annual financial statements for auditing?</td>
<td>YES</td>
</tr>
<tr>
<td>1.0</td>
<td>If YES, you will be required to submit audited annual financial statements (on request during the tender evaluation period) for the past three years or since the date of establishment if established during the past three years.</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>Do you have any outstanding undisputed commitments for municipal services towards any municipality for more than three months or any other service provider in respect of which payment is overdue for more than 30 days?</td>
<td>YES</td>
</tr>
<tr>
<td>2.0</td>
<td>If NO, this serves to certify that the bidder has no undisputed commitments for municipal services towards any municipality for more than three months or other service provider in respect of which payment is overdue for more than 30 days. If YES, provide particulars on a letterhead. (Attach this letter to the back inside cover of this procurement document).</td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>Has any contract been awarded to you by an organ of state during the past five years, including particulars of any material non-compliance or dispute concerning the execution of such contract?</td>
<td>YES</td>
</tr>
<tr>
<td>3.0</td>
<td>If YES, provide particulars on a letterhead. (Attach this letter to the back inside cover of this procurement document).</td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>Will any portion of goods or services be sourced from outside the Republic, and, if so, what portion and whether any portion of payment from the municipality / municipal entity is expected to be transferred out of the Republic?</td>
<td>YES</td>
</tr>
<tr>
<td>4.0</td>
<td>If YES, provide particulars on a letterhead. (Attach this letter to the back inside cover of this procurement document).</td>
<td></td>
</tr>
</tbody>
</table>

### SECTION E: MBD 6.1: PREFERENCE POINTS CLAIM TO THE PREFERENTIAL REGULATIONS

Preference points for this tender shall be awarded as per the Tender Data and the Preferential Procurement Regulations (January 2017). Failure on the part of a tenderer to submit a B-BBEE Verification Certificate from a Verification Agency accredited by the South African Accreditation System (SANAS) or a Registered Auditor approved by the Independent Regulatory Board of Auditors (IRBA) or an Accounting Officer as contemplated in the Close Corporation Act (CCA) together with the bid, will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed.

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

<table>
<thead>
<tr>
<th>Ref</th>
<th>Description</th>
<th>Complete or Circle Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>B-BBEE Status Level of Contribution claimed:</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>Will any portion of the contract be sub-contracted?</td>
<td>YES</td>
</tr>
<tr>
<td>1.0</td>
<td>If YES, indicate:</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>(i) what percentage of the contract will be subcontracted?</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>(ii) the name of the sub-contractor?</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>Name: ………………………………………………………………………………………………………………………………………………………</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>(iii) the B-BBEE status level of the sub-contractor?</td>
<td>YES</td>
</tr>
<tr>
<td>2.0</td>
<td>(iv) whether the sub-contractor is an EME?</td>
<td>YES</td>
</tr>
</tbody>
</table>

The undersigned, certify that the B-BBEE status level of contribution indicated in paragraph 1.0 above qualifies the company / firm for preference points and acknowledges that the remedies as per Clause 14 of the Preferential Procurement Regulations (2017) shall apply.

### SECTION F: MBD 6.2: DECLARATION CERTIFICATE FOR LOCAL PRODUCTION AND CONTENT FOR DESIGNATED SECTORS

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

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

<table>
<thead>
<tr>
<th>Ref</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>General Conditions</td>
</tr>
<tr>
<td>1.1</td>
<td>Preferential Procurement Regulations, 2017 (Regulation 8) makes provision for the promotion of local production and content.</td>
</tr>
<tr>
<td>1.2</td>
<td>Regulation 8(1) prescribes that in the case of designated sectors, where in the award of bids local production and content is of critical importance, such bids must be advertised with the specific bidding condition that only locally produced goods, services or works or locally manufactured goods, with a stipulated minimum threshold for local production and content will be considered.</td>
</tr>
<tr>
<td>1.3</td>
<td>Where necessary, for bids referred to in paragraph 1.2 above, a two-stage bidding process may be followed, where the first stage involves a minimum threshold for local production and content and the second stage price and B-BBEE.</td>
</tr>
<tr>
<td>1.4</td>
<td>A person awarded a contract in relation to a designated sector, may not sub-contract in such a manner that the local production and content of the overall value of the contract is reduced to below the stipulated minimum threshold.</td>
</tr>
</tbody>
</table>
1.5 The local content (LC) expressed as a percentage of the bid price must be calculated in accordance with the SABS approved technical specification number SATS 1286: 2011 as follows:

\[ LC = \left[ 1 - \frac{x}{y} \right] \times 100 \]

Where:  
- \( x \) is the imported content in Rand
- \( y \) is the bid price in Rand excluding value added tax (VAT).

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


1.6 A bid may be disqualified if –

(a) this Declaration Certificate and the Annex C (Local Content Declaration: Summary Schedule) are not submitted as part of the bid document; and

(b) the bidder fails to declare that the Local Content Declaration Templates (Annex C, D and E) have been audited and certified as correct.

2.0 Definitions

2.1 “bid” includes written price quotations, advertised competitive bids or proposals;

2.2 “bid price” price offered by the bidder, excluding value added tax (VAT);

2.3 “contract” means the agreement that results from the acceptance of a bid by an organ of state;

2.4 “designated sector” means a sector, sub-sector or industry that has been designated by the Department of Trade and Industry in line with national development and industrial policies for local production, where only locally produced services, works or goods or locally manufactured goods meet the stipulated minimum threshold for local production and content;

2.5 “duly sign” means a Declaration Certificate for Local Content that has been signed by the Chief Financial Officer or other legally responsible person nominated in writing by the Chief Executive, or senior member / person with management responsibility (close corporation, partnership or individual);

2.6 “imported content” means that portion of the bid price represented by the cost of components, parts or materials which have been or are still to be imported (whether by the supplier or its subcontractors) and which costs are inclusive of the costs abroad (this includes labour and intellectual property costs), plus freight and other direct importation costs, such as landing costs, dock duties, import duty, sales duty or other similar tax or duty at the South African port of entry;

2.7 “local content” means that portion of the bid price which is not included in the imported content, provided that local manufacture does take place;

2.8 “stipulated minimum threshold” means that portion of local production and content as determined by the Department of Trade and Industry;

2.9 “sub-contract” means the primary contractor’s assigning, leasing, making out work to, or employing another person to support such primary contractor in the execution of part of a project in terms of the contract.

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

<table>
<thead>
<tr>
<th>Description of services, works or goods</th>
<th>Stipulated minimum threshold</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
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<td></td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>%</td>
</tr>
</tbody>
</table>

4.0 Does any portion of the services, works or goods offered have any imported content?  

| YES | NO |

4.1 If yes, the rate(s) of exchange to be used in this bid to calculate the local content as prescribed in paragraph 1.5 of the general conditions must be the rate(s) published by the SARB for the specific currency at 12:00 on the date of advertisement of the bid.

The relevant rates of exchange information is accessible on www.reservebank.co.za.

Indicate the rate(s) of exchange against the appropriate currency in the table below (refer to Annex A of SATS 1286:2011):

<table>
<thead>
<tr>
<th>US Dollar</th>
<th>Pound Sterling</th>
<th>Euro</th>
<th>Yen</th>
<th>Other</th>
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</thead>
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</tbody>
</table>

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

5.0 Were the Local Content Declaration Templates (Annex C, D and E) audited and certified as correct?  

| YES | NO |

5.1 If yes, provide the following particulars:

(a) Full name of auditor: ……………………………………………………………………………………………………………………………

(b) Practice number: ……………………………………… (c) Telephone number: ………………………………………

(d) Email address: ………………………………………………………………………………………………………………………………………

(Documentary proof regarding the declaration will, when required, be submitted to the satisfaction of the Accounting Officer / Accounting Authority)

6.0 Where, after the award of a bid, challenges are experienced in meeting the stipulated minimum threshold for local content the dti must be informed accordingly in order for the dti to verify and in consultation with the Accounting Officer / Accounting Authority provide directives in this regard.
LOCAL CONTENT DECLARATION
(REFER TO ANNEX B OF SATS 1286:2011)
LOCAL CONTENT DECLARATION BY CHIEF FINANCIAL OFFICER OR OTHER LEGALLY RESPONSIBLE PERSON NOMINATED IN WRITING BY THE CHIEF EXECUTIVE OR SENIOR MEMBER/PERSON WITH MANAGEMENT RESPONSIBILITY (Close Corporation, Partnership or Individual)

IN RESPECT OF BID No: ___________________________

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

NB 1 - The obligation to complete, duly sign and submit this declaration cannot be transferred to an external authorized representative, auditor or any other third party acting on behalf of the bidder.

NB 2 - Guidance on the Calculation of Local Content together with Local Content Declaration Templates (Annex C, D and E) is accessible on http://www.thedti.gov.za/industrial development/ip.jsp. Bidders should first complete Declaration D. After completing Declaration D, bidders should complete Declaration E and then consolidate the information on Declaration C. Declaration C should be submitted with the bid documentation at the closing date and time of the bid in order to substantiate the declaration made in paragraph (c) below. Declarations D and E should be kept by the bidders for verification purposes for a period of at least 5 years. The successful bidder is required to continuously update Declarations C, D and E with the actual values for the duration of the contract.

I, the undersigned in Section H of these Consolidated MBD returnable questionnaires (comprising 8 pages), do hereby declare the following:

(a) The facts contained herein fall within my own personal knowledge.
(b) I have satisfied myself that:
   (i) the goods/services/works to be delivered in terms of the above-specified bid comply with the minimum local content requirements as specified in the bid, and as measured in terms of SATS 1286:2011; and
   (ii) the declaration templates have been audited and certified to be correct.
(c) The local content percentages (%) indicated below has been calculated using the formula given in clause 3 of SATS 1286:2011, the rates of exchange indicated in paragraph 4.1 above and the information contained in Declaration D and E which has been consolidated in Declaration C;
   • Bid price, excluding VAT (y) .......................................................................................................................... R
   • Imported content (x), as calculated in terms of SATS 1286:2011................................................................. R
   • Stipulated minimum threshold for local content (paragraph 3 above) ......................................................... %
   • Local content %, as calculated in terms of SATS 1286:2011................................................................. %

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

(d) I accept that the Procurement Authority / Municipality /Municipal Entity has the right to request that the local content be verified in terms of the requirements of SATS 1286:2011.

(e) I understand that the awarding of the bid is dependent on the accuracy of the information furnished in this application. I also understand that the submission of incorrect data, or data that are not verifiable as described in SATS 1286:2011, may result in the Procurement Authority / Municipal / Municipal Entity imposing any or all of the remedies as provided for in Regulation 14 of the Preferential Procurement Regulations, 2017 promulgated under the Preferential Policy Framework Act (PPPPA), 2000 (Act No. 5 of 2000).

SECTION G: MBD8: DECLARATION OF BIDDER’S PAST SUPPLY CHAIN MANAGEMENT PRACTICES
This Municipal Bidding Document must form part of all bids invited. It serves as a declaration to be used by municipalities and municipal entities in ensuring that when goods and services are being procured, all reasonable steps are taken to combat the abuse of the supply chain management system.

The bid of any bidder may be rejected if that bidder, or any of its directors have:
(a) abused the municipal entity’s supply chain management system or committed any improper conduct in relation to such system;
(b) been convicted for fraud or corruption during the past five years;
(c) wilfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past five years; or
d) been listed in the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004).

In order to give effect to the above, the following questions must be answered.

1.0 Is the bidder or any of its directors listed on the National Treasury’s Database of Restricted Suppliers as companies or persons prohibited from doing business with the public sector?
Companies or persons who are listed on this Database were informed in writing of this restriction by the Accounting Officer / Authority of the institution that imposed the restriction after the audi alteram partem rule was applied. The Database of Restricted Suppliers now resides on the National Treasury’s website (www.treasury.gov.za) and can be accessed by clicking on its link at the bottom of the home page.

If yes, furnish particulars: …………………………………………………………………………………………………………………………

2.0 Is the bidder or any of its directors listed on the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004)?
The Register for Tender Defaulters can be accessed on the National Treasury’s website (www.treasury.gov.za) by clicking on its link at the bottom of the home page.

If yes, furnish particulars: …………………………………………………………………………………………………………………………

3.0 Was the bidder or any of its directors convicted by a court of law (including a court of law outside the Republic of South Africa) for fraud or corruption during the past five years?

If yes, furnish particulars: …………………………………………………………………………………………………………………………

T2: Returnable Documents   Page 33   Document Version: 18/02/2020
In order to give effect to the above, the following Certificate of Bid Determination must be completed and submitted with the accompanying bid. The following MBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.

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

- the intention or decision to submit or not to submit, a bid;
- the submission of a bid which does not meet the specifications and conditions of the bid;
- bidding with the intention not to win the bid.

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

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.

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

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

1.0 Confirms that the contents of these Consolidated MBD returnable questionnaires (comprising 8 pages) fall within my personal knowledge and are to the best of my Knowledge and belief, both true and correct;

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

3.0 Confirms that no partner, member, director or other person, who wholly or partly exercise control over the enterprise, has within the last five years been convicted of fraud or corruption;

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

5.0 Certify that the B-BBEE status level of contribution indicated in Section E.1: Item 1.0 qualifies the enterprise for preference points and acknowledges that the remedies as per Clause 14 of the Preferential Procurement Regulations (2017) shall apply. In the event of a contract being awarded as a result of points claimed, the enterprise may be required to furnish documentary proof to the satisfaction of the employer that the claims are correct;

6.0 Accept that, in addition to cancellation of a contract, action may be taken against me should these declarations prove to be false.

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

Name .................................................. Position .............................................
Experienced Tenderer (R.C. Water Retaining Structures)

Refer to Clause F3.11.9 for Functionality Points evaluation prompts (if applicable).

Tendering Firm's experience with reference to the present day value (excluding VAT) of successfully completed contracts over the last 15 years involving the construction of reinforced concrete water retaining structures equal or greater than 10Mℓ:

A separate sheet to be completed for each project. Tenderers are to submit copies of signed completion certificates for all projects submitted.

<table>
<thead>
<tr>
<th>Contract Description:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Month and Year</td>
<td></td>
</tr>
<tr>
<td>Commenced:</td>
<td></td>
</tr>
<tr>
<td>Award Value (VAT Excl.)</td>
<td></td>
</tr>
<tr>
<td>Month and Year</td>
<td></td>
</tr>
<tr>
<td>Completed:</td>
<td></td>
</tr>
<tr>
<td>Completed Value</td>
<td></td>
</tr>
<tr>
<td>(VAT Excl.)</td>
<td></td>
</tr>
<tr>
<td>Name of Client:</td>
<td></td>
</tr>
<tr>
<td>Tel. No.:</td>
<td></td>
</tr>
<tr>
<td>Name of Client's</td>
<td></td>
</tr>
<tr>
<td>Representative:</td>
<td></td>
</tr>
<tr>
<td>Tel./ Cell No.:</td>
<td></td>
</tr>
<tr>
<td>Name of Consulting</td>
<td></td>
</tr>
<tr>
<td>Engineering Firm:</td>
<td></td>
</tr>
<tr>
<td>Tel. No.:</td>
<td></td>
</tr>
<tr>
<td>Name of Consultant's</td>
<td></td>
</tr>
<tr>
<td>Representative:</td>
<td></td>
</tr>
<tr>
<td>Tel./ Cell No.:</td>
<td></td>
</tr>
</tbody>
</table>

Details of the above Contract

The following information is required for evaluation of the above contract and the Tenderer shall provide such information to the best of his knowledge:

1. Description and scope of construction work completed:

2. Names and capacities of key personnel (contract site project manager, concrete foremen, civils...
foremen, etc.) that were involved on the above contract and who will be employed on this contract:

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

Attach additional pages if more space is required

**Note to Tenderer:**

It is a strict requirement that the Tenderer submit proof of completion of the contract (and to the value stipulated above) by attaching a copy of the final (signed) payment certificate (including final summary of sections) and signed Certificate of Completion of Works. Failure to do so will lead to the conclusion that the work was not successfully completed and NO points will awarded for any relevant experience claimed for that contract.

NAME : ................................................................. (Block Capitals)

SIGNATURE : .......................................................... DATE: .........................

(of person authorised to sign on behalf of the Tenderer)
**PROPOSED ORGANISATION and STAFFING**

Refer to Clause F3.11.9 for Functionality Points evaluation prompts (if applicable).

The tenderer should propose the structure and composition of their team i.e. the main disciplines involved, the key staff member / expert responsible for each discipline, and the proposed technical and support staff and site staff.

The roles and responsibilities of each key staff member / expert should be set out as job descriptions. In the case of an association / joint venture / consortium, it should, indicate how the duties and responsibilities are to be shared.

The tenderer must attach his / her organization and staffing proposals to this page. (This is to include both the on-site and off-site staffing resources used for this project)

In addition to any lists, this information should also be shown in an organogram format (flow chart) clearly indicating the staff hierarchy and reporting lines, again for on- and off-site resources.

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** : ........................................................................  (Block Capitals)

**SIGNATURE** : .................................................................  DATE: ...................  

* (of person authorised to sign on behalf of the Tenderer)
KEY PERSONNEL

Refer to Clause F3.11.9 for Functionality Points evaluation prompts (if applicable).

The Tenderer shall list below the personnel which he intends to utilize on the Works, including key personnel (Contract's Manager, Site Agent, and Foremen) which may have to be brought in from outside if not available locally.

<table>
<thead>
<tr>
<th>CATEGORY OF EMPLOYEE</th>
<th>NUMBER OF PERSONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KEY PERSONNEL, PART OF THE CONTRACTOR'S ORGANISATION</td>
</tr>
<tr>
<td>Site Agent, Contract Managers</td>
<td></td>
</tr>
<tr>
<td>Foremen, Quality Control and Safety Personnel</td>
<td></td>
</tr>
<tr>
<td>Technicians, Surveyors, etc</td>
<td></td>
</tr>
<tr>
<td>Artisans and other Skilled workers</td>
<td></td>
</tr>
<tr>
<td>Plant Operators</td>
<td></td>
</tr>
<tr>
<td>Unskilled Workers</td>
<td></td>
</tr>
<tr>
<td>Others:</td>
<td></td>
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<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NAME: ........................................................................ (Block Capitals)

SIGNATURE: ...............................................................

(OF PERSON AUTHORISED TO SIGN ON BEHALF OF THE TENDERER)

DATE: ...........................................
EXPERIENCE OF KEY PERSONNEL

Refer to Clause F3.11.9 for Functionality Points evaluation prompts (if applicable).

The experience of assigned staff member in relation to the Scope of Work will be evaluated from three different points of view:

1) General experience (total duration of professional activity), level of education and training and positions held of each discipline specific team leader.

2) The education, training, skills and experience of the Assigned Staff in the specific sector, field, subject, etc which is directly linked to the scope of work.

3) The key staff members’ / experts’ knowledge of issues which the tenderer considers pertinent to the project e.g. local conditions, affected communities, legislation, techniques etc.

A CV of the contract manager, site agent(s) and general foreman of not more than 2 pages should be attached to this schedule:

Each CV should be structured under the following headings:

a) Personal particulars
   - name
   - date and place of birth
   - place (s) of tertiary education and dates associated therewith
   - professional awards

b) Qualifications (degrees, diplomas, grades of membership of professional societies and professional registrations)

c) Skills

d) Name of current employer and position in enterprise

e) Overview of post graduate / diploma experience (year, organization and position)

f) Outline of recent assignments / experience that has a bearing on the scope of work

NAME : ........................................................................ (Block Capitals)

SIGNATURE : ................................................................. DATE: .................................
(of person authorised to sign on behalf of the Tenderer)
QUALIFICATIONS OF CONTRACT MANAGER

Refer to Clause F3.11.9 for Functionality Points evaluation prompts (if applicable).

The person nominated for the key personnel position above shall provide all the information required below and sign the declaration at the end of this form.

<table>
<thead>
<tr>
<th>Full Name &amp; Surname:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ID/ Passport No.</td>
<td>Age:</td>
</tr>
<tr>
<td>Name of Tertiary Institution/s Attended:</td>
<td></td>
</tr>
<tr>
<td>Tertiary Qualification/s (and Year/s Obtained):</td>
<td></td>
</tr>
<tr>
<td>Name of Professional Institution/s Registered With:</td>
<td>Registration Number/s:</td>
</tr>
</tbody>
</table>

Note: Certified copies of all relevant qualifications and registrations must be attached to this form.

Declaration by nominee for key staff position above:

I, the undersigned, declare that all the information provided above and in forms that follow correctly describes my qualifications and experience.

I, the undersigned do hereby agree to present myself for an interview with the Client or a representative of the Client should further clarity be required on the information provided herein.

NAME : ................................................................. (Block Capitals)

SIGNATURE : ........................................................... DATE: .........................
(of person authorised to sign on behalf of the Tenderer)

Note to Tenderer:

The Tenderer shall ensure that this form is signed by the person nominated for the above key staff position and that all the information provided is true. Any inconsistency in the information provided will lead to the conclusion that the person nominated is not suitably qualified for the position and NO points will be awarded.

SIGNATURE ............................................................. DATE: .........................
(of person authorised to sign on behalf of the Tenderer)
EXPERIENCE AS CONTRACT MANAGER ON CONTRACTS FOR THE CONSTRUCTION OF
REINFORCED CONCRETE WATER RETAINING STRUCTURES OF MINIMUM CAPACITY 10ML

(Copies shall be made of this page to suit the number of contracts)

<table>
<thead>
<tr>
<th>Contract Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period of Construction</td>
</tr>
<tr>
<td>(MM/YY to MM/YY):</td>
</tr>
<tr>
<td>Name of Client:</td>
</tr>
<tr>
<td>(Note: Client implies: eThekwini Municipality, Cape Town Municipality, Umgeni Water, etc.)</td>
</tr>
<tr>
<td>Name of Consulting Engineering Firm:</td>
</tr>
<tr>
<td>Name of Civil Contractor:</td>
</tr>
<tr>
<td>Name of Referee for the above contract:</td>
</tr>
<tr>
<td>Referee Tel. No. / Cell No.:</td>
</tr>
<tr>
<td>Capacity (ML)</td>
</tr>
<tr>
<td>Details of Structure</td>
</tr>
</tbody>
</table>
QUALIFICATIONS OF SITE AGENT

Refer to Clause F3.11.9 for Functionality Points evaluation prompts (if applicable).

The person nominated for the key personnel position above shall provide all the information required below and sign the declaration at the end of this form.

<table>
<thead>
<tr>
<th>Full name &amp; Surname:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID/Passport No.:</td>
</tr>
<tr>
<td>Age:</td>
</tr>
<tr>
<td>Name of Client:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of Tertiary Institution/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tertiary Qualification/s (and Year/s Obtained):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Name of Professional Institution/s Registered With:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration Number/s:</td>
</tr>
</tbody>
</table>

Note: Certified copies of all relevant qualifications and registrations must be attached to this form.

Declaration by nominee for key staff position above:

I, the undersigned, declare that all the information provided above and in forms that follow correctly describes my qualifications and experience.

I, the undersigned do hereby agree to present myself for an interview with the Client or a representative of the Client should further clarity be required on the information provided herein.

NAME : ........................................................................ (Block Capitals)

SIGNATURE : ............................................................... DATE: .........................
(of person authorised to sign on behalf of the Tenderer)

Note to Tenderer:

The Tenderer shall ensure that this form is signed by the person nominated for the above key staff position and that all the information provided is true. Any inconsistency in the information provided will lead to the conclusion that the person nominated is not suitably qualified for the position and NO points will be awarded.

SIGNATURE ............................................................... DATE: .........................
(of person authorised to sign on behalf of the Tenderer)
EXPERIENCE AS SITE AGENT ON CONTRACTS FOR THE CONSTRUCTION OF REINFORCED CONCRETE WATER RETAINING STRUCTURES OF MINIMUM CAPACITY 10Mℓ

(Copies shall be made of this page to suit the number of contracts)

<table>
<thead>
<tr>
<th>Contract Title:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Period of Construction (MM/YY to MM/YY):</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of Client:</th>
<th></th>
</tr>
</thead>
</table>

(Note: Client implies: eThekwini Municipality, Cape Town Municipality, Umgeni Water, etc.)

<table>
<thead>
<tr>
<th>Name of Consulting Engineering Firm:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Civil Contractor:</td>
<td></td>
</tr>
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<td>Name of Referee for the above contract:</td>
<td></td>
</tr>
<tr>
<td>Referee Tel. No. / Cell No.:</td>
<td></td>
</tr>
<tr>
<td>Capacity (Mℓ)</td>
<td></td>
</tr>
<tr>
<td>Details of Structure</td>
<td></td>
</tr>
</tbody>
</table>
EXPERIENCE OF CONCRETE (LEAD) FOREMAN

Refer to Clause F3.11.9 for Functionality Points evaluation prompts (if applicable).

The person nominated for the key personnel position above shall provide all the information required below and sign the declaration at the end of this form.

<table>
<thead>
<tr>
<th>Full name &amp; Surname:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ID/Passport No.:</td>
<td>Age:</td>
</tr>
</tbody>
</table>

Declaration by nominee for key staff position above:

I, the undersigned, declare that all the information provided above and in forms that follow correctly describes me and my experience.

I, the undersigned do hereby agree to present myself for an interview with the Client or a representative of the Client should further clarity be required on the information provided herein.

NAME : ................................................................. (Block Capitals)

SIGNATURE : ................................................................. DATE: .................................
(of person authorised to sign on behalf of the Tenderer)

Note to Tenderer:

The Tenderer shall ensure that this form is signed by the person nominated for the above key staff position and that all the information provided is true. Any inconsistency in the information provided will lead to the conclusion that the person nominated is not suitably qualified for the position and NO points will be awarded.

SIGNATURE ................................................................. DATE: .................................
(of person authorised to sign on behalf of the Tenderer)
EXPERIENCE AS CONCRETE LEAD FOREMAN FOR THE CONSTRUCTION OF REINFORCED CONCRETE WATER RETAINING STRUCTURES WITH MINIMUM CAPACITY 10Mℓ

(Copies shall be made of this page to suit the number of contracts)

<table>
<thead>
<tr>
<th>Contract Title:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Period of Construction</td>
<td></td>
</tr>
<tr>
<td>(MM/YY to MM/YY):</td>
<td></td>
</tr>
<tr>
<td>Name of Client:</td>
<td></td>
</tr>
</tbody>
</table>

(Note: Client implies: eThekwini Municipality, Cape Town Municipality, Umgeni Water, etc.)

<table>
<thead>
<tr>
<th>Description of RC Water Structures Constructed on above Contract and Dimensions (i.e. diameter &amp; depth / length, width &amp; depth):</th>
<th>Capacity (Mℓ)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

(Note: Description implies: reservoir, silo, sedimentation tank, digester, etc.)

<table>
<thead>
<tr>
<th>Contract Title:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Period of Construction</td>
<td></td>
</tr>
<tr>
<td>(MM/YY to MM/YY):</td>
<td></td>
</tr>
<tr>
<td>Name of Client:</td>
<td></td>
</tr>
</tbody>
</table>

(Note: Client implies: eThekwini Municipality, Cape Town Municipality, Umgeni Water, etc.)

<table>
<thead>
<tr>
<th>Description of RC Water Structures Constructed on above Contract and Dimensions (i.e. diameter &amp; depth / length, width &amp; depth):</th>
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<tbody>
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<td></td>
</tr>
</tbody>
</table>

(Note: Description implies: reservoir, silo, sedimentation tank, digester, etc.)
EXPERIENCE AS CIVIL FOREMAN ON CONTRACTS FOR THE CONSTRUCTION OF
REINFORCED CONCRETE WATER RETAINING STRUCTURES OF MINIMUM CAPACITY 10M³

Refer to Clause F3.11.9 for Functionality Points evaluation prompts (if applicable).

Full name & Surname:  

ID/Passport No.:  Age:

Declaration by nominee for key staff position above:

I, the undersigned, declare that all the information provided above and in the forms that follow correctly describes me and my experience.

I, the undersigned do hereby agree to present myself for an interview with the Client or a representative of the Client should further clarity be required on the information provided herein.

NAME : ........................................................................  (Block Capitals)

SIGNATURE : ……………………………..…………………..………  DATE: ................................
(of person authorised to sign on behalf of the Tenderer)

Note to Tenderer:
The Tenderer shall ensure that this form is signed by the person nominated for the above key staff position and that all the information provided is true. Any inconsistency in the information provided will lead to the conclusion that the person nominated is not suitably qualified for the position and NO points will be awarded.

SIGNATURE …………………………………………………………………           DATE: ………………………
(of person authorised to sign on behalf of the Tenderer)
EXPERIENCE AS CIVIL FOREMAN ON CONTRACTS FOR THE CONSTRUCTION OF REINFORCED CONCRETE WATER RETAINING STRUCTURES OF MINIMUM CAPACITY 10M\(\ell\)

(Copies shall be made of this page to suit the number of contracts)

<table>
<thead>
<tr>
<th>Contract Title:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Period of Construction (MM/YY to MM/YY):</td>
<td></td>
</tr>
<tr>
<td>Name of Client:</td>
<td></td>
</tr>
</tbody>
</table>

(Note: Client implies: eThekwini Municipality, Cape Town Municipality, Umgeni Water, etc.)

**DESCRIPTION OF WORK COMPLETED**

<table>
<thead>
<tr>
<th>Contract Title:</th>
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<tbody>
<tr>
<td>Period of Construction (MM/YY to MM/YY):</td>
<td></td>
</tr>
<tr>
<td>Name of Client:</td>
<td></td>
</tr>
</tbody>
</table>

(Note: Client implies: eThekwini Municipality, Cape Town Municipality, Umgeni Water, etc.)

**DESCRIPTION OF WORK COMPLETED**
PRELIMINARY PROGRAMME

Refer to Clause F3.11.9 for Functionality Points evaluation prompts (if applicable).

The Tenderer shall detail below or attach a preliminary programme reflecting the proposed sequence and tempo of execution of the various activities comprising the work for this Contract. The programme shall be in accordance with the information supplied in the Contract, requirements of the Project Specifications and with all other aspects of his Tender.

The preliminary programme submitted by the Contractor must include the following:

- Time to apply for construction permit.
- Insurances and other documentation.
- Construction duration.
- Consultation with CPG Partner/s
- Lead time for ordering & purchasing of all major equipment, steel pipelines, isolation valves, non-return valves, air valves and control valves.

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>WEEKS / MONTHS</th>
</tr>
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<tbody>
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</tbody>
</table>

Note: The programme must be based on the completion time as specified in the Contract Data. No other completion time that may be indicated on this programme will be regarded as an alternative offer, unless it is listed in Table (b) of Form “Amendments, Qualifications, and Alternatives” hereafter and supported by a detailed statement to that effect, all as specified in the Tender Data.
The assessment of the Tenderer's Preliminary Programme shall be done in accordance with table below:

<table>
<thead>
<tr>
<th>Inadequate</th>
<th>Not submitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>Programme is inadequate and / or is considered unrealistic and does not achieve the required completion date.</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>Programme is considered realistic and includes the main components and sub-components and compliance with the completion date.</td>
</tr>
<tr>
<td>Good</td>
<td>Programme is considered realistic and includes the main components and sub-components and linkages and compliance with the completion date</td>
</tr>
</tbody>
</table>

NAME : .................................................. (Block Capitals)

SIGNATURE : .................................................. DATE: .............................
(of person authorised to sign on behalf of the Tenderer)
CONSTRUCTION APPROACH, METHODOLOGY, AND QUALITY ASSURANCE PLAN

Refer to Clause F3.11.9 for Functionality Points evaluation prompts (if applicable).

Construction Approach and Methodology

The construction approach and methodology must respond to the Scope of Work and outline the proposed approach to undertake the work showing a detailed programme including health and safety aspects, the use of plant and resources for this Project.

Quality Assurance / Quality Control

The quality control statement must discuss what tests and control measures are to be employed on site to attain the specified results and is to cover the program associated activities. The Tenderer shall attach to this form a certified copy of his ISO 9001/2000/2008 accreditation. In the absence of such accreditation, the Tenderer may attach his own documented Quality Assurance Plan for consideration, the extent of which shall be no more than 5 A4 pages

The tenderer must attach his / her Construction Methodology and Quality Control information to this page.

NAME : .......................................................... (Block Capitals)

SIGNATURE : ..................................................... DATE: .........................
(of person authorised to sign on behalf of the Tenderer)
SCHEDULE OF PROPOSED SUBCONTRACTORS

The following firms have been identified as possible subcontractors for work in this contract.

<table>
<thead>
<tr>
<th>NAMES AND ADDRESSES OF PROPOSED SUBCONTRACTORS</th>
<th>NATURE AND EXTENT OF WORK TO BE SUBCONTRACTED</th>
<th>PREVIOUS EXPERIENCE WITH SUBCONTRACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Attach additional pages if more space is required

NAME : ........................................................................  (Block Capitals)

SIGNATURE : ........................................................................  DATE: ................................
(of person authorised to sign on behalf of the Tenderer)
**PLANT and EQUIPMENT**

Refer to Clause F3.11.9 for Functionality Points evaluation prompts (if applicable).

The following are lists of major items of relevant equipment that I / we presently own or lease and will have available for this contract if my / our tender is accepted.

(a) Details of major equipment that is owned by me / us and immediately available for this contract.

<table>
<thead>
<tr>
<th>DESCRIPTION (type, size, capacity etc)</th>
<th>QUANTITY</th>
<th>YEAR OF MANUFACTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

*Attach additional pages if more space is required*

(b) Details of major equipment that will be hired, or acquired for this contract if my / our tender is accepted

<table>
<thead>
<tr>
<th>DESCRIPTION (type, size, capacity etc)</th>
<th>QUANTITY</th>
<th>HOW ACQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>HIRE/BUY</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SOURCE</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Attach additional pages if more space is required*

The Tenderer undertakes to bring onto site without additional cost to the Employer any additional plant not listed but which may be necessary to complete the contract within the specified contract period.

NAME : ........................................................................  (Block Capitals)

SIGNATURE : .................................................................  DATE: ..........................

(of person authorised to sign on behalf of the Tenderer)
TENDERERS FINANCIAL STANDING

In terms of the Standard Conditions of Tender, the Tenderer shall provide information about his commercial position, which includes information necessary for the Employer to evaluate the tenderer's financial standing.

To that end, the Tenderer must provide with the Tender Offer a bank code or bank rating, certified by his banker, to the effect that he has the financial resources to successfully complete the contract at the tendered amount over the specified contract period. The letter of confirmation of the Tenderer's bank rating shall be attached to this form.

However, should the Tenderer be unable to provide a bank rating with the tender, he shall state the reasons as to why he was unable to do so and in addition provide the following details of his bankers and bank account that he intends using for the project.

Name of account holder:

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

Name of Bank: .......................................................... Branch: ......................

Telephone number: ............................................. Fax. No. : ......................

Name of contact person at Bank:

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

Note:

The Employer undertakes to treat the information contained herein as confidential and to use it strictly for the purpose of evaluation of the Tender Offer.

NAME : .......................................................... (Block Capitals)

SIGNATURE : .......................................................... DATE: .........................

(of person authorised to sign on behalf of the Tenderer)
CONTRACTOR’S HEALTH AND SAFETY DECLARATION

Refer to Clause F3.11.9 for Functionality Points evaluation prompts (if applicable).

In terms of Clause 5(1)(h) of the OHSA 1993 Construction Regulations 2014 (referred to as “the Regulations” hereafter), a Principal Contractor may only be appointed to perform construction work if the Client is satisfied that the Principal Contractor has the necessary competencies and resources to carry out the work safely in accordance with the Occupational Health and Safety Act No 85 of 1993 and the OHSA 1993 Construction Regulations 2014.

To that effect a person duly authorised by the tenderer must complete and sign the declaration hereafter in detail.

Declaration by Tenderer

1. I the undersigned hereby declare and confirm that I am fully conversant with the Occupational Health and Safety Act No 85 of 1993 (as amended by the Occupational Health and Safety Amendment Act No 181 of 1993), and the OHSA 1993 Construction Regulations 2014.

2. I hereby declare that my company has the competence and the necessary resources to safely carry out the construction work under this contract in compliance with the Construction Regulations and the Employer’s Health and Safety Specifications.

3. I propose to achieve compliance with the Regulations by one of the following:
   (a) From my own competent resources as detailed in 4(a) hereafter: YES NO
   (b) From my own resources still to be appointed or trained until competency is achieved, as detailed in 4(b) hereafter: YES NO
   (c) From outside sources by appointment of competent specialist Subcontractors as detailed in 4(c) hereafter: YES NO

4. Details of resources I propose:

   (Note: Competent resources shall include safety personnel such as a construction supervisor and construction safety officer as defined in Regulation 8, and competent persons as defined in Regulations 9, 10, 11, 12, 13, 14, 16, 17, 20, 21, 22, 23(1), 24, 25, 26, 27, 28 and 29, as applicable).

   (a) Details of the competent and qualified key persons from my company’s own resources, who will form part of the contract team:

<table>
<thead>
<tr>
<th>NAMES OF COMPETENT PERSONS</th>
<th>POSITIONS TO BE FILLED BY COMPETENT PERSONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(b) Details of training of persons from my company's own resources (or to be hired) who still have to be trained to achieve the necessary competency:

(i) By whom will training be provided? .................................................................

(ii) When will training be undertaken? .................................................................

(iii) List the positions to be filled by persons to be trained or hired:

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

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

(c) Details of competent resources to be appointed as subcontractors if competent persons cannot be supplied from own company:

Name of proposed subcontractor: .................................................................

Qualifications or details of competency of the subcontractor:

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

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

5. I hereby undertake, if my tender is accepted, to provide, before commencement of the works under the contract, a suitable and sufficiently documented Health and Safety Plan in accordance with Regulation 7(1) of the Construction Regulations, which plan shall be subject to approval by the Client.

6. I confirm that copies of my company's approved Health and Safety Plan, the Client's Safety Specifications as well as the OHSA 1993 Construction Regulations 2014 will be provided on site and will at all times be available for inspection by the Principal Contractor's personnel, the Client's personnel, the Employer's Agent, visitors, and officials and inspectors of the Department of Labour.

7. I hereby confirm that adequate provision has been made in my tendered rates and prices in the Bill of Quantities to cover the cost of all resources, actions, training and all health and safety measures envisaged in the OHSA 1993 Construction Regulations 2014, and that I will be liable for any penalties that may be applied by the Client in terms of the said Regulations (Regulation 33) for failure on the Principal Contractor's part to comply with the provisions of the Act and the Regulations.

8. I agree that my failure to complete and execute this declaration to the satisfaction of the Client will mean that I am unable to comply with the requirements of the OHSA 1993 Construction Regulations 2014, and accept that my tender will be prejudiced and may be rejected at the discretion of the Client.

NAME : ................................................................. (Block Capitals)

SIGNATURE : ................................................................. DATE: .................................

(of person authorised to sign on behalf of the Tenderer)
CONTRACT PARTICIPATION GOALS – CONTRACTOR

Objective

The objective of eThekwini Water & Sanitation empowerment initiative is to bring about meaningful transformation in all procurement projects and in particular in the built environment through the following:

- Meaningful Economic Participation;
- Local Economic Development;
- Transfer of Technical, Management and Entrepreneurial Skills; and
- Creation of sustainable Black Enterprises

Contract Participation Goals

Contract Participation Goal (CPG) – the final value of services paid to the CPG Partner/s based on the final Contract Price.

At the time of awarding the Contract, the 30% minimum CPG amount will be based on the Contract Sum exclusive of the following:

- VAT and CPA

During Contract implementation, adjustments relating to Provisional Sums and Contingencies linked to the CPG allocation will be agreed upon between the parties to the contract, as and when the need arises.

The CPG is expressed as a percentage of the total contract amount.

Tenderers are required to achieve at least 30% Contract Participation Goals (CPG) of the value of goods, services and Works paid to one or more targeted enterprises to comply with eThekwini Municipality BBBEE policy initiative.

- 30% includes any special materials.
- 30% excludes VAT and CPA
- The tenderer will be required to achieve the actual Rand value committed for the CPG, adjusted according to the following:
  - Variation Orders- Each VO will be evaluated by the Employer’s Agent and the Project Manager to determine whether it should be counted, in its entirety or partially, as part of CPG or not.
  - Re-measurable items (including CPA and provisional sums) Each re-measurable item change will be evaluated by the Employer’s agent and Project Manager to determine whether it should be counted as part of CPG or not.

Within 2 weeks of the award of the Contract, the tenderer will be required to submit a cash flow projection for the main contractor and the CPG partner/s.

Applicability

The CPG target shall be achieved through the following mechanisms:

- The main Contractor may propose a suitable targeted enterprise or CPG partner/s provided there is a statement of no objection from eThekwini Water & Sanitation.
- From the 30% CPG, 10% shall be allocated to Military Veterans, if located within the ward 96.
Sub-contracting of the CPG Partner/s at the same rate / price that the tender would have offered to EWS whilst making a profit margins consistent to the profit margins that the main contractor would have made under normal trading processes.

The working capital arrangements between the main contractor and the CPG Partner/s must be agreed upon between the two parties prior to commencement of the works to ensure that the CPG Partner does not have cash flow challenges during contract implementation.

### Targeted Enterprise

<table>
<thead>
<tr>
<th>Annual Turnover</th>
<th>Black Ownership</th>
<th>Tax Clearance Certificate</th>
<th>CPG Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE&lt; R15 m</td>
<td>At least 51%</td>
<td>Required</td>
<td>30% Min.</td>
</tr>
</tbody>
</table>

For each monthly invoice submitted by the Main Contractor, the Targeted Enterprise(s) costs per function must be clearly articulated to enable the CPG targets to be easily and regularly monitored.

The Main Contractor must pay the amount due to the Targeted Enterprise within 3 days of receiving payment from the Employer.

**Eligibility Criteria for Targeted Enterprise**

- The Main Contractor must not have equity holding exceeding 20%, either directly or through a flow through principle
- SARS registration and tax clearance
- Company registration
- Must be at least 51% Black-owned

**Black Owned**

- Black people who hold at least 51% of the exercisable voting rights
- Black people who hold at least 51% of the economic interest

**Subcontracting as Condition of Tender**

For contracts above R30m, the 2017 PPPFA Regulations require organs of State to identify tenders, where it is feasible, to subcontract a minimum of 30% of the Contract Price to the following designated groups:

(a) an EME or QSE;
(b) an EME or QSE which is at least 51% owned by black people;
(c) an EME or QSE which is at least 51% owned by black people who are youth;
(d) an EME or QSE which is at least 51% owned by black people who are women;
(e) an EME or QSE which is at least 51% owned by black people with disabilities;
(f) an EME or QSE which is 51% owned by black people living in rural or underdeveloped areas or townships;
(g) a cooperative which is at least 51% owned by black people;
(h) an EME or QSE which is at least 51% owned by black people who are military veterans; or
(i) more than one of the categories referred to in paragraphs (a) to (h).

In addition to the above, the eThekwini Municipal Council has adopted a framework for empowerment strategies for contracts between R5m and R30m.
Penalties for not achieving the minimum CPG

In the case where the minimum CPG value of 30% is not achieved. The Main Contractor will be penalized as follows:

<table>
<thead>
<tr>
<th>No.</th>
<th>CPG not achieved in contract</th>
<th>Penalty Factor</th>
<th>Application</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 – 30%</td>
<td>0.5</td>
<td>For every percentage CPG not achieved; the CPG amount not achieved in Rands will be multiplied by the corresponding penalty factor. The factored amount in Rands will be deducted from the Main Contractor's Payment Certificates</td>
<td>The Main Contractor is to support and mentor the Targeted Enterprise(s) to achieve the project milestones as part of the objectives to transfer Technical, Management and Entrepreneurial skills.</td>
</tr>
</tbody>
</table>

Monitoring and Reporting on CPG

- EWS will monitor CPG implementation on site. This may include direct contact with CPG Partner/s on site for verification purposes.
- The CPG Partner/s shall be in agreement with the measurement and payment for the work completed, for the purposes of submitting payment certificates, as determined by the Contractor.
- CPG Partner/s shall attend all contractual meetings relevant to their scope of work including contract award negotiations, monthly contract site meetings and technical meetings.
JOINT VENTURES AGREEMENTS

Joint Venture agreement and Power of Attorney Agreements to be attached here (if applicable).
RECORD OF ADDENDA TO TENDER DOCUMENTS

I / We confirm that the following communications received from the Employer or his representative before the date of submission of this tender offer, amending the tender documents, have been taken into account in this tender offer.

<table>
<thead>
<tr>
<th>ADD.No</th>
<th>DATE</th>
<th>TITLE OR DETAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>2</td>
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<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NAME : .............................................................. (Block Capitals)

SIGNATURE : .......................................................... DATE: .........................
(of person authorised to sign on behalf of the Tenderer)
AMENDMENTS, QUALIFICATIONS AND ALTERNATIVES

(This is not an invitation for amendments, deviations or alternatives but should the Tenderer desire to make any departures from the provisions of this contract he shall set out his proposals clearly hereunder. The Employer will not consider any amendment, alternative offers or discounts unless forms (a), (b) and (c) have been completed to the satisfaction of the Employer).

I / We herewith propose the amendments, alternatives and discounts as set out in the tables below:

<table>
<thead>
<tr>
<th>(a) AMENDMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAGE, CLAUSE OR ITEM NO</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

(1) Amendments to the General and Special Conditions of Contract are not acceptable;
(2) The Tenderer must give full details of all the financial implications of the amendments and qualifications in a covering letter attached to his tender.

<table>
<thead>
<tr>
<th>(b) ALTERNATIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROPOSED ALTERNATIVE</td>
</tr>
<tr>
<td>--------------------</td>
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<td></td>
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<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

(1) Individual alternative items that do not justify an alternative tender, and an alternative offer for time for completion should be listed here.
(2) In the case of a major alternative to any part of the work, a separate Bill of Quantities, programme, etc, and a detailed statement setting out the salient features of the proposed alternatives must accompany the tender.
(3) Alternative tenders involving technical modifications to the design of the works and methods of construction shall be treated separately from the main tender offer.

<table>
<thead>
<tr>
<th>(c) DISCOUNTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITEM ON WHICH DISCOUNT IS OFFERED</td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
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</tbody>
</table>

(1) The Tenderer must give full details of the discounts offered in a covering letter attached to his tender, failing which, the offer will be prejudiced.

NAME : ............................................................... (Block Capitals)
SIGNATURE : ....................................................... DATE: .....................
(of person authorised to sign on behalf of the Tenderer)
PART C1: AGREEMENT AND CONTRACT DATA
C1.1: FORM OF OFFER AND ACCEPTANCE
C1.1.1: OFFER

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

Contract No:  WS.7338
Contract Title: Construction of a 10.0 Mℓ Concrete Reservoir for Adams Mission 6 in Ward 96

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

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

* The offered total of the prices inclusive of Value Added Tax is:
R................................................. (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 to the Tenderer before the end of the period of validity stated in the Tender Data, whereupon the Tenderer becomes the party named as the Contractor in the Conditions of Contract identified in the Contract Data.

For the Tenderer:

* Name of Tenderer (organisation) : .................................................................

* Signature (of person authorized to sign the tender) : .................................................................

* Name (of signatory in capitals) : .................................................................

Capacity (of Signatory) : .................................................................

Address : ............................................................................................................................

Witness:

Signature : ................................................................. Date : .................................................................

Name (in capitals) : .................................................................

Notes:
* Indicates what information is mandatory.
Failure to complete the mandatory information and sign this form will invalidate the tender.
C1.1: FORM OF OFFER AND ACCEPTANCE

C1.1.2: FORM OF ACCEPTANCE

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

The terms of the contract are contained in:
- Part C1: Agreement and Contract Data, (which includes this Agreement)
- Part C2: Pricing Data, including the Bill of Quantities
- Part C3: Scope of Work
- Part C4: Site Information

and the schedules, forms, drawings and documents or parts thereof, which may be incorporated by reference into Parts C1 to C4 above.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules as well as any changes to the terms of the Offer agreed by the Tenderer and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Agreement. No amendments to or deviations from said documents are valid unless contained in this Schedule, which must be duly signed by the authorised representatives of both parties.

The Tenderer shall within two weeks after receiving a completed copy of this Agreement, including the Schedule of Deviations (if any), contact the Employer’s agent (whose details are given in the Contract Data) to arrange the delivery of any bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the Conditions of Contract identified in the Contract Data at, or just after, the date this Agreement comes into effect. Failure to fulfill any of these obligations in accordance with those terms shall constitute a repudiation of this Agreement.

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

Signature (person authorized to sign the acceptance) : .................................................................

Name (of signatory in capitals) : ........................................................................................................

Capacity (of Signatory) : ...................................................................................................................

Name of Employer (organisation) : ....................................................................................................

Address : .........................................................................................................................................

: ..............................................................................................................................................

Witness:

Signature : ................................................... Date : ..................................................

Name (in capitals) : .............................................
C1.1: FORM OF OFFER AND ACCEPTANCE

C1.1.3: SCHEDULE OF DEVIATIONS

1. Subject
   Details

2. Subject
   Details

3. Subject
   Details

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

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

FOR THE TENDERER

Signature
Name (in capitals)
Capacity
Name and Address of Organisation
Witness Signature
Witness Name
Date

FOR THE EMPLOYER

Signature
Name (in capitals)
Capacity
Name and Address of Organisation
Witness Signature
Witness Name
Date
C1.2: CONTRACT DATA

C1.2.1 CONDITIONS OF CONTRACT

C1.2.1.1 GENERAL CONDITIONS OF CONTRACT

The Conditions of Contract are the General Conditions of Contract for Construction Works (2015 3rd Edition), (GCC 2015) published by the South African Institution of Civil Engineering. Copies of these conditions of contract may be obtained from the South African Institution of Civil Engineering (Tel: 011-805-5947, Fax: 011-805-5971, E-mail: civilinfo@saice.org.za).

The Contract Data (including variations and additions) shall amplify, modify or supersede, as the case may be, the GCC 2015 to the extent specified below, and shall take precedence and shall govern.

Each item of data given below is cross-referenced to the clause in the GCC 2015 to which it mainly applies.

C1.2.2 CONTRACT DATA

C1.2.2.1 DATA TO BE PROVIDED BY THE EMPLOYER

1.1.1.13 The Defects Liability Period, from the date of the Certificate of Completion, is 1 Year

1.1.1.14 The period of performance is 36 months and the time for achieving Practical Completion, from the Commencement Date is 430 Days. The period as stated in 5.3.2, and the 37 days referred to in 5.3.3, are included in the above time for achieving Practical Completion. The special non-working days as stated in 5.8.1 are excluded from the above time for achieving Practical Completion.

1.1.1.15 The Employer is the eThekwini Municipality as represented by: ENGINEERING WATER AND SANITATION

1.2.1.2 The address of the Employer is:
Physical: 3 Prior Road, DURBAN, 4001
Postal: Engineering Unit, PO Box 680, Durban, 4001
Telephone: 031-311-8148 (t)
Fax: 031-311-8549 (f)
E-Mail: Bhavna.Soni@durban.gov.za

1.1.1.16 The name of the Employer’s Agent is W.A. Marais

1.2.1.2 The address of the Employer’s Agent is:
Physical: Bigen Africa, Block B, 5 Bellevue Road, Kloof
Postal: 1469, Kloof, 3640
Telephone: 031 717 2571 (t)
Fax: Willie Marais
E-Mail: willie.marais@bigengroup.com

1.1.1.26 The Pricing Strategy is by Re-measurement Contract.

3.2.3 The Employer’s Agent shall obtain the specific approval of the Employer before executing any of his functions or duties according to the following Clauses of the General Conditions of Contract:
• 6.3: Council approval in order to authorize any expenditure in excess of the Tender Sum plus 10% contingencies.

5.3.1 The **documentation required** before commencement with Works execution are:
- Health and Safety Plan (refer to Clause 4.3)
- Initial programme (refer to Clause 5.6)
- Security (refer to Clause 6.2)
- Insurance (refer to Clause 8.6)

5.3.2 The **time to submit the documentation** required before commencement with Works is 28 Days.

5.3.3 Add the following paragraph:

“If a construction work permit, in terms of Clause 3(1) of the Construction Regulations (2014), is applicable, the instruction to commence carrying out of the works may only be issued once the construction work permit has been obtained by the Employer’s Agent. If a construction work permit is applicable, the contractor shall allow for a minimum period of 56 days, after the submission (or re-submission) of the documentation referred to in Clause 5.3.1., for the issuing of the construction work permit.”

5.4.2 The access and possession of Site shall not be exclusive to the Contractor but as set out in the Site Information.

During the execution of the Works no persons other than the employees of the Contractor, Sub contractors, shall be allowed on the Site, except with the written consent of the Employer’s Representative. However, access and facilities to inspect the Works shall at all times be afforded to the Employer’s Representative. The access to and possession of the Site referred to in this clause shall not be exclusive to the Contractor, but only such as is necessary to enable it to execute the Works. The Contractor shall, in accordance with the instruction of the Employer’s Representative, afford to all other contractors engaged by the Employer to work on the Site and all other persons lawfully upon the Site, all reasonable opportunities for carrying out their work provided that this does not obstruct or disturb the progress of the Works. The Contractor shall also afford such opportunities to the employees of the Employer. The Site and any area and/or accommodation allocated to the Contractor by the Employer is to be used exclusively for the execution of the Works. The Contractor is not permitted to conduct any business other than in connection with the Contract on the Site

5.8.1 The **non-working days** are Saturdays and Sundays.

(5.1.1) The **special non-working** days are:
- All statutory holidays as declared by National or Regional Government.
- The year-end break:
  - Commencing on the first working day after 15 December.
  - Work resumes on the first working day after 5 January of the next year.

5.8.1 Delete the words "sunset and sunrise" and replace with “17:00 and 07:00”.

5.12.2.2 **Abnormal Climatic Conditions (Rain Delays)** - The numbers of days per month, on which work is expected not to be possible as a result of rainfall, for which the Contractor shall make provision, is given in the table below. During the execution of the Works, the Employer’s Agent’s Representative will certify a day lost due to rainfall only if at least 75% of the work force and plant on site could not work during that specific working day.
Extension of time as a result of rainfall shall be calculated monthly being equal to the number
days certified by the Employer’s Agent’s Representative as lost due to rainfall, less the number
of days allowed for as in table below, which could result in a negative figure for certain months.
The total extension of time for which the Contractor may apply, shall be the cumulative algebraic
sum of the monthly extensions. Should the sum thus obtained be negative, the extension of time
shall be taken as NIL.

<table>
<thead>
<tr>
<th>Month</th>
<th>Days Lost</th>
<th>Average Rainfall</th>
<th>Month</th>
<th>Days Lost</th>
<th>Average Rainfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>4*</td>
<td>134</td>
<td>July</td>
<td>1</td>
<td>39</td>
</tr>
<tr>
<td>February</td>
<td>3</td>
<td>113</td>
<td>August</td>
<td>2</td>
<td>62</td>
</tr>
<tr>
<td>March</td>
<td>3</td>
<td>120</td>
<td>September</td>
<td>2</td>
<td>73</td>
</tr>
<tr>
<td>April</td>
<td>2</td>
<td>73</td>
<td>October</td>
<td>3</td>
<td>98</td>
</tr>
<tr>
<td>May</td>
<td>2</td>
<td>59</td>
<td>November</td>
<td>3</td>
<td>108</td>
</tr>
<tr>
<td>June</td>
<td>1</td>
<td>28</td>
<td>December</td>
<td>1*</td>
<td>102</td>
</tr>
<tr>
<td>TOTAL</td>
<td>27</td>
<td>1009mm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = The number of working days lost allows for the annual statutory Construction holiday in
December and January of each year.

5.13.1  The **penalty for delay** in failing to complete the Works is **0.05% of the tender sum** (per calendar Day).

5.14.1  The **requirements for achieving Practical Completion** will be determined by the Employer’s
Agent (in consultation with the Contractor) and recorded in the minutes of the first Site Meeting /
Handover Meeting. (Refer to 1.1.1.24 for a generic definition.) The requirements are to be
regularly reviewed with respect to any variations to the Contract. Practical Completion will only
be considered upon final testing of the reservoir and upon all pipework having been connected
and tested and commissioned and declared operational and the whole system constructed under
this contract having been declared fit for purpose.

5.16.3  The **latent defect liability** period is **10 Years**.

6.2.1  **Security (Performance Guarantee):** Delete the word “selected” and replace it with “stated”.

The liability of the Performance Guarantee shall be as per the following table:

<table>
<thead>
<tr>
<th>Value of Contract (incl. VAT)</th>
<th>Performance Guarantee Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than or equal to R 1m</td>
<td>Nil</td>
</tr>
<tr>
<td>Greater than R 1m and less than or equal to R 10m</td>
<td>5% of the Contract Sum</td>
</tr>
<tr>
<td>Greater than R 10m</td>
<td>10% of the Contract Sum</td>
</tr>
</tbody>
</table>

6.5.1.2.3  The **percentage allowance** to cover overhead charges for daywork are as follows:

- **80%** of the gross remuneration of workmen and foremen actually engaged in the daywork;
- **15%** on the net cost of materials actually used in the completed work.
- **15%** on the net cost of plant actually used in the completed work
No allowance will be made for work done, or for materials and equipment for which daywork rates have been quoted at tender stage.

6.8.2 **Contract Price Adjustment Factor:** The value of the certificates issued shall be adjusted in accordance with the Contract Price Adjustment Schedule (GCC 2015 - page 86) with the following Indices / Descriptions / Coefficients:

- The proportion not subject to adjustment: $x = 0.10$.
- The base month will be the month prior to the month in which tenders close.
- The Index shall be based on **December 2016 = 100**.

<table>
<thead>
<tr>
<th>STATS SA Statistical Release</th>
<th>Table</th>
<th>Description</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0141</td>
<td>Table A</td>
<td>Geographic Indices; CPI per Province; Kwa-Zulu Natal</td>
<td>$a = 0.28$</td>
</tr>
<tr>
<td>P0151.1</td>
<td>Table 4</td>
<td>Plant and Equipment</td>
<td>$b = 0.28$</td>
</tr>
<tr>
<td>P0151.1</td>
<td>Table 6</td>
<td>Civil Engineering Material (excluding bitumen)</td>
<td>$c = 0.38$</td>
</tr>
<tr>
<td>P0142.1</td>
<td>Table 1</td>
<td>Coke, petroleum, chemical, rubber and plastic products; Coal and petroleum products; Diesel</td>
<td>$d = 0.06$</td>
</tr>
</tbody>
</table>

6.8.3 Price adjustments for variation in the cost of the special material(s) listed below, will be allowed.

6.10.1.5 The **percentage advance** on materials not yet built into the Permanent Works is **80%**.

6.10.3 **Retention Money:** Delete the word “selected”.

The percentage retention on the amounts due to the Contractor is 10%.

The limit of “retention money” is 5% of the Contract Sum.

Should the Contract Price exceed the Contract Sum then the limit of “retention money” is 5% of the Contract Price.

Interest will not be paid on retention withheld by the Employer.

8.6.1.2 The **value of Plant and materials** supplied by the Employer to be included in the insurance sum: **R 0.00**

8.6.1.3 The **amount to cover professional fees** for repairing damage and loss to be included in the insurance sum: **R 0** (not required)

8.6.1.2 **SASRIA Coupon Policy** for Special Risks to be issued in joint names of Council and Contractor for the full value of the works (including VAT).

8.6.1.3 The limit of indemnity for **liability insurance**: **R 10,000,000.00**

8.6.1.4 **Ground Support Insurance:***

- Minimum amount for any one occurrence, unlimited as to the number of occurrences, against any claim for damages or loss caused by vibration and / or removal of lateral support: **R 10,000 000.00**
• Maximum first excess: **R 25,000.00**.

8.6.1.5 Furthermore, the insurance cover effected by the Contractor shall meet the following requirements:

**Third Party Insurance (Public Liability)**
- Minimum amount for any one occurrence, unlimited as to the number of occurrences, for the period of the contract, inclusive of the maintenance period: **R 25,000,000.00**
- Consequential loss to be covered by policy: **Yes**
- Liability section of policy to be extended to cover blasting: **Yes**
- Maximum excess per claim or series of claims arising out of any one occurrence: **R25,000.00**

**Principal’s own surrounding Property Insurance**
- Minimum amount for any one occurrence unlimited as to the number of occurrences against any claim for damage which may occur to the Council’s own and surrounding properties: **R5,000,000.00**
- Maximum first excess: **R 25,000.00**

**Insurance of Works**
- Minimum amount for additional removal of debris (no damage): **R 2,000,000.00**
- Minimum amount for temporary storage of materials off site, excluding Contractor’s own premises: **R 2,000,000.00.00**
- Minimum amount for transit of materials to site: **R 2,000,000.00**

8.6.5 **Approval by Employer**: At the end of the sub-clause, add the following paragraph:

"Except where otherwise provided in the Special Conditions of Contract, the insurance cover effected by the Contractor in terms of this clause shall not carry a first loss amount greater than those set out below:

<table>
<thead>
<tr>
<th>Contract Price</th>
<th>First Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than R 100,000</td>
<td>R 5,000</td>
</tr>
<tr>
<td>R 100,000 to R 500,000</td>
<td>R 10,000</td>
</tr>
<tr>
<td>R 500,000 to R 1,000,000</td>
<td>R 20,000</td>
</tr>
<tr>
<td>R 1,000,000 to R 2,000,000</td>
<td>R 30,000</td>
</tr>
<tr>
<td>R 2,000,000 to R 4,000,000</td>
<td>R 40,000</td>
</tr>
<tr>
<td>Greater than R 4,000,000</td>
<td>R 50,000</td>
</tr>
</tbody>
</table>

The insurance policy shall contain a specific provision whereby cancellation of the policy prior to the end of the period referred to in Cause 8.2.1 cannot take place without the prior written approval of the Employer."

10.5.1 **Dispute resolution** shall be by ad-hoc adjudication.

10.7.1 Failing ad-hoc adjudication, the determination of disputes shall be by arbitration.
C1.2.2.2 DATA TO BE PROVIDED BY CONTRACTOR

1.1.1.9 The legal name of Contractor is:

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

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

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

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

1.2.1.2 The Physical address of the Contractor is:

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

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

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

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

The Postal address of the Contractor is:

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

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

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

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

The contact numbers of the Contractor are:
Telephone: ...............................................................
Fax: ...............................................................

The E-Mail address of the Contractor is:

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

..............................................................
C1.2.3 ADDITIONAL CONDITIONS OF CONTRACT

C1.2.3.1 COMMUNITY LIAISON OFFICER

The Ward Councillor(s) in whose ward(s) work is to be done will, collectively, identify a community liaison officer (CLO) for the project and make the person known to the Contractor within two days of being requested to do so. The Contractor will be required to enter a written contract with the CLO that specifies:

- Acts as advisor to the Contractor on all matters relating to assigned areas of responsibility for the purpose of providing information to meet municipality goals and objectives. The hours of work and the wage rate of the CLO is (200% of the Civil Engineering Industry minimum wage).
- The duration of the appointment.
- The duties to be undertaken by the CLO which could include:
  - Assisting in all respects relating to the recruitment of local labour.
  - Acting as a source of information for the community and councillors on issues related to the contract.
  - Keeping the Contractor advised on community issues and issues pertaining to local security.
  - Assisting in setting up any meetings or negotiations with affected parties.
  - Keeping a written record of any labour or community issue that may arise.
  - Any other duties that may be required by the Contractor.

The minimum skills for the CLO shall include:

- An ability to work with others
- An ability to communicate in Local language and English
- Sound Writing skills to communicate in writing
- Sound Interpersonal skills

Responsibility for the identification of a pool of suitable labour shall rest with the CLO, although the Contractor shall have the right to choose from that pool. The Contractor shall have the right to determine the total number labourers required at any one time and this may vary during the contract.

The Contractor shall have the right to replace labour that is not performing adequately. Should such occasion arise, it must be done in conjunction with the CLO.

Payment: The CLO will be reimbursed from the PC Sum item in the Preliminary & General Section of the Bill of Quantities.

C1.2.3.2 EMPLOYMENT OF LOCAL LABOUR

It is a condition of contract that the contractor will be required to employ local labour as specified in eThekwini Council Policy “The use of CLOs and Local Labour”. The contractor will be required to ensure that a minimum of 50% of the labour force is made up of local labour. For the purposes of this contract, “Local labour” will be deemed to be any persons who reside within Ward(s) 96. The contractor will be required to provide proof of authenticity of local labour. Signed confirmation by the appointed CLO will suffice for this.
No additional costs will be entertained due to this Particular Specification. The contractor will remain responsible for providing proper supervision of all labour and will be responsible for the quality of work produced.

C1.2.3.3 FTE (Full Time Equivalent) EMPLOYMENT INFORMATION

It is a condition of contract that the Contractor supplies the Employer’s Agent’s Representative with information in respect of the employment of all foremen, artisans and labour (skilled and unskilled) employed to work on this contract. The information required is:

- Initials (per ID doc)
- Last Name (per ID doc)
- ID Number
- Disability (y / n)
- Education Level

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>No Schooling</td>
<td>Grade 1-3</td>
<td>Grade 4</td>
<td>Grade 5-6</td>
</tr>
<tr>
<td>Level 6</td>
<td>Level 7</td>
<td>Level 8</td>
<td>Level 9</td>
<td>Level 10</td>
</tr>
<tr>
<td>Grade 7-8</td>
<td>Grade 9</td>
<td>Grade 10-11</td>
<td>Grade 12</td>
<td>Post Matric</td>
</tr>
</tbody>
</table>

- Category of Employment

| Category A: Employed as Local Labour for this contract only |
| Category B: Temporarily employed by the Contractor |
| Category C: Permanently employed by the Contractor |

In addition, the following information is required in respect of each person listed above, on a monthly basis:

- Number of days worked during the month;
- Daily wage rate;
- Number of training days during the month.

The information is to be forwarded in a format acceptable to the Employer’s Agent’s Representative, but preferably in the form of an emailed EXCEL file (an original file, to be used as a template, will be issued to the Contractor). Contractors without computer facilities will be required to submit a hard copy of the information in a format as agreed to between the Contractor and the Employer’s Agent’s Representative.

In addition to the tax invoice, to be submitted by the Contractor with his monthly statement, mentioned in Clause 6.10.4 of GCC 2015, the Employer reserves the right to withhold payment until the monthly FTE information has been forwarded to the Employer’s Agent’s Representative. No additional payment for complying with the above will be made and the Contractor is to make allowance for complying through the time related P & G items (sum) under Part AA: Preliminaries, of the Bill of Quantities.

C1.2.3.3 PERFORMANCE MONITORING OF SERVICE PROVIDERS

The Contractor shall be subjected to “Performance Monitoring” assessments in terms of the applicable Section of the Employer’s Supply Chain Management Policy.

Key Performance Indicators (KPIs) are specified in the Part C3: Scope of Works or will be discussed and agreed with the Contractor before commencement of the contract.
C1.2.3.4 EMPOWERMENT STRATEGIES

For contracts above R30m, the 2017 PPPFA Regulations require organs of State to identify tenders, where it is feasible, to subcontract a minimum of 30% of the value of the contract to the following designated groups:

(a) an EME or QSE;
(b) an EME or QSE which is at least 51% owned by black people;
(c) an EME or QSE which is at least 51% owned by black people who are youth;
(d) an EME or QSE which is at least 51% owned by black people who are women;
(e) an EME or QSE which is at least 51% owned by black people with disabilities;
(f) an EME or QSE which is 51% owned by black people living in rural or underdeveloped areas or townships;
(g) a cooperative which is at least 51% owned by black people;
(h) an EME or QSE which is at least 51% owned by black people who are military veterans; or
(i) more than one of the categories referred to in paragraphs (a) to (h).

In addition to the above, the eThekwini Municipal Council has adopted a framework for empowerment strategies for contracts between R5m and R30m.

A 30% CPG is applicable. (Refer to Returnable Document: Contract Participation Goal for further details and requirements).

C1.2.3.5 EXCEPTED RISKS (Clause 8.3)

Pursuant to Clause 8.3 of the Conditions of Contract (GCC 2015), the Employer shall not be liable for the payment of standing time costs as a result of the occurrence of any of the “Excepted Risks” as defined under Clause 8.3.

However, the Employer shall reimburse the Contractor in respect of plant de-establishment and re-establishment costs as a result of “Excepted risks” when a written instruction to de-establish is issued to the Contractor.
C2.1: PRICING ASSUMPTIONS / INSTRUCTIONS

C2.1.1 GENERAL

The Bill of Quantities forms part of the Contract Documents and must be read and priced in conjunction with all the other documents comprising the Contract Documents (refer to F.1.2 of the Tender Data).

C2.1.2 PRICING INSTRUCTIONS AND DESCRIPTION OF ITEMS IN THE SCHEDULE

Measurement and payment shall be in accordance with the relevant provisions of Clause 8 of each of the Standard Engineering Specifications referred to in the Scope of Work. The Preliminary and General items shall be measured in accordance with the provisions of C2.1.8.

The descriptions of the items in the Bill of Quantities are for identification purposes only and comply generally with those in the Standard Engineering Specification.

Clause 8 of each Standard Engineering Specification, read together with the relevant clauses of the Scope of the works, set out what ancillary or associated work and activities are included in the rates for the operations specified. Should any requirements of the measurement and payment clause of the applicable Standard Engineering Specification, or the Scope of the works, conflict with the Bill of Quantities, the requirements of the Standard Engineering Specification or Scope of the work, as applicable, shall prevail.

C2.1.3 QUANTITIES REFLECTED IN THE SCHEDULE

The quantities given in the Bill of Quantities are estimates only, and subject to re-measuring during the execution of the work. The Contractor shall obtain the Employer’s Agent’s detailed instructions for all work before ordering any materials or executing work or making arrangements for it.

The Works as finally completed in accordance with the Contract shall be measured and paid for as specified in the Bill of Quantities and in accordance with the General and Special Conditions of Contract, the Specifications and Project Specifications and the Drawings. Unless otherwise stated, items are measured net in accordance with the Drawings, and no allowance has been made for waste.

The validity of the contract will in no way be affected by differences between the quantities in the Bill of Quantities and the quantities finally certified for payment.

C2.1.4 PROVISIONAL SUMS / PRIME COST SUMS

Where Provisional Sums or Prime Cost sums (PC Sum) are provided for items in the Bill of Quantities, payment for the work done under such items will be made in accordance with Clause 6.6 of the General Conditions of Contract. The Employer reserves the right, during the execution of the works, to adjust the stated amounts upwards or downwards according to the work actually done under the item, or the item may be omitted altogether, without affecting the validity of the Contract.

The Tenderer shall not under any circumstances whatsoever delete or amend any of the sums inserted in the "Amount" column of the Bill of Quantities and in the Summary of the Bill of Quantities unless ordered or authorized in writing by the Employer before closure of tenders. Any unauthorized changes made by the Tenderer to provisional items in the schedule, or to the provisional percentages and sums in the Summary of the Bill of Quantities, will be treated as arithmetical errors.

C2.1.5 MONTHLY PAYMENTS

Unless otherwise specified in the Specifications and Project Specifications, progress payments in Interim Certificates, referred to in Clause 6.10.1 of the General Conditions of Contract, in respect of "sum" items in the Bill of Quantities shall be by means of interim progress instalments assessed by the Employer’s Agent and based on the measure in which the work actually carried out relates to the extent of the work to be done by the Contractor.

C2.1.6 PROVISIONAL SUMS / PRIME COST SUMS

Where Provisional Sums or Prime Cost sums (PC Sum) are provided for items in the Bill of Quantities, payment for the work done under such items will be made in accordance with Clause 6.6 of the General Conditions of Contract. The Employer reserves the right, during the execution of the works, to adjust the stated amounts upwards or downwards according to the work actually done under the item, or the item may be omitted altogether, without affecting the validity of the Contract. The Tenderer shall not under any circumstances whatsoever delete or amend any of the sums inserted in the "Amount" column of the Bill of Quantities and in the Summary of the Bill of Quantities unless ordered or
authorized in writing by the Employer before closure of
tenders. Any un authorized changes made by the
Tenderer to provisional items in the schedule, or to the
provisional percentages and sums in the Summary of the
Bill of Quantities, will be treated as arithmetical errors.

C2.1.7 PRICING OF THE BILL OF QUANTITIES

The prices and rates to be inserted by the Tenderer in
the Bill of Quantities shall be the full inclusive prices to
be paid by the Employer for the work described under
the several items, and shall include full compensation for
all costs and expenses that may be required in and for
the completion and maintenance during the defects
liability period of all the work described and as shown on
the drawings as well as all overheads, profits, incidentals
and the cost of all general risks, liabilities and obligations
set forth or implied in the documents on which the Tender
is based.

Each item shall be priced and extended to the "Total"
column by the Tenderer, with the exception of the items
for which only rates are required (Rate Only), or items
which already have Prime Cost or Provisional Sums
affixed thereto. If the Contractor omits to price any items
in the Bill of Quantities, then these items will be
considered to have a nil rate or price.

All items for which terminology such as "inclusive" or "not
applicable" have been added by the Tenderer will be
regarded as having a nil rate which shall be valid
irrespective of any change in quantities during the
execution of the Contract.

All rates and amounts quoted in the Bill of Quantities
shall be in Rands and Cents and shall include all levies
and taxes (other than VAT). VAT will be added in the
Summary of the Bill of Quantities.

C2.1.8 "RATE ONLY" ITEMS

The Tenderer shall fill in rates for all items where the
words "Rate Only" appear in the "Total" column. "Rate
Only" items have been included where:
(a) an alternative item or material is contemplated;
(b) variations of specified components in the make-up of
   a pay item may be expected; and
(c) no work under the item is foreseen at tender stage
   but the possibility that such work may be required is
   not excluded.

For "Rate Only" items no quantities are given in the
"Quantity" column but the quoted rate shall apply in the
event of work under this item being required. The
Tenderer shall however note that in terms of the Tender
Data the Tenderer may be asked to reconsider any such
rates which the Employer may regard as unbalanced.

C2.1.9 PRELIMINARY AND GENERAL

The Preliminary and General Section is provided to
cover the Contractor’s expenses incurred in complying
with the requirements of the tender documents and
consists of the following parts:
• Part AA: Preliminaries
• Part AB: General Specifications
• Part AH: Occupational Health and Safety

Fixed Charge Items: Each item should be priced
separately and, subject to the Engineer certifying in
terms of Clause 6.7 of the General Conditions of
Contract that the work has been done, payment will be
made as follows:
(i) the total amount due when the certified value fixed
charge items in this section is less than 5% of the net
contract price;
(ii) when the certified value of fixed charge items in this
section is greater than 5% of the net contract price,
payment will be limited to 5% of the net contract
price. The remainder will be paid when the value of
the work done under the contract, excluding the value
of fixed charge items in this section, is greater than
50% of the net contract price, excluding the value of
fixed charge items in this section.

Time Related Items: Any Time Related items not priced
shall be deemed to be covered by the prices of other
items in the section.

Payment of Time Related items in this section will be
made throughout the contract period, the amount per
month being the value of the item divided by the
completion in months or, if specified in weeks, the
equivalent number of months, in terms of Clause 5.5 of
the General Conditions of Contract. The final monthly
increment will only be paid upon the issue of a
completion certificate.
C2.2: BILL OF QUANTITIES

The Bill of Quantities follows and comprises of 39 pages. The pages are numbered 77 to 116.
## PART C3: SCOPE OF WORK

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| C3.2 | PROJECT SPECIFICATIONS | 122 |
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| PS.2 | Services |
| PS.3 | Watermains |
| PS.4 | Sewers |
| PS.5 | Stormwater |
| PS.6 | Electrical Plant |
| PS.7 | Telkom S.A. Limited / Neotel Plant |
| PS.8 | CCTV Plant |
| PS.9 | Management of the Environment |
| PS.10 | Occupational Health and Safety |
| PS.11 | Site Security |
| PS.12 | Stakeholder and Community Liaison and Social Facilitator |

### C3.3 STANDARD SPECIFICATIONS

- C3.3.1 Listing of the Standard Specifications
- C3.3.2 Amendments to the Standard Specifications

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| | Covid Health and Safety Specification | (9 Pages) |
| | Site Specific Health and Safety Specification in terms of 2014 construction regulations | (22 pages) |
| | Baseline Risk Assessment | (11 Pages) |
| C3.4.2 | PEM Environmental Management Specifications | (60 Pages) |
| C3.4.3 | PS ELE Electrical Project Specifications | (63 Pages) |
| C3.4.4 | PS ELT Telemetry Project Specifications | (11 Pages) |
| C3.4.5 | PS CAT Cathodic Protection and Alternating Current Mitigation Technical | (212 Pages) |

### VOLUME 3: TENDER DRAWINGS

| C3.5 | CONTRACT AND STANDARD DRAWINGS |
| C3.5.1 | Contract Drawings / Details |
| C3.5.2 | Standard Drawings |
C3.1: PROJECT DESCRIPTION AND SCOPE OF CONTRACT

C3.1.1 Description of Works

Adams Mission has over the past 10 years developed with substantially large houses, with an average area of 300m², that require full pressure connections. This has led to a strain on the existing water infrastructure and supply network.

The Planning Department conducted a feasibility study on the existing infrastructure in the southern region, including the Adams Mission area, from this study a recommendation was made to upgrade the existing 2 M ℓ Adams Reservoir 6 (Reservoir AM 6) to a storage capacity of 10M ℓ. Due to land constraints and storage capacity optimization, the existing reservoir will be demolished in order to construct the new 10Mℓ reinforced concrete reservoir.

This project aims to augment the existing bulk storage to serve existing consumers in Adams Mission Ward 96 and provide additional water storage in the reservoir as per Municipality’s Policy to have a 48-hour storage capacity for supply reservoirs. The summary and extent of the project are highlighted below.

C3.1.1 Overview of the Works

This scope of work of this contract include the demolition and removal of the existing 2Ml reservoir and construction of the new 10Ml reinforced concrete reservoir with associated interconnecting pipework. The extent of this project is as listed below:

C3.1.1 Extent of the Works

- Replacement/ refurbishment of Security Fence, and access gate
- Accommodation of traffic where works is required in existing site and roads
- Earthworks to construct the platform for the structures including access temporary and permanent where applicable.
- Earthworks for reservoir site and concrete infill including access where applicable, pipeline and cable trenching, laying, bedding and backfilling of meter installation, power supply
- Barricading all earthworks and trenches
- Watertight reinforced concrete reservoir comprising one cell with overall dimensions of 55m x 34m x 6m high comprising of walls bases, surface beds, concrete columns, brick cladding, and a reinforced concrete roof.
- Concrete infill below reservoir floor level and under-drainage system beneath the reservoir
- Reinforced concrete chambers
- Planning for ordering and of all materials; ordering of all pipes, valves materials and fittings
- Pipe Valves and Valve chambers within the reservoir site
- Fabrication, supplying, laying, jointing, testing of pipes, pipe specials and fittings, that shall connect to the existing pipework
- Proving and locating existing reservoir inlet and outlet pipes at the reservoir site
- Locate, relocate supply and install temporary bypass where required
- Laying, jointing, testing and disinfecting of steel pipes, fittings and valves of diameter up to and including DN 600;
- Bulk meter installation on the reservoir inlet and outlet pipelines;
- Supply and installation of all control valves and isolating valves on the inlets, outlet and scour pipelines;
• Supplying, laying and jointing of gravity drains and overflow pipes with manholes and head walls inside and outside the fenced area up to suitable point of discharge;
• Laying, jointing, testing and disinfecting Steel/uPVC pipes, fittings and valves
• Supplying, laying and jointing of gravity drains and overflow pipes with manholes and head walls
• Ancillary steel pipework fittings and structural steel elements
• Tie in to existing reservoir and supply and distribution lines
• Protection of all existing and new services affected by the construction of the associated works.
• Refurbishing of site parking, access roads, and construction of new where required;
• Construction of road drainage systems
• Dry stack / gabion and retaining walls and drains where required
• Top-soiling and grassing
• Upgrade of electrical and Control equipment
• Supply installation commissioning of works including all mechanical, electrical and telemetry equipment cables and meter signal cables.
• Telemetry instrumentation, power supply and all ducting
• Installation of an above ground kiosk (where applicable) for meter signal converter complete with electrical components
• Testing, commissioning of the works
• Planning and liaising with eThekwini operations for shutdowns of reservoir inlet supply pipelines or reservoir outlet pipelines, including all risk assessments and method statements which are to be approved by the Employer’s Representative and EWS Operations
• Demolish and remove existing 2,0Mℓ reservoir structure, reinforce concrete structure
• Demolish and remove pipes/and chamber complete and dismantle steelwork
• Cathodic Protection

C3.1.1 Temporary Works

24-hour access is required for the EWS operational staff, the contractor to ensure he provide safe access for the duration of the project. The Contractor shall carry out such temporary work, including the necessary access and construction roads, shoring of trenches and excavations etc., as he may require enabling the permanent work to be constructed without interruption of water supply to the surrounding communities. He shall allow for the cost of all temporary works, including design and their removal, in his tendered rates.

Temporary works are expected to include:

• Necessary site access and deviations for traffic where the proposed works will disrupt traffic;
• Shoring, dewatering and related temporary works required during excavation of trenches and excavations as required to enable the permanent works to be constructed.
• Trenches and excavations as required to enable the permanent works to be constructed
• Any temporary support structures required to protect and maintain services;
• Any temporary pipe specials and fittings.
C3.1.2 Description of Site and Access

The new reservoir site consisting of a 2.0 Mℓ Concrete Reservoir with associated infrastructure and existing reservoir is located south of Durban, in an area currently surrounded by farmland, formal and informal housing developments. The site coordinates are as follows:

<table>
<thead>
<tr>
<th>Co-ordinate List</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proposed Reservoir Site</strong></td>
</tr>
<tr>
<td><strong>Point Const.</strong></td>
</tr>
<tr>
<td>PR1</td>
</tr>
<tr>
<td>PR2</td>
</tr>
<tr>
<td>PR3</td>
</tr>
<tr>
<td>PR4</td>
</tr>
</tbody>
</table>

Access to the reservoir site is via local gravel access roads.

Also refer to volume 2 drawing number 3168.00.AA.01.U001 Sheet 1 for a locality map showing the location of the project.

C3.1.3 Nature of Ground and Subsoil Conditions

A geotechnical investigation with details of ground and subsoil conditions along the proposed site has been carried out by Davies, Lynn & Partners. The results of tests on ground and subsoil conditions for Adams Mission 6 Reservoir Site is included in Section C4 Site Information. Trial holes may be excavated by Tenderers, (with the prior written consent of the Engineer’s representative) to assist in the pricing of their excavation rates. Any trial hole shall be barricaded and shall be backfilled immediately after inspection of the soil conditions.

The tenderer shall be fully liable for any claims for losses, damage or injuries arising or as a consequence of carrying out trial hole excavations for the purpose of this tender.

Furthermore, the Engineer’s authority for the carrying out of any exploratory excavations is subject to the Tenderer indemnifying the Employer and the Engineer against any such Claims.

C3.1.4 Material supplied by the Employer

The employer will supply the following materials which will be collected from eThekwini Water Services Springfield park stores, unless otherwise indicated.

a) At Hammarsdale Water Depot,

mPVC spigot and socket water pipes with moulded rubber rings to SABS 966

<table>
<thead>
<tr>
<th>(a)</th>
<th>Class 10 pipes</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1</td>
<td>250 mm Diameter</td>
</tr>
<tr>
<td>.1</td>
<td>400mm Diameter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(b)</th>
<th>Class 16 pipes</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1</td>
<td>200 mm Diameter</td>
</tr>
<tr>
<td>.1</td>
<td>250mm Diameter</td>
</tr>
</tbody>
</table>

b) At the Springfield store, Electron road approximately 40km from the site:
• All valves and air valves including jointing materials and matching flanges
• Type No.5 valve covers and frames for scour valve chambers
• Pipeline route markers posts

Materials to be supplied by the employer is as listed on the schedule of quantities. A provisional sum has been allowed for material that may not be available at the EWS stores.

List of materials to be supplied by the Employer are detailed below

<table>
<thead>
<tr>
<th>Billed Item</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1.1</td>
<td>Precast Concrete Route Markers</td>
<td>no</td>
<td>10</td>
</tr>
<tr>
<td>8.12.3</td>
<td>Type No 5 Valve Cover</td>
<td>no</td>
<td>6</td>
</tr>
<tr>
<td>10.4.3.3</td>
<td>465 x 465 Air Vent at inlet chamber</td>
<td>no</td>
<td>4</td>
</tr>
<tr>
<td>10.4.3.4</td>
<td>Air Vent for Concrete chamber</td>
<td>no</td>
<td>6</td>
</tr>
<tr>
<td>10.4.6</td>
<td>Type No 2 Valve Cover</td>
<td>no</td>
<td>4</td>
</tr>
<tr>
<td>11.5.1</td>
<td>250mm Gate valve</td>
<td>no.</td>
<td>1</td>
</tr>
<tr>
<td>11.5.2</td>
<td>400mm Gate valve</td>
<td>no.</td>
<td>3</td>
</tr>
<tr>
<td>11.7.4</td>
<td>R32 - 300 Dia Gate Valve</td>
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<td>1</td>
</tr>
<tr>
<td>11.7.11</td>
<td>R39 - 150 Gate Valve</td>
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<td>1</td>
</tr>
<tr>
<td>11.7.18</td>
<td>T32 - 400 Gate Valve</td>
<td>no</td>
<td>2</td>
</tr>
<tr>
<td>11.7.29</td>
<td>T43 - 250 Gate Valve</td>
<td>no</td>
<td>2</td>
</tr>
<tr>
<td>11.7.40</td>
<td>U32 - 400 Gate Valve</td>
<td>no</td>
<td>2</td>
</tr>
<tr>
<td>11.7.49</td>
<td>U41 - 250 Gate Valve</td>
<td>no</td>
<td>2</td>
</tr>
<tr>
<td>11.7.64</td>
<td>S24 - 300 Gate Valve</td>
<td>no</td>
<td>1</td>
</tr>
<tr>
<td>11.7.70</td>
<td>S30 - 300 Butterfly Valve</td>
<td>no</td>
<td>2</td>
</tr>
<tr>
<td>11.7.72</td>
<td>S32 -50 Air Valve</td>
<td>no</td>
<td>2</td>
</tr>
<tr>
<td>11.7.84</td>
<td>A2 - 150 Butterfly Valve</td>
<td>no</td>
<td>1</td>
</tr>
<tr>
<td>11.7.86</td>
<td>A4 - 100 Air Valve</td>
<td>no</td>
<td>1</td>
</tr>
</tbody>
</table>

*All other materials are to be supplied by the Contractor and are to be allowed for in the rates.*

Once the materials are delivered to site, the Engineer is to be notified in order that arrangements may be made for the inspection of the materials. No materials are to be utilised until they have been accepted by the Engineer in writing. Such written acceptance shall not prejudice the right of the Engineer to reject such materials should they be shown to be defective at a later stage.

**C.3.1.5 Procedure for the withdrawal of Materials**

The Contractor shall notify the Engineer at least one week in advance of his intention to withdraw materials from the Employer's stores.

A list of the materials which he wishes to withdraw shall accompany such notification. The Engineer shall then issue to the Contractor the necessary requisition forms to allow him to withdraw the required materials from the Employer's store. Contractors are to note that materials are to be collected between 08h00 and 14h00 on weekdays, the Contractor must supply craneage where required.
C.3.1.6 Ownership of materials once collected by Contractors

All materials supplied by the Employer remain the property of the Employer even after being collected by the Contractor. However, the Contractor shall become fully responsible for these materials once he has drawn them from the Employer's stores. Tenderers are to note the requirements of PSL 8.2.1 of PSL: Medium pressure pipelines, in particular that the rate for pipe laying shall include for the collection of the pipe to site. This rate shall not be sub-divided to allow for prior payment for delivery alone. An item has been allowed for in the Schedule of Quantities, covering the costs incurred by the Contractor during inspection and acceptance of all materials supplied by the Employer.

C3.1.7 Losses of and Damage to Materials

It shall be the responsibility of the Contractor to check, on receiving, the condition of all materials supplied to him by the Employer. All defects shall be recorded on the delivery forms and the Engineer shall be notified in writing. The Employer will then:

(a) Replace the defective materials, or
(b) Repair the defective materials, or
(c) Instruct the Contractor to repair the materials at the Employer's cost.

However, should the Engineer not be notified in writing of any defective or damaged materials, it will be assumed that all materials were handed over to the Contractor in a good condition. Any damage reported thereafter will be to the Contractor's account.

The Contractor shall be responsible for any loss of materials supplied by the Employer.

C3.1.8 Return of Excess Materials

On completion of the works the Contractor shall be responsible for the return of all surplus materials to the Employer's store at Electron Road, Springfield or respective pipe yards (an item has been included in the Schedule of Quantities for this purpose).

Contractors are to note that materials may only be returned to the stores between 08h00 and 14h00 on weekdays and must notify the Engineer of their intention to do so.

This item shall include for the provision of craneage at the Employer's store for the off-loading of all material.

C3.1.9 Pipe Storage Areas

There is limited space on site for storage of pipes and it is recommended that the Contractor collect pipe just prior to laying thereof. The Contractor shall take full responsibility for the safety of all pipes once collected from the Employer's pipe yard. The Contractor's attention is drawn to the clauses “Losses of and Damage to Materials” and “Damage to Coating and Lining” in respect of pipes stored in this area.

On collection of pipes, the Contractor, together with the Engineer's representative shall inspect all the pipes, and shall mutually agree the extent of damage to pipe lining and coating. This information shall be made known to the Engineer in writing. From the date of collection, the Contractor shall become fully responsible for the pipes, and any damages found and not recorded at the time of hand-over shall be deemed the Contractors responsibility.

Any further materials collected from the eThekwini Water Store off Electron Road may be stored at the Contractors campsite.

C.3.1.10 Construction Causeways/Routes

Access over private property requires the permission of the owners and the Contractor is required to make contact with relevant parties to ensure that the necessary permission is obtained prior to any work commencing on the various properties. Where the Contractor has gained permission to
construct temporary access routes etc from the relevant parties, the Contractor shall maintain such throughout the contract period by filling, watering, compacting and grading suitably imported gravel fill material, inclusive of forming drainage channels as necessary giving vehicular passable access to the property owners and tenants, construction teams, etc. at all times, all to the satisfaction of the Engineer.
C3.2: PROJECT SPECIFICATION

PREAMBLE

In the event of any discrepancy between a part or parts of the Standard or Particular Specifications and the Project Specification, the Project Specification shall take precedence. In the event of a discrepancy between the Specifications, (including the Project Specifications) and the drawings and / or the Bill of Quantities, the discrepancy shall be resolved by the Employer’s Agent before the execution of the work under the relevant item.

C3.2.1 GENERAL

PS.1 PROGRAMME, METHOD OF WORK, AND ACCOMMODATION OF TRAFFIC

This Clause is to be read in conjunction with the provisions and obligations as contained in SANS 1921-1 and SANS 1921-2.

PS.1 PROGRAMME

The time for completion of the Contract is as specified in the Contract Data.

PS.1.1 Preliminary Programme

The Contractor shall include with his tender a preliminary programme on the prescribed form (see Part T2.2: Preliminary Programme) to be completed by all Tenderers. The programme shall be in the form of a simplified bar chart with sufficient details to show clearly how the works will be performed within the time for completion as stated in the Contract Data.

Tenderers may submit tenders for an alternative Time for Completion in addition to a tender based on the specified Time for Completion. Each such alternative tender shall include a preliminary programme similar to the programme above for the execution of the works, and shall motivate his proposal clearly by stating all the financial implications of the alternative completion time.

The Contractor shall be deemed to have allowed fully in his tendered rates and prices as well as in his programme for all possible delays due to normal adverse weather conditions (refer to Clause 5.12.2.2) and special non-working days (refer to Clause 5.1.1.1) as specified in the Contract Data.

PS.1.2 Programme in Terms of Clause 5.6 of the General Conditions of Contract

It is essential that the construction programme, which shall conform in all respects to Clause 5.6 of the General Conditions of Contract, be furnished within the time stated in the Contract Data (refer to Clause 5.3.1/2).

The preliminary programme to be submitted with the tender shall be used as basis for this programme.

The Tenderer's attention is drawn to the fact that a number of factors will affect the programming of and method of carrying out the works. The more important of these are:
[Detail any factors which may affect the programming of the project]

(1) Construction works Restriction due to Formal and informal housing and infrastructure in close proximity of the site Time Allowances due to Restricted Construction and Construction in Limited Areas.

(2) Time allowances to be made for the ordering of special items.

(3) Notification required by service organisations.

(4) Any special sequence in which work must be carried out. Must certain areas of work be finished before work commences on others?

(5) If delays are anticipated with service relocations the contractor should be asked to allow time.

(6) Is work required out of normal hours?

(7) Vehicular access to the site and private property is to be maintained.

(8) Traffic restrictions.

(9) Demolition of existing reservoir

Attention is drawn to the requirements set out in PSG 7.3.9 for water-tightness testing, and a period of not less than twenty-one (21) days shall be allowed for water-tightness testing in accordance with the specification. The backfilling and brick cladding around the reservoir shall only be done after successful completion of the water-tightness test.

The filling of the reservoir shall be done through the new inlet pipelines and valves. The reservoir will be filled by the Employer for the first time with no cost to the Contractor. If the required level needs to be lowered for any remedial works, then the cost of this water shall be charged to the Contractor.

Those known, existing services in the area of the works have been depicted on the contract drawings. It is evident, however, that the status of existing service records as far as can be ascertained might not reflect the actual situation in the field. As such, due allowance has been made in the Bill of Quantities for the proving of services where directed by the Engineer.

Planning and liaising with eThekwini Operations for shutdowns of reservoir inlet supply pipelines or reservoir outlet pipelines, including all risk assessments and method statements which are to be approved by the Employer’s Representative and EWS Operations have to be submitted formally at least 14 days prior to the actual date of the event taking place.

**PS.1.3 Requirements for Accommodation of Traffic**

**PS.1.3.1 General**

Accommodation of traffic, where applicable, shall comply with SANS 1921-2: 2004: Construction and Management Requirements for Works Contracts, Part 2: Accommodation of Traffic on Public Roads occupied by the Contractor. The Contractor shall obtain this specification from Standards South Africa if accommodation of traffic will be involved on any part of the construction works.

Clause 4.10.4 of SANS 1921-2: 2004 shall be replaced with the following:

“Road signs and markings shall comply with the requirements of “The South African Road Traffic Signs Manual - Volume 2: Roadworks Signing”.”
PS.1.3.2 Basic Requirements

The travelling public shall have the right of way on public roads, and the Contractor shall make use of approved methods to control the movement of his equipment and vehicles so as not to constitute a hazard on the road.

The Contractor shall ensure that all road signs, barricades, delineators, flagmen and speed controls are effective and that courtesy is extended to the public at all times.

Failure to maintain road signs, warning signs or flicker lights, etc, in a good condition shall constitute ample reason for the Employer’s Agent to suspend the work until the road signs, etc, have been repaired to his satisfaction.

The Contractor may not commence constructional activities affecting existing roads before adequate provision has been made to accommodate traffic in accordance with the requirements of this document and the South African Road Traffic Signs Manual.

The Contractor shall construct and maintain all temporary drainage works necessary for temporary deviations. The Contractor shall ensure that the existing property accesses are maintained at all times. Where necessary the Contractor shall make allowance in the rates for completing the work required to the accesses out of normal hours.

PS.1.3.3 Traffic Safety Officer

Where warranted by traffic conditions on or near the site, the Contractor shall nominate a suitable member of his staff as traffic safety officer to be responsible for the arrangement and maintenance of all the measures for the accommodation of traffic for the duration of the project. Duties of the traffic safety officer shall be in compliance with the Occupational Health and Safety Act 1993 and the Construction Regulations 2014.

PS.1.3.4 Payment

The Contractor’s tendered rates for the relevant items in the Bill of Quantities shall include full compensation for all possible additional costs which may arise from this, and no claims for extra payment due to inconvenience as a result of the modus operandi will be considered.

PS.1.3.5 Pedestrian movement

The Contractor shall make provision for accommodating all pedestrian movements in the area of the works. Allowance shall be made in the relevant rates for any barricades and signs required.

PS.1.3.6 Temporary Reinstatement

Provided always that if in the course or for the purpose of the execution of the works or any part thereof any road or way shall have been broken up, then notwithstanding anything herein contained:

(a) if the permanent reinstatement of such road or way is to be carried out by the appropriate authority or by some person other than the contractor (or any subcontractor
to him), the contractor shall at his own cost and independently of any requirement of or notice from the Engineer be responsible for the making good of any subsidence or shrinkage or other defect, imperfection or fault in the temporary reinstatement of such road or way, and for the execution of any necessary repair or amendment thereof from whatever cause the necessity arises, until the end of the period of maintenance in respect of works beneath such road or way until the authority or other person as aforesaid shall have taken possession of the site for the purpose of carrying out permanent reinstatement (whichever is the earlier), and shall indemnify and save harmless that Council against and from any damage or injury to the Council or to third parties arising out of or in consequence of any neglect or failure of the Contractor to comply with the foregoing obligations or any of them and against and from all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

(b) where the authority or person as aforesaid shall take possession of the site as aforesaid in sections or lengths, the responsibility of the contractor under paragraph (a) of this sub-clause shall cease in regard to any such section or length at the time possession thereof is so taken, but shall during the continuance of the said period of maintenance continue in regard to any length of which possession has not been taken and the indemnity given by the contractor under the said paragraph shall be construed and have effect accordingly.

PS.2 SERVICES

This Clause is to be read in conjunction with the provisions and obligations as contained in SANS 1921-1 and SANS 1921-2.

PS.2.1 Existing Services

The Tenderer's attention is drawn to the numerous existing services in the area. Although every effort has been made to depict these services accurately the positions shown must be regarded as approximate.

PS.2.2 Proving Underground Services

This clause must be read in conjunction with Clause DB.5.1.2 and 5.1.2.4, the requirements of which shall be extended to cover all earthworks operations whether for trenching or bulk earthworks, in the vicinity of underground services.

It is stressed that all services in a particular area must be proven before commencing work in that area.

Insofar as bulk earthworks are concerned, where services are indicated on the drawings or where from site observations can reasonably be expected that such services are likely to exist where excavations are to take place, the Contractor shall without instructions from the Employer’s Agent carefully excavate by hand to expose and prove their positions.

The cost of the proving trenches is to be included in the work covered by Clause DA.8.3.

When a service is not located in its expected position the Contractor shall immediately report such circumstances to the Employer’s Agent who will decide what further searching or other
necessary action is to be carried out and shall instruct the Contractor accordingly. The cost of this additional searching shall be to the Council's cost and shall be paid for under PSA8.6.6 - Proving Existing Services.

Should any service be damaged by the Contractor in carrying out the works and should it be found that the procedure as laid down in this clause has not been followed then all costs in connection with the repair of the service will be to the Contractor's account.

When electrical cables are not in the positions shown on drawings of eThekwini Electricity and cannot be found after proving trenches have been put down, assistance may be obtained by calling an official of the Works Branch on Telephone No. 311-1111 during office hours, or by contacting Control on Telephone No. 305-7171 after hours.

It should be noted that 33,000 Volt and 132,000 Volt cables may only be exposed by the eThekwini Electricity's personnel. The cables are usually protected by concrete covering slabs, and therefore if the slabs are inadvertently exposed, excavation work must stop, and the eThekwini Electricity shall be contacted immediately on the above telephone numbers.

Proving of services shall be completed at least two weeks in advance of the actual programmed date for commencing work in the area. The position of these services located must be co-ordinated and levelled by the Contractor, and the information given in writing to the Employer's Agent's Representative.

The requirements of this clause do not relieve the Contractor of any obligations as detailed in the Conditions of Contract or under Clause 4.17 of SANS 1921-1.

**PS.2.3 New Services and Relocation of Existing**

This clause shall be read in conjunction with Clause PS.1.

New services are either to be installed by the Contractor as part of the contract or by others during the contract period. In the latter case excavation and subsequent backfilling of the trench from the top of the bedding layer shall generally be carried out by the Contractor.

Relocation of services shall generally be carried out by the relevant services organisation. Generally their work shall include the excavating and bedding the service which will include backfilling to a depth of approximately 300 mm above the service. The remainder of the backfilling shall be carried out by the Contractor.

Generally work shall only commence on the installation of new services once the bulk earthworks have been completed and roughly trimmed to level along a substantial portion of the services route. In addition no sidewalk, verge, median or island shall be surfaced or topsoiled until all work on the services has been completed.

Services affected by the contract are described as follows:

- PS.3: Watermains;
- PS.6: Stormwater;
- PS.7: Electrical Cables / Lighting;
- PS.8: Telkom / Neotel;
- PS.9: CCTV;
Further to the above, tenderers are referred to the services drawing and are to note that several minor cables / pipes may be encountered during excavation works which may require to be relocated to some extent. It is anticipated that the two week period required under PS.2.2 will allow sufficient time for these relocations.

**PS.2.4 Accommodation of Services**

Further to Clauses PS.1 and PS.2 of this specification, tenderers are to note that allowance must be made under this item and / or the appropriate rates, for all costs incurred as a result of complying with these clauses. It shall also cover liaison with the services organisations and accommodation of their work gangs / contractors on site.

**PS.2.5 Protection of Services**

This Clause should be read with Clause 5.4 of SANS 1200 A and the relevant amendments. The Contractor shall take all the necessary steps to ascertain the location of existing services before commencing any section of the Works and shall exercise the greatest care when working in the vicinity of such services. The Contractor shall take all necessary steps to protect any existing works or service whatsoever, against damage which may arise as a result of his operations on Site. The Contractor shall bear the cost of the repair of damage to any known service, the possible existence of which could reasonably have been ascertained by him beforehand. Work is to take place alongside existing high pressure water pipelines, electricity cables, fibre optic cables and there like, and this is of regional strategic importance and must therefore remain in service at all times during the construction of this project.

Unless otherwise instructed by the Employer’s Representative, no services shall be left exposed after its exact location has been determined and all excavations carried out for the purpose of exposing underground services shall be promptly backfilled and compacted. Services left exposed shall be suitably protected from damage and in such a manner as will eliminate any danger arising there from to the public and/or workmen.

Should damage occur to any existing services, the Contractor shall immediately inform the Employer’s Representative, or when this is not possible, the relevant authority, and obtain instructions as to who should carry out repairs in urgent cases, the Contractor shall take appropriate steps to minimise damage to and interruption of the service. No repairs of telecommunication cables and electrical powerlines and cables shall be attempted by the Contractor.

Buried electrical and telephone cables shall be exposed using hand tools initially before allowing the uncontrolled use of picks and other implements, or before using machines to excavate. Supporting or diverting cables must be done by, or in consultation with, officials of the Electricity Service Unit, Eskom or Telkom respectively. When cables are not in the positions shown on the drawings and cannot be found after proving trenches have been put down, assistance may be obtained by calling an official from the appropriate authority during office hours.

Existing services including water mains, sewer pipes, stormwater pipes and drains, electricity and telephone lines, cables, poles and conduits shall be protected, supported, maintained in service and restored to the condition in which found by the Contractor at his expense, or where necessary by the appropriate authority at the Contractor’s expense. Provided that where it is
necessary to relocate such existing services, such relocation shall be arranged by and carried out at the Employer’s expense.

**PS 2.6 PERMITS**

The Contractor shall be responsible for obtaining all necessary permits to transport materials to the area, blasting if required etc.

**PS 2.7 ATTENDANCE AT SITE MEETINGS**

The Contractor and Sub-Contractors shall attend regular site meetings as and when these are required by the Employer’s Representative. The objectives of such meetings will be to review progress and ensure compliance with the programme, discuss, and where possible solve any problems that may arise and generally liaise with all parties concerned with the

**PS 2.8 RESERVOIR SHUTDOWNS**

Shutdowns will be planned to fit in with supply and demands experienced with EWS Operations.

Maximum shutdown duration will be 8 hours and is subjected to being reduced. Contractor must plan and programme the works to be done during shutdown periods such that it will fit in a single or multiple shutdown period. The Contractor must plan such that the existing reservoir is at full capacity for closure of inlet supply. Some shutdowns will be after normal working hours. Each shutdown requires planning and liaising with eThekwini Operations including all risk assessments and method statements which are to be approved by the Employer’s Representative and EWS Operations, this is to be provided to EWS Operations with the 14-day notice period. Where valves are not operational the contractor must bring it to the Employer’s Representative attention.

The rate for shutdowns must include for but is not limited to all planning, risk assessments, method statements, shop drawings and other works.

**PS 3 WATERMAINS**

**PS.3.1 General**

Tenderer’s attention is drawn to the following points regarding the water mains to be installed as part of this contract.

**PS.3.2 Water Main Valve Access**

Due to the dangerous situation occurring when water main valves are covered over, the Contractor shall maintain access to all water main valves at all times. During asphalt layer work, after each pass by the paving machine, the valves shall be exposed and access maintained in a safe condition.

Whatever method the Contractor chooses to use for this work, the cost of raising the valves from existing level to ultimate level shall be paid only once, irrespective of the number of times the valve is uncovered. Spacer rings required for the height adjustment of valve covers shall be supplied by the Water and Sanitation Unit. Before final setting in position of valve covers
the Contractor shall liaise with the Employer’s Agent regarding the direction in which covers shall be placed.

PS.3.3 Restriction on Compactive Equipment

The Contractor is to note that existing watermains traverse the site of the works and special care is to be taken in close proximity to these mains and connections. The existing mains and connections shall be proved on site by the Contractor prior to any construction work commencing in the vicinity of the water mains.

Under no circumstances will heavy road-making equipment, other heavy plant or vibratory compaction equipment be permitted to operate within 800 mm vertically or horizontally of the existing mains or connections. The permissible compaction plant within this restricted area shall be the equivalent of a "Bomag 90" under static compaction, or similar approved plant. When the roadworks are far enough advanced to provide a minimum of 800 mm cover to the existing mains, the above restriction will fall away.

The Contractor is to take cognisance of the above requirements when entering rates in the Bill of Quantities and in the programming of the works. No claim for additional payment based on the inability to use plant as a result of the requirements of this clause will be accepted. The Contractor will be held liable for any costs should the watermain or electrical cables be damaged during construction.

PS.3.4 Restricted Construction and Construction in Limited Areas

Working space will be limited due to the presence of buildings, structures and certain underground and overhead services which exist on and next to the site. The method of construction in these restricted areas will depend largely on the Contractor’s resources. Tenderers are to take cognisance of this fact and allow for the difficulty of working in a restricted space and working in close proximity of a public school, houses and informal structures surrounding the site in the rates. No additional payment will be made for this requirement.

The Contractor shall familiarize himself of construction activities required on slopes, next to existing facilities, formal and informal structures and the impact that this has on the safety of his employees as well as the safety of the general public living next to the works site or general public passing by.

All tendered rates shall be deemed to include for compliance with the relevant Health and Safety specification and legislation.

PS.4 SEWERS

The sewer reticulation should not be affected by the construction of the works.

PS.4.1 Blockage of Foul Water Sewers

The Contractor shall be responsible for ensuring that cementitious sludge, sand and rubble from the works do not enter the foul water reticulation system. The Contractor shall be liable for any costs incurred by the Council or others as a result of blockages in the reticulation system attributed to failure to comply with the above requirement.
PS.5  STORMWATER

The proposed stormwater system to be constructed will include the completion of the reservoir sub soil drainage system, therefore the excavation of the drain pipes will extend to below the reservoir foundations. Extreme care should be taken not to damage the reservoir structure.

PS.5.1  Blockage Stormwater Sewers

The Contractor shall be responsible for ensuring that cementitious sludge, sand and rubble from the works do not enter the stormwater reticulation system. The Contractor shall be liable for any costs incurred by the Council or others as a result of blockages in the reticulation system attributed to failure to comply with the above requirement.

PS.6  ELECTRICAL PLANT

PS.6.1  General

Various types of electrical cables including high voltage, low voltage, street lighting and domestic connection cables are affected by the contract. The laying, relocation and jointing of all cables will be carried out by eThekwini Electricity’s work gangs, or agents appointed by them, whilst the excavation and backfilling forms part of this contract. Close liaison will therefore be necessary with eThekwini Electricity throughout the contract.

PS.6.2  MV / LV Cables

Certain MV / LV cables are to be replaced within the contract area (see drawing 3168.00.GZ.07.U001 – Sheet 24).

PS.6.3  Relocation of Existing Services

Should it be necessary to adjust the line, level and / or position of any service not catered for in the contract to enable the construction to proceed the Contractor shall on no account effect such adjustment himself but shall notify the Engineer who will arrange for the work to be carried out at no cost to the Contractor.

PS.7  TELKOM S.A. LIMITED / NEOTEL PLANT

No work to Telkom / Neotel Plant is envisaged, but the tenderers attention is drawn to the fact that Telkom / Neotel copper cables and fibre optic cables are existing in the contract area.

PS.8  CCTV PLANT

No work to CCTV Plant is envisaged, or exists.

PS.9  MANAGEMENT OF THE ENVIRONMENT

The Contractor shall pay special attention to the following:
PS.9.1  Natural Vegetation

The Contractor shall confine his operation to as small an area of the site as may be practical for the purpose of constructing the works.

Only those trees and shrubs directly affected by the works and such others as the Employer’s Agent may direct in writing shall be cut down and stumped. The natural vegetation, grassing and other plants shall not be disturbed other than in areas where it is essential for the execution of the work or where directed by the Engineer.

PS.9.2  Fires

The Contractor shall comply with the statutory and local fire regulations. He shall also take all necessary precautions to prevent any fires. In the event of fire the Contractor shall take active steps to limit and extinguish the fire and shall accept full responsibility for damages and claims resulting from such fires which may have been caused by him or his employees.

PS.9.3  Environmental Management Plan

In addition to the above, all requirements according to the Environmental Management Plan as detailed in C3.4: Particular Specifications, will be adhered to.

PS.10  OCCUPATIONAL HEALTH AND SAFETY

PS.10.1  General Statement

When considering the safety on site the Contractor’s attention is drawn to the following:

It is a requirement of this contract that the Contractor shall provide a safe and healthy working environment and to direct all his activities in such a manner that his employees and any other persons, who may be directly affected by his activities, are not exposed to hazards to their health and safety. To this end the Contractor shall assume full responsibility to conform to all the provisions of the Occupational Health and Safety Act No 85 and Amendment Act No 181 of 1993, and the OHSA 1993 Construction Regulations 2014 issued on 7 February 2014 by the Department of Labour.

For the purpose of this contract the Contractor is required to confirm his status as mandatory and employer in his own right for the execution of the contract by entering into an agreement with the Employer in terms of Section 37(2) of the Occupational Health and Safety Act.

PS.10.2  Health and Safety Specifications and Plans to be submitted at tender stage

PS.10.2.1  Employer’s Health and Safety Specification

The Employer’s Health and Safety Specification is included in Part C3.4: Particular Specifications.
PS.10.2.2 Tenderer’s Health and Safety Plan

At tender stage only a brief overview of the tenderers perception on the safety requirements for this contract will be adequate. This will be attached to Part T2.2: Contractor’s Health and Safety Plan.


The detailed safety plan will take into consideration the site specific risks as mentioned under PS.10.1 and must cover at least the following:

(i) A proper risk assessment of the works, risk items, work methods and procedures in terms of Regulations 9 to 29;
(ii) Pro-active identification of potential hazards and unsafe working conditions;
(iii) Provision of a safe working environment and equipment;
(iv) Statements of methods to ensure the health and safety of subcontractors, employees and visitors to the site, including safety training in hazards and risk areas (Regulation 7);
(v) Monitoring health and safety on the site of works on a regular basis, and keeping of records and registers as provided for in the Construction Regulations;
(vi) Details of the Construction Supervisor, the Construction Safety Officers and other competent persons he intends to appoint for the construction works in terms of Regulation 8 and other applicable regulations; and
(vii) Details of methods to ensure that his Health and Safety Plan is carried out effectively in accordance with the Construction Regulations 2014.

The Contractor’s Health and Safety Plan will be subject to approval by the Employer, or amendment if necessary, before commencement of construction work. The Contractor will not be allowed to commence work, or his work will be suspended if he had already commenced work, before he has obtained the Employer’s written approval of his Health and Safety Plan.

Time lost due to delayed commencement or suspension of the work as a result of the Contractor’s failure to obtain approval for his safety plan, shall not be used as a reason to claim for extension of time or standing time and related costs

A generic plan will not be acceptable.

PS.10.3 Cost of compliance with the OHSA Construction Regulations

The rates and prices tendered by the Contractor shall be deemed to include all costs for conforming to the requirements of the Act, the Construction Regulations and the Employer’s Health and Safety Specification as applicable to this contract. Should the Contractor fail to comply with the provisions of the Construction Regulations, he will be liable for penalties as provided in the Construction Regulations and in the Employer’s Health and Safety Specification.

Items that may qualify for remuneration will be specified in the Employer’s Health and Safety Specification.
PS.11 SITE SECURITY

The Contractor shall, for the duration of the contract, provide sufficient fulltime security and watchmen to adequately ensure the safety and protection of the works, the Contractor’s staff, including local labour and subcontractors, and all site plant and construction equipment required for the works.

It must be noted that there are high incidents of theft of electrical cables and damage to motor control centres on site. The Contractor may need consider making provision for armed guards on site for the duration of the contract until completion certificates have been issued. It may also be in the Contractor’s interest that the work be programmed so that the electrical equipment be installed and energised then directly placed into operation where possible.

The Contractor shall not be reimbursed by the Client for the loss or damage of any materials, vehicles and machinery whatsoever through theft or robbery (armed or unarmed) from the site of the works or his construction camp. Neither will a claim for extension of time be considered for the time lost due to the loss or damage caused by such theft or robbery.

Site Security, in conjunction with the SAPS (where necessary), shall be responsible for removal of disruptive elements, that may interrupt the progress of the contract through acts such as, but not limited to, intimidation, threats of disruption, violent disruption, or criminal and illegal activity by the local community or independent organisations or entities that may result in slowing down or partial or total stoppage of the works.

Payment for this item shall be made under Section 1, Part AB of the Bill of Quantities.

PS.12 STAKEHOLDER AND COMMUNITY LIASON AND SOCIAL FACILITATION

a) Purpose

To give effect to the need for transparency and inclusion in the process of delivering services, the Contractor shall liaise with the project Stakeholders and affected Communities for the duration of the Contract’s life cycle. This shall be achieved through structured engagement with the Project Steering Committee (PSC) which will be established by the Employer for this purpose.

a) Contractor's Responsibility

(i) Stakeholder and Community engagement shall be executed based on the Employer’s social facilitation principles and processes.

(ii) The Contractor shall make use of the PSC as the official communication channel, and utilise it to facilitate harmonious relationships, with project Stakeholders and affected Communities. The PSC shall be held accountable to disseminate project information discussed at the PSC to its respective constituencies.

(iii) As a party to the functioning of the PSC, the Contractor shall delegate from among its site personnel a responsible person to serve on, and participate in, the PSC and its business.

(iv) The Contractor shall provide the PSC with any assistance and information that it requires to execute its duties, e.g. meeting venue on site, Target Group reports, etc.
Note:

In terms of the Conditions of Contract, all Targeted Labour recruitment and employment, and Targeted Enterprises' selection and appointment, as well as its associated risks, shall remain the sole responsibility of the Contractor. The Employers assistance in establishing a PSC and providing a CLO to the Contractor, shall not relieve the Contractor of its obligations under the Contract and shall not attract any liability to the Employee.
C3.3: STANDARD SPECIFICATIONS

C3.3.1 The standard specifications on which this contract is based are the South African Bureau of Standards Standardized Specifications for Civil Engineering Construction SABS 1200, also now referred to as SANS 1200.

Although not bound in, nor issued with this document, the following sections of the Standardised Specifications of SANS 1200 shall form part of this Contract:

PSA GENERAL - SABS 1200 A
PSAB ENGINEER'S OFFICE - SABS 1200 AB
PSC SITE CLEARANCE - SABS 1200 C
PSD EARTHWORKS - SABS 1200 D
PSDB EARTHWORKS (PIPE TRENCHES) - SABS 1200 DB
PSDK GABIONS AND PITCHING - SABS 1200 DK35
PSDM EARTHWORKS (Roads, subgrade) - SABS 1200 DM
PSG CONCRETE (Structural) - SABS 1200 G
PSH STRUCTURAL STEEL WORK – SABS 1200 H
PSL MEDIUM PRESSURE PIPELINES - SABS 1200 L
PSLB BEDDING (PIPES) - SABS 1200 LB
PSLD SEWERS - SABS 1200 LD
PSLE STORM WATER DRAINAGE
PSM ROADS (GENERAL) - SABS 1200 M
PSME SUBBASE - SABS 1200 ME
PSMJ SEGMENTED PAVING - SABS 1200 MJ
PSMK KERBING AND CHANNELLING - SABS 1200 MK
PSMM ANCILLARY ROADWORKS - SABS 1200 MM

The following SANS specifications are also referred to in this document and the Contractor is advised to obtain them from Standards South Africa (a division of SABS) in Pretoria.

SANS 1914:2002 Targeted Construction Procurement. Part 1 – Participation of targeted enterprises
SANS 1914-1 to 6 (2002) Targeted Construction Procurement
SANS 1921 – 1:2004 Construction and Management Requirements for Works Contracts Part 1: General Engineering and Construction Works and where accommodation of traffic is involved
SANS 1921-2:2004 Construction and Management Requirements for Works Contracts Part 2: Accommodation of Traffic on Public Roads Occupied by the Contractor
SANS 1921-3:2004 Construction and Management Requirements for Works Contracts Part 3: Structural Steelwork
SANS 1921-5:2005 Construction and Management Requirements for Works Contracts Part 3: Earthworks activities which are to be performed by hand
SANS 10396: 2003 Implementing Preferential Construction Procurement Policies using Targeted Procurement Procedures
SANS 719: 2008  Electric welded low carbon steel pipes for aqueous fluids (large bore) (200mm nominal bore to 2230mm)
SANS 1123:2007  Pipe Flanges
BS EN 1092-1: 2007  Flanges and their Joints – Circular flanges for pipes, valves, fittings and accessories, PN designated
SANS 1217:2001  The production of painted and powder coated steel pipes
The following non-SANS specifications are referred to in this document and the Contractor is advised to obtain them from the relevant authorities:
BS 534  Steel pipes, joints and specials for water and sewage
BS EN 10224:2002,
BS EN 10311:2005  Specification for Steel pipes, joints and specials for water and sewage
C3.3.2 AMENDMENTS TO THE STANDARD SPECIFICATIONS

INTRODUCTION

In certain clauses the standard, standardized and particular specifications allow a choice to be specified in the project specifications between alternative materials or methods of construction and for additional requirements to be specified to suit a particular contract. Details of such alternative or additional requirements applicable to this contract are contained in this part of the project specifications. It also contains additional specifications required for this particular contract.

The number of each clause and each payment item in this part of the project specifications consists of the prefix PS followed by a number corresponding to the number of the relevant clause or payment item in the standard specifications. The number of a new clause or payment item, which does not form part of a clause or a payment item in the standard specifications and which is included here, is also prefixed by PS, but followed by a new number which follows on the last clause or item number used in the relevant section of the standard specifications.

PSA GENERAL - SABS 1200 A
PSAB ENGINEER’S OFFICE - SABS 1200 AB
PSC SITE CLEARANCE - SABS 1200 C
PSD EARTHWORKS - SABS 1200 D
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PSMK KERBING AND CHANNELLING - SABS 1200 MK
PSMM ANCILLARY ROADWORKS - SABS 1200 MM
C3.4: PARTICULAR SPECIFICATIONS

In addition to the Standardized and Project Specifications the following Particular Specifications / Policies shall apply to this contract and are available on web address: ftp://ftp.durban.gov.za/cesu/StdContractDocs/:

C3.4.1 Covid Health and Safety Specification (9 Pages)

Site Specific Health and Safety Specification in terms of 2014 construction regulations (22 pages)

Baseline Risk Assessment (11 Pages)

C3.4.2 PEM Environmental Management Specifications (60 Pages)

C3.4.3 PS ELE Electrical Project Specifications (63 Pages)

C3.4.4 PS ELT Telemetry Project Specifications (11 Pages)

C3.4.5 PS PU Building Work (12 Pages)

C3.4.6 PS CAT Cathodic Protection and Alternating Current Mitigation Technical (212 Pages)

C4 SITE INFORMATION (Volume 2)

C4.1 Locality Plan (Included in Vol 3)

C4.2 Conditions on Site (Geotechnical Report) (white)

C4.3 Test Results (white)

C5 Geotechnical Report
## ETHEKWINI MUNICIPALITY
### Occupational Health & Safety Unit

### COVID 19 Health and Safety Specification

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<td>Internal Reference no.</td>
<td>COVID 58 /06/2020</td>
</tr>
<tr>
<td>Compiled by (Safety officer)</td>
<td>Name and surname: Hlengiwe Njapha Signature: [Signature] Date: 11/06/2020</td>
</tr>
<tr>
<td>Reviewed by (Manager: Safety &amp; Risk)</td>
<td>Name and surname: Arty Zondi Signature: [Signature] Date: 11/06/2020</td>
</tr>
</tbody>
</table>
COVID 19 HEALTH AND SAFETY SPECIFICATION

Background:

Corona viruses are a large family of viruses that are found both in humans and animals. Some of these viruses are known to cause illnesses ranging from common cold to severe respiratory diseases. Corona virus (COVID-19) was identified in December 2019 in China. COVID-19 infections have spread to other countries in the world. Exposure to Covid-19 may cause flue like symptoms such as coughing, sneezing, headaches, fever, sore throat and at times affect the lungs and airways of employees. Symptoms can be mild, moderate, severe or fatal.

Coronavirus Disease 2019 (COVID-19) is a respiratory disease caused by the SARS-CoV-2 virus. To reduce the impact of COVID-19 outbreak conditions on businesses, workers, customers, and the public, it is important for all employers to plan now for COVID-19. For employers who have already planned for influenza outbreaks involving many staff members, planning for COVID-19 may involve updating plans to address the specific sources of exposure, routes of transmission, and other unique characteristics of SARS-CoV-2 (i.e. compared to influenza virus outbreaks).

Introduction

The legislation governing workplaces in relation to COVID-19 is the Occupational Health and Safety Act, Act 85 of 1993, as amended, read with the Hazardous Biological Agents Regulations. Section 8 (1) of the Occupational Health and Safety (OHS) Act, Act 85 of 1993, as amended, requires the employer to provide and maintain as far as is reasonably practicable
a working environment that is safe and without risks to the health of employees. Specifically, section 8(2)(b) requires steps such as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard before resorting to Personal Protective Equipment (PPE). However, in the case of COVID-19, a combination of controls is required, although the main principle is to follow the hierarchy of controls.

While engineering and administrative controls are considered more effective in minimizing exposure to SARS-cov-2, PPE may also be needed to prevent certain exposures. While correctly using PPE can help prevent some exposures, it should not take the place of other prevention strategies.

This is a risk assessment for dealing with the current COVID-19 situation in the construction site. It may not likely to cover all scenarios therefore Construction Management should develop Standard Operating Procedures as there may be unique circumstances and make a necessary call in the interest of the health and safety of employees.

This is a risk assessment for dealing with the current COVID-19 situation in the construction site. It may not likely to cover all scenarios therefore management should develop SOP’s as there may be unique circumstances and make a necessary call in the interest of the health and safety of Contractor employees.

Definitions

“BCEA” means the Basic Conditions of Employment Act, 1997 (Act No.75 of 1997)

“COVID-19” means Coronavirus Disease 2019

“Disaster Management Act” means the Disaster Management Act, 2002 (Act No.57 of 2002)


“PPE” means personal protective equipment

“virus” means SARS-Cov-2 virus

“Worker” means any person who works in an employer’s workplace including an employee of the employer or contractor, a self-employed person or volunteer

“workplace” means any premises or place where a person performs work
“NICD” means National Institute for Communicable Diseases
“OMP” means Occupational Medical Practitioner

COVID 19 Risk Assessment:

- The Contractor must ensure that COVID 19 Risk Assessment (COVID 19 Health and Safety Plan) is conducted and submitted to the Client prior to the commencement of the construction work, it must be in line with the Client COVID 19 Health and Safety Specification.
- The Contractor must appoint COVID 19 Compliance Manager to ensure that all necessary COVID 19 safety precautions are implemented to prevent the spread.

Training and awareness:

- The Contractor must ensure that all employees are inducted on COVID19 contractor risk assessment to prevent the spread.
- The Contractor must ensure that the employees are trained on COVID 19 to prevent the spread of the virus, training records must be kept in the Safety File.
- COVID-19 Direction on Health and Safety in the Workplace Government Gazette dated 29 April 2020, must be used as guideline and be customized to specific construction site.
- The Contractor must provide workers with information that raises awareness in any form or manner, including where reasonably practicable leaflets and notices placed in conspicuous places in the workplace informing workers of the dangers of the virus, the manner of its transmission, the measures to prevent transmission such as personal hygiene, social distancing, use of cloth masks, cough etiquette and where to go for screening or testing if presenting with symptoms.

Hand Hygiene:

- The Contractor must provide adequate facilities for the washing of hands with soap and clean water on each construction site.
- The Contractor must provide 70% alcohol-based hand sanitizers at strategic points of the construction site.
- The Contractor must paper towels to dry hands after hand washing.

Cleaning and Disinfecting surfaces:

- The Contractor must take measures to ensure that all work surfaces and equipment are disinfected before work begins, regular during the working period and upon completion the work.
- The Contractor must ensure frequently cleaning and disinfecting objects and surfaces that are touched regularly particularly in areas of high use such as shared tools, taps, ablution facilities, hand rails light switches, eating and changeroom areas, shared construction vehicles, etc. using appropriate disinfecting solutions such clean water, soap and bleach.
Social Distancing:

- The Contractor must arrange the construction site to ensure minimal contact between workers and as far as practicable that there is a minimum of 1.5 meter distance between workers while they are working. Employees are aware to maintain social distance when working.
- The Contractor must ensure that social distancing measures are implemented through supervision of both the construction site and in the common areas outside the workplace, through queue control or within the workplace, these measures may include dividing the workers into groups or staggering break times to avoid the concentration of workers in common areas.
- The Contractor must ensure that where the minimum distance is impossible employees must always be instructed to wear cloth mask/FFP1/2 mask or reducing the number of workers present in the construction site at any time to achieve the required social distancing.
- The Contractor must ensure that employees working in offices are provided with physical barriers placed between work their workstations.

Personal Protective Equipment (PPE)

- The Contractor must ensure that every worker is provided with two cloth masks to be worn when in workplace or public which comply with the requirement set out in the guideline issued by Department of Trade, Industry and Competition.
- The main benefit of everyone wearing a cloth mask is to reduce the amount of virus droplets being coughed up by those with infection and transmitted to others and to surface that others may touch.
- Every Contractor must ensure that workers are informed, instructed, trained and informed as to the correct use of cloth mask.
- The Contractor must ensure to issue face shield/visors where applicable as double protection.

Point of entry screening

- The Contractor must identify the screening area for each construction site.
- The Contractor must ensure that the daily point of entry screening is conducted when entering construction site by a person nominated by the Contractor.
- The Contractor must ensure that all employees and visitors are screened and only those with all clear will be given clearance to carry on with construction work.
- The Contractor must ensure that during the screening a 1.5 m distance is maintained and FFP1/2 mask to be worn by a nominated person.
- The Contractor must ensure that the screening person is trained.
- The Contractor must ensure that a bottle of sanitiser is available at the screening area.
- The Contractor must ensure that the thermal device are provided during the screening process.
The Contractor must ensure that all employees complete a COVID 19 Questionnaire which will be used to screen potential risk personnel entering the construction site.

Symptomatic employees

- The Contractor must ensure that any person who ticks YES to one or more symptoms will be sent home and be advised to seek testing by a healthcare provider.
- The Contractor must ensure that employees who are sick with continuous cough, sore throat, difficulty breathing, or a high temperature in the workplace will be encouraged to stay home.
- The Contractor must ensure that the positive tested COVID 19 case, the employee is on paid sick leave in terms of section 22 of BCEA or if the employee’s sick leave is exhausted, the Contractor shall apply for an illness benefit.
- The Contractor must ensure that employees confirmed to have COVID 19 will be managed in line with National Department of Health COVID 19 guidelines.
- The Contractor must isolate the worker with confirmed COVID case and issued him/her with FFP2 or surgical mask, arrange for the worker to be transported for further medical examination or testing, in a manner that does not place other workers or members of the public at risk
- The Contractor must ensure that the driver who is transporting the Person Under Investigation is provided with surgical mask or FFP2 mask.
- The Contractor must assess the risk of transmission, disinfect the work area and refer those workers who may be at risk for screening to prevent possible transmission.
- The Contractor must advise the Communicable Disease Centre (CDC) so that other contacts be identified and be investigated
- The Contractor must ensure that tested positive for COVID 19 is not discriminated in terms of Employment Equity Act no. 55 of 1998.
- The Contractor must ensure that if there is evidence that the worker contracted COVID 19 as a result of occupational exposure, lodge a claim for compensation in terms of the Compensation for Occupational Injuries and Diseases Act no. 130 of 1993.
- The Contractor must ensure that if a worker has been diagnosed with COVID 19 and isolated in accordance with the National Department of Health Guidelines, a Contractor may only allow a worker to return to work on the following conditions, the worker has undergone a medical evaluation confirming that the worker has been tested negative for COVID 19.

Emergency Numbers

- Corona virus (COVID-19) 24-Hour Hotline number:0800 029 999
- Corona virus (COVID-19) WhatsApp Number: 0600 12 3456
- COVID-19 National Crisis Helpline - 0861 322 322
- NICD (National Institute of Communicable Diseases) 24-Hour toll-free hotline number: 0800 029 999 or 0800 111 132
- SAPS gender-based violence service complaints (SAPS) - 0800 333 177
GBV (Gender Based Violence) Command Centre -0800 428 428/ *120*7867# (free from any cell phone)/ SMS Line: 32312
Women Abuse Helpline - 0800 150 150
People Opposing Women Abuse (POWA) - Tel: 011 642 4345/ Afterhours cellphone: 0837651235
Child Line - 0800 055 555
LifeLine South Africa - 0800 012 322 (free on mobile networks including landlines)
FAMSA - Advice on family relationships - 011 975 7107
Human trafficking - Report cases of human trafficking - hotline operated by the Salvation Army and Be Heard - 08007 37283 (0 8000-rescue)
National Human Trafficking Helpline - 0800 222 777
Persons with Disabilities - SMS ‘help’ to 31531
National AIDS Helpline - 0800 012 322
Suicide HELpline - 0800 567 567
Stop Gender Violence - Anonymous, confidential and accessible telephonic information, counselling and referrals, in all 11 official languages - 0800 150 15
Substance Abuse Helpline - 0800 12 13 14

Recommended Best Practice

- The Contractor must ensure that vulnerable and 60 years old workers are identified and received a special measure for their protection.
- The Contractor must ensure that for communication strategy Microsoft Team, ZOOM or Skype or cell phones are used to prevent the spread of COVID 19 virus.
- The Contractor must ensure to keep the workplace well ventilated by natural or mechanical means to reduce the SARS – CoV – 2 viral loads.

References

- COVID-19 Disaster Management Act
- Occupational Health & Safety Act 85 of 1993
- Hazardous Biological Agents Regulations
- National Institute for Occupational Health (NIOH)

N.B. Please be aware that we are waiting for COVID 19 Construction Health and Safety Guideline issued by Department of Labour, which that they might be changes on this SPECIFICATION.
Covid-19 access into construction site, point of entry screening questionnaire

Company / Construction Site: __________________________________________

Name and Surname: ______________________________________ Co No: _________________

Line Manager Name: __________________________________________

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
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<tbody>
<tr>
<td>1. Have you had flu or symptoms of flu in the last few weeks?</td>
<td></td>
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<tr>
<td>2. Do you have a persistent cough that has started in the last few days?</td>
<td></td>
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<tr>
<td>3. Do you have symptoms of fever? (red, tearing or burning eyes, sweats, clammy hands)?</td>
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<tr>
<td>4. Do you have any signs of a respiratory infection, shortness of breath, difficulty breathing? (Self-test: Hold in your breath for 10 seconds)</td>
<td></td>
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</tr>
<tr>
<td>5. In the last 14 to 21 days, have you travelled outside the borders of South Africa?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. In the last 14 to 21 days, have had contact with anybody that has travelled outside the Provincial or South African borders?</td>
<td></td>
<td></td>
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<tr>
<td>7. Have you been near or in contact with anyone who has symptoms or tested positive for COVID-19?</td>
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</tr>
</tbody>
</table>

If you have answered yes to any of the above questions, please inform your supervisor immediately. Brief description of events (When, where and who else were you with:)
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

Personal Commitment
✓ I further undertake to immediately report any change in my medical condition to my supervisor/manager!
✓ I will always maintain excellent personal and company hygiene standards!
✓ I will utilize PPE and sanitizers provided to me to prevent the spread of the virus!
✓ I will ensure all equipment / materials handed over to another person has been cleaned and sanitized!
✓ I will not abuse, misuse, share or lose the PPE and related materials / equipment issued to me!

Employee Signature
Date

Temperature: _____ ⁰C. (If temperature is at 38°C or higher refer to Process Flow Annexure 1 document then deny entry, isolate and start reporting process)

Entry Cleared      Yes [ ] No [ ]

Construction Manager/Supervisor: ___________________________ Signature: _______ Date: __________

Comments:_________________________________________________________________________________
_______________________________________________________________________________________
_______________________________________________________________________________________
## Site Specific Health and Safety Specification in terms of 2014 Construction Regulations 5.1(b)

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<td>Contract Number</td>
<td></td>
</tr>
<tr>
<td>Compiled by (Safety Officer)</td>
<td>Name and Surname: Mngeni Nkapha</td>
</tr>
<tr>
<td></td>
<td>Signature: [Signature]</td>
</tr>
<tr>
<td></td>
<td>Date: 19 March 2020</td>
</tr>
<tr>
<td>Approved by (Safety and Risk Manager)</td>
<td>Name and Surname: [Signature]</td>
</tr>
<tr>
<td></td>
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33. Stacking and Storage on Construction Site
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35. Structures
36. Corona Virus
1. PROJECT DESCRIPTION

The Construction of a new 10ML – Reinforced Concrete Reservoir and associated infrastructure

2. LIMITATIONS OF LIABILITY

The Principal Contractor shall enter into a Mandatory Agreement with the Client, as defined in Section 37(2) of the Occupational Health and Safety ACT.

The Principal Contractor shall ensure that each contractor appointed by the Principal Contractor and each sub-contractor appointed by a contractor also into a Mandatory Agreement with the Principal Contractor, as defined in Section 37(2) of the Occupational Health and Safety ACT. These agreements shall be included in the Principal Contractor’s H&S File on site and be valid for the duration of the contractors’ work on the construction site.

3. PURPOSE OF THE CONSTRUCTION H&S SPECIFICATION

This document defines the minimum management requirement that is to be implemented by the Principal Contractor/Contractor for the management of Health and Safety on any eThekwini Municipality project.

The aim of this document is to present the health and safety aspects that need to be controlled and managed on the project.

This Health and Safety specification identifies and encompasses the working behaviours and safe work practices that are expected of all employees, Vendors and Contractors, Sub-Contractors and Visitors, engaged on construction site.

Providing a guideline to comply with best Health & Safety practices and the Occupational Health and Safety Act85/1993 as amended, including reference to applicable legislative requirement.
4. PROJECT HEALTH AND SAFETY COST

The Client must ensure that potential Principal Contractor submitting tenders have made adequate provision for the cost of health and safety measures. The Principal Contractor shall allow in their cost provision for complying with the requirements of this Client Health and Safety Specification; resources for the following H&S controls shall be in place.

<table>
<thead>
<tr>
<th>H&amp;S cost item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Full /Part time safety officer</td>
<td>Full/Part time attendance on site of a SACPCMP registered safety officer from the start of construction until the end of project handover</td>
</tr>
<tr>
<td>2. First Aiders</td>
<td>First Aid training</td>
</tr>
<tr>
<td>3. Competent inspectors</td>
<td>Statutory inspections of excavations, temporary works, fire extinguishers, lifting equipment, lifting machinery, construction vehicles and mobile plant, portable electrical equipment, Electrical Installation Controller etc.</td>
</tr>
<tr>
<td>4. Medical certificate of fitness</td>
<td>Medical examination of all employees and certification of fitness by an Occupational Medicine Practitioner Pre-employment and annual</td>
</tr>
<tr>
<td>5. PPE</td>
<td>Standards set for all employees Including community and environment</td>
</tr>
<tr>
<td>6. Dust mitigation</td>
<td>To reduce dust exposure to the employees and the public</td>
</tr>
<tr>
<td>7. Public protection and barricading</td>
<td>Barricading, shoring and notices</td>
</tr>
<tr>
<td>8. Employee facilities</td>
<td>Refer to the Facilities Regulations (drinking water, change facility, personal lockers, and wash facilities, eating facilities, ablution toilets)</td>
</tr>
<tr>
<td>9. Traffic management</td>
<td>Traffic controller’s training and traffic signage</td>
</tr>
<tr>
<td>10. Signage</td>
<td>All construction safety signage required for the project</td>
</tr>
<tr>
<td>11. Other</td>
<td><strong>Excavation, Blasting and Compaction risk handling</strong></td>
</tr>
</tbody>
</table>
5. SCOPE OF WORK

The works will broadly include but not limited to:
Earthworks founding improvements including bulk and restricted excavation, backfill of the works and structures
Construction of a Square – 10 ML Reinforced concrete reservoir with associated, in and outlet control structures
Appurtenant pipework, fittings and temporary bypass work
Storm water and drainage control for the works
Upgrading of the parking and access road at the reservoir
Repair and replacement of access control gates and fences
Upgrade and installation of new electrical supply, telemetry, and cathodic installations
Including the protection of the existing services during construction

6. COMPENSATION FOR OCCUPATIONAL INJURIES AND DISEASES ACT

The Principal Contractor, each contractor and each sub-contractor shall submit proof of Good Standing with COIDA Commissioner or a Mutual Association licensed in terms of Section 30 of COIDA, prior to starting any work on site.

A copy of the Letter of Good Standing with COIDA Commissioner must be included in the H&S Plan of each contractor working on the site and must remain updated for the duration of the construction work.

7. APPLICATION FOR CONSTRUCTION WORK PERMIT

The Principal Contractor shall assist the Client in compiling the evidence required by the Department of Labour for the issuing of the Construction Work Permit.

The Principal Contractor shall ensure that the H&S Plan presented for approvals includes:

- Evidence that the Principal Contractor made adequate provision for the cost of H&S measures
- Evidence that the Principal Contractor has the necessary competencies and resources to carry out the construction work safely.
- A copy of the Letter of appointment of the Construction Manager in terms of CR 8(1) + proof of his qualification, competence and registration where applicable.
- Proof of the registration of the Principal Contractors Health & Safety officer with the SACPCMP.
The Principal Contractor shall display the work permit number at the main site entrance. This display must be conspicuous to the satisfaction of the Department of Labor. The permit must be noticeable.

The construction works can only commence once the construction work permit is issued by the Department of Labor.

8. MANAGEMENT AND SUPERVISION OF CONSTRUCTION WORK

8.1 Construction Manager

The Principal Contractor shall appoint a full-time competent person as the construction manager with the duty of managing all construction on the site including the duty of ensuring occupational health and safety compliance.

The Construction Manager must demonstrate competency in relation to work being performed and the ability to manage construction work which may include making all statutory appointments in terms of health and safety.

8.2 Construction Health and Safety Officer

The Principal Contractor shall appoint a full-time competent Construction health and Safety Officer for the construction work. The Construction Safety Officer shall be full on the construction site for this project.

The Safety Officer shall be registered with the South African Council for the Projects and Construction Management Professions. Proof of competence and registration of the appointed Construction Safety Officer must be included in the H&S Plan.

8.3 Construction Supervisor

A Construction Manager must in writing appoint construction supervisors responsible for construction activities and ensuring occupational health and safety compliance on the construction site. A contractor must, upon having considered the size of the project, in writing appoint one or more competent employees for different sections thereof to assist the construction supervisor contemplated in sub regulation (7), and every such employee has, to the extent clearly defined by the contractor in the letter of appointment, the same duties as the construction supervisor: Provided that the designation of any such employee does not relieve the construction supervisor of any personal accountability for failing in his or her supervisory duties in terms of this regulation.
9. PRINCIPAL CONTRACTOR’S HEALTH AND SAFETY PLAN

The Principal Contractor shall submit a suitable, sufficiently documented and coherent specific health and safety plan based on the Client documented Health and Safety Specification. The health and safety plan shall include but not limited to the following

- Objectives
- Scope of work
- Management of construction and supervision
- Monitoring and review plan
- Sub-contractor management
- Risk Assessment & Written Safe Working Procedures
- Roof work planning/ methodology
- Incident Management & First Aid
- Emergency procedures/ plan
- Fire Prevention & Protection
- Public Health and Safety
- Working Close to Existing Structures
- PPE Provision
- Health & Safety Signage
- Excavations
- Earthworks, Improvements, Compaction and use of Explosives
- Structures
- Site establishment
- Soil poisoning
- Existing services
- Demolishing Structures
- Construction Vehicles and Mobile Plants
- Hand & Electrical Tool Management
- Construction Employees Facilities
- Health & Safety Policies
- Health and Safety Training & Competencies
- Housekeeping
- Hazardous Chemicals
- Inductions
- Medicals
- Site Security
- Stacking and Storage
- Internal and external Audit
• Inspection Registers
• Toolbox Talks
• Site Establishment
• Removal of Rubble and Large Trees
• Corona Virus

10. HAZARD IDENTIFICATION AND RISK ASSESSMENT

The Principal Contractor shall before commencement of any construction and during such construction works have risk assessments performed by appointed competent person in writing which forms part of the health and safety plan to be applied.

The following problems will be encountered during construction Specific attention to be given to the following,

• Methods of excavation
• Compaction equipment and the use thereof
• Blasting- fly rocks and Boulders,
• Drilling- Noise and Vibration,
• Handling of overburden and heavy machinery,
• Storage of diesel,
• Slope failures

The provisions of Regulation 9 of the Construction Regulations shall be followed in every detail.

11. HEALTH AND SAFETY FILE

The Client must discuss and negotiate with a Principal Contractor the content of the Health and Safety Plan and thereafter finally approve the Health and Safety plan for implementation. The recommended Health and Safety file shall include the following:

• Client Health & Safety Specification
• Principal Contractor Health & Safety Plan
• Letter of good standing
• Section 37.2 Mandatory Agreement
• Contractor appointment letter in terms of CR 5.1(k)
• Legal appointments and competencies (Site manager, Site supervisor, Safety officer, Risk assessor, Incident investigator, Fall protection planner, Temporary work designer, Temporary work supervisor, Electrical installation supervisor)
• Risk Assessments as per scope of work
• Written Safe Working Procedures as per risk assessment
12. HEALTH AND SAFETY REPRESENTATIVES AND COMMITTEE

Health and Safety Representatives

- The Principal Contractor shall ensure that Health and Safety Representatives are appointed in writing and exercise their functions as defined in OHSA.
- The Principal Contractor shall elect and appoint a health and safety representative regardless of the number of employees on the site.
- The H&S representative shall at all times be on site and report to the Health and Safety Officer and Construction Manager.

Health and Safety Committee

- The Principal Contractor shall ensure that the H&S committee meets on a monthly basis
- The Principal Contractor’s management and each contractor shall be represented at the H&S committee meeting; contractors with more than 20 employees shall have an H&S representative at each committee meeting and each contractor shall have a management member attending each H&S committee meeting.

13. CLOSE-OUT CONSOLIDATED HEALTH AND SAFETY FILE

The Principal Contractor shall compile a consolidated H&S file and hand over to the Water and Sanitation Unit – Prior Road for attention: Roxanne. OHS Unit will conduct a project close out using the appropriate checklist before the completion of the project.
14. HEALTH AND SAFETY TRAINING

The Principal Contractor shall ensure that employees are trained on health and safety measures this shall include but not limited to:

- Written Safe Working Procedures
- Risk Assessments
- Health and Safety Plan
- Emergency Management Plan
- Induction
- Toolbox Talks
- MSDS

15. INCIDENTS MANAGEMENT & FIRST AID

All incidents and accidents as per Section of the Act must be reported, recorded and investigated as per General Administration Regulation 8 & 9

Where a fatality or permanent disabling injury or incident occurs on the Construction site, the Client must ensure that the Principal Contractor provides the Provincial Director with a report contemplated in Section 24 of the Act and the report includes the measures that the Principal Contractor intends to implement to ensure a safe construction site.

16. HEALTH AND SAFETY AUDITS

The Client must ensure that periodic health and safety audits are conducted at intervals mutually agreed upon between the Principal Contractor and the Client at least every 30 days, the copy of the health and safety audit report must be provided to the Principal Contractor within seven days after the audit.

17. FIRE PRECAUTIONS ON CONSTRUCTION SITE

The Principal Contractor shall provide suitable fire extinguishers which shall be serviced regularly in accordance with the manufacture’s recommendations.

Safety signage shall be prominently displayed in all areas where fire extinguishers are located. The Principal Contractor shall arrange for training of the relevant personnel, in the use of fire extinguishers.
The provisions of Regulation 29 of the Construction Regulations as well as Regulation 9 of Environmental Regulation for Workplaces shall be followed in every detail.

18. ELECTRICAL INSTALLATIONS AND MACHINERY ON CONSTRUCTION SITE.

The Principal Contractor shall designate a competent electrician in writing who shall control all electrical installations.

All temporary electrical installations used by the contractor are inspected at least once a week by a competent person and the inspection findings are recorded in a register kept on the construction site.

All Electrical machinery is inspected by the authorized operator or user on daily basis using a relevant checklist prior to use and the inspection findings are recorded in a register kept on the construction site.

The provisions of Regulation 5, 6 & 9 of the Electrical Installation Regulations shall be followed in every detail.

19. PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING.

The Principal Contractor shall ensure that every employee is issued with, and wears SANS-approved P.P.E. as per the conducted risk assessment.

Failure to use protective equipment as per the risk assessment shall require disciplinary intervention and this process shall be documented in the induction.

No employer shall in respect of anything which he is in terms of this Act required to provide or to do in the interest of health or safety of an employee make any deductions from any employee’s remuneration or require or permit any employee to make any payment to him or to any other person.

The provisions of Regulation 2 of the General Safety Regulations shall be followed in every detail.

20. OCCUPATIONAL HEALTH AND SAFETY SIGNAGE

The Principal Contractor shall erect and maintain quality safety signage

The signage shall include but is not limited to:

- The construction work permit number displayed at the entrance
- Access restrictions
• A sign indicating that all visitors must report to the site office and must be accompanied by the Principal Contractor when accessing the site
• The name and telephone number of the responsible person(s)
• Emergency telephone number(s)
• PPE to be worn at the particular site
• When falling objects may occur, relevant barricading and warning signs must be erected
• Excavations, heights structures, temporary structures and all risk areas must be indicated as per the specific methods defined in the H&S Plan.

21. DUTIES OF PRINCIPAL CONTRACTORS AND CONTRACTORS

Contractors and sub-contractors must be given a copy of the H&S specification and any additional specification issued by the Client and shall comply with these specifications integrally. All employers working on the site shall conform to the standard in the CHSS. All the duties of the Principal Contractor in this CHSS equally apply, in full, to contractors of such Principal Contractor and to sub-contractors of such contractors.

The Principal Contractor shall ensure that the comprehensive and updated list of all the contractors and sub-contractors on site includes:

• A reference to the agreements between the parties, including all contractors
  Section 37(2) agreements with the Principal Contractor
• The type of work being done
• The date of the approval of the H&S Plan
• The date of expiry of the COIDA certificate of good standing
• The date of the last monthly audit

Prior to the commencement of any construction activities can commence the contractor will

• Conduct a detailed Condition survey to identify the condition of the structures within 100m of the site fence and include fences and houses, the survey to include home owner’s name, Structural photos of all structures. Provide 3 copies to the Engineer for review and acceptance.

The provisions of Regulation 7 of the Construction Regulations shall be followed in every detail.
22. FALL PROTECTION AND WORKING IN FALL RISK POSITIONS

The Principal Contractor shall ensure that the fall protection plan include a risk assessment for all work carried out from the fall risk position and the safe work procedures.

All employees working from fall risk position are subject to medical examination. The Training Programme must be in place for employees working from a fall risk position. The procedures addressing the inspection, testing and maintenance of all fall risk protection equipment. The rescue plan detailing procedure, personnel and suitable equipment to be used to rescue a person. The Principal Contractor must that a competent person is designated to be responsible for the preparation of the fall protection plan.

The provisions of Regulation 10 of the Construction Regulations shall be followed in every detail.

23. EXCAVATION AND COMPACTION

The Principal Contractor must ensure that all excavation and compaction work is carried out under the supervision of a competent person who has been appointed in writing for that purpose.

The Principal Contractor shall take cognizance of the geotechnical study pertaining to the conditions of the construction site and must plan all excavation work in accordance with the recommendations of the professional engineer.

The Principal Contractor must ensure that every excavation, including all bracing and shoring, is inspected daily, prior to the commencement of each shift and that no person enters the excavation or works in a risk zone until the excavation is assessed and declared safe.

All excavations must be left open for the minimum of time required and those that are left open on the site must be protected by a barrier or a fence of at least one meter in height as close to the excavation as is practicable. The protective barrier or fence must adequately prevent persons from falling into the excavation and barrier taping is not sufficient for this purpose

Excavation shoring and bracing, if required shall be designed by a designer appointed in writing who shall inspect and approve the installed shoring and bracing

Where persons work, inspect or test excavations, warning signs must be in place next to an excavation.
The provisions of Regulation 13 of the Construction Regulations shall be followed in every detail.

24. PUBLIC HEALTH AND SAFETY

The site shall at all times be secured to prevent the unauthorized access of persons to construction risk areas.

Appropriate health and safety signage shall be posted and access control to site must be exercised via a single access point.

All members entering the site must indicate in what capacity they are visiting the site.

The access point must be designed and constructed to allow for temporary parking, entry of construction vehicles, entry of personnel transport vehicles and entry of individual workers and other persons.

The principal Contractor shall ensure that each person visiting the site shall be inducted to the site and such abridged induction shall outline the hazards from on-site activities and the precautions to be observed to avoid or minimize those risks.

Visitors must only enter when accompanied by a responsible person designated by the Principal Contractor.

25. NIGHT; WEEK–END WORK

No night or weekend work shall be performed unless authorized by the Principal Agent or Lead Engineers.

Where weekend work is planned the Principal Contractor shall ensure that its construction supervisor is on site, this applies even if only contractors or sub-contractors are working on the site.

Where weekend work is planned each contractor or sub-contractor shall ensure that its construction supervisor is on site, this applies even if the Principal Contractor’s manager or supervisor is on the site.

26. CONSTRUCTION EMPLOYEES FACILITIES

The Principal Contractor shall provide at or within reasonable access of every construction site, the following clean, hygienic and maintained facilities:

(a) Shower facilities after consultation with the employees or employees
representatives, or at least one shower facility for every 15 persons; 
(b) at least one sanitary facility for each sex and for every 30 workers; 
(c) changing facilities for each sex; and 
(d) sheltered eating areas.

The provisions of Regulation 2, 3, 4, 6, 7, 9 of the Facilities Regulations shall be followed in every detail.

27. CRANES AND LIFTING OPERATIONS

The Principal Contractor must ensure the cranes used are:
Are designed and erected under the supervision of a competent person; 
A relevant risk assessment and method statement are developed and applied; The effects of wind forces on the crane are taken into consideration and that a wind speed device is fitted that provides the operator with an audible warning when the wind speed exceeds the design engineer’s specification; The bases for tracks for rail-mounted tower cranes are firm, level and secured; The tower crane operators are competent to carry out the work safely; and The tower crane operators have a medical certificate of fitness to work in such an environment, issued by an occupational health practitioner in the form of Annexure 3

28. STORAGE AND USE OF FLAMMABLE LIQUIDS

No flammable substances must be stored on site unless these are stored in a flammable store or cabinet approved by the Municipal Chief Fire Officer, no other materials shall be stored in the flammable store or cabinet.

Where required the H&S Plan shall include a method statement detailing the safe use, storage, decanting and spill controls for all flammable liquids used and stored on site.

The provisions of Regulation 25 of the Construction Regulations shall be followed in every detail.

29. HAZARDOUS CHEMICAL SUBSTANCE

With respect to hazardous chemical substances used, the contractor shall ensure that:

- All MSDS are included in the H&S File
- A HCS risk assessment is included in the H&S Plan
- The safe use, storage, emergency procedures and safe disposal of hazardous substances are addressed in a method statement(s) included in the H&S Plan.
- Proof of competency and signed letters of appointment of the person responsible for chemical handling is included in the H&S File.
Any hazardous chemical substance intended to be applied on site during the project (i.e. after approval of the H&S Plan) shall be subject to an issue-based risk assessment and method statement which must be presented to the Client Agent prior to the substance being introduced on site.

The provisions of Regulation 3, 5, 7, 8, 9, 9A, 10, 11, 14, 15 of the Hazardous Chemical Substances Regulations shall be followed in every detail.

30. EXPLOSIVE AND FASTENING DEVICES

The principal Contractor shall submit proof of competency and the appointment letter of the person in charge of explosives as well as actuating fastening devices and of the person in charge of the issuing and collection of Explosives, cartridges and nails. This shall be placed in the H&S Plan.

The H&S Plan shall include the method statement for the safe use of explosives, actuating fastening devices including the type PPE, barricading and warning notice which the Contractor intends to use and the method of accounting for cartridges and nails and explosives.

The H&S Plan shall include proof of training and competency of all operators using explosive actuating fastening devices.

A template inspection register of explosive, and actuating fastening device shall be included in the H&S Plan.

A template record for the issuing and collection of explosives, cartridges and nails shall be included in the H&S Plan.

For the purpose of acquisition / transport of the cartridges the Principal Contractor is required to hold a permit in terms of the Explosive’s Act. This permit for the transportation of Blank cartridges used in Power-Actuated Tools shall be placed in the H&S Plan:

- Application for registration, licenses and permits must be submitted by the Chief Inspectors Office in Pretoria.
- The Principal Contractor is required to be in possession of a continuous transport license but is not required in terms of the Explosives Act to hold a permit for the use of the blank cartridges.
- Once the cartridges are delivered to the appointed responsible person is then required to ensure that the Regulations governing the safe use of explosive powered tools in terms of the Construction Regulation 21 of the Occupational Health and Safety Act, Act 85 of 1993 are complied with.
The provisions of Regulation 21 of the Construction Regulations shall be followed in every detail.

31. HOUSEKEEPING AND GENERAL SAFE GUARDING ON CONSTRUCTION SITE

The Principal Contractor shall appoint a person responsible for general housekeeping and stacking and storage of materials and equipment on the entire site.

The provisions of Regulation 27 of the Construction Regulations shall be followed in every detail.

32. CONSTRUCTION MEDICALS

A Principal Contractor must ensure that all his or her employees have a valid medical certificate of fitness specific to the construction work to be performed and issued by an Occupational Health Practitioner in the form of Annexure 3.

33. STACKING AND STORAGE ON CONSTRUCTION SITE

A Principal Contractor must, in addition to compliance with the provisions for the stacking of articles in the General Safety Regulations, 2003, ensure that—
A competent person is appointed in writing with the duty of supervising all stacking and storage on a construction site; Adequate storage areas are provided; There are demarcated storage areas; and storage areas are kept neat and under control.

34. INDUCTION AND TOOLBOX PROGRAMME

No contractor may allow or permit any employee or person to enter any site, unless that employee or person has undergone health and safety induction training pertaining to the hazards prevalent on the site at the time of entry.
A contractor must ensure that all visitors to a construction site undergo health and safety induction pertaining to the hazards prevalent on the site and must ensure that such visitors have the necessary personal protective equipment.
A contractor must at all times keep on his or her construction site records of the health and safety induction training contemplated in sub-regulation (6) and such records must be made available on request to an inspector, the client, the client's agent or the principal contractor. The Principal Contractor must ensure that the toolbox talks are conducted on weekly basis and the training records kept on the safety file
35. STRUCTURES

A contractor must ensure that all reasonably practicable steps are taken to prevent the uncontrolled collapse of any new or existing structure or any part thereof, which may become unstable or is in a temporary state of weakness or instability due to the carrying out of construction work; No structure or part of a structure is loaded in a manner which would render it unsafe; All drawings pertaining to the design of the relevant structure are kept on site and are available on request to an inspector, other contractors, the client and the client’s agent or employee.

36. CORONA VIRUS

Principal Contractor shall comply with the Covid 19 RMP issued by Occupational Health and Safety Unit.
## Designer’s Health and Safety Checklist

### Item and Legal Reference | Y/N | Comment
--- | --- | ---
CR 6(1) (a) Has the designer familiarized himself with the Construction Regulations 2014 (particularly Regulation 6) and the Safety Standards incorporated into these Regulations? | Yes | To be included as part
CR 6(1) (b) During the design stage, was the Client’s Health and Safety Specifications given due consideration? | Yes | Included in Construction tender
The structural design aspects that could have an effect on the pricing of construction work? | Yes | On site manufacturing was reviewed
The geotechnical-science aspects? | Yes | Major Blasting and Hard rock removal Risk identified to be addressed by contractor
The weight which the structure is designed to safely withstand? | Yes | Standard design
| CR 6(1)(d) | Has the designer communicated all known and anticipated hazards and risks associated with the construction of the designed structure? Furthermore, has the safe method statement been developed to ensure that construction work is safely executed? | yes | Contractor to note compaction risk close to existing structures  
Contractor to provide prior to construction can commence |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CR 6 (1) (e)</td>
<td>As far as is reasonably practicable, are the dangerous processes and materials been eliminated or replaced in the design?</td>
<td>Yes</td>
<td>Contractor to consider prior to construction can commence</td>
</tr>
<tr>
<td>CR 6(1) (f)</td>
<td>Has due consideration been taken during the design stage, for the safe maintenance of the structure after its completion?</td>
<td>Yes</td>
<td>Access roads to be upgraded</td>
</tr>
<tr>
<td>CR 6 (g-i)</td>
<td>Is the designer aware of his/her responsibility to carry out periodic site inspections to ensure that the structure is constructed correctly in accordance with the design?</td>
<td>Yes</td>
<td>Part of appointment of Engineer</td>
</tr>
<tr>
<td>CR 6(1) (j)</td>
<td>Have all ergonomic hazards been considered for the lifecycle of the structure (i.e. during construction and after completion)?</td>
<td>Yes</td>
<td>Contractor will be restricted to normal working hours</td>
</tr>
</tbody>
</table>

(Please ensure that the checklist is completed in full particularly the comments column)

Name of Designer__________________________________________________________

Designer’s Title (e.g. Engineer, Architect)_____________________________________

Signature________________________________________

Date_____________________


Received by (Principal contractor): __________________________

Signature: ________________________________

Date: ________________________________
# Baseline Risk Assessment

<table>
<thead>
<tr>
<th>Document Title</th>
<th>Baseline Risk Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td>eThekwin Municipality – Water and Sanitation</td>
</tr>
<tr>
<td>Project</td>
<td>Construction of a new 10ML -Reinforced Concrete Reservoir and associated infrastructure</td>
</tr>
<tr>
<td>Contract Number</td>
<td></td>
</tr>
<tr>
<td>Compiled by (Safety Officer)</td>
<td>Name and Surname: Hlengiwe Nqapha</td>
</tr>
<tr>
<td></td>
<td>Signature:</td>
</tr>
<tr>
<td></td>
<td>Date: 19 March 2020</td>
</tr>
<tr>
<td>Approved by (Safety and Risk Manager)</td>
<td>Name and Surname: Tefelizwe Zalozi</td>
</tr>
<tr>
<td></td>
<td>Signature:</td>
</tr>
<tr>
<td></td>
<td>Date: 19 March 2020</td>
</tr>
<tr>
<td>Revision Number</td>
<td>BRA12/03/2020</td>
</tr>
</tbody>
</table>
BASELINE RISK ASSESSMENT

1. INTRODUCTION: In accordance with the Occupational Health and Safety Act, (Act 85 of 1993) the Legislator places specific requirements on an Employer. One of these is prescribed in Section 8(i) of the Act where it requires the Employer to ascertain the risks and dangers which may occur within the workplace or section of the workplace and then goes on to establish working procedures or practices.

2. PURPOSE: This is conducted to create a benchmark of the potential risks that apply to the whole project or business operation.

3. SCOPE: This assessment could be approached on a site, regional or national level concerning any facet of the business operation or process or activity.

4. REVIEW AND MONITORING PLAN

The risk assessment form part of the health and safety plan to be applied on the site and must include the following:

(a) The identification of the risk and hazards to which persons may be exposed.
(b) An analysis and evaluation of the risks and hazards identified based on a documented method

5. REFERENCES

(a) Scope of Work
(b) Occupational Health & Safety Act and its Regulation
(c) Geotechnical Report
SCOPE OF WORK

- The demolishing and disposal of existing 2 ML reinforced concrete reservoir and structures
- Earthwork founding improvements including bulk and restricted excavation, backfill of the works and structures.
- Construction of a Square- 4 ML Reinforced concrete reservoir with associated, in and outlet control measures
- Appurtenant pipework, fittings and temporary bypass work
- Storm water and drainage control for the works
- Upgrading of the parking and access road at the reservoir
- Repair and replacement of access control gates and fences
- Upgrade and installation of a new electrical supply, telemetry, and cathodic installations
- Including the protection of the existing services during construction
1. **RISK ESTIMATION AND EVALUATION**

**RISK CLASSIFICATION USING A RISK SCORE TECHNIQUE**

<table>
<thead>
<tr>
<th>Exposure (E) How frequently does the hazardous event occur</th>
<th>Risk classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuously ................................................................</td>
<td>10</td>
</tr>
<tr>
<td>Frequently (daily) ..................................................</td>
<td>6</td>
</tr>
<tr>
<td>Occasionally (weekly) ...............................................</td>
<td>3</td>
</tr>
<tr>
<td>Unusually (monthly) ..................................................</td>
<td>2</td>
</tr>
<tr>
<td>Rarely (few a year) ..................................................</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Probability (P) The probability of a loss when the hazardous event does occur</th>
<th>Risk classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent (happens often) ...........................................................................</td>
<td>10</td>
</tr>
<tr>
<td>Probable (quite possible) ...........................................................................</td>
<td>6</td>
</tr>
<tr>
<td>Occasional (unusual, but possible) ..........................................................</td>
<td>3</td>
</tr>
<tr>
<td>Remotely possible (has happened somewhere) ..............................................</td>
<td>1</td>
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<tr>
<td>Improbable (practically impossible) ..........................................................</td>
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<tr>
<th>Severity (S) Consequences of the hazardous event</th>
<th>Risk classification</th>
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<tbody>
<tr>
<td><strong>Catastrophic</strong> many fatalities; or interruption of longer than 2 weeks; or asset or environmental damage (or both) exceeding R100m ...................</td>
<td>100</td>
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<tr>
<td><strong>Disaster</strong> (few fatalities; or interruption between one and 2 weeks; or asset or environmental damage (or both) exceeding R10m) ......................</td>
<td>40</td>
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<tr>
<td><strong>Very serious</strong> (one fatality; or interruption of 6 days; or asset or environmental damage (or both) exceeding R100,000 ..................</td>
<td>7</td>
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<tr>
<td><strong>Important</strong> (temporary disability; or interruption between 6 and 24 hours; or damage exceeding R10,000 .........................</td>
<td>3</td>
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<tr>
<td><strong>Noticeable</strong> (first aid needed; or interruption of less than 6 hours; damage exceeding R1000) ..................................................</td>
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<thead>
<tr>
<th>Risk classification (Risk score = E x P x S )</th>
<th>Risk classification</th>
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<tbody>
<tr>
<td>Over 400-------5</td>
<td>Very high risk – discontinue operation or activity</td>
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<tr>
<td>200 to 400 ------ 4</td>
<td>High risk – immediate correction needed</td>
</tr>
<tr>
<td>70 to 200-------3</td>
<td>Substantial risk – correction needed</td>
</tr>
<tr>
<td>20 to 70-------2</td>
<td>Possible risk – attention needed</td>
</tr>
<tr>
<td>Under 20 ------ 1</td>
<td>Risk accepted</td>
</tr>
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## BASELINE RISK ASSESSMENT WORKSHEET: IDENTIFYING EXISTING & POTENTIAL RISKS

<table>
<thead>
<tr>
<th></th>
<th>Site Access</th>
<th>Activity</th>
<th>Hazard</th>
<th>Risk</th>
<th>Risk Evaluation</th>
<th>Risk Score</th>
<th>Risk level</th>
<th>Risk Rank</th>
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<tbody>
<tr>
<td>1</td>
<td></td>
<td>Accessing the site using construction vehicles or walking to site.</td>
<td>Excessive speed, head on collision, employees knocked by moving vehicles. Road blocked off due to community protest. Manual Handling and excessive lifting.</td>
<td>Accidents, damage to equipment or severe injuries or death. Back injuries,</td>
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<td>4</td>
<td>Demolition (existing 2ML reservoir)</td>
<td>Using small electric breakers, compressed air breakers, motorized mechanical means, explosives/ blasting</td>
<td>Noise, electrocution, dust, falling objects</td>
<td>Inhalation, hearing Impairment and injuries</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>108</td>
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<tr>
<td>5</td>
<td>Drainage/Storm water</td>
<td>Lay, bed and joint of pipes</td>
<td>Unsafe access to excavation Manual handling of pipes Possible pinch of fingers Engulfment of excavation</td>
<td>Personal injuries. Possible pinch Death/ body injury</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>108</td>
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<tr>
<td>6</td>
<td>Existing Services</td>
<td>Identify the existing Snakes</td>
<td>Poisoned and death.</td>
<td>6</td>
<td>6</td>
<td>7</td>
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<tr>
<td>Service</td>
<td>Unforeseen Hazards</td>
<td>Personal Injuries</td>
<td>Score</td>
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<tr>
<td>Pipelaying</td>
<td>Accessing trenches Mechanical lifting of Pipe and Trench collapse, falling objects/material Incorrect lifting of pipes</td>
<td>Personal injuries/death Injury to muscle</td>
<td>252</td>
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<tr>
<td>Working at height</td>
<td>Erection of Scaffolding by a Competent person Unsafe scaffolding/trestle scaffolds Unsafe scaffolding could collapse resulting in</td>
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<td>11 Steelfixing</td>
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<td>critical injuries</td>
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<td></td>
<td>Placing steel reinforcement</td>
<td>Struck by piece of steel</td>
<td>Serious cut or eye damage</td>
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<tr>
<td></td>
<td>Cutting steel reinforcement</td>
<td>Operating electric angle grinder or drop saw</td>
<td>Electric shock, burns or electrocution</td>
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<td></td>
<td></td>
<td>Cutting steel with Oxy Acetylene</td>
<td>Fire and/or burns to the body</td>
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<td></td>
<td>Damage to eyes</td>
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<td>12 Erecting, Installing of Shutters</td>
<td>Install Shutters prior to casting pouring</td>
<td>Sling might break/snap; Material might slip out of sling hold</td>
<td>Injury to employee; Damage to property</td>
<td>6</td>
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<td>Incorrectly interpreted signs from Banks man could result in an accident</td>
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<td></td>
<td>13 Upgrade of the parking and access road</td>
<td>Layer works Compaction</td>
<td>Nose, dust Inclement weather, including localized flooding Smoking/open fires Vibration (rolling compaction)</td>
<td>Rain causing slippery conditions and localised flooding causing property damage, injury and possible death Heat stroke from being exposed to the sun for too long and sunburn</td>
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<td>Bush fires caused by cigarette/open fires causing smoke, inhalation possible death</td>
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<td>14</td>
<td>Construction Mobile Plant and Equipment</td>
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<td></td>
<td>Use of Plant &amp; Equipment on site</td>
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<td>Incompetent operator</td>
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<td>Unsafe plant &amp; equipment</td>
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<td></td>
<td>Collusion with other vehicles.</td>
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<td></td>
<td>Petrol and oil spillages.</td>
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<td>Personal injuries.</td>
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<td>Motor vehicle accident.</td>
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<td>Environmental contamination.</td>
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<td>Injury or damage to property.</td>
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<td>Inability to respond to emergencies.</td>
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<td>Insufficient or no emergency equipment or personnel.</td>
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<td>Development and Implementation of an Emergency Management Plan</td>
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<td>Failure to have a basic, site specific emergency management plan.</td>
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<td>Workers not trained in the Emergency Plan.</td>
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<td>Insufficient or no emergency equipment or personnel.</td>
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<td>Injury or damage to property.</td>
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<td>Inability to respond to emergencies.</td>
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<td>Insufficient or no emergency equipment.</td>
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<td>15</td>
<td>Emergency Management</td>
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<td>16</td>
<td>Community Risk Management</td>
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<tr>
<td>Managing community risk</td>
<td>Failure to adequately monitor and manage the multi-faced social issues.</td>
<td>Violent protests. Injury to employees and property damage.</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>108</td>
<td>3</td>
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<thead>
<tr>
<th>17</th>
<th>Subcontractor Management</th>
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<tr>
<th>18</th>
<th>Block work</th>
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</table>
**RISK PROFILE:** Construction of a new 10ML -Reinforced Concrete Reservoir and associated infrastructure
C3.4.2 ENVIRONMENTAL MANAGEMENT SPECIFICATIONS

PEM: ENVIRONMENTAL MANAGEMENT SPECIFICATION

PEM.1 PURPOSE

The purpose of the EMP is to encourage good management practices through planning and commitment with respect to environmental issues, and to provide rational and practical environmental guidelines to minimise disturbance of the natural environment.

PEM.2 RESPONSIBILITIES FOR ENVIRONMENTAL MANAGEMENT

The contractor will be responsible for environmental control on site during construction and the maintenance period. The construction activities will be monitored by an independent environmental specialist and audited against the EMP.

PEM.3 TRAINING AND INDUCTION OF EMPLOYEES

The contractor has a responsibility to ensure that all those people involved in the project are aware of and familiar with the environmental requirements for the project (this includes subcontractors, casual labour, etc.).

PEM.4 COMPLAINTS REGISTER AND ENVIRONMENTAL INCIDENT BOOK

Any complaints received by the project team from the community will be recorded. The complaint will be brought to the attention of the site manager.

All complaints received will be investigated and a response given to the complainant within 28 days.

All environmental incidents occurring on the site will also be recorded.

PEM.5 ENVIRONMENTAL SAFETY

The management of impacts associated with various categories of concern is discussed as separate topics, indicated below.

PEM.5.1 Soil

(a) Topsoil should be temporarily stockpiled, separately from (clay) subsoil and rocky material, when areas are cleared. If mixed with clay sub-soil the usefulness of the topsoil for rehabilitation of the site will be lost.

(b) Stockpiled topsoil should not be compacted and should be replaced as the final soil layer. No vehicles are allowed access onto the stockpiles after they have been placed.

(c) Stockpiled soil should be protected by erosion-control berms if exposed for a period of greater than 14 days during the wet season. The need for such measures will be indicated in the site-specific report.

(d) Topsoil stripped from different sites must be stockpiled separately and clearly identified as such. Topsoil obtained from sites with different soil types must not be mixed.
(e) Topsoil stockpiles must not be contaminated with oil, diesel, petrol, waste or any other foreign matter, which may inhibit the later growth of vegetation and micro-organisms in the soil.

(f) Soil must not be stockpiled on drainage lines or near watercourses without prior consent from the Project Manager.

(g) Soil should be exposed for the minimum time possible once cleared of invasive vegetation, that is the timing of clearing and grubbing should be co-ordinated as much as possible to avoid prolonged exposure of soils to wind and water erosion. Stockpiled topsoil must be either vegetated with indigenous grasses or covered with a suitable fabric to prevent erosion and invasion by weeds.

(h) Limited vehicular access is allowed across rocky outcrops and ridges.

(i) All cut and fill surfaces need to be stabilized with appropriate material or measures when major civil works are complete.

(j) Erosion and donga crossings must be dealt with as river crossings. Appropriate soil erosion and control procedures must be applied to all embankments that are disturbed and destabilized.

(k) All equipment must be inspected regularly for oil or fuel leaks before it is operated. Leakages must be repaired on mobile equipment or containment trays placed underneath immobile equipment until such leakage has been repaired.

(l) Soil contaminated with oil must be appropriately treated and disposed of at a permitted landfill site or the soil can be regenerated using bio-remediation methods.

(m) Runoff must be reduced by channelling water into existing surface drainage system.

**PEM.5.2 Water**

(a) Adequate sedimentation control measures must be instituted at any river crossings when excavations or disturbance of a riverbanks or riverbeds takes place.

(b) Adequate sedimentation control measures must be implemented where excavations or disturbance of drainage lines of a wetland may take place.

(c) All fuel, chemical, oil, etc spills must be confined to areas where the drainage of water can be controlled. Use appropriate structures and methods to confine spillages such as the construction of berms and pans, or through the application of surface treatments that neutralise the toxic effects prior to the entry into a water course.

(d) Oil absorbent fibres must be used to contain oil spilt in water.

(e) During construction through a wetland, the majority of the flow of the wetland should be allowed to pass down stream.

(f) Vehicular traffic across wetland areas must be avoided.

(g) No dumping of foreign material in streams, rivers and/or wetland areas is allowed.
(h) The wetland area and/or river must not be drained, filled or altered in any way including alteration of a bed and/or, banks, without prior consent from the DWAF. The necessary licenses must be obtained in terms of Section 21 and 22 of the National Water Act, 36 of 1998 from DWAF.

(i) No fires or open flames are allowed in the vicinity of the wetland, especially during the dry season.

(j) No swimming, washing (including vehicles and equipment), fishing or related activity is permitted in a wetland or river without written permission from the Project Manager.

(k) Disturbances to nesting, breeding and roaming sites of animals in or adjacent to wetland areas must be minimized.

PEM.5.3 Air

(a) Speed limits must be implemented in all areas, including public roads and private property to limit the levels of dust pollution.

(b) Dust must be suppressed on access roads and construction sites during dry periods by the regular application of water or a biodegradable soil stabilisation agent. Water used for this purpose must be used in quantities that must not result in the generation of run-off.

(c) The site-specific investigation will quantify the impact of dust on nearby wetlands, rivers and dams in terms of sedimentation. Mitigation measures identified during the site specific study must be implemented.

(d) The Contractor must notify the Principal of all schools within 50m of the site of proposed activities. The Principal must in turn ensure that children with allergies and respiratory ailments take the necessary precautionary measures during the construction period. The Contractor must ensure that construction activities do not disturb school activities e.g. dust clouds may reduce visibility affecting sports activities.

(e) Waste must be disposed of, as soon as possible at a municipal transfer station, skip or on a permitted landfill site. Waste must not be allowed to stand on site to decay, resulting in malodours.

(f) Noise control measures must be implemented. All noise levels must be controlled at the source. All employees must be given the necessary ear protection gear. IAP’s must be informed of the excessive noise factors.

(g) The Contractor must inform all adjacent landowners of any after-hour construction activities and any other activity that could cause a nuisance e.g. the application of chemicals to the work surface. Normal working hours must be clearly indicated to adjacent land owners.

(h) No loud music is allowed on site and in construction camps.

(i) No fires are allowed if smoke from such fires will cause a nuisance to IAP’s.
PEM.5.4 Social and Cultural

(a) Access by non-construction people onto any construction sites must be restricted. The Contractors activities and movement of staff must be restricted to designated construction areas only.

(b) The Contractors crew must be easily identifiable due to clothing, identification cards or other methods.

(d) Rapid migration of job seekers could lead to squatting and social conflict with resident communities and increase in social pathologies if not properly addressed. The Contractor must ensure that signs indicating the availability of jobs are installed.

(d) Criteria for selection and appointment (by the Contractor) of construction labour must be established to allow for preferential employment of local communities. The Local Authority must be actively involved in the process of appointing temporary labourers.

(e) Sub-Contractors and their employees must comply with all the requirements of this document and supporting documents e.g. the Contract document that applies to the Contractor. Absence of specific reference to the sub-contractor in any specification does not imply that the sub-contractor is not bound by this document.

(f) No member of the construction workforce is allowed to wander around private property, except within the immediate surrounding of the site.

(g) The Contractor must provide suitable sanitation facilities for site staff. Sanitation provided during the construction phase should be managed so that it does not cause environmental health problems. The use of the surrounding veld for toilet purposes is not permitted under any circumstance.

(h) The Contractor must arrange for all his employees and those of his sub-contractors to be informed of the findings of the environmental report before the commencement of construction to ensure:

(i) A basic understanding of the key environmental features of the work site and environments, and

(j) Familiarity with the requirements of this document and the site specific report.

(k) Supervisory staff of the Contractor or his sub-contractors must not direct any person to undertake any activities which would place such person in contravention of the specifications of this document, endanger his/her life or cause him/her to damage the environment.

(l) The demand for construction materials and supplies will have an effect on the local economy. This impact can be optimised by sourcing and purchasing materials locally and regionally wherever possible, insofar as the material complies with the design specification.

(m) The Contractor must maintain a detailed complaints register. This must be forwarded, together with solutions, to the authorities when requested.
PEM.5.5  Aesthetics

(a)  Scenic Quality

Damage to the natural environment must be minimized.

Trees and tall woody shrubs must be protected from damage to provide a natural visual shield. Excavated material must not be placed on such plants and movement across them must not be allowed, as far as practical.

The clearing of all sites must be kept to a minimum and surrounding vegetation must, as far as possible, be left intact as a natural shield.

No painting or marking of natural features must be allowed.

(b)  All above ground structures could be treated or painted to blend in with the natural environment.

(c)  Cut and fill areas, river and stream crossings and other soil stabilisation works must be constructed to blend in with the natural environment.

(d)  Natural outcrops, rocky ridges and other natural linear features, must not be bisected. Vegetation on such features must, as far as possible, not be cut unless absolutely necessary for construction.

(e)  Excavated material must be flattened (not compacted) or removed from site. No heaps of spoil material must be left on site once the Contractor has moved to a new construction site.

(f)  Any complaints from interest groups regarding the appearance of the construction site must be recorded and addressed promptly by the Contractor.

PEM.5.6  Archaeology and Cultural Sites

(a)  All finds of human remains must be reported to the nearest police station.

(b)  Human remains from the graves of victims of conflict, or any burial ground or part thereof which contains such graves and any other graves that are deemed to be of cultural significance may not be destroyed, damaged, altered, exhumed or removed from their original positions without a permit from the South African Heritage and Resource Agency (SAHRA).

(c)  Work in areas where artefacts are found must cease immediately.

(d)  Under no circumstances must the Contractor, his/her employees, his/her sub-contractors or his/her sub-contractors’ employees remove, destroy or interfere with archaeological artefacts. Any person who causes intentional damage to archaeological or historical sites and/or artefacts could be penalised or legally prosecuted in terms of the National Heritage Resources Act, 25 of 1999.

(e)  A fence at least 2 m outside the extremities of the site must be erected to protect archaeological sites.
(f) All known and identified archaeological and historical sites must be left untouched.

(g) Work in the area can only be resumed once the site has been completely investigated. The Project Manager will inform the Contractor when work can resume.

PEM.5.7 Flora

(a) All suitable and rare flora and seeds must be rescued and removed from the site. They must be suitably stored, for future use in rehabilitation.

(b) The felling and/or cutting of trees and clearing of bush must be minimised.

(c) Bush must only be cleared to provide essential access for construction purposes.

(d) The spread of alien vegetation must be minimized.

(e) Any incident of unauthorised removal of plant material, as well as accidental damage to priority plants, must be documented by the Contractor.

(f) Woody vegetative matter stripped during construction must either be spread randomly throughout the surrounding veld so as to provide biomass for other micro-organisms and habitats for small mammals and birds, or it may be stockpiled for later redistribution over the reinstated topsoiled surface. No vegetative matter must be burnt or removed for firewood other than those removed during the grubbing and clearing phase. Such vegetation can be made available to the local inhabitants to be used as firewood.

(g) No tree outside the footprint of the Works area must be damaged.

PEM.5.8 Fauna

(a) No species of animal may be poached, snared, hunted, captured or willfully damaged or destroyed.

(b) Snakes and other reptiles that may be encountered on the construction site must not be killed unless the animal endangers the life of an employee.

(c) Anthills and/or termite nests that occur must not be disturbed unless it is unavoidable for construction purposes.

(d) Disturbances to nesting sites of birds must be minimized.

(e) The Contractor must ensure that the work site is kept clean and free from rubbish, which could attract pests.

PEM.5.9 Infrastructure

(a) The relevant authorities must be notified of any interruptions of services, especially the Local Municipality, National Road Agency, Spoornet, TELKOM and ESKOM. In addition, care must be taken to avoid damaging major and minor pipelines and other services.

(b) The integrity of property fences must be maintained.

(c) No telephone lines must be dropped during the construction operations, except were prior agreement by relevant parties is obtained. All crossings must be protected, raised or relocated as necessary.
(d) All complaints and/or problems related to impacts on man-made facilities and activities must be promptly addressed by the Contractor and documented.

(e) Storage Facilities

- Proper storage facilities should be provided for the storage of oils, grease, fuels, chemicals and hazardous materials.

- The Contractor must ensure that accidental spillage does not pollute soil and water resources.

- Fuel stock reconciliation must be done on all underground tanks to ensure no loss of oil, which could pollute groundwater resources.

- Cement must be stored and mixed on an impermeable substratum

(f) Traffic Control

All reasonable precautions must be taken during construction to avoid severely interrupting the traffic flow on existing roads, especially during peak periods.

Before any work can start the Local Traffic Department must be consulted about measures to be taken regarding pedestrian and vehicular traffic control.

(g) Access Roads

The Contractor and the affected landowner must collaborate on the planning and construction of new access routes and the repair or upgrading of existing routes.

Access to the site must be controlled such that only vehicles and persons directly associated with the work gains access to the site.

Temporary access roads must not be opened until required and must be restored to its former state as soon as the road is no longer needed.

(h) Batching Plants

Concrete must be mixed only in an area demarcated for this purpose. All concrete spilled outside this area, must be promptly removed by the Contractor and taken to a permitted waste disposal site. After all concrete mixing is complete, all waste concrete must be removed from the batching area and disposed of at an approved dumpsite. Stormwater must not be allowed to flow through the batching area. Water laden with cement must be collected in a retention area for evaporation and not allowed to escape the batching area. Operators must wear suitable safety clothing.

(i) Chemical toilet facilities should be managed and serviced by a qualified company. No disposal or leakage of sewerage should occur on or near the site.

(j) Blasting

Blasting must not endanger public or private property.
Noise mufflers and/or soft explosives must be used to minimize the impact on animals.

All the provisions of the Explosives Act, 26 of 1956 and the Minerals Act, 50 of 1991 must be complied with.

The Contractor must take measures to limit flyrock.

**PEM.5.10 Safety**

(a) Measures must be taken to prevent any interference that could result in flashover of power lines due to breaching of clearances or the collapse of power lines due to collisions by vehicles and equipment.

(b) Measures must be taken during thunderstorms to protect workers and equipment from lightning strikes.

(c) All tall structures must be properly earthed and protected against lightning strikes.

(d) The process of excavation and back filling must be carried out as a sequential process following one another as quickly as possible. Excavations must only remain open for a minimum period of time and during this time they must be clearly demarcated. If excavations place the public at risk these sites must be fenced.

(e) The residents directly affected by open trenches must be notified of the dangers. This will be done during the site-specific phase.

**PEM.5.11 Waste**

Solid Waste

(a) Littering on site and the surrounding areas is prohibited.

(b) Clearly marked litterbins must be provided on site. The Contractor must monitor the presence of litter on the work sites as well as the construction campsite.

(c) All bins must be cleaned of litter regularly.

(d) All waste removed from site must be disposed at a municipal/permitted waste disposal site.

(e) Excess concrete, building rubble or other material must be disposed of in areas designated specifically for this purpose and not indiscriminately over the construction site.

(f) The entire works area and all construction sites must be swept of all pieces of wire, metal, wood or other material foreign to the natural environment.

(g) Contaminated soil must be treated and disposed of at a permitted waste disposal site, or be removed and the area rehabilitated immediately.

(h) Waste must be recycled wherever possible.
Liquid Waste

(a) The Contractor must maintain mobile toilets on site.

(b) The Contractor must provide adequate and approved facilities for the storage and recycling of used oil and contaminated hydrocarbons. Such facilities must be designed and sited with the intention of preventing pollution of the surrounding area and environment.

(c) All vehicles must be regularly serviced in designated area within the Contractors camp such that they do not drip oil.

(d) All chemical spills must be contained and cleaned up by the supplier or professional pollution control personnel. Run-off from wash bays must be intercepted.

Hazardous Waste

(a) No hazardous materials must be disposed of in the veld or anyplace other than a registered landfill for hazardous material. Hazardous waste must be stored in containers with tight lids that must be sealed and must be disposed at an appropriately permitted hazardous waste disposal site. Such containers must not be used for purposes other than those originally designed for.

(b) The Contractor must maintain a hazardous material register.

PEM.5.12 Rehabilitation and Site Clearance

(a) When all major construction activities are completed, the site must be inspected to determine site-specific rehabilitation measures. This may be considered as unplanned work e.g. soil rehabilitation due to oil spills.

(b) All temporary buildings and foundations, equipment, lumber, refuse, surplus materials, waste, construction rubble fencing and other materials foreign to the area must be removed.

(c) If waste products cannot be recycled they must be disposed of at a permitted landfill site.

(d) All drainage deficiencies including abandoned pit latrines and waste pits must be corrected.

(e) Cut and fill areas must be restored and re-shaped.

(f) The area must be restored to its natural vegetation condition using indigenous trees, shrubs and grasses as directed by a grassland and/or rehabilitation expert.

(g) Borrow pits must be re-shaped into even slopes and surfaces to blend with the natural terrain and topsoil must be replaced.

(h) The grass mix, shrubs and trees used for rehabilitation must be compatible with the species identified in the site-specific investigation.
(i) Areas compacted by vehicles during construction must be scarified to allow penetration of plant roots and the regrowth of natural vegetation.

PEM.6 MEASUREMENT AND PAYMENT

An item has been included in the Bill of Quantities Schedule 1 to comply with the above actions.
C3.4.3 PS ELE ELECTRICAL PROJECT SPECIFICATIONS

1. GENERAL DESCRIPTION AND EXTENT OF WORK

This scope of work for the contract is the electrical installation at Adams Mission 5 Reservoir comprising:

- Main LV distribution equipment including distribution boards;
- Sub-main cable installation including all cable containment, fixings, terminations etc;
- Lighting installation complete with all luminaires, lamps, controls, containment, final circuit wiring etc;
- Small power installation including supply, installation, terminations, and cable containment systems etc;
- Lightning Protection, Earthing and Bonding installation;
- Testing and commissioning;
- Systems Training;
- As-Built Handover Documentation

This work is to be done in accordance with the contractor's installation programme and relevant division of work between trades as detailed elsewhere in this document.

2. DIVISION OF WORK

2.1 Principal Building Contractor (PBC)

The Contractor will be responsible for providing the PBC with drawings indicating builders work requirements. Including but not limited to penetrations, plinths, co-ordination of supply points.

2.2 Electrical Sub-Contractor (Contractor)

The extent of the work to be undertaken by the Contractor as part of this contract is shown on the contract drawings and listed in the Bills of Quantities for pricing.

2.3 Plumbing Sub-Contractor

Hot water cylinders/boilers will be provided, installed and connected up, mechanically and electrically by the Plumbing Sub-Contractor. The Contractor will bring an electricity supply to a position agreed with the PBC and terminate this supply in the isolator specified. The Plumbing Sub-Contractor's electrician will be responsible for connecting up and wiring between isolator and hot water boiler.

The Contractor will be responsible for earthing hot and cold water piping and for all cross-bonding of the plumbing system. The Contractor is not responsible for the control and/or protection of the hot water cylinders/boilers.
2.4 Telemetry Sub-Contractor

Telemetry equipment will be provided, installed and connected by the Telemetry Sub-Contractor. The Contractor will bring an electricity supply to a position agreed with the PBC and terminate this supply in the isolator specified. The Telemetry Sub-Contractor will be responsible for connecting up and wiring between isolator and equipment.

The Contractor will be responsible for the installation of cast-in / built in wireways to a position agreed with the PBC, for the installation of wiring by the Telemetry Sub-Contractor.

The Contractor is not responsible for the control and/or protection of the Telemetry equipment.

3. CONTRACT DRAWINGS

The tender drawings will become the contract drawings and will be revised, amplified and extended as necessary and in accordance with the development of the Architect's design.

The Sub-Contractor shall price for monitoring the Architect's and Structural Engineer's drawings as issued to site, monitoring changes such as locations and swings of doors, windows, wall penetrations, etc. and for locating the electrical outlets and the installation generally to suit, as well as for informing the Engineer.

4. COST VARIATIONS

Upon general revisions of an electrical drawing the relevant cost implications will be calculated, using the rates included in the Bill of Quantities. Where there are no Bills of Quantities rates the calculation will be based on rates generally applicable to the industry which will become the agreed “non scheduled item” rates. Scope of work changes will be calculated using rates included in the Bills of Quantities and the agreed “non scheduled item” rates. The cost of the remeasured work and scope of work changes is to be agreed no a monthly basis. Variation Order No. 1 will be an omit of all contingency and provisional items.

Should the Contractor not agree with the rates of any non scheduled items or with the re-measurement quantities produced by the Engineer, he is required to advise the Engineer accordingly, within 2 (two) weeks of the date shown on the drawings and/or variation order, and to provide substantiation for the pricing revisions he requires, and the relevant costing details.

Under no circumstances will variation pricing be re-calculated at the request of the Contractor, after the 2 (two) weeks time period has expired.

Where it is imperative that the Contractor takes instructions from persons other than the Engineer, and acts immediately in the interests of the Employer to avoid abortive work or fruitless expenditure, it is mandatory for him to advise the Engineer telephonically of the cost implications, preferably before proceeding with the work but, at latest, within 24 (twenty four) hours of commencing the change. Failure to observe the foregoing (whether the instruction is given verbally or in writing) will result in the Contractor being held responsible for the cost of the variation work.

5. TESTING, SETTING AND COMMISSIONING

Comprehensive records of quality control, pre-testing, testing, pre-commissioning and commissioning documentation are to be included in the O&M documentation.
All records are to be dated, and signed.

Except where otherwise provided in the contract documents, the Contractor shall provide:

A test schedule for each section of the works or item of equipment/plant to be tested, giving the time, date and place of the test, detailing the test procedure, the type and number of tests to be carried out, and the type, make and serial numbers of all test instruments that will be used;

All labour, materials, power, fuel, accessories and properly calibrated instruments necessary for carrying out the tests.

The Contractor shall give 14 (fourteen) days notice, in writing, when any portion of the installation or plant is ready for testing.

In the event of the plant or installation not passing the tests, the Employer shall be at liberty to deduct from the contract price, any reasonable expenses incurred in repeating the tests.

The Contractor shall carry out preliminary tests necessary to satisfy himself that the plant, materials and equipment comply with the provisions of the contract and are in a suitable state to satisfy the requirements of the Specification. The Contractor is required to record these preliminary test results (in a manner to be agreed with the Engineer), and to submit one typed copy to the Engineer for comment, prior to the Engineer attending the acceptance tests.

If the Contractor fails to undertake the acceptance tests within a reasonable period of time, the Employer may arrange to have the tests performed by another party. All tests so made shall be at the risk and expense of the Contractor.

The drawings and specifications contain details of any specific equipment, tests and setting requirements. In general, however, the following should be regarded as a minimum requirement:

- Each circuit shall be checked for insulation resistance to earth and between phases and neutral, using a hand-cranked 500 volt megger;
- The earth loop resistance and circuit resistance of each circuit shall be checked, using a null balance megger or earth loop tester;
- The main earth system resistance shall be verified, using a hand-cranked null balance megger;
- The on load volt drop and load balancing of all circuits and distribution boards shall be verified;
- The earthing of all water and waste pipes shall be verified, using a null balance megger;
- The lighting level in all areas shall be measured, using a suitable digital instrument;
- The value at which all earth leakage units trip when tested at each outlet position in turn, shall be measured.

It is a requirement of this contract that the Contractor undertake all the above tests and submit the results in typed format on the Ibuya test report (1 per distribution board) to the Engineer. The test report is to be attached to the certificate of compliance.

The Engineer will subsequently request the Contractor to repeat all, or part, of these tests, during the final inspection prior to handover.

The Contractor shall set all fault protection overload devices to the prescribed settings/levels, and to list these settings in the as built drawings and manuals.
6. APPROVALS

The drawings, documents and specification indicate the type, size and make of equipment, materials and components required.

The Contractor will be required to supply, strictly in accordance with these requirements, unless otherwise approved by the Engineer.

Approval, in all instances, shall be taken as formal approval, in writing, by the Engineer. Verbal approval will not be recognized and the Contractor will be held responsible for any subsequent costs or fruitless expenditure involved.

7. GUARANTEES

The Contractor shall provide a twelve-month guarantee of all labour, materials and equipment supplied in terms of this contract.

The guarantee period shall commence from the date of practical completion of the whole project in terms of the Principal Building Agreement.

During the guarantee period, the Contractor will maintain (as per manufacturer’s warranty requirements), without charge, all equipment supplied under this contract and, notwithstanding anything to the contrary, shall replace all components that fail, free of charge.

The guarantee is deemed to cover all items of equipment and materials, such as control fuses, lamps, starters, ballasts gauges, switches, relays etc. In the case of power fuses, the Contractor will only be required to replace these items free of charge where failure has occurred due to an inherent or latent defect in the installation.

When purchasing materials and equipment from suppliers, the Contractor shall obtain formal cessions of all guarantees covering the materials and equipment, from the supplier, in favour of the Employer. The Contractor should, therefore qualify all orders accordingly.

Where the Contractor is responsible for supplying transformers, distribution boards, M.V. switchgear etc. etc., be shall take ultimate responsibility for the guarantee of this equipment.

The Contractor will also be responsible for the guarantee of all components and equipment specified by name in the documents or as otherwise approved by the Engineer.

In the event of the Contractor objecting to certain types of equipment, component, manufacturer, or otherwise, this shall be stated at the time of tendering. The Contractor shall also indicate at least two alternatives that are acceptable generally and in terms of the 12 months guarantee requirement.

During the guarantee period, the Contractor will be contacted directly in regard to complaints or failures and shall in turn contact and direct the relevant supplier/manufacturer or his own staff, irrespective of whose ultimate responsibility it shall be to correct the situation.

8. STANDARDS

The latest editions and/or amendments of the following Standards and Codes of Practice are applicable:

- The South African National Standard (S.A.N.S.) Specifications, as applicable to this contract;
• The Occupational Health and Safety Act, (Act 85 of 1993) as amended;
• The latest edition of the S.A.N.S. 10142 Code of Practice for the Wiring of Premises;
• I.E.C. Standard Specifications and Codes of Practice, where the S.A.N.S. and B.S.S. equivalents are not available;
• The British Standard Specifications (B.S.S.) and Codes of Practice, where the S.A.N.S. and I.E.C. equivalents are not available.

9. MATERIALS AND EQUIPMENT

Wherever possible, material and equipment shall be of South African manufacture and of the same make and type throughout the installation.

Where materials and equipment are specified by name, make or type number, alternatives will not be considered, unless it is to the Employer's advantage.

10. EQUIPMENT DELIVERY

The Contractor shall place orders timeously for all materials and equipment. The responsibility for verifying delivery times of items specified rests solely with the Contractor.

In this regard, the Contractor's attention is directed to long lead cabling, distribution board and luminaires.

11. DRAWINGS, SAMPLES, AND OPERATING MANUALS

11.1 Installation and Shop Drawings & Samples

Installation and shop drawings are drawings, diagrams, illustrations, Schedules, performance charts and information brochures which are prepared by the Contractor or his suppliers, to illustrate some detailed engineering or installation aspect of the works.

Samples are physical examples, provided by the Contractor or his representative and suppliers, illustrating the intended quality and type of materials, equipment and workmanship, and to establish standards by which the works will be judged.

The relevant sections of the specifications indicate specific installation/shop drawing and sample requirements. The Contractor shall allow for the production of such additional drawings and information as may be necessary, from time to time, to illustrate compliance with the specifications, installations, method/procedure, or engineering aspects.

Samples and mockups will be required for all aesthetically prominent accessories or installations.

The Contractor shall inspect all drawings, including structural and other services, installation, shop and design drawings, pertaining to the works, and shall make the necessary allowance in the tender price for the minor extras and omissions which might occur as the result of these final detailed coordinated installation and shop drawings.

The Contractor shall review, stamp with his approval and submit with reasonable promptness, and in orderly sequence so as to cause no delay in the work, all drawings and samples required by the contract documents.

At the time of each submission the Contractor shall inform the Engineer, in writing, of any deviation in the installation and shop drawings or samples, from the requirements of the contract documents.
By submitting installation and shop drawings and samples, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, and that he has checked and co-ordinated each installation and shop drawing and sample, with the requirements of the works and of the contract documents.

The Engineer will review drawings and samples with reasonable promptness, but only for conformance with the design concept of the project and the contract documents.

The Contractor shall make any corrections required in terms of the Specification, and shall re-submit the required number of corrected copies of drawings or samples. The Contractor shall direct specific attention, in writing, on re-submitted installation and shop drawings, to revisions other than the corrections required by the Engineer on previous submissions.

The Contractor shall submit drawings for review, at least 6 (six) weeks in advance of the required ordering, manufacturing or installation dates.

The reviewing of drawings or samples by the engineer shall not relieve the Contractor of responsibility for any deviation from the requirement of the contract documents including compliance with program, responsibility for errors or omission in the drawings or samples, etc.

11.2 Record Drawings

Record drawings shall be maintained on a current basis as work progresses. Site inspections shall include a review of the record drawings, for the area or equipment inspected.

The Contractor shall be provided with a set of prints to be kept by him on site and dimensioned by the Contractor showing the exact locations of all electrical equipment, cast or built in conduits, sleeves etc.

The positions of all cables, sleeves, conduit, service routes, joints etc. shall be dimensioned on a triangular basis.

Prior to commissioning and handover, the Contractor shall provide a complete set of record drawings, cross-referenced to the Operating and Maintenance Manuals where necessary, and in sufficient detail to enable the employer to carry out proper maintenance, and to facilitate subsequent alterations and additions to the system.

Drawings, Legends, Schedules, Diagrams, intended for framing and wall-mounting, shall be of the fade-free, black ink on a transparency, or photographic type.

11.3 Operation/Maintenance Manuals

The operation and maintenance manuals shall contain all information required to enable the safe and efficient operation and maintenance of all systems associated with the building.

Prior to commissioning, the Contractor shall submit a draft copy of the indexed, loose-leaf manuals, containing complete operating and maintenance instructions for all mechanical and electrical systems specified under this contract.

Manuals shall be hard covered, at least A4 in size, and must be provided with transparent plastic over-covers and reinforcing ring binders, for each page.
Post commissioning and handover, the Contractor shall provide three copies of indexed, loose-leaf manuals, and an electronic copy (CD/DVD) containing complete operating and maintenance instructions for all mechanical and electrical systems specified under this contract, including comprehensive testing and commissioning records.

All manuals must lie flat when open.

Content shall be printed. Photocopies from product brochures will not be accepted. Only information relevant to this contract should be included.

The scope of content should include:

- Contractors and specialist supplier details
- Emergency contact details
- Health and safety documentation
- Project Systems description
- Modes of operation including emergency procedures and call out personnel
- Maintenance instructions and schedules and fault finding advice
- Asset register
- Equipment schedules
- Advice on disposal
- Software schedules and licenses
- Parts identification and recommended spares
- Guarantee information with work/inspection/maintenance required to ensure guarantees are not nullified
- Manufacturer’s technical literature.
- Test Certificates - Refer to Ibuya “Typical Test Report”
- Commissioning data
- Certificates of compliance per distribution board
- Statutory certification
- Copies of standard Ibuya A4 Distribution Board Legend cards.
- System training records
- Record drawings
- Modification information

Note: Certificates of compliance to include the relevant Ibuya Test Certificate and legend card.

11.4 Logbooks

Logbooks shall be provided in each plant room, and must be at least A4 in size, typed and feint-line ruled, to provide the following columns and column headings on each page:

- Date.
- Description of Work.
- Artisan's Signature.
- Time Spent.

The logbooks shall be provided prior to commissioning and start-up of the plant, are to be kept up-to-date by the Contractor, from date of handover of the plant.

All logbooks must lie flat when open.
12. **TRAINING**

Prior to handover, the Contractor shall conduct comprehensive training sessions for each installed system to minimum three client representatives to enable proper running and maintenance of the installed systems.

Proposed training times shall be submitted by the Contractor at least two weeks prior to the proposed date, and shall be agreed upon by both parties.

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

- Systems set-up and configuration;
- Modes of operation of the system;
- Systems preventative maintenance and trouble shooting.

Training sessions shall be documented and submitted with the handover documents for reference.

Separate training sessions shall be documented for each portion of the works.

13. **REGISTERED PERSONNEL**

The Contractor shall have at least one installation electrician in full time employment assigned permanently to this project.

The Contractor shall appoint an approved inspection authority who shall certify compliance from commencement to commissioning of the electrical installation as per the requirements of section 5.5 of the Certificate of Compliance.

Proof of these aspects shall be submitted with the completed tender document.

14. **SERVICE CONDITIONS**

<table>
<thead>
<tr>
<th>Normal Service</th>
<th>As scheduled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum ambient temp.</td>
<td>+40°C</td>
</tr>
<tr>
<td>Minimum ambient temp.</td>
<td>-5°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>Max. Humidity: 95%</td>
</tr>
<tr>
<td>Rain fall</td>
<td>high in summer months, low in winter months.</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Corrosive due to wind blown salt spray</td>
</tr>
</tbody>
</table>

All equipment and materials shall be suitable for the climatic and environmental conditions pertaining to coastal conditions.

Metalwork exposed to sea water, salt water vapour and the weather shall be stainless steel or protected against corrosion to the approval of the engineer.

Contact between dissimilar metals shall be avoided. As a minimum, the following electrode potentials shall not be exceeded.

- for connections exposed to the weather, salt water vapour or salt water, 0.25V.
- for connections of interior parts subjected to condensation but not contaminated by salt, 0.50V.
15. ELECTRICAL SUPPLY SYSTEM

The Supply Authority Electricity Grid consists of system voltages of 132kV; 11kV; 400V 3-phase CNE and 230V single phase (50Hz).

15.1 Supply Technical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Voltage</td>
<td>11,000V ±10% / 400V ±10% as applicable</td>
</tr>
<tr>
<td>Rated Frequency</td>
<td>50Hz</td>
</tr>
<tr>
<td>Phase rotation</td>
<td>3 phase, RWBR (clockwise)</td>
</tr>
<tr>
<td>Design SSCC</td>
<td>20kA at 11 kV</td>
</tr>
</tbody>
</table>

16. ELECTRICITY SUPPLY AUTHORITY

The Contractor shall liaise with the Supply Authority to ensure that all applications to commence work are submitted, fees paid and local requirements complied with.

The installation shall comply with the Supply Authority's requirements in all respects and good engineering practice.

17. EARTHING

All cable containment exposed metal work is to be earthed and earths are to be continuous for the length of the run and include all bends.

All circuits are to be provided with a separate earth wire as specified or as per SANS 10142 as a minimum requirement.

Circuit earths and earth loop impedance must all be verified and the Engineer informed so that satisfactory operation of protection devices can be checked.

17.1 Earthing conductor system

The total earthing system of any electrical installation shall be in accordance with SANS 10142. Earth conductors shall be stranded copper with green PVC insulation installed on a radial arrangement from each distribution board, with no T joints or interconnection of circuits.

17.2 Sub-Distribution Boards

A separate earth connection shall be provided between the earth busbar in each sub-distribution board and the earth busbar in the Main LV distribution board. These connections shall consist of PVC insulated stranded copper conductors installed along the same routes as the supply cables or in the same conduit as the supply conductors.

17.3 Ring Mains

Common earth conductors may not be used where various circuits are installed in the same wiring channel.

17.4 Clean Power Earthing

Earthing for the reticulation of clean power circuits shall follow the following rules:
i) All sub-distribution boards containing clean power circuits shall be provided with a clean earth bar, completely insulated from the rest of the board and domestic earthing systems.

ii) PVC-insulated earth conductors shall be used throughout for the clean power system. These conductors shall be fixed to the clean earth bars by means of lugs and bolts, always ensuring that the connections are completely insulated from domestic earth components.

iii) Clean power earth conductors shall always be installed in radial fashion and no earth loops shall be formed.

iv) The Contractor shall ensure that complete isolation is maintained, at all times, between clean earth conductors and terminations, and the domestic earth system, particularly at equipment boxes and sockets.

v) The Contractor shall also ensure that connectors, plug boxes, female sockets, etc., used for clean power circuits are adequately designed to provide complete isolation from the domestic earth system.

vi) It will be expected of the Contractor, as part of hand over procedure, to demonstrate adequate isolation, (better than 1 Ohm), between all clean earth points and the remainder of the domestic earth system.

18. BONDING

The Contractor shall cross bond and earth all metallic services in the vicinity of electrical equipment and circuiting including hot and cold water pipes, waste and drain pipes, ceiling grids, cable trays, hand rails etc. The earth loop impedance to the furthest point from local distribution board of all metallic services shall be checked and submitted to the Engineer for approval.

All steel pipes shall be connected with solid 12mm x 0.8mm perforated or solid copper strapping to the nearest distribution board. The strapping shall be fixed to the pipe work with brass nuts and bolts and against walls with brass screws at 150mm centres.

In all cases where steel pipes are positioned within 1.5m of distribution boards, an earth connection consisting of copper strapping shall be installed between the pipe work and the board. In vertical building ducts accommodating steel pipes and electrical cables, all pipes shall be earthed at each distribution board.

19. LIGHTNING PROTECTION

The Contractor shall arrange for the specialist lightning protection contractor to monitor the bonding of the column and roof steel. This contractor shall provide the necessary earthing spikes/conductors as indicated and shall complete the lightning protection system in accordance with the relevant SANS code of practice and the contract drawings.

20. SURGE PROTECTION

When specified the surge protection is to comply with the following:
Protection against lightning: Class 1 - 25 kA, (10/350 µS) impulse current waveform protection device on all phases and neutral at the power supplies source to equipment at 400/230 Volts. Connection to be suitable for TNS earthing systems.

Protection against surges: Class 2 - 20 kA (8/20 µS) surge current waveform protection device on all phases and neutral power supplies to equipment at 400/230 Volts in local DB. Connection to be suitable for TNS earthing systems.

Protection against surges: Class 3 - 5 kA (8/20 µS), surge current wave and (1.2/50 µS) voltage waveform and Voltage peak of 1.5 kV on all phases and neutral power supplies to equipment at 400/230 Volt within 10 metres of equipment.

Internal Equipment Protection: Surge protection to electronics equipment shall be provided as required by the equipment manufacturer to be suitable for coordination and cascading with the above protection.

21. **L.V. DISTRIBUTION BOARD & MOTOR CONTROL CENTRE**

21.1 **Scope**

The specification covers all low voltage Switchgear and control gear assemblies.

21.2 **Standards Requirements**

Low Voltage Switchgear and Control Gear Assemblies, are to be manufactured in accordance with SANS 1473–1 (as amended), SANS IEC 60439-1 (as amended) and SANS 10142-1 (as amended) specifications.

With regard to the above specification the following applies to the manufacture of the distribution boards.

21.3 **Board Construction and Design**

21.3.1 **Construction**

a) Floor standing multi cubicle type assembly/unless otherwise specified

b) Stationary indoor installation

c) IP54 unless otherwise specified

d) Form 2b unless otherwise specified (Terminals in cable chamber for outgoing conductors, per functional unit, to be individually shrouded with 5 mm thick transparent polycarbonate cover)

e) Naturally ventilated

f) **Physical Dimensions**

1) **Dimension** as shown on layout drawings

2) **Cable entry** Top entry via a 300 mm wide cable entry cover along the full length of the distribution board
21.3.2 Electrical Characteristics

<table>
<thead>
<tr>
<th></th>
<th>a) Operational Voltage</th>
<th>b) Insulation Voltage</th>
<th>c) Impulse Withstand Voltage</th>
<th>d) Rated short time withstand current (fault level) as shown on the single line diagrams</th>
<th>e) Rated peak withstand current is to be in accordance with table 5 in SANS IEC 60439-1.</th>
<th>f) Cross sectional area of protective conductors with regard to thermal stresses due to current of short duration are to be based on a duration of 0.1 seconds.</th>
<th>g) Earthing system: TN-S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>400 Volts phase to phase 230 Volts phase to neutral/earth</td>
<td>1000 Volts phase to phase</td>
<td>2 500 Volts phase to phase</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Rated currents of circuits and electrical equipment as shown on the drawings DO NOT take into account the derating of such circuits and electrical equipment due to temperature rise.

21.3.3 Environmental Conditions

<table>
<thead>
<tr>
<th></th>
<th>a) Maximum air temperature (at any point) within the distribution board is not to exceed 10°C above ambient of 40°C maximum and an average of 35°C over a 24 hour period.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Note: Should the heat rise within the distribution board exceed the above limits due to the limitations of the room size etc. tenderers are to advise the anticipated heat rise in each cubicle.</td>
</tr>
<tr>
<td></td>
<td>b) Relative humidity – As per clause 6.12.1 in SANS IEC 60439-1.</td>
</tr>
<tr>
<td></td>
<td>c) Pollution degree 3 applies</td>
</tr>
<tr>
<td></td>
<td>d) Installed at sea level/inland as applicable</td>
</tr>
</tbody>
</table>

21.3.4 Testing

|   | a) Tenderer to advise whether distribution boards are fully type tested, partially type tested or specially type tested assemblies. Compliance/non compliance is to be indicated. |
|   | b) Routine tests are to be carried out at the place of manufacture and repeated on site. |

21.4 General

The following general requirements are to be complied with provided they do not conflict with the above requirements. Any conflicts are to be advised by the tenderer at the time of tender.

21.4.1 Enclosures

Enclosures for distribution boards and control panels shall be wall or floor mounting as indicated, shall be engineered to accommodate the necessary equipment specified and to comply with this specification.

The minimum thickness of the chassis and partition metal work shall be 1.5 mm for assemblies not exceeding 0.75 m² or 2 mm for larger panels. Thicker sheets shall be used for very large panels and where the weight of the equipment would cause buckling or vibration.
Lap welding of panels and boxing of sections, is unacceptable unless specifically approved. Bolted stiffening channels and braces are acceptable.

Completed sheet metal enclosures shall be free, internally and externally, from burrs, sharp edges and blemishes. A removable steel base frame shall be allowed for floor mounting boards. Removable lifting eyes shall be provided for heavy panels.

All switchboard covers/doors are to be of the hinged type. Covers which have to be lifted out of position are unacceptable.

Main switchboards and motor control panels are to be extendable in both directions.

Unless otherwise specified, all wall mounting boards shall be front access only, and shall be manufactured in two parts:

a) a rear chassis, either built into or attached to, the supporting wall;

b) an outer panel, secured to the chassis on completion of the work, and readily removable from it.

The chassis will be manufactured from zinc coated mild steel, zintex steel, other approved method of electro galvanised mild steel or 3 CR12. The chassis shall have suitable knockouts, along the top and bottom panels, for the terminations of all conduits, in not more than two rows. A feeder cable entry knockout shall also be provided, suitable for the feeder cable rating indicated on the drawings.

The outer panel, secured to the chassis by means of adjustable bolts, carrying the equipment trays, the busbars and the wiring harness, is to be securely supported.

21.4.2 Painting

Tenderers are to price the following paint specification as a minimum requirement:

The surface is to be prepared prior to painting by phosphatisation cleaning/degreasing treatment. The surface is then to be coated with an etching primer, followed by a base coat and an epoxy polyester powder coating to a minimum thickness of 110 µm.

The colour of the finishing coats shall be decided at the time of shop and installation drawing approval.

Any on site paint damage to be treated and touched up immediately.

21.4.3 Accessories

Hinges shall be of the brass lift off type. Door/cubicle catches shall be of the Barker Nelson type provided these meet the standard specification. Rear covers to be hinged and locked by electrical panel key and shall not be secured by screws or bolts. Weld-on type hinges and door locks will not be acceptable.

Door opening, closing, latching and de-latching operations shall be smooth and quick, whilst ensuring proper compression of the sealing gaskets without damaging or marking the paintwork or corrosion-resistant surface of the Board.
Sealing strips and gaskets shall be made of durable, non-hardening synthetic rubber or other suitable material. Care must be taken to ensure that even pressure is exerted along the entire length of the gasket, and that neither deflection nor buckling of panels occurs when the gasket is compressed.

For switchboards intended for use indoors, and for external use in areas remote from the coast (100 kms), bolts, nuts and washers shall be cadmium-plated, electro-plated or galvanised.

For switchboards intended for use outdoors or in coastal areas e.g. Durban area, the minimum corrosion specification for all nuts, bolts and washers shall be 316 L stainless steel. Busbar bolts must be high tensile steel type, complete with lock-nuts and lock washers. To avoid damage to the paintwork, screws, bolts, door locks, etc., must not be in direct contact with painted surfaces.

The use of self-tapping screws is unacceptable. All tapped holes in metalwork shall have a minimum tapped thread length equal to the diameter of the tapped hole. All concealed/inaccessible nuts are to be of the permanently captive type. The electrogalvanised caged nut is unacceptable.

Tapped holes shall have the exposed metalwork protected against corrosion by the application of a suitable inhibitor over the tapped area, such as Tectyl or copperslip.

21.4.4 Cabling, Wiring and Busbars

The main busbars (including the neutral) shall be installed together along the top (wherever possible) of the switchboard, and along its full length. Busbars connected to C.B. stubs are to be sized and connected in accordance with the C.B. manufacturer’s requirements.

All outgoing circuit breakers on main switchboards shall be connected to vertical busbar droppers with copper busbar tails. Busbar tails to be shrouded.

Busbar droppers from the main busbars to be segregated from cable chamber.

All outgoing circuit breakers on main switchboards shall be fitted with copper busbar tails to facilitate cable terminations in the cable chamber and not on the circuit breaker. Busbar tails shall be shrouded.

Spare spaces shall be fitted with copper busbar tails (load and supply side) for future connection.

Phase identification shall be Red, White, Blue, reading top to bottom, left to right, and from front to back, when facing the front face of the board.

The insulation of the busbars and conductors shall not be stripped beyond the leading edge of the connection/terminal in which it has to be accommodated. Stripping shall be carried out without damage to the conductor, by means of a cable stripper.

Crimping lugs and ferrules shall be used for connection into equipment not provided with screw-type compression terminals. All crimps of conductors 35 mm² and above are to be subjected to test crimps.

All wiring and terminations shall be readily accessible. Under no circumstances may terminal rails be fixed to the D.B. tray or the side panels of the D.B. tray or the side panels of the D.B., or located close to live terminals, or positioned behind wiring run to equipment in the board.
The wiring shall be carried out neatly, along perpendicular lines, and it shall be accommodated in enclosed wiring channels.

The wiring shall not preclude the removal of, nor block the access to, any component.

Insulated conductors shall not be bunched together in order to avoid heat accumulation within the core of the bunch. If bunching of conductors in unavoidable, the conductors should be de-rated in accordance with the relevant Table of the S.A.N.S. 10142 as amended, Code of Practice, control and indication for the Wiring of Premises or BS7671.

Sub-distribution circuits protected by HRC fuses need only be rated for the maximum prospective asymmetrical fault level possible when the largest fusible link is installed in the fuse base.

The minimum conductor area of any wiring shall not be less than 2,5 mm² and no hard drawn copper wiring is to be used within the board. All wiring is to be of the tinned, fine stranded flexible type.

All wiring within boards is to be insulated. No B.C. wiring is permitted for either phase neutral or earth wiring; the earth bar being the exception. Single phase distribution boards shall be wired in red and black PVC insulated conductors. Three phase distribution boards shall be wired in red, white and blue, black and green PVC insulated conductors.

Control panels and motor contactor boards shall be wired on the power side, with red, white and blue insulated conductors. Live control wiring shall be orange. Unearthed and DC control wiring shall be grey.

Neutral connections shall be black, this colour must not be used for any other connection. Earth wiring shall be insulated green, or striped green-yellow, conductors.

Cable colour coding shall be discussed with the Engineer when foreign equipment, wired to different standards, is to be incorporated in the installation.

21.4.5 General and Installation Arrangement Details

Large air circuit breakers and switch fuse units shall not be positioned at high level, unless facilities are provided to assist maintenance staff in withdrawing these units.

The arrangement shall be such that sufficient space exists between adjacent items of equipment for the installation of incoming and outgoing conductors and for heat dissipation.

Moulded case circuit breakers in main switchboards shall be mounted side on.

The Board shall be of sufficient dimension to allow the installation of all equipment specified and any future equipment indicated on the drawings, without unduly restricting the access to, and the clearance between, the various rows.

Particular attention shall be paid to the accommodation and bending of incoming and outgoing conductors within the enclosure, and the working space necessary for making off the cables, installing the lugs and connecting into the equipment. Suitable provision shall be made for vermin-proofing the cable entries and earthing the armouring. Busbar bending radii shall not be less than the minimum permissible for the thickness of busbar being used.
Control/metering fuses or circuit breakers shall be base mounted on the relevant busbar. Unprotected wiring may not be run off busbars or from C.B. power terminals to remote fuses/equipment. These fuses/circuit breakers shall be easily accessible and completely safe for maintenance staff to service and repair.

Ring type current transformers shall be insulated from the busbars and fixings making electrical contact with the bar must be total shrouded and locked into position with lock nuts. Current transformers around different phase may not touch each other. A minimum clearance of 50 mm is to be maintained between adjacent CT’s, and between CT’s and adjacent busbars.

In general, main switchboards shall be arranged such that it is possible to make off and terminate cables and install additional switches, without any risk of coming into contact with live conductors.

Main switchboard panels shall be of uniform width, with not more than two size variations, i.e. 600 mm and 750 mm.

Single phase sections of three phase boards shall be separated from each other. Lighting on the left-hand side and single phase power circuit on the right-hand side or lower section or top section. Three phase power circuits are to be grouped together and be remote from the above single phase circuits. Extra space for future circuits shall be allowed for, as specified. Covers are to be provided over spare spaces. Similar provision for future circuits shall be made on the busbars, neutral and earth bars.

All parts of the distribution board metalwork shall be electrically continuous, and a suitable stud shall be provided for the earthing of the enclosures.

Particular attention shall be paid to the earth continuity of removable and hinged access panels, particularly those carrying supervisory and control equipment. Flexible copper straps may be used for the purpose of ensuring the earth continuity between the board and the panels.

A removable facia cover shall be provided behind a hinged door through which toggles and other operating handles shall project and fixed by means of suitable fasteners. This plate shall be supported so that its replacement and removal is easily achieved without having to manoeuvre the plate so that fasteners can engage.

All wiring terminations and connections shall be made behind the facia plate and shall not be accessible without its prior removal. The board shall be designed so that the switch toggles, instruments, etc., are easily accessible to operators of average height, (i.e. upper edge of equipment shall not be higher than 2 m or lower than 0.25 m above floor level) unless otherwise specified.

LV main and sub-distribution boards and motor control panels shall be erected, installed and commissioned in the positions shown on the drawings.

During transport to site and installation, the boards shall be protected against mechanical damage and vibration.

Boards shall not be moved on to site, nor be installed, until all building services and finishing trade work has been completed in the room or vicinity of where the boards are to be installed. If boards are installed prior to this the entire unit in each case must be shrouded in PVC bubble type wrapper.
The boards shall be installed in such a manner as to facilitate extensions, maintenance, testing and repair work, with easy access to cable entries/terminations, current transformers, potential transformers, small wiring terminal boards and relays, and busbar connections.

21.4.6 Installation/Shop Drawings and Samples

Drawings of all equipment shall be submitted to the Engineer, in triplicate, for approval, at least 6 (six) weeks in advance of the latest manufacturing commencement date.

As a minimum, the shop drawings shall indicate:

a) Busbar and dropper bracing and support details, including actual or type test certificate from an accepted testing station, in substantiation of short circuit capacity and withstand capability of the system.

b) Temperature rise calculation for each cubicle based on all circuits are equipment (including space for future) to be installed in the cubicle.

c) Main and distribution busbar section and size including selection/sizing criteria and calculations in substantiation of the full load rating (including derating for temperature rise limits and sizes/connection details to circuit breakers).

d) Equipment selection to achieve full load rating requirements shown on drawings to accommodate derating for temperature rise.

e) Time current characteristics of the incoming and outgoing circuit breakers and switch fuse units on transparent drawing paper to facilitate superposition of the characteristics on one another.

f) Fully dimensioned and detailed equipment layout/front elevation and sectional side elevations.

g) Details of construction, compliance with IP rating, access and cable termination facilities etc.

As a minimum, the dimensioned installation drawings shall indicate:

h) Position of switchboard relative to cable trenches, cable trays, adjacent wall and equipment.

i) Surrounding clear space between walls and adjacent equipment for access and maintenance purposes.

j) Cable entry details and cable routing and crossover aspects when entering the board.

k) Details of supports across trenches and the interface between the cable trench covers and switchboard.

The record drawings and manuals shall comprise the relevant final as approved and installed installation and shop drawings. The maintenance and fault finding manuals shall be explicit, shall cross-reference to the drawings, schematics and control logic diagrams, and shall provide full maintenance details, requirements, methods and schedules for each and every type of device employed. Furthermore, the manual shall contain spare parts lists and numbers, for all equipment.
21.4.7 Typical Arrangement Drawings

Arrangement drawings are included as a guide, and illustrate the desired arrangement concepts. In pricing and engineering the boards, cognisance must be taken of the actual constraints imposed due to the size and type of equipment to be accommodated, the location of the board within the building, the manner of installation, number and size of the circuits, cable entries, access and routing limitations within the building.
21.4.8 Labelling

All labels are to be of the traffolite type and fixed to the board with nuts and bolts. All internal control and indication components are to be labelled and correspond to the as built drawings.

21.4.9 Trench Boxes

Wherever necessary, cable trench covers must be cut to size and replaced to fit snugly around floor standing boards.

21.5 Witnessing of Tests

The engineer reserves the right to be present at any of the tests specified (factory or site tests). The Engineer shall be notified in time (2 weeks notice) to enable him to attend the tests should he wish to do so.

The tenderer shall replace any part of the Distribution Board should it be found not compliant with the specification, during tests or inspections. The replacement of any parts shall be for the Tenderer’s cost.

No Distribution Board shall be dispatched from the manufacturer’s works without the Engineer’s approval of its testing and overall quality.

21.6 Test Certificates

Two copies of test certificates shall be supplied to the Engineer prior to the equipment being delivered to site.

A copy of the factory and on site test certificates shall be incorporated into each maintenance manual.

A copy of the As Built shop drawings (including any on site modifications) and wiring diagrams shall be incorporated into each maintenance manual.
SCHEDULE OF TESTS FOR COMPLIANCE WITH FULLY, PARTIALLY AND SPECIALLY TYPE TESTED ASSEMBLIES TO BE COMPLETED BY TENDERER, SUPPORTING DOCUMENTATION TO SUBSTANTIATE EACH OF THE FOLLOWING TESTS ARE TO BE SUBMITTED AT TENDER

<table>
<thead>
<tr>
<th>No</th>
<th>Characteristics to be checked</th>
<th>Type Tested Assembly (TTA) Tenderer to confirm compliance with the following type tests</th>
<th>Partially Type Tested Assembly (PTTA) Tenderer to confirm compliance by type test, calculation or visual inspections</th>
<th>Specially Type Tested Assembly (PTTA) Tenderer to confirm compliance by type test, calculation or visual inspections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Temperature rise limits</td>
<td>Verification of temperature rise limits by test</td>
<td>Verification of temperature rise limits by test or extrapolation from type-tested ASSEMBLIES</td>
<td>Verification of temperature rise limits by test or extrapolation from type-tested ASSEMBLIES</td>
</tr>
<tr>
<td>2</td>
<td>Dielectric properties</td>
<td>Verification of dielectric properties by test</td>
<td>Verification of dielectrical properties by test according to 8.2.2 or 8.3.3, or verification of insulation resistance according to 8.3.4 (see No. 11)</td>
<td>Verification of dielectrical properties by test according to 8.2.2 or 8.3.3, or verification of insulation resistance according to 8.3.4 (see No. 11)</td>
</tr>
<tr>
<td>3</td>
<td>Short-circuit withstand strength</td>
<td>Verification of the short-circuit withstand strength by test</td>
<td>Verification of the short-circuit withstand strength by test or by extrapolation from similar type-tested arrangements</td>
<td>Verification of the short-circuit withstand strength by test or by extrapolation from similar type-tested arrangements</td>
</tr>
<tr>
<td>4</td>
<td>Effectiveness of the protective circuit</td>
<td>Verification of the effective connection between the exposed conductive parts of the ASSEMBLY and the protective circuit by inspection or by resistance measurement</td>
<td>Verification of the effective connection between the exposed conductive parts of the ASSEMBLY and the protective circuit by test or appropriate design and arrangement of the protective conductor (see 7.4.3.1.1. last paragraph)</td>
<td>Verification of the effective connection between the exposed conductive parts of the ASSEMBLY and the protective circuit by inspection or by resistance measurement</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
<th>No</th>
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<tr>
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<tr>
<td>No</td>
<td>Characteristics to be checked</td>
<td>Type Tested Assembly (TTA)</td>
<td>Partially Type Tested Assembly (PTTA)</td>
<td>Specially Type Tested Assembly (PTTA)</td>
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<td>Tenderer to confirm compliance with the following type tests</td>
<td>Tenderer to confirm compliance by type test, calculation or visual inspections</td>
<td>Tenderer to confirm compliance by type test, calculation or visual inspections</td>
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<tr>
<td>5</td>
<td>Clearances and creepage distances</td>
<td>Verification of clearances and creepage distances</td>
<td>YES</td>
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<td>NO</td>
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<tr>
<td>6</td>
<td>Mechanical Operation</td>
<td>Verification of mechanical operation</td>
<td>YES</td>
<td>Verification of mechanical operation</td>
<td>YES</td>
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<td>7</td>
<td>Degree of protection</td>
<td>Verification of the degree of protection</td>
<td>YES</td>
<td>Verification of the degree of protection</td>
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</table>

Tenderers are to list the fault free zones, cubicles, switching devices and associated control, measuring, signalling, protective, regulating equipment which are excluded from the above tests as they are considered unlikely to influence the performance.

<table>
<thead>
<tr>
<th>Equipment</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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<td>2</td>
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<tr>
<td>3</td>
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<td>9</td>
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<tr>
<td>10</td>
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</tbody>
</table>

For partially and specially type tested assemblies as a minimum, test 3 is to be verified by type testing, tests 1, 4 and 5 by calculation and tests 2, 6 and 7 by visual inspection (calculations and visual inspection to be signed off by a professionally registered electrical engineer employed by the manufacturer).
22. CABLING AND BUSBARS

22.1 Standards

Where applicable, equipment shall comply with the latest edition and amendments of:

SANS 97 – Electric Cables (Impregnated paper insulated metal-sheathed)
SANS 1507 - Electric cables with extruded solid dielectric insulation for fixed installations
SANS 1339 – Electric Cables (XLPE)
BS1858 – Bitumin based filling compound
SANS 808 Glands for use on flameproof enclosures

22.2 Equipment

22.2.1 Busbars

Busbars are to consist of copper conductors. Phase conductors are to be fully rated for the current rating as shown \(1.6A/mm^2\) with a maximum rise of 15°C (on the copper) above an ambient room temperature of 40°C. The neutral bar is to be 1000% of the rating of one of the phase conductors and made of copper. No internal earth conductor is required.

Conductors to be manufactured form 99% pure electrolytic copper.

The spacing of the bars is not to exceed 10 mm between the phase conductors and phase to neutral, except at the termination and joints. (Supplier to advise spacing at the joints at time of tender.)

The busbar is to be rated at IP54 over the complete length of busbar including joints.

Joint covers are to be manufactured with a fixing arrangement to allow easy and safe installation and removal, (cable ties are not acceptable). Joint cover material shall allow infra red testing of the joints without removing the cover.

Transformer and Main LV board panel flanged end feed units are to be suitably arranged to terminate on to transformer bushings via flexibles. Flexibles to be supplied with the busbar flanged end unit.

The busbar (including covers) shall be painted hammertoe grey Plascon CEP 5010.

Each section of busbar is to be tested at 2 kV for 1 minute at the factory and on site prior to installation on site. On completion of the busbar installation the busbar is to be retested at 2 kV for 1 minute.

All the above tests are to be recorded on a single test sheet per busbar run and submitted to the Engineer prior to energising.

Copies of the above test to be included in the as built manuals.

22.2.2 PILCSTA and PILCSWA Cables

Paper-insulated cables shall be manufactured in accordance with SANS 97.

Cable-end boxes shall comply with BS 542 and the filling compound to BS 1858.
The ends shall be terminated in cable-end boxes filled with bituminous cold filling or resin oil semi-fluid compound or heat-shrinkable terminations in accordance with the specification, and to the manufacturer’s recommendation.

Before terminating or joining PILCSTA and PILCSWA cables, a test to establish the presence of moisture must be carried out. The test procedure must be forwarded to the Engineer for approval.

The armouring shall be bonded to the main earth bar of the switchgear or transformer, but the bond shall be easily removable for testing purposes.

All cut cable-ends, which will be exposed to the atmosphere for more than two hours shall be sealed and wiped to prevent penetration of moisture.

22.2.3 PVC-Insulated Cables

PVC-insulated cables shall be manufactured in accordance with SANS 1507.

PVC cable glands shall be made of a barrel carrying a cone bush screwed into one end and a nickel-plated brass nipple and galvanised steel lock-nut on the other end.

Flameproof glands shall comply with SANS 808 Groups 1, 2 (a) and 2 (b).

All cable ends shall be terminated with approved glands ensuring a watertight connection between the sheath, gland and equipment. In cases where copper ECC earth conductors are jointed to the armouring, special glands adhering to SANS 1507 shall be used for ECC cables.

The glands to be used shall be constructed so that the armouring of the cable is clamped between two bevelled cores with a screw-clamp, with the cable gland screwed to the gland plate or equipment and fixed with a locknut.

A neoprene or PVC shroud of the correct size shall be used to seal the gland and sheath watertight.

A supporting channel or other approved means of support shall be provided to remove mechanical stress from the cable glands.

22.2.4 XLPE Cables

XLPE isolated cables shall be manufactured in accordance with SANS 1339 Table A.

Cable ends shall be terminated strictly in accordance with manufacturer’s specifications. The termination shall withstand the same test voltage as the rest of the cable.

Termination for XLPE cables must have a satisfactory stress relief in order to keep the partial discharges extinguished.

Outdoor termination must be able to withstand air pollution and bad weather without any signs of surface current tracking.

Taped or prefabrication terminations may be used, in accordance with the manufacturer’s recommendation.
22.3 Cable Installation

The storage, transportation, handling and laying of cables shall be according to first-class practice, and the Contractor shall have adequate and suitable equipment and labour to ensure that no damage is done to the cables during such operations.

All possible care shall be exercised in off-loading cables on site. Any drums which show signs of damage or mishandling, shall not be used and must be replaced with fresh stocks.

Cable drums remain the property of the Contractor and shall be removed from site and disposed of by him.

The Contractor is wholly responsible for making his own arrangements regarding the transportation to and from site, and the storage on site, of material and equipment; and the loss of or damage thereto, during transportation or storage on site, of material and equipment.

Tenderers shall satisfy the Engineer that they are competent to install/lay the cables specified, and must have had previous experience of cable laying and jointing of the sizes and types of cable indicated.

Where cables have to be drawn around corners, skid plates shall be used for this purpose, and these plates shall be well lubricated. The skid plates shall be securely fixed between rollers and shall be constantly examined during cable-laying operations.

Cables shall be visually inspected for damage during and after laying. Any damage shall be reported immediately to the Engineer, who will advise as to what action is to be taken.

The intention to carry out all cable-laying operations must be given to the Engineer, in advance, to allow inspection of the works.

Cable pulling and laying shall preferably be done manually wherever possible. Mechanical means, such as winches and the like, may only be used subject to the approval of the Engineer. No cable shall be subjected to a tension exceeding that stipulated by the cable manufacturer.

The Contractor shall maintain an approved means of communication between operators at the pulling end and the drum end of the cables, during laying operations.

L.V. cables (except where more than one run in a pipe) shall be spaced at least 150 mm apart. Two pilot cables can be run next to each other but must be 600 mm from the nearest 11 kV cable. Cables may not be buried or laid on top of each other.

Cable pipes must maintain or exceed the specified cable spacings. Where additional pipes or cable protection materials are required to be laid, the Engineer shall be advised timely of the location and quantity of such materials required. The Contractor shall be responsible for the laying and jointing of these pipes, at a rate agreed before work commences.

All cables are to be labelled at each end and at every change in direction or position within a group of cables. Cables are to be labeled at both sides of horizontal or vertical penetrations through structure or building fabric.
Whenever cables enter building, or are exposed for any reason, the exposed portion shall be suitably protected by means of concrete slabs or suitable pipes or ducts, which shall be galvanised if of steel construction.

22.4 Testing and Commissioning

22.4.1 400V Cables

Low tension cables shall be tested to earth and between phases, with a 500 Volt "Megger" test set.

22.4.2 11000V Cables

11 kV cabling shall be as follows:

<table>
<thead>
<tr>
<th></th>
<th>500 V Megger between phases</th>
<th>500 V Megger between phases and SWA/copper tape</th>
<th>Pressure Test sheath to 4 kV DC between armouring and mass of earth for 1 minute</th>
<th>Pressure Test Phase to phase at 12 kV DC for 10 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable drum arrival on site</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>After cable installed and before ends prepared</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>After ends are prepared, before bolting to equipment</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>

On completion of the test on any cable, the Contractor shall, without delay, submit 3 (three) copies of Certified Test Reports to the Engineer.

The costs of all the tests mentioned above shall be borne by the Contractor as part of the tendered price.

The Engineer reserves the right to carry out any further tests deemed necessary, using the Contractor's instruments and equipment.

23. CABLE TRAYS AND LADDERS

23.1 General

Cable trays and ladders shall comply with SANS 763 with respect to finishes.

The Contractor shall supply and install all cable trays and/or ladders as specified or as required including the necessary supports, clamps, hangers, fixing materials, bends, angles, junctions, reducers, T-pieces, etc. He shall further liaise with the Main Contractor for the provision of holes and access through the structure and finishes.

23.2 Supports

Trays shall be supported at the following maximum intervals:

- 1.6mm Thick metal trays with 12mm return: 1000mm
- Metal trays with folded overreturn and 50mm upstand: 1220mm
- 2.4mm Thick metal trays and 75mm return: 1500mm
- Metal cable ladders other than those mentioned below: 1500mm
3.0mm Thick PVC trays with 40mm return    1000mm
4.0mm Thick PVC trays with 60mm return    1500mm

In addition, trays and ladders shall be supported at each bend, offset and T-junction. The above spacing of supports is applicable to both vertical and horizontal installation of trays and ladders.

23.3 Joints

Joints shall be smooth without projections or rough edges that may damage the cables. The Contractor will be required to cover joints with rubber cement or other non-hardening rubberised or plastic compound if in the opinion of the Engineer joints may damage cables. Joints shall as far as possible be arranged to occur at supports. Where joints do not coincide with supports, joint shall, in the case of trays with single returns, be made by means of wrap-around pieces of the same thickness of the tray and at least 450mm long. The two cable tray ends shall butt tightly at the centre of the splice and the splice shall be bolted to each cable tray by means of at least eight round head bolts, nuts and washers. Splices shall have the same finish as the rest of the tray. Where joints which do not coincide with supports occur in trays with folded over returns, tight fitting metal guide pieces, at least 450mm long, shall be inserted in the folded return to provide the necessary support to the two cable tray ends. Splices as described above shall be provided at joints, which do coincide with supports if the loaded tray sags adjacent to the joint due to the interruption of the bending moment in the tray.

23.4 Fixing

Trays and cable ladders shall be bolted to supports by at least two round head bolts per support. Bolts shall be securely tightened against the tray surface to avoid projections, which might damage cables during installation.

23.5 Fixing to the Structure

The support for cable trays and ladders shall in all cases be securely fixed to the structure by means of heavy duty, expansion-type anchor bolts. Cantilevered trays shall be supported at two points with a minimum of two expansion bolts per support. It is the responsibility of the Contractor to ensure that adequate fixing is provided since cable trays and ladders that work loose shall be rectified at his expense. The fixing shall take into account site conditions that prevail during installation.

23.6 Earthing

Metal trays and ladders shall be bonded to the earth bar of the switchboard to which the cables are connected with a Cu PVC cable. Bare copper stranded conductors or copper tape shall be bolted to the tray or ladder to ensure electrical continuity. These shall be installed on the outside of the tray to ensure they are visible and are not damaged by cable installation.

23.7 Expansion Joints

Where cable trays/ladders have to cross expansion joints, the trays/ladders must form a gap of at least 25mm between the two sections. Cables installed across expansion joints, must have enough slack to accommodate the expansion of the building.
24. TRENCHING

Tenderers are to note that:

**Hard rock:**
shall mean granite, quartzitic sandstone, slate and rock of a similar or greater hardness, solid shale and boulders over 0.03m³ in volume.

**Soft rock:**
shall mean rock that can be loosened by hand-pick and includes hard shale, compact ouklip and boulders from 75mm in diameter up to 0.03m³ in volume.

**Earth**
shall mean ground that can be removed by pick and hand shovel and includes loose gravel, clay, made-up ground, loose or soft shale, loose ouklip and boulders less than 75mm in diameter.

25. CONDUIT AND WIRING CHANNELS

Unless otherwise specified, all conduit is to be concealed by casting/building into walls and slabs, or by running in ceiling spaces and within purlins.

Conduit runs to wall luminaire outlets shall, in all instances, be from above the outlet and not below via floor slabs. No conduit is permitted in ground slabs, unless otherwise indicated on the drawings, or required by building construction techniques and sequences. Luminaire conduit shall be looped from outlet to outlet, and no additional drawbox positions will be permitted.

No more than two right-angled bends between draw boxes is permitted.

All 150 x 50, 150 x 150, or larger, terminal conduit boxes shall be of galvanised steel type. The corresponding PVC type will not be accepted. PVC round conduit boxes that have covers fixed by screwing directly into the PVC box, are unacceptable.

In coastal areas (within 70 kms of the coastline) all galvanised sheet steel outlet boxes are to be given two coats of Red Lead or Glyptal Primer, before installation.

Conduit shall only be run parallel or at right angles to outside walls when run in ceiling spaces, unless otherwise indicated on drawings.

Exposed metal conduit threads are to be protected against corrosion.

No running joints are allowed unless agreed by the Engineer, in writing.

Black enamelled steel conduit may not be used in coastal areas. All steel conduit systems must be electrically continuous. PVC conduit systems are to be provided with an earth wire for each circuit.

All draw trays shall be sheet steel galvanised and painted as above, or as specified.

Conduits across expansion joints shall be arranged in such a manner that each side of the joint is free to move relative to the other, without damage to conduit or wiring.

Unless otherwise indicated, only one circuit is to be installed in each conduit. This does not apply to conduits rising from distribution draw trays. In this case the Contractor is to de-rate conductors by
50% (fifty per centum) and ensure that conduit trunking capacity is adequate to provide 50% (fifty per centum) (maximum) occupancy.

Final positions of all outlets are to be verified on site with the Structural Engineer's detailed drawings.

In general, the following heights above finished floor level, to underside of box are to be observed unless otherwise indicated on the drawings:

<table>
<thead>
<tr>
<th>Outlet Type</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall switches</td>
<td>2100 mm</td>
</tr>
<tr>
<td>Wall outlets for luminaries</td>
<td>500 mm</td>
</tr>
<tr>
<td>Wall mounted socket outlets</td>
<td>150 mm above counter</td>
</tr>
<tr>
<td>Wall mounted socket outlets in kitchen and over work tops</td>
<td>2400 mm</td>
</tr>
<tr>
<td>Bells, buzzers and fire alarm bells</td>
<td>1600 mm</td>
</tr>
<tr>
<td>Fire alarms</td>
<td>500 mm</td>
</tr>
<tr>
<td>Telephone outlets</td>
<td>2400 mm</td>
</tr>
<tr>
<td>Clock outlets</td>
<td></td>
</tr>
</tbody>
</table>

Where the Engineer has any reason to suspect that wiring has been damaged during drawing into conduit, the Contractor will be requested to withdraw the wiring for inspection. For pricing purposes sub-contractors should allow for the withdrawing and reinstatement of five circuits, overall.

The Contractor should, therefore make due allowance for this.

The conduit routes shown on the drawings are schematic, and the Contractor must ensure that the manner of installation and routing of all conduit is carried out in accordance with the Regulations and good engineering practice, and takes cognizance of the relevant architectural/building restraints.

The capacity of conduits will be checked on site. Where the recommended capacity is exceeded, the Contractor will be required to re-wire the circuits concerned.

All accessories such as boxes for socket outlets, switches, lights, etc., shall be accurately positioned. It is the responsibility of the Contractor to ensure that all accessories are installed level, square, and at the correct height.

It shall be the responsibility of the Contractor to determine the correct final floor, ceiling and roof levels in conjunction with the Principal Contractor. Draw boxes shall be installed as inconspicuously as possible and shall not be installed in positions where they will be inaccessible after completion of the installation. Positions of all draw boxes shall be indicated on the "AS BUILT" drawings.

Galvanised steel draw wires shall be installed in all unwired conduits, e.g., conduits for future extensions, telephone installations and other services.

A maximum of two 90° bends or the equivalent displacement will be allowed between outlets and/or boxes.

Care shall be taken to prevent debris or moisture entering conduits during and after installation. Conduit ends shall be sealed by means of a solid plug, which shall be screwed to the conduit end. Conduits shall be cleaned and swabbed to remove oil, moisture or other debris that may be present before conductors are installed. Swabs shall not be attached to the conductors.

25.1 Termination of Conduits

a) Switchboards, Power skirting, etc.
Conduits shall be terminated by means of a brass female bush and two lock nuts in distribution boards and power skirting, etc. The conduit end shall only project far enough through the hole to accommodate the bush and lock nut.

b) **Draw Boxes**

A female bush and two lock nuts shall be used to terminate conduits at draw boxes should there be sufficient room in the box. Where there is insufficient room, a coupling and a brass male bush may be used with sufficient allowance for the reduction of the internal diameter by the male bush.

### 25.2 Screws, Bolts and Nuts

Steel locknuts of thick gauge steel with milled sides shall be used in all cases. Cadmium-plated bolts and nuts shall be used, except where the installation is exposed to the weather, in which case brass bolts and nuts shall be used. Screws shall be installed in all tapped holes in fittings and accessories to prevent damage to the screw thread by concrete or plaster. The screws shall be screwed down completely to prevent damage to the thread on the screw.

### 25.3 Installation in Concrete

a) **Timeous Installation**

In order to prevent delay to building operations, the Contractor shall ensure that all conduits and accessories to be cast into concrete are placed in position in good time. Once the installation has been completed, the Contractor shall advise the Engineer in order that he may inspect the installation prior to concrete being cast. The Contractor or his representative shall be in attendance when the concrete is cast.

b) **Draw Boxes and Joints**

Draw boxes, expansion joints and round ceiling boxes shall be installed where required, and shall be neatly finished to match the finished slab and wall surfaces. Ceiling draw boxes shall be of the deep type. In hollow tile slabs, rear entry draw boxes shall be used. In columns where flush mounted draw boxes are installed, the conduits shall be offset from the surface of the column immediately after leaving the draw box.

Draw boxes shall be installed at maximum intervals of 15m in straight runs. Where these boxes will be visible on the bottom of ceiling slabs, the boxes shall be positioned so that they will be hidden by light fittings, etc.

Couplings are to be taped up with adhesive rubber tape to prevent the ingress of concrete slurry.

c) **Cover Plates**

Draw boxes and/or inspection boxes shall where possible; be grouped together under a common approved plate. The cover plate shall be secured by means of screws.

d) **Fixing to the Shuttering**

All conduits, draw boxes, etc., shall be securely fixed to the shuttering to prevent displacement when concrete is cast. Draw boxes and outlet boxes shall preferably be secured by means of...
a bolt and nut installed from the back of the box, through the shuttering. Wire will not be accepted for securing boxes to the shuttering where off-shutter finishes are required. Where fibre-glass shuttering is used, the conduits and boxes shall be fixed to the reinforcing steel only and no holes shall be drilled or made in shuttering.

All draw boxes and outlet boxes shall be plugged with wet paper before they are secured to the shuttering.

e) Expansion Joints

Conduits shall not be installed across expansion joints if avoidable.

f) Screed

Where conduits are installed in screed, the top of the conduit shall be at least 20mm below the surface of the screed. A minimum distance of twice the outside diameter of the conduit shall be left free between adjoining conduits. Conduits shall be secured to the concrete slab at intervals not exceeding 2.0m.

g) Inspection

After removal of shuttering, all conduits shall be checked to ensure that they are not blocked. Errors that occur during the installation of the conduits, or any lost draw boxes, or blocked conduits shall be immediately reported to the Engineer in order that an alternative route may be planned and approved before any additional concrete is cast.

25.4 Surface Installation

a) Appearance

All conduits shall be installed horizontally or vertically as determined by the route. Where conduits are to be installed directly alongside doorframes, beams, etc., that are not true, the conduits shall be installed parallel to these.

b) Saddles

Conduits shall be firmly secured by means of equidistant spaced saddles. Conduits shall be secured within 150mm before and after each 90° bend. Saddles shall be fixed by means of screws and plugs and not by means of nails.

c) Joints

Joints will only be allowed in surface conduit lengths exceeding 3500mm.

d) Accessories

Inspection bends or tee pieces shall not be used. Non-inspection type bends may be used in the case of 32mm or 50mm diameter conduits.

All draw boxes supporting light fittings or other equipment shall be fixed independently of the conduit installation.
25.5 Future Extensions

a) Open Roof Spaces

Conduits for future switch and socket outlets in roof spaces with more than 900mm free space shall terminate 40mm above the tie beams. The conduit ends shall be threaded and provided with a coupling and brass plug.

b) Concrete Slabs

Conduit ends shall protrude 150mm from the concrete to facilitate the installation of future extensions. All such conduits shall be connected to a draw box, which is cast into the concrete within 2m of the end of the concrete. Conduit ends shall be threaded and provided with a coupling and brass plug. In cases where holes cannot be drilled through the shuttering to accommodate the conduit end, a deep draw box with rear entry may be placed around the conduit end.

c) Cover Plates

All boxes for future switch and socket outlets shall be covered by blank cover plates. All boxes for future light fittings shall be covered with round oversized cover plates.

25.6 Expansion Joints

Where conduits cross expansion joints in the structure, approved type draw boxes, which provide a flexible connection in the conduit installation, shall be provided.

The draw box shall be installed adjacent to the expansion joint of the structure and a conduit sleeve one size larger than that specified for the circuit, shall be provided on the side of the draw box nearest
the joint. The one end of the sleeve shall terminate at the edge of the joint and the other shall be secured to the draw box, by means of locknuts and a standard bushed adaptor.

The circuit conduit passing through the sleeve shall be terminated 40mm inside the draw box and in the case of metallic conduit; the conduit end shall be fitted with a brass bush. The gap between the sleeve and the conduit at the joint shall be sealed to prevent ingress of wet cement. In the case of metallic conduit, an earth clip shall be fitted to the conduit projection inside the draw box and the conduit bonded to the box by means of 2.5mm² bare copper earth wire and a brass bolt and nut.

In addition to an earth wire, which may be specified for the circuit, a 2.5mm² bare copper wire shall be provided between the first conduit box on either side of the joint in the case of metallic conduit. The conduit boxes shall be drilled and tapped, and the earth wire shall be bonded to the boxes by means of lugs and brass screws.

Draw boxes and the expansion joint shall be provided with a suitable steel cover plate fixed to the box by means of screws. The cover plates shall be installed before the ceilings are painted.

Where a number of conduits are installed in parallel they shall cross the expansion joints of the structure via a single draw box. A number of draw boxes adjacent to each other will not be allowed.

25.7 Chases and Builder’s Work

Electrical materials required to be built-in shall be supplied and fixed in position by the Contractor as required by the programme of the Principal Contractor. The Contractor shall ensure that these materials are installed in the correct positions.

On contracts on which there is no builder, the Electrical Contractor shall cover conduits installed in chases by means of a 4:1 mixture of coarse sand and cement, finished 6mm below the face of the plaster and roughened. In all cases, chases shall be deep enough to ensure that the conduits are at least 20mm below the finished plaster surface.

Where the Contractor is responsible for the cutting of chases, building-in of conduits or other equipment, he will be held responsible for all damage as a result of this work and will be required to make good. Chases shall be carried out by means of a cutting machine.

Under no circumstances shall face brick walls or finished surfaces be chased or cut without the written permission of the Engineer. Where it is necessary to cut or drill holes in the concrete structure, the prior permission of the Structural Engineer shall be obtained.

25.8 Wiring Channels

The channels shall be either hot dip galvanised or electro-galvanised, shall be coated with cold galvanising at all joints, sections that have been cut and at places where the galvanising has been damaged. Powder coated ducts shall be touched up at joints, cuts and damaged portions, using paint recommended by the manufacturer of the channels.

a) Cover Plates

Channels up to 125mm wide shall have snap-in cover plates of metal or PVC, whilst channels wider than 125mm shall have metal cover plates fixed in position by screws.

The finish of steel cover plates shall be the same as that of the channels.
b) **Accessories**

All accessories, i.e., hangers, brackets, etc., shall be purpose-made and in general have the same finish as the channels.

c) **Capacities of Channels**

Trunking is defined as a channel having one or more sides removable for access to wiring, whilst ducting has no removable sides.

In the case of trunking, the overall cross-sectional areas of all the conductors, including insulation, shall not exceed 45% of the internal cross-sectional area of the trunking whilst in the case of ducting, this figure shall be 40%.

Where trunking or ducting is run in a distribution board, it shall be filled to not more than 30% unless it is ventilated, in which case, the former figures shall apply.

Common wire ways will be permitted only in the case of conductors carrying relatively low currents, namely lighting and single phase socket outlet circuits. In such cases, the maximum number of wires per conduit shall be in accordance with SANS 10142.

d) **Fixing of Channels**

The Contractor shall supply and install all hangers, supports or fixings for the channels. Channels up to 75 x 75mm shall be supported at maximum intervals of 600mm and larger channels at maximum intervals of 1m. Channel runs shall be carefully planned to avoid clashes with other services and to ensure that all covers can be removed after completion of the entire installation. Purpose-made clamps, hangers etc., shall be used as required. Where it is not possible to support the channels at the specified intervals, they shall be supported in a sound manner to the satisfaction of the Engineer.

e) **Installation in Concrete**

Channels shall be filled with polystyrene or other suitable fillers to prevent ingress of cement and shall be securely fixed in position to the shuttering.

f) **Joints**

Adjoining lengths shall be aligned and securely jointed by means of fishplates fixed by mushroom bolts, washers and nuts or connection pieces that are pop-riveted to both adjoining sections. Adjoining sections shall butt tightly. Covers shall fit tightly across the joint.

Where channels cross expansion joints in the concrete, suitable expansion joints shall be provided in the channels by means of fishplates pop-riveted or screwed to the channel on one side of the expansion joint and floating freely in the channel on the other side of the expansion joint.
g) **Support for Conductors**

All conductors in inverted cable channels shall be retained by means of metal clips or metal spacer bars at not less than 1m centres. Clamps shall be provided on suitable draw boxes for this purpose.

h) **Internal Finishes**

Burrs and sharp edges shall be removed and the inside edges of all joints shall be lined with rubber cement or other suitable rubberised or plastic compound to prevent laceration of the conductor insulation.

All holes through which conductors pass shall be fitted with grommets.

i) **Vermin Proofing**

All wire ways shall be vermin proof after installation. Holes shall be covered by means of screwed metal plugs or by means of metal strips that are bolted or pop-riveted to the channel.

26. **WIRING INSTALLATION**

26.1 Type of Conductors

All wiring shall be carried out with PVC insulated, stranded copper conductors and bare stranded copper earth wires, complying with SANS 10150.

Conductors shall be installed in conduit, trunking or ducting. Under no circumstances will open wiring be acceptable.

Where surface wiring cannot be avoided, aluminium sheathed cable may be used instead of surface mounted conduit, but prior permission from the Engineer shall be obtained.

Conductors connected to different distribution boards shall not be installed in a common wire way.

26.2 Looping

All wiring shall be carried out by means of the loop-in system. Jointing of conductors shall only be carried out in accessible boxes or in conduit runs. Conductor jointing shall be carried out by means of ferrules insulated with PVC tape.

26.3 Grouping of Circuits

Where conductors of more than one circuit are installed in wire ways, the conductors of each circuit shall be taped together at intervals of one metre with PVC tape. A common unbroken earth conductor may be installed into the wire ways, and subsidiary earth wires to the various outlets, shall be connected to this earth wire by means of crimped connections.

26.4 Different Phases

With the exception of 3-phase outlets, circuits of different phases shall not be present at switch or socket outlet boxes.
26.5 Vertical Wireways

Conductors installed in vertical wireways shall be secured at intervals not exceeding 5m in order to support the mass of the conductors. Suitable clamps shall be provided for this purpose.

26.6 Connections

When more than one conductor enters a terminal, the strands shall be securely twisted together. Under no circumstances shall strands be cut off.

26.7 Earthing Conductors

When earth continuity conductors are looped between outlets, the looped conductor ends shall be twisted together and then soldered or ferruled in order to ensure that earth continuity is maintained when the conductor is removed from a terminal.

When a single earth conductor is used for a group of current carrying conductors as in power skirting trunking or ducting, the size of the earth conductor shall be to the approval of the Local Supply Authority.

26.8 Single Pole Switches

Single pole switches shall be connected so as to break the phase conductor, and not the neutral conductor.

26.9 Wiring in Partitions

Where wiring is installed in demountable partitions, the metal supports for the partitions may be utilised for carrying wiring subject to:

a) The conductors not being exposed,
b) the metal supports being properly earthed,
c) a separate bare earth continuity conductor being drawn in together with the current carrying conductors, with this earth continuity conductor being connected to the metal parts of the switches and socket outlets, and
d) the conductors being installed in non-flammable sections of the partitions.

Conductors enclosed in copper braiding may be installed in demountable partitions.

The braiding may be used as the earth continuity conductor. This wiring shall be jointed to the conduit or cable installation by means of jointing the conductors and earth continuity conductor in a suitable draw box with ferrules or screwed terminal blocks. This draw box shall be situated immediately above the partition.

26.10 Colours

The colours of conductor insulation for sub-circuits shall, as far as possible, correspond with the colour of the supply phase. The colours of conductors for the wiring of two-way and intermediate switches shall differ from those of phase conductors.

Not more than two wires are to be terminated at any one terminal.
Before terminating, the strands of the conductor are to be tightly twisted to ensure a good and lasting terminal contact. Untwisted wire terminations will be rejected.

Insulation of wiring or cable conductors that have been nicked or cut during preparation of the end will be rejected if these cannot be adequately reinstated by oversleeving.

Insulation must not be pared back excessively at the terminal. Maximum excess of 3 mm is permitted.

Wiring connections to luminaires should either be looped in and out without being cut in half or a scotch clip type T off connection used to avoid intermittent and difficult to locate open circuits occurring.

26.11 Within Distribution Boards

All boards are to be left in a completely clean and dust free condition.

Incoming wiring must be neatly run and located clear of equipment.

During installation, paintwork is to be protected at all times.

Unless otherwise agreed, not more than one live or incoming supply is permitted per board and all incoming live wiring is to be simultaneously isolated by a single action isolating device.

Live terminals in boards are to be shrouded.

All terminals and busbars are to be checked for tightness.

Circuit cards are to indicate circuit numbers as on the layout drawings, phasing, type of circuit and circuit identity i.e. "s.s.o's for fridges 11 to 15" etc.

Final circuit labelling is to be given to the board manufacturer by the contractor and shall reflect layout drawing circuit number and phasing.

All metal in or on boards is to be effectively earthed.

Any holes required on gland plates or boards are to be neatly punched and the bare metal treated to prevent rust.

26.12 Wiring Terminals

a) Terminal bodies and screws shall be of non-corrosive metal, enclosed in fire resistant, moulded plastic insulating bodies. Terminal bodies or screws shall not project beyond the insulating material and shall afford suitable protection against accidental contact by personnel and against short circuits and tracking.

b) The construction of the terminal block and mounting rail shall be such as to ensure a firm and positive location of the terminal blocks. It shall be possible to add additional terminal blocks within the terminal sequence without having to disconnect or dismantle the terminal strip. The terminal blocks shall be held in position by means of standard end clamps.
c) It shall be possible to intermix terminals of various sizes, i.e. for different sizes of conductors, whilst utilising the same mounting rail. Where smaller terminal blocks occur adjacent to larger terminal blocks, suitable shielding barriers shall be inserted to cover the terminals that might otherwise be exposed.

d) The terminal bodies and clamping screws shall be so constructed as to ensure that conductors are not nicked or severed when the clamping screws are tightened. Screws shall not come in direct contact with the conductors.

e) Terminals shall be sized and rated to match the conductors that are connected to them.

f) Each terminal block shall have provision for clip-in numbering or labelling strips to be installed, together with protective, clear caps over the sheets.

27. LUMINAIRES

27.1 General

The mounting positions of light fittings shall be verified on site. All fittings shall be placed symmetrically with respect to ceiling panels, battens, beams, columns or other architectural features of the space unless otherwise shown.

The layout as shown in the document shall generally be adhered to, but any discrepancies or clashes with structural or other features must be referred to the Engineer before commencing with the installation. Should the Contractor neglect to refer such discrepancies to the Engineer, costs incurred as a result of subsequent alterations to suit the building or structural features will be for the Contractor's account.

27.2 Cover Plates

Cover plates shall be fitted over all draw boxes and outlets intended for fittings that are not covered by the fitting canopy, lamp holder, ceiling rose or similar accessories.

27.3 Fixing to Draw Boxes

Where an outlet box or draw box provides the necessary support for light fittings, all fittings with the exception of fluorescent fittings mounted against the ceiling shall be fixed directly to the box. Fittings with a mass in excess of 10kg shall however be suspended independently of the outlet box.

27.4 Hangers and Supports

Where provision has not been made for the fixing of fittings, the Contractor shall supply the necessary supports, hangers, conduit extensions, angle brackets or any other fixing method approved by the Engineer.

27.5 Suspended Luminaires

The necessary hangers shall be provided where fittings, which are of the non-suspension type, have to be fixed below roof slabs. The use of 20mm conduits fixed to the roof slab is preferred. Provision shall be made for adjustments to enable the levelling of fittings.
Suspended conduit shall be fixed to the ceiling by means of screwed dome lids, bolts and nuts. Ball-and-joint type dome lids shall be used where conduit lengths exceed 600mm. Wiring shall be installed in the conduit hangers.

27.6 Suspended Wiring Channels

Light fittings (especially fluorescent fittings) may also be suspended from ceilings by means of suspended metal channels. The metal channel may be supported by conduits or threaded rods. Should metal rods be utilised, these shall be screwed to anchor bolts fixed in the roof slab. Wiring shall either be installed in conduits fixed to the metal channel or in the metal channels, covered with a suitable cover plate. Purpose-made clamps shall be used to fix the fittings to the wiring channel.

27.7 Fittings Fixed to False Ceilings

In all cases where light fittings are fixed to false ceilings, the Contractor shall ensure that the ceiling is capable of carrying the weight of the fittings before commencing installation. Should any doubt exist in this regard, the matter shall be referred to the Engineer.

When fluorescent fittings are fitted to false ceilings they should be flush mounted with no visible gap if possible. Where the construction of the fitting causes a gap between the fitting and ceiling, the maximum gap allowable is 2mm. The fitting shall be fixed to the ceiling beams. In the case of tiled ceilings with exposed or concealed T-section supports, the fittings shall be fixed to the metal supports by means of butterfly screws or bolts with nuts and washers. Self-tapping screws may not be used. Fittings shall be neatly fixed with regard to the ceiling layout.

27.8 Glassbowl Fittings

Unless specified to the contrary, glass bowl fittings shall be installed with the underside at least 2m above finished floor.

27.9 Fluorescent Fittings Fixed to Concrete Slabs

Fluorescent fittings to be installed directly against concrete slabs or walls shall be fixed to the outlet box and at two additional points.

Shot-fired fixings are not acceptable. If specified or where approved by the Engineer, fluorescent fittings may be fixed to metal channels installed against concrete slabs or walls. The metal channel fixing may, in this case, be shot-fired. Purpose-made clamps shall be used to fix fittings to wiring channels.

27.10 Continuous Rows of Light Fittings

In cases where fluorescent fittings are installed end to end in a continuous row only one connection outlet per circuit need be supplied.

All fittings shall be coupled to one another by means of nipples or brass bushes and locknuts to ensure that wiring is not exposed and that earth continuity is maintained. Fittings on the same circuit may be wired through the channel formed by the fitting bodies. In this case internal connections shall be made at terminal blocks. The wiring for any other circuits or outlets, even though these may be in the same row may not be installed through the fitting canopies. The Contractor shall ensure continuous rows are straight and parallel to the relevant building lines.
27.11 Recessed Light Fittings

In all false ceilings where wiring channels are used, recessed light fittings shall be connected to the main wiring channels by means of 5A sockets mounted on or adjacent to the channels and 0.5mm², 3 core flexible cable complete with 5A plug tops, not exceeding 3m in length.

27.12 Special Ceilings

In cases where special ceilings e.g., aluminium strips, decorative glass, metal leaves, etc., are to be installed, the Contractor and Manufacturer of the ceiling shall agree upon the method of fixing of light fittings in the ceiling.

27.13 Bulkhead Fittings

Surface mounted bulkhead fittings shall not be screwed directly to conduit ends. The conduit shall terminate in a round draw box at the top or rear of the fittings. The PVC insulated conductors shall terminate in a porcelain terminal strip in the draw box. Asbestos or silicon-rubber insulated conductors shall be installed from the terminal strip to the fitting lamp holder. Screw-type connectors are not acceptable (e.g., "SCREW IT").

27.14 Connections to Light Fittings

a) Connectors

Where connectors have to be provided to effect connections to the wiring of light fittings and other appliances, brass screw couplers shrouded in porcelain, neoprene or PVC or approved spring steel locking connectors insulated in unbreakable material shall be used. Other types of connectors are not acceptable (e.g., "SCREW IT").

b) Knock-outs

Where knockouts are used for the wiring of light fittings and other appliances, brass bushes or gripper glands shall be provided.

c) Type of Conductor

PVC insulated conductors, unless protected by an approved heat resistant sheathing, should not be used where the temperature of the insulation is likely to exceed 70º C. In fittings capable of housing incandescent lamps above 60W, the interconnecting wiring from the lamp holder to the circuit wiring shall consist of varnished cambric insulated roved and braided asbestos or heat resisting silicon compound insulated conductors. Refer also the provisions of SANS 10142, Clause 6.21.1 (f).

27.15 High Bay Fittings

The Contractor and luminaire manufacturer shall decide upon the method of fixing fittings in the ceiling, whether by suspending from the roof purlins or mounting on cross-beams. The Engineer shall approve the method before the fittings are fixed. Fittings must be fixed at least 1m above the maximum working height, e.g., above the maximum reach of cranes.

The lighting circuits shall be wired with 4mm² PVC insulated conductors in a 3-phase configuration and 2.5mm² bare copper earth conductors installed in "Unistruts".
High-bay fittings shall be suitable to accommodate 250W or 400W elliptical or tubular mercury vapour coated, high-pressure sodium or metal halide lamps and associated control gear as required.

All high-bay fittings shall be supplied with a safety chain.

27.16 Tubular Fluorescent Lamp Luminaires for Interior Applications

a) General

Light fittings, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets etc., as applicable, and shall be delivered to site in a protective covering.

Tenders shall be accompanied by full descriptive information of the light fittings offered. Photometric data, i.e., polar curves and coefficients of utilization certified by the SABS shall be submitted with tenders for luminaires offered. Photometric data shall not be older than 2 years.

b) Technical Requirements

Tubular fluorescent lamp luminaires shall bear the SABS mark and comply fully with SANS 1119 and all amendments as well as the additional requirements of this specification. Components shall bear the SABS mark where applicable.

The reflector shall be firmly held in position with a latching device operating on one of the following principles:

i) Spring steel latches.

ii) Spring loaded latches and locating pins.

i) Non-detachable plated metal or plastic screws, with or without locating pins.

Plastic used as a spring mechanism is not acceptable as a fixing device for reflectors.

All components including screws, bolts and nuts utilized in the construction of the luminaire for fixing its components shall be corrosion proof.

Industrial type luminaires shall be fitted with detachable side reflectors, manufactured of cold rolled steel, not less than 0.7mm thickness. The design of the reflectors shall be such to improve the downward light output ratio and decrease the upward light output ratio to a value of less than 2%.

c) Control Gear for Fluorescent Lamp Luminaires

Ballasts shall comply with SANS 890 and 891 and bear the SABS mark.

Ballasts shall further be suitable for the fitting to ensure that the thermal limits specified in SANS 890 and 891 are not exceeded.
d) Lamps

If no colour is specified in the Detail Specification, the light colour shall correspond to colour 2 (4300 °K) of SANS 1041.

e) Lamp Holders

Lamp holders shall preferably be of the spring loaded telescopic type, but ratchet types such as "ROTOLOK" or "TWISTLOCK" are acceptable. Where ratchet types are used a 1mm air path shall be allowed between the lamp cap and lamp holder and the lamp holder shall house a rotational inset to accommodate the lamp rotation.

All lamp holders provided shall be suitable to accommodate from 0.5mm² solid core wire and allow for 2.0mm lamp tolerance compensation.

f) Paint Finish

Sheet metal components of the luminaire shall be painted in accordance with SANS 1119. Baked enamel, electro statically applied powder coating or similar proven methods may be used.

Care shall be taken to ensure that all edges and corners are properly covered.

The finish shall be smooth, glossy and free from grit or any other surface imperfections.

Prior to painting, all metal parts shall be thoroughly cleaned of rust, mill scale, grease and foreign matter to a continuous metallic finish. Sand or shot blasting or acid pickling and washing shall be employed for this purpose.

The paint process shall conform SANS 1274 type 3.

28. TERMINAL DEVICES

28.1 General

This section covers the requirements for switches and sockets for installation under normal environmental conditions.

a) Switches shall comply with SANS 60669 as amended.

b) Sockets shall comply with SANS 164 as amended.

28.2 Escutcheon Plates

Where flush mounted switches or sockets are installed in special wall finishes e.g., wood or board panels, acoustic tiles or other cladding, etc., and where the wall finishes have to be cut to accommodate the switch, it may be necessary to fix an escutcheon plate to the wall to cover the cut-outs. The escutcheon plate shall fit closely around the switch boxes and shall be fixed independently of the switch boxes and cover plates. Bevelled cover plates that overlap the switch boxes shall be used. Cover plates shall be fixed to the switch boxes and shall fit firmly against the escutcheon plate.
28.3 Flush Cover Plates

a) Cover plates shall conform to SANS 60669 and SANS 1085 and shall bear the SABS mark.

b) Cover plates shall be finished in ivory coloured baked enamel, anodised aluminium or natural bronze unless otherwise specified.

c) Cover plates shall have bevelled edges which overlap the box in order to mask rough wall finishes.

d) Cover plates shall under no circumstances be cut unless specifically authorised by the Engineer.

Appearance

All boxes and cover plates shall be installed parallel to and in line with relevant horizontal and vertical planes unless specified to the contrary.

The sides of adjacent switches, sockets, push-buttons, etc., shall be parallel or perpendicular to each other and uniformly spaced.

All switches and sockets shall be of the same manufacture / product range, and shall be sampled for approval prior to order.

28.4 Light Switches

Wall and Surface Mounted Switches

a) All light switches shall be installed at door handle height unless specified to the contrary. Mounting heights given shall be measured from the finished floor level to the centre of the switch.

b) All switches shall be suitable for mounting in 100mm x 50mm x 50mm galvanised steel or stove enamelled boxes.

c) Unless otherwise specified, switches shall be of the tumbler operated microgap, 250V, 16A type and of silent operation.

c) Where more than one switch is required at any one position, approved multiple-gang units shall be used and installed in a common switch box.

Watertight Switches

a) Switches that are exposed to the weather or are installed in damp areas, shall be of the waterproof type.

b) Watertight switches shall be 16A, single pole, unless specified to the contrary, and suitable for surface mounting.

c) The switch mechanism may be on the front or side of the box but the ON/OFF positions shall be clearly marked.
Pull Switches

a) Pull switches shall be rated 10A as required and shall be suitable for ceiling mounting on a round conduit box. They shall contain heavy brass contacts and a strong quick acting mechanism, and be suitable for operation on 250V, 50Hz systems.

b) Each switch shall be complete with a 1.25m length of nylon cord.

Partition Switches

a) Light switches installed in mullions shall be purpose-made.

b) Switches installed in the metal supports do not require switch boxes.

c) Switches may not be flush mounted in partition walls without switch boxes.

28.5 Socket Outlets

a) Switched sockets shall be suitable for use with 400/230V, 50Hz systems and switches and sockets shall be rated not more than 16A, 250V or 63A, 400V unless specified to the contrary.

b) Miniature circuit breakers of the correct rating may be used in lieu of a switch with single phase sockets where specified. Miniature circuit breakers shall be contained under the same cover plate and shall conform to SANS 156.

Flush Socket Outlets

Flush socket outlets shall be of the Legrand, Crabtree, Clipsal, or approved equal type.

Flush sockets shall consist of a 16A switch and 3-pin plug receptacle with shuttered live and neutral sockets and an earth socket operating the shutters conforming to SANS 164-1, and a 16A switch and 3-pin plug receptacle with shuttered live and neutral sockets and an earth socket conforming to SANS 164-2. Unless otherwise specified the unit shall be suitable for mounting in a standard 100 x 100 x 50mm box, and shall consist of white inserts in white cover plates:

Mounting Heights

Mounting heights given shall be measured from the finished floor level to the centre of the socket. Unless otherwise specified socket outlets shall be installed at the following heights above finished floor levels:

Flush mounted, in general 300mm
Surface mounted, in general 1400mm
Kitchens, laundries, shops 1100mm
Factories, workshops, garages 1400mm

Walls

Where the lower portions of brick walls consist of face bricks and the upper portion of the wall is plastered, the outlets shall be installed in the plastered portion of the wall. If however the plastered portion of the wall commences 650mm or more above floor level, the outlets shall be installed in the face bricks. Where a wall has different surface finishes, the outlets shall be installed on one of the walls finishes only and not in the joints between the different wall finishes. All outlets shall be installed at least 150mm away from door frames.
Surface Mounted Socket Outlets

Sockets for surface mounting shall consist of units equal to the flush mounted units, but contained in a purpose-made pressed steel box, conforming to SANS 1065 and SANS 1085 where applicable.

Dedicated Socket Outlets

Dedicated socket outlets shall be of the Legrand, Crabtree, Clipsal, or approved equal type.

Dedicated sockets shall consist of a 16A switch and 3-pin plug receptacle with shuttered live and neutral sockets and an earth socket operating the shutters conforming to SANS 164-4. Unless otherwise specified the unit shall be suitable for mounting in a standard 100 x 100 x 50mm box, and shall consist of red inserts in red cover plates:

Dedicated socket outlets utilised for critical application shall have the following features:

a) Distinctively coloured plug top covers, to distinguish the dedicated male plugs from domestic plugs. Unless otherwise specified, dedicated plug tops shall be red:

b) A graded series of shaved earth pins to facilitate the necessary discipline for plugging male plugs into corresponding female sockets. Unless otherwise specified, dedicated socket outlets shall be 0° shaved earth pin.

3-Phase Welding Plugs

a) The 3-phase outlets shall consist of 63A switched socket outlets and shall be of the 4-pin "Crabtree/Clipsal" type or equivalent, complete with base and matching insert.

b) The construction shall be such that the plug can only be inserted the correct way.

c) The plug-in opening shall have a spring-loaded cover to prevent accidental contact with live parts.

29. CONNECTIONS TO EQUIPMENT

29.1 General

This section covers connections to equipment in general electrical installations under normal environmental conditions, up to system voltages of 600V.

29.2 Connections to Distribution Boards

Conduit Entries

Wherever necessary, conduits connected to distribution boards shall terminate in a common fabricated sheet-steel draw box, or wiring channel installed in the vicinity of the distribution board. In open roof spaces and/or electrical ducts, this draw box shall be placed in a roof space of not less than 900mm clearance. Lighting and plug circuits may be separately grouped in common conduits or metal ducts (trunking) from the distribution board to the draw box. The draw box shall be of sheet steel with a minimum thickness of 1.6mm and shall be provided with a removable cover plate.
Flush Mounted Distribution Boards

Where flush mounted distribution boards are required, the recessed distribution board tray shall be built into the brick or concrete wall. All conduits from the floor or roof shall be fully recessed and shall be bonded directly to the tray.

Cable Connections

Where underground cables have to be connected to distribution boards, it shall be the responsibility of the Contractor to ensure that sleeves are built in correctly to enable installation and connection of the cable to the switchboard. A metal cable duct with cover plate shall be installed from the sleeve to the switchboard and shall be painted the same colour as the switchboard. The sleeves shall be sealed with non-hardening compound after installation of cables to render the system vermin proof.

Cable Trenches

Where cables in floor trenches have to be connected to wall mounted distribution boards, approved sleeves or conduits shall be installed from the side of the trench to the bottom of the distribution boards.

These sleeves shall be positioned and fixed before the concrete is cast.

29.3 Connections to Motor Driven Equipment

An isolator, or starter containing an isolator, shall be installed within 2.0m of the equipment. The 0.3 requirements of SANS 0142 shall be met. If this isolator cannot be installed on a wall, board or other suitable place an approved free-standing pillar shall be provided. The pillar shall be 1.0m high and outside of normal walkways, etc.

The connection to the equipment shall be made as follows:

a) Metal reinforced plastic or PVC covered metal flexible conduits shall be used with individual conductors or a multicore PVC insulated cable and separate bare earth conductor installed inside the conduit. The flexible conduit shall not be longer than 600mm. Screwed conduit shall be used from the end of the flexible conduit to the isolator and/or starter.

b) Multicore armoured PVC insulated cable and separate bare earth conductor. The installation and termination of the cables shall be done in accordance with Section 4.8 of this document.

c) Cables and flexible conduits shall be provided with sufficient slack to allow positional adjustment of the equipment.

Supply cables to equipment shall not be installed across floors.

29.4 Connections to Heaters, Fans and Air Conditioning Units

Isolators

A flush mounted double pole isolator with a rating of 20A for units smaller than 3kW, and 30A for units with a rating between 3kW and 5kW, shall be provided within 1.0m of the unit and at least 1.5m above floor level unless situated in power skirting or a floor duct. Only where heaters or fans are mounted in easily accessible positions, and where an isolator switch is incorporated in the unit, may this isolator be omitted. Where flush isolators are employed, flush conduit shall be installed to link
with the equipment outlet point. Flexible cords of sufficient rating may be used for the final connection to the equipment.

Wiring

The minimum conductor size to be used shall be 4mm². Each fan, heater or air conditioning unit shall be on a separate circuit.

Recessed Wall Heaters

The heater frame or tray shall be built or cast into the wall. Conduits shall terminate on the frame near the terminals. PVC insulated conductors may not be installed in the frame.

Surface Mounted Heaters, Fans and Air Conditioning Units

a) Connection points to surface mounted heaters and fans shall consist of a recessed draw box in the vicinity of the terminals of the unit. In workshops and industrial areas the connections shall be made by means of flexible conduit connected to dome lids on the draw box.

b) PVC insulated 3-core flexible cables ("Cabtyre") may be used for the connection.

c) Where "Cabtyre" is used, a bush shall be provided at the rear of the fan, heater or air conditioning unit for cable entry and a bush and clamp (or gripper gland) at the draw box. The clamp shall tightly grip the outer insulation of the cable to prevent tension on the connections between cable and conductors in the draw box.

Radiant Heaters

The installation of radiant heaters and asbestos heaters, where specified, shall comply with the requirements of paragraph 10.4.4 with the exception that they shall be mounted on spacers 25mm away from the mounting surface.

Unit heaters (i.e., combined fan and heaters) shall be mounted 2.25m above the finished floor level unless specified to the contrary and shall be firmly fixed by means of anchor bolts or by another approved method. Refer to the requirements of SANS 0142.

29.5 Connection to Cooking Appliances

Unless specified to the contrary, the circuit connection to each cooking appliance shall consist of 10mm² PVC insulated conductors and a 6mm² stranded earth conductor in conduit.

A flush mounted isolator shall be provided in accordance with SANS 0142. A white baked enamel cover plate shall be provided, situated wholly on the tiled or plastered surface where applicable.

Conduits shall terminate 450mm above floor level behind stoves. Connections from the conduit end to the stove shall be installed in accordance with SANS 0142. Sufficient slack shall be provided in the flexible connection to move the appliance 600mm away from its normal position for cleaning or maintenance.

Alternatively a 45A, 3-pin or 32A, 3-pin socket outlet may be mounted on a round draw box 450mm above floor level. The connection to the appliance shall consist of a plug and 10mm² or 4mm² PVCinsulated cable. The cable shall be long enough to enable the appliance to be moved 600mm from its normal position for cleaning or maintenance.
Crimped lugs shall be provided on all conductors or cable cores for connections to cooking appliances. Soldered lugs may not be used.

Each appliance shall be connected to a separate circuit. A separate earth wire shall be provided for each appliance.

"The supply to each electric cooking appliance that is supplied from fixed wiring or through a stove connector shall have a readily accessible means of disconnection that is not fixed to, but is more than 3m from the appliance and is in the same room".

The following shall be noted in this regard:

a) A cooking appliance that is built-in shall not be supplied from a stove connector.

b) Although a maximum distance of 3m is permitted, the switch disconnector shall be as close as practicable to, but preferably not above, the appliance and at a height from the floor of not less than 0.5m and not more than 2.2m.

c) If mounted more than 0.5m from the appliance, the purpose of the switch disconnector shall be clearly indicated.

d) If a stove connector is used:

   i) the connector tubes shall point downwards, and

   ii) the conductors between the connector and the appliance shall be adequately protected from mechanical damage, e.g., by means of heavy-duty type sheathed flexible cord that complies with the relevant requirements of SANS 168, or by means of flexible conduit.

29.6 Connections to Hot Water Cylinders

Each hot water cylinder shall be served by a separate circuit with a separate earth conductor.

Each hot water cylinder shall be protected by earth leakage protection with \( I_{\Delta n} \) not exceeding 30mA.

The conduit from the switchboard to the cylinder shall terminate in a draw box within 1.0m of the cylinder terminals. The connection to the draw box may be conductors in conduit or PVC insulated cable. The connection between the draw box and the cylinder terminals shall consist of screwed metallic conduit. Only in instances where cylinders are mounted out of normal reach may flexible conduits and round boxes with dome lids be used for the final connection.

The following conductor sizes shall be used to connect cylinders up to 6kW capacity:

For cylinders with a capacity more than 6kW, details to be provided by the Engineer.

29.7 Connections to Clean Power Equipment

Connections to clean power shall only be made using components and methods to prevent the incoming clean earth conductor coming into contact with any portion of the domestic earthing system. Particular attention shall be paid to prevent equipment chassis earthing, earthing of outlet boxes, etc., coming into contact with any of the clean earth system components.
30. SERVICES INTERFACE TESTING

The requirements as outlined in this section are the minimum requirement to be completed by the contractor to demonstrate correct operation of the systems, and for inclusion in the as built manuals on completion of the project.

30.1 Purpose of Services Interface Testing

To ensure the satisfactory and safe operation of the building. To achieve this each service and the interface of all services must be verified to ensure correct operation under all possible conditions that may be encountered during the operation of the building. The only way to check that this will be achieved, is to initially and correctly test each system in detail and then in conjunction with each other.

30.2 Test Co-Ordinator

The Principal Building Contractor (PBC) is contractually responsible for co-ordinating all site activities, and is therefore responsible to plan, organise and program the various sub trades in terms of the site program.

This document is therefore an aide to the PBC and the various sub-contractors involved to ensure that the Client can be satisfied that all systems work individually and collectively under all conditions that will be encountered. Notwithstanding anything to the contrary, the ultimate responsibility for the equipment on site and for on-site safety aspects remains with the PBC and/or the contractors. The sub-contractors must therefore be present to operate the relevant plant and to ensure overloading or stressing does not occur.

30.3 Test Procedure

Each services sub contractor is to provide an overview of their system, a brief description of how the service operates under the various operational conditions (refer to item 1.5).

30.3.1 Individual Services Preliminary Testing

Each service consulting engineer should produce a detailed testing sequence of;

Tests to be carried for the particular service;
How these are to be carried out to ensure compliance with the contract documents and specified conditions;
The testing sequence priority, the required readings and the test equipment to be employed;
The sequence of tests to suit the system/s and the service completion program starting with the control and safety systems;
The required final test report.

The PBC in conjunction with the particular services contractor prepares a suitable testing program.

The protection, control and safety aspects of each service are to be individually tested by service contractor as per the test report completed prior to permanent power being made available for plant start up (i.e. before driven equipment is started up).

Once this is done then each service can be individually tested and commissioned into service in terms of its intended design function.
Once each service has undergone start up and the respective consultants are satisfied that the plants are operating correctly and safely with the safeties and protection in place the usual on going testing, balancing and setting can continue for each service.

30.3.2 Combined Services Preliminary Testing

Each service consulting engineer should produce detailed testing procedure outlining the following:

- Tests to be carried out with each service to be interfaced with, for their area of responsibility;
- The testing sequence, required reading and test equipment to be employed;
- The required final test reports.

The PBC in conjunction with the particular services contractor prepares a suitable testing program.

Once this is achieved the interfacing with other systems/services can be tested and commissioned into service.

For each services interface the relevant contractors, consultants, suppliers must be present with the principal contractor or his appointed agent undertaking the overall programming control and coordination.

30.3.3 Combined Services Final Testing and Commissioning

The PBC (with the assistance of the Service Consultants) should produce test schedules with details of;

- Test to be conducted for each possible operational condition;
- Testing sequence and required results;
- Equipment required for testing, commissioning;
- Personnel to be present for each test;
- The required final test report.

(Refer to item 1.7 for an example of the above requirement.)

30.4 Services

The following services generally interface with or rely on another service;

Electrical
Heating, Ventilation & Air-conditioning
Sprinkler & Fire Protection
Smoke Extraction
Lifts
Escalators
Fire Pumps
Domestic Water Pumps
Sump Pumps
Smoke Detection
Ventilation
Access & Security
Building Management System
Public Address
30.5 Possible Building Operational Conditions

The generic operational conditions are:

- Normal conditions
- Mains power failure (short duration)
- Mains power failure (extended duration)
- Fire condition, mains power available
- Fire condition, during Mains power failure
- Mains power failure during fire condition

Project specific operational conditions should be added as required;

30.6 Brief Overview of Tests

Tests should be carried out demonstrating the correct operation under each possible operational condition.

30.6.1 Normal Conditions

All services to be operational as they would under normal conditions.

30.6.2 Mains Power Failure (Extended Duration)

All services to be operational as they would under normal conditions

Simulate mains power failure.

Ensure correct operation of all essential services.

Re-instate mains power.

Ensure all services return to normal operation.

30.6.3 Mains Power Failure (Short Duration)

All services to be operational as they would under normal conditions

Simulate mains power failure and after 30 seconds re-instate mains power.

Ensure all services return to normal operation.

Simulate mains power failure and after 5 seconds re-instate mains power.

Ensure all services return to normal operation.

30.6.3 Fire Condition

All services to be operational as they would under normal conditions

Simulate fire condition in single fire zone.

Ensure correct start-up / shutdown and operation of equipment as required by the fire engineer.
Reset alarm.

Ensure all services return to normal operation.

Repeat test for each fire zone.

Simulate fire condition in multiple fire zones.

Ensure correct start-up / shutdown and operation of equipment as required by the fire engineer.

Reset alarm.

Ensure all services return to normal operation.

30.6.4 Fire Condition During Power Failure

All services to be operational as they would under normal conditions

Simulate mains power failure.

Ensure correct operation of all essential services.

Simulate fire condition in single fire zone.

Ensure correct start-up / shutdown and operation of equipment as required by the fire engineer.

Reset alarm.

Ensure all services return to normal operation.

Repeat test for each fire zone.

Simulate fire condition in multiple fire zones.

Ensure correct start-up / shutdown and operation of equipment as required by the fire engineer.

Reset alarm.

30.6.5 Power Failure During Fire Condition

All services to be operational as they would under normal conditions

Simulate fire condition in single fire zone.

Ensure correct start-up / shutdown and operation of equipment as required by the fire engineer.

Simulate mains power failure.

Ensure correct re-start and operation of equipment as required by the fire engineer.

Simulate fire condition in single fire zone.

Ensure correct start-up / shutdown and operation of equipment as required by the fire engineer.
Re-instating mains power

Ensure correct re-start and operation of equipment as required by the fire engineer.

Reset alarm

Ensure all services return to normal operation.

30.7 Test Schedules

All tests, timings, settings and readings of all relevant devices as well as corrective action for system failure to be recorded and attached to the completed testing schedules.

Sample test schedules are included for reference.

<table>
<thead>
<tr>
<th>SERVICES CO-ORDINATED TESTING SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Reference</td>
</tr>
<tr>
<td>Test Co-Ordinator</td>
</tr>
</tbody>
</table>

TEST 1

TEST TO VERIFY THE CORRECT SYSTEMS OPERATION UNDER NORMAL CONDITIONS

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME ALLOCATED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ACTION</th>
<th>ATTENDANCE</th>
<th>VERIFIED</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure all services are operating i.e. lights, air conditioning, lifts, escalators, ventilation fans, domestic water pumps, fire alarm panel, fresh air fans, all electronic systems, parking control, staircase pressurisation fans, cooking extract fans.</td>
<td>✔ / ✔</td>
<td>✔ / ✔</td>
<td></td>
</tr>
<tr>
<td>Ensure diesel generators, fire pumps, smoke extract fans are set on auto</td>
<td>✔ / ✔</td>
<td>✔ / ✔</td>
<td></td>
</tr>
</tbody>
</table>
## SERVICES CO-ORDINATED TESTING SCHEDULE

### TEST 2

**TEST TO VERIFY THE CORRECT SYSTEMS OPERATION UNDER LONG DURATION MAINS FAILURE CONDITIONS**

<table>
<thead>
<tr>
<th>ACTION</th>
<th>ATTENDANCE</th>
<th>VERIFIED</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure all services are operating i.e lights, air conditioning, lifts, escalators, ventilation fans, domestic water pumps, fire alarm panel, fresh air fans, all electronic systems, parking control, staircase pressurisation fans, cooking extract fans.</td>
<td></td>
<td>X / ✓</td>
<td></td>
</tr>
<tr>
<td>Ensure diesel generators, fire pumps, smoke extract fans are set on auto</td>
<td></td>
<td>X / ✓</td>
<td></td>
</tr>
<tr>
<td><strong>Trip Mains Power</strong> Generators to start up, run up to speed and send signal to Main L.V. Board/s to activate changeover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency Lighting to remain operational</td>
<td></td>
<td>X / ✓</td>
<td></td>
</tr>
<tr>
<td>Change over to take places within 15 seconds of power failure.</td>
<td></td>
<td>X / ✓</td>
<td></td>
</tr>
<tr>
<td>Schedule of equipment to run on generators to be produced, and checked</td>
<td></td>
<td>X / ✓</td>
<td></td>
</tr>
<tr>
<td>The delayed start up times of the above loads to be measured and recorded.</td>
<td></td>
<td>X / ✓</td>
<td></td>
</tr>
<tr>
<td><strong>Re-instate Mains</strong> The essential loads to continue running on generator supply for +/- 30 seconds</td>
<td></td>
<td>X / ✓</td>
<td></td>
</tr>
<tr>
<td>Change over from generator to mains at Main LV. Board/s to take place</td>
<td></td>
<td>X / ✓</td>
<td></td>
</tr>
</tbody>
</table>
## SERVICES CO-ORDINATED TESTING SCHEDULE

### TEST 3

**TEST TO VERIFY THE CORRECT SYSTEMS OPERATION UNDER SHORT DURATION MAINS FAILURE CONDITIONS**

<table>
<thead>
<tr>
<th>ACTION</th>
<th>ATTENDANCE</th>
<th>VERIFIED</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure all services are operating i.e lights, air conditioning, lifts, escalators, ventilation fans, domestic water pumps, fire alarm panel, fresh air fans, all electronic systems, parking control, staircase pressurisation fans, cooking extract fans.</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure diesel generators, fire pumps, smoke extract fans are set on auto</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Trip Mains Power</strong> Generators to start up, run up to speed and send signal to Main L.V. Board/s to activate changeover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency Lighting to remain operational</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change over to take places within 15 seconds of power failure.</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Re-instate Mains</strong> The essential loads to continue running on generator supply</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Trip Mains Power After 2 seconds</strong> The essential loads to continue running on generator supply</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Re-instate Mains</strong> The essential loads to continue running on generator supplied for +/- 30 seconds</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Trip Mains Power During Generator Rundown Period</strong> Generators to take load immediately</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Re-instate Mains</strong> The essential loads to continue running on generator supply +/- 30 seconds</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change over from generator to mains at Main L.V. Board/s to take place</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**SERVICES CO-ORDINATED TESTING SCHEDULE**

**Project Reference**

**Test Co-Ordinator**

**TEST 4**

**TEST TO VERIFY THE CORRECT SYSTEMS OPERATION UNDER FIRE CONDITIONS**

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME ALLOCATED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ACTION</th>
<th>ATTENDANCE</th>
<th>VERIFIED</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure all services are operating i.e. lights, air conditioning, lifts, escalators, ventilation fans, domestic water pumps, fire alarm panel, fresh air fans, all electronic systems, parking control, staircase pressurisation fans, cooking extract fans.</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure diesel generators, fire pumps, smoke extract fans are set on auto</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activate Fire Alarm (Zone 1) Ensure alarm is audible</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schedule of equipment to run on fire signal to be produced, and checked</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cause and Effect Schedule to be produced, and checked</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reset Fire Alarm Ensure audible alarm stops</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure all equipment returns to normal operation.</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activate Fire Alarm (Zone x) Repeat test for all zones</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## SERVICES CO-ORDINATED TESTING SCHEDULE

### TEST 5

**TEST TO VERIFY THE CORRECT SYSTEMS OPERATION UNDER FIRE CONDITIONS DURING POWER FAILURE**

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME ALLOCATED</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>ACTION</th>
<th>ATTENDANCE</th>
<th>VERIFIED</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure all services are operating i.e lights, air conditioning, lifts,</td>
<td></td>
<td>x / ✓</td>
<td></td>
</tr>
<tr>
<td>escalators, ventilation fans, domestic water pumps, fire alarm panel,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fresh air fans, all electronic systems, parking control, staircase</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pressurisation fans, cooking extract fans.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure diesel generators, fire pumps, smoke extract fans are set on</td>
<td></td>
<td>x / ✓</td>
<td></td>
</tr>
<tr>
<td>auto</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trip Mains Power</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generators to start up, run up to speed and send signal to Main L.V.</td>
<td></td>
<td>x / ✓</td>
<td></td>
</tr>
<tr>
<td>Board/s to activate changeover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency Lighting to remain operational</td>
<td></td>
<td>x / ✓</td>
<td></td>
</tr>
<tr>
<td>Change over to take places within 15 seconds of power failure.</td>
<td></td>
<td>x / ✓</td>
<td></td>
</tr>
<tr>
<td>Repeat Test 4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## SERVICES CO-ORDINATED TESTING SCHEDULE

### TEST 6

**TEST TO VERIFY THE CORRECT SYSTEMS OPERATION OF MAINS POWER FAILURE UNDER FIRE CONDITIONS**

<table>
<thead>
<tr>
<th>Action</th>
<th>Attendance</th>
<th>Verified</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure all services are operating i.e lights, air conditioning, lifts, escalators, ventilation fans, domestic water pumps, fire alarm panel, fresh air fans, all electronic systems, parking control, staircase pressurisation fans, cooking extract fans.</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure diesel generators, fire pumps, smoke extract fans are set on auto</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activate Fire Alarm (Zone 1)</td>
<td>Ensure alarm is audible</td>
<td>x / ✓</td>
<td></td>
</tr>
<tr>
<td>Schedule of equipment to run on fire signal to be produced, and checked</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cause and Effect Schedule to be produced, and checked</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trip Mains Power</td>
<td>Generators to start up, run up to speed and send signal to Main L.V. Board/s to activate changeover</td>
<td>x / ✓</td>
<td></td>
</tr>
<tr>
<td>Emergency Lighting to remain operational</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change over to take places within 15 seconds of power failure.</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment to re-start in fire mode, running on generator.</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Re-instate Mains</td>
<td>The fire loads to continue running on generator supplied for +/- 30 seconds</td>
<td>x / ✓</td>
<td></td>
</tr>
<tr>
<td>Change over from generator to mains at Main L.V. Board/s to take place</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment to re-start in fire mode</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reset Fire Alarm</td>
<td>Ensure audible alarm stops</td>
<td>x / ✓</td>
<td></td>
</tr>
<tr>
<td>Ensure all equipment returns to normal operation.</td>
<td>x / ✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
30.8 Safety

Appropriate equipment to be provided to ensure the safe undertaking of the testing, including two way radios for communication between various parties, Hearing protection for persons in generator / plant rooms, torches and safety lighting.

All persons on site are to be made aware of the test schedule.

30.9 Operation and Maintenance Manuals

Completed testing schedules are to be included in the relevant manual.

The system overview, how the system operates under the various building functional conditions and the remedial action should the system fail to operate correctly for the various building operational conditions should be included in the manual.
C3.4.4 PS ELT TELEMETRY PROJECT SPECIFICATIONS

1. GENERAL

This standard specification furnishes information and sets out requirements for the installation of instrumentation and telemetry equipment.

All equipment and material shall be of a quality and type approved by the Engineer.

No equipment or material shall be installed unless it complies with the requirements of this specification.

All equipment and material shall be checked for suitability, quality and adherence to this specification. Every approval must be obtained by the Contractor prior to installation.

Any installation or installation procedure which is in contravention to this specification shall be made good or replaced, to the satisfaction of the Engineer, and all costs for making good or replacement shall be for the contractors account.

Failure to adhere to the requirements of this specification may result in the equipment or material being rejected by the Engineer.

2. STANDARD OF WORK

The complete instrumentation installation shall be carried out by skilled, competent and qualified operatives to the highest standard of safety and workmanship, using the correct tools for the operations and best quality materials.

A clean, orderly and safe environment shall be maintained in the Instrumentation Contractor’s construction areas.

Cabling and wiring shall form a neat and functional appearance.

Work shall be planned such that access to equipment for the current installation or future maintenance shall not be obstructed.

The completed installation including supports, brackets, wiring, cabling and piping shall present a clean, tidy appearance and shall conform to good engineering practice.

The contractor shall install instruments and other equipment in accordance with the manufacturer’s instructions, and the project drawings, taking due cognisance of the Standards and Codes listed in this Specification.

The standards and codes which shall apply to this project are those issued by the following organisations:

- ICASA – Independent Communications Authority of South Africa
- IEC 62305“Lightning Protection of Equipment”.
- Deutsche Industrie Normen (DIN)
- American National Standards Institute (ANSI)
- The Instrumentation, Systems and Automation Society (ISA)
3. SUPPORT BRACKETING AND FIXING

The drilling of holes in structural steelwork is not permitted except with the prior written approval of the engineer.

The drilling of holes in vessels or pipework is expressly prohibited.

Mounting brackets shall be manufactured from hot dipped galvanised steel.

Instrument supports and mounting brackets shall be of a suitable strength and rigidity to ensure proper operation of the instrument. Careful attention shall be given to ensure that instruments are not mounted on or attached to equipment or structures which are subject to vibration. All proposed locations must be approved by the Engineer before installation.

Brackets shall in general, be made of hot dipped galvanised steel flat bar, angle or channel.

4. CABLE RACK AND SUPPORTS

Cable racks shall be mounted in the vertical position. Racks shall not be mounted in the horizontal position without the prior written permission of the Engineer.

Cable rack/tray bends and tees shall be constructed as to allow all cables within trays to have a bending radius of not more than the manufacturer’s specifications. No right-angle jointing of rack/tray shall be allowed.

Cable rack/trays shall be properly aligned and supported and the completed installation should have no visible deflection and be devoid of any distortion, kinks or sags.

The maximum distance between centres of adjacent supports shall be 1.5 metres. Additional supports shall be located at the joints of straight tray lengths and at every change in direction.
Supports shall be attached to permanent members of the building.

Cable racks to be fabricated mild steel and hot dipped galvanised similar or equal to the ‘O’ line support system.

Touching up after fabrication shall be by cold galvanising.

Hot dipped galvanised conduits shall be utilized for single cable runs to instruments from main trays.

Where required, any cable in danger of mechanical damage shall be protected by using galvanised pipe or channel. 25mm dia. galvanised conduit shall be used for cabling running inside a Water Tower.

Cable rack/trays shall be installed in accordance with the route diagram. Minor deviations in routing to avoid interference may be allowed subject to the approval of the Engineer. Where no cable routing drawing is available the cable routes shall be “site” determined in conjunction with the Engineer. Cable racks/trays shall be installed a minimum of 300mm above floor level.

Cable tray shall be linked across joints using 4mm2 earth wire with a cable lug bolted to the tray at each side of the joint. Cable tray runs shall be earthed.

All cables run on racking or in conduit shall be fully supported to within 150mm from the gland entry on the equipment serviced or as cable size dictates.

5. CABLING AND WIRING

Cables General

Cable sizes, number of cores and cable number shall be as indicated on the cable schedules. Cables shall be tested per drum length on delivery to site prior to installation. Results shall be documented.

Cable drums shall be rolled in the proper direction to prevent loosening of the cable. Cable shall be drawn into position using a sufficiency of rollers and cornering apparatus to avoid damaging the cable by excessive bending or dragging.

Cable shall be stored in dry areas.

The contractor shall observe the manufacturer’s recommendations for minimum bending radius but shall never use less than the following radii:

- Unarmoured cables: 5 times the overall outside diameter of the cable.
- Armoured cables: 10 times the overall outside diameter of the cable.

Clips, saddles or clamps for securing of cables shall have smooth and rounded edges and shall not damage the cable sheath of serving. The type of saddle or clamps shall be approved by the Engineer before installation commences.

Instrument signal and electric power may not run bunched in the same rack/tray. If instrument cables are required to run on the same cable rack as electrical cables, then they must be installed on opposite sides of the rack/tray to ensure maximum separation.
To avoid interference arising from electrical power supply voltage dips or spikes, instrument signals and electrical power cables shall only cross at right angle to each other.

On no account shall instrument signal and electrical power wiring be transmitted in the same multi-core cable. Solenoid coils of 24V DC may be run with instrument switching signals. Instrumentation cables may only be installed a maximum of 2 deep on racks if approved by the Engineer.

Joints in cables are permitted only where the length of the run exceeds the standard manufactured length of cable available on a drum. In these cases, the joints shall be made in a junction box mounted above ground for ease of access. No through jointing of cables shall be permitted on cable racks/trays or in any cable way.

All cables shall be labelled at each end with a strap on plastic marker tags bearing the cable number as shown on the cable schedule. (Black letters on a yellow background).

All cables shall be mechanically anchored at the position of termination using flanges of the correct size, as follows:

- Where equipment supplied is provided with cable entries having DIN, NPT, etc., threads, the contractor shall provide all necessary adapters to permit the use of standard ISO Metric thread cable glands.

- Where glands are to be used with non-threaded clearance holes, a heavy-duty lock-nut, together with suitable weatherproofing gaskets shall be provided. Holes with a tolerance greater than 1.5mm larger than the gland size shall not be accepted.

- Cables shall always be made off according to the gland manufacturers recommendations.

- When glanding off SWA cables in non-conducting enclosures the gland shall be provided with an internal earthing washer and connected to a suitable earth connection.

**Cable Termination and Connection**

All instruments, control panels, junction boxes, etc., shall be wired in accordance with the relevant project drawings.

Each conductor shall be fitted with an insulated double crimp lug of the correct size. Pin lugs shall be used for pressure type terminals. Ring or spade lugs shall be used for post type terminals.

A proprietary type of wire stripper must always be used. The stripping tool must be checked regularly and is subject to inspection by the Engineer. The termination of stranded conductors where one or more strands have been damaged or broken is expressly prohibited.

The crimping tool used for attaching termination lugs shall be of the ratchet type which requires a specific amount of pressure prior to release, recommended by the manufacture of the crimp lugs.

All wires are to be terminated. Spare terminals shall be provided for unused pairs or cores. All spare terminals of field multi-cores shall be connected together and bonded to instrument earth.
Terminated wires shall be arranged neatly and loomed where necessary using cable ties. Spiral lacing shall be used for flexible or semi flexible looms.

Each wire shall be numbered with the respective terminal number by means of interlocking slip-on plastic ferrules of the correct size. Split or clip on ferrules are not acceptable. The ferrules shall be a tight or interference fit on the wire.

Cable colours:

- Normal signal cables - black outer sheath
- Earth cables - green

Conductors to be 0.5mm flexible stranded twisted copper wire for normal instrument signals and 1.5mm for solenoid valves.

Nylon washers shall be put on all cable glands and cable gland adapters on weatherproof boxes. Cables must not be trapped in lagging.

Cables to field instruments must have at least 30cm slack which should be neatly looped before the instrument.

Cables incorporating shields or screens shall have the shield or screen isolated for electrical earth throughout its length and it shall be earthed only at the point indicated on the drawing.

Only cable in the following standard sizes shall be used:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Pair(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>24</td>
</tr>
</tbody>
</table>

For field instrumentation power supply only 3 core S.W.A. or Dekaron cable shall be used.

The approved cable is Dekaron type 1853 for single pair and 1875 for multi pairs. The conductor size shall be 0.5mm² for all instrumentation signals unless specified otherwise in the instrument cable schedule.

Cables are to be labelled according to the cable schedule.

6. **JUNCTION BOXES**

Junction boxes must be numbered on the door or lid with an engraved plastic type label having numbers at least 5mm in height. (Refer section 12 Instrument Labels).

Terminal rails and individual terminals shall be numbered.

An earth plate or rings for the cable glands shall be put in the bottom of each junction box, where required.

Cables must enter from the bottom of the junction box.

Spare holes for cable glands must be plugged with the approved type of plugs.
Shield wires must be strapped together.

The box must be classified IP65 or better.

The box must be mounted securely.

Junction boxes shall be polycarbonate. Painting or other colouring is not required.
Figure 1: Field wiring through Junction Box
7. TELEMETRY CABINET

7.1 Construction

Telemetry assemblies shall be wall mounted, with front access, suitable for bottom cable entries from cable trenches below the assembly. The schematic drawings or project specification show the specific requirements applicable to each assembly.

The assembly shall be constructed of electrolytically deposited zinc coated metal steel sheet similar to Zintex manufacture, having a minimum thickness of 2mm except for gland plates which shall be a minimum of 3mm. If thinner material is offered, the construction technique must be approved by the Employer's representative prior to fabrication. The assembly shall be powder coated.

The degree of protection shall not be less than IP 55, in accordance with SANS 1222 and capable of withstanding the temperature, humidity and conditions normally associated with heavy industrial applications. The assembly shall be fully vermin proofed. The cabinet shall be fitted with a removable gland plate positioned at the bottom of the panel. All cabling shall enter through this gland plate only.

The manufacturer's detailed working drawings of the assembly must be approved by the Employer's Representative before any fabrication commences. Any other construction or type of assembly proposed as an alternative to that specified, must have the approval of the Employer's Representative in writing.

In general, the panel shall be Siemens Grey, but the final colours are to be confirmed with the Employee's Representative.
7.2 Panel Wiring

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>220 V AC</td>
<td>Brown</td>
</tr>
<tr>
<td>Neutral</td>
<td>Blue</td>
</tr>
<tr>
<td>+24 V dc</td>
<td>Red</td>
</tr>
<tr>
<td>-24 Vdc</td>
<td>Black</td>
</tr>
</tbody>
</table>

Each end of the conductor shall be terminated in a pre-insulated, pin type lug, applied by means of the recommended colour coded crimping tool. All control wiring shall be clearly marked by interlocking plastic ferrules, the numbers corresponding to wire numbers on the schematic diagrams.

If control and/or supervisory wiring is required for equipment which is installed on the doors of the panel the wiring shall be bunched together and suitably strapped with spiral binding in the form of a vertical "U" loop between the door and the panel, to ensure that there is no tension on the wiring when the door is rotated along is vertical axis. Approved wiring supports shall be fixed onto the hinged panels, to relieve the weight of the cables off the equipment terminals. Each door shall be suitably earthed.

Ensure correct sizing of lugs to wire dimensions where two wires need to be grouped together then double entry bootlace lugs shall be used.

There shall be no joins for lengthening of incoming cables/wires.

Telemetry panel wires shall be neatly grouped utilizing correct slots of trunking only 1mm panel wire shall be used for 24 vdc positive wiring.

Only 1.5mm panel wire shall be used for 24vdc negative wiring. Earth for DB Boards shall be green 2.5mm.

Only one common shall be taken to MCC. One common only shall link different modules/boards. 10mm earth wire shall interconnect Telemetry Panel and Earth Bar.

Mains supply shall be via 2.5mm 2 CORE ECG cable, armoured – No Surfix shall be used.
All cable shields shall be neatly twisted together and terminated to an earth terminal in the Telemetry panel.

Return cables should be fed via appropriately sized PVC conduit to the nearest cable tray which feeds the Telemetry panel.

Incoming cables/wires shall be cut to size with no excessive slack or bundling of cable/wires.

7.3 Surge Protection

Where specified the Telemetry System shall be equipped with surge protection devices of an approved manufacture and bearing the SANS mark.

The available incoming 230VAC supplies on each site shall be regarded as an industrial supply and as such shall be fitted with surge protection.

Equipment which is connected to signal lines of any type which run for any distance outside a building, shall be surge protected to survive twenty 8/20 microsecond current impulses with maximum amplitude of 10 kA when applied in common mode between the signal lines connected.
together and to the system earth. Ten of the test pulses shall be applied as positive pulses with respect to earth and the other ten as negative pulses.

In addition, the protected equipment shall be able to survive 8/20 microsecond current impulses with maximum amplitude of 2 kA when applied in differential mode.

The test pulses shall be at intervals of not less than one minute.

Surge protection devices shall be chosen in such a way that the protected circuit shall still function to specification despite the introduction of series and/or shunt impedances by the protecting devices.

The above test specifications are based on recommendations of the Council for Scientific and Industrial Research (CSIR report No Ek/85/6/1.)

8. RADIO ANTENNA

Remote Sites will utilize a Half Wave Dipole antenna mounted on a 6m pole.

Repeater sites will utilize Collinear 6db gain antenna mounted on a 2m pole.

Base Station equipment will utilize a Yagi specification antenna mounted on a 6m pole.

Different antennas have different terminations; the Contractor shall ensure that the correct N type fitting is used.

The antenna requirements listed should be based on the results of a computer based radio path study which is done prior to installation.

9. EXISTING TELEMETRY ROOM

9.1 Floor

The Contractor shall strip the existing floor coating where required and shall prepare the concrete surface in accordance with the floor coating manufacturer’s recommendation to receive a screed coat, primer and two coats of a two component, solvent free, water dispersed, and polyamide-cured epoxy emulsion floor coating with a semi matt finish such as abe.cote 337 epoxy floor coating. The floor coating shall cover the entire floor and shall have a wet film thickness of 100μm.

The Contractor shall ensure that the final floor levels do not hinder door opening and closing. (colour)

9.2 Painting

After removal of all redundant brackets and fixtures lightly chip away and remove loose material. Patch using Prostruct 528 VO-MCI or similar. Protect patched from rapid evaporation.

The Contractor shall prepare the surface of the walls stripping loose any flaking paint completely and shall apply a suitable primer prior to painting all in accordance with the manufacturer’s recommendation and specification.

The internal walls and ceiling of the Telemetry Room shall receive two coats of Dulux Weatherguard or similar approved acrylic polymer paint with a textured, matt finish. Each coat shall have a dry film thickness of 50 - 75μm and a spreading rate of 4-6m² per litre.

The paint colours are to match the current colours of the respective elements. (colour)
10. SECURITY SAFE DOOR

Each Telemetry room shall be fitted with a security type safe door. Doors are to be supplied and installed complete with outer frame. The door shall be fitted with an 8-bolt locking mechanism and shall have a removable door handle and a 7-lever security keylock. The keylock shall be fitted with a recessed cover plate secured by means of 4 countersunk Allen screws. The doors outer plate shall have a minimum plate thickness of 6mm. The door shall be hinged on the right-hand side. Both the door and frame shall be hot dipped galvanized.

Doors referred to as D1 in the BOQ shall be fitted with a Multilock A380AL lock.

Table 1: Door Specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Zinga Door or similar approved by the Engineer</td>
</tr>
<tr>
<td>Door</td>
<td>Overall thickness – 120mm</td>
</tr>
<tr>
<td>Outer Plate</td>
<td>6mm</td>
</tr>
<tr>
<td>Corrosion Protection</td>
<td>Hot Dipped Galvanised</td>
</tr>
<tr>
<td>Boltwork</td>
<td>8 Bolts of 40mm diameter – 4 front and 4 back</td>
</tr>
<tr>
<td>Locking:</td>
<td>D1: A380AL Multilock</td>
</tr>
<tr>
<td></td>
<td>D2: H4 Key</td>
</tr>
<tr>
<td>Approximate Weight</td>
<td>180kg</td>
</tr>
<tr>
<td>Finish Spec</td>
<td>Zinga Paint</td>
</tr>
<tr>
<td>Wall Opening</td>
<td>1970H x 670W mm</td>
</tr>
<tr>
<td>Door Opening (180°)</td>
<td>1883H x 760W mm</td>
</tr>
<tr>
<td>Over door frame</td>
<td>2032.5H x 1000W mm</td>
</tr>
<tr>
<td>Door Clearance Diameter (180°)</td>
<td>1617.5 mm</td>
</tr>
<tr>
<td>Projection of Door (180°)</td>
<td>192.5mm</td>
</tr>
<tr>
<td>Locking:</td>
<td>D1: A380AL Multilock</td>
</tr>
<tr>
<td></td>
<td>D2: H4 Key</td>
</tr>
</tbody>
</table>
11. NEW TELEMETRY ROOM

11.1 Foundation

Excavate a 3.5m x 3.5m area to a depth of 630mm. Compact bottom of excavation to 93% Mod AASHTO. Spray bottom and sides of excavation with soil poisoning.

Fill excavated area with 450mm deep G6 classified selected fill in 150mm layers, compacting each layer to 95% Mod AASHTO. 2 x 100mm PVC cable sleeves shall be cast into the slab and shall exit at right angles into an adjacent trench for cable entries through the slab and into the new security building.

Lay down 250micron damp proof membrane and cast 25 MPa foundation slab, 180mm thick. The foundation slab shall be cast with Ref 617 mesh placed 40mm from the top and bottom. Apply curing compound once the concrete has set and keep covered with a hessian cloth/sand for a period of 7 days.
11.2 Concrete Security Room

The contractor shall supply and install on the prepared concrete slab a pre-fabricated concrete Security Room complete with a Security Safe Door as described here in Item 10. The room shall have a minimum size of 2.04 x 2.04 x 2.4m high and shall have a flat overhanging roof and solid base. The walls, roof and base shall have a minimum thickness of 100mm. Two 100mm cable entry points shall be cast into the base of the room and shall align with the PVC pipes cast into the foundation. The Security Room shall be manufactured using 45 mPa concrete with 10mm reinforcing bar in combination with high strength 42.5N power Crete.

Doors on bunkers used for ‘Low Power’ remote telemetry units shall be fitted with a Multilock A380AL lock.

Doors on bunkers used for solenoid valve assemblies shall be fitted with a new H4 lock.

12. CONCRETE BUNKER

A secure concrete bunker shall be provided for remote mounted equipment which does not have mains power available.

The bunker shall be manufactured using 45Mpa concrete with 10mm reinforcing bar in combination with high strength 42.5N power Crete. The bunker shall be fitted with a stiffened 800 x 600 x 6 galvanized mild steel door. The door shall be fitted with a keyed double throw dead bolt lock. Hinges shall not be visible or exposed and shall be welded to the reinforcing cage. The bunker shall be fitted with a galvanized mild steel chassis plate for mounting of equipment. A galvanized steel gland plate shall be provided at the base of the bunker for cable entry.

13. EARTHING SYSTEM

A solid copper earth bar shall be provided inside each Telemetry room. The earth bar shall be supported on robust spacers.

The earth bar shall have a cross-section of not less than 40mm x 6mm and shall be drilled with the requisite number of holes for the individual connection of all cable ECC and other earth conductors. High tensile phosphor bronze or cadmium plated nuts, bolts and lock washers shall be provided through the earth bar at each earth position and at least 5 additional holes shall be provided for future connections, each being fitted with nuts and bolts as above.

The earthing positions shall be evenly spaced along the length of the earth bar and the bar must be clearly identified as the earth.

All equipment shall be bonded, to prevent unequal potentials. As a minimum there shall be 2, 1.8 m copper rods spaced 2m apart.
Figure 3: Earth Feed into room

NOTES:
1. EARTH BAR MOUNTED 150mm ABOVE FLOOR.
2. SLEEVE TO BE SEALED AFTER CABLE IS COMPLETE.
14. **INSTRUMENT TRANSDUCER CORING (WHERE APPLICABLE)**

Transducer coring shall be 150 mm in diameter, and shall be cut no less than 1.5m from reservoir walls, clear of any internal obstructions, and near to the outlet to minimize turbulence. Before coring commences the position shall be approved by an EWS appointed engineer. The coring shall be enclosed with a galvanized lockable Top Hat as per general arrangement drawing.

A 20mm Size ‘0’ CCG box shall be installed inside the Top Hat for termination of transducer and corresponding outgoing cable.
15. **INSTRUMENT LABELS**

Each instrument shall be fitted with a label giving the function and tag number as detailed in the label schedule. Field mounted instruments including final control elements shall have labels mounted on a bracket which is fixed independent of the instrument and stays in position if the instrument is removed. The label must be in a clearly visible location.

Labels shall be made of laminated trafolite and have black letters on a white background.
The size of the labels shall be:

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>Field Instruments/ Transmitters/ Control Valves</td>
<td>80mmW x 30mmH</td>
</tr>
<tr>
<td>Type 2</td>
<td>Cabinets/ Field Junction Boxes</td>
<td>200mmW x 30mmH</td>
</tr>
<tr>
<td>Type 3</td>
<td>Terminal Rails</td>
<td>39mmW x 18mmH</td>
</tr>
<tr>
<td>Type 4</td>
<td>Power Supplies</td>
<td>70mmW x 20mmH</td>
</tr>
<tr>
<td>Type 5</td>
<td>Power Rails</td>
<td>15mmW x 10mmH</td>
</tr>
<tr>
<td>Type 6</td>
<td>Marshalling Cubicles</td>
<td>150mmW x 50mmH</td>
</tr>
<tr>
<td>Type 7</td>
<td>Distribution Boards</td>
<td>150mmW x 50mmH</td>
</tr>
</tbody>
</table>

The type number shall be included in the label schedule with the letter size.

16. **INSTRUMENT NUMBERING**

The instrumentation shall be tagged according to the following system:

- Prefix: Site Number
- Instrument type: modified ISA abbreviation
- Instrument number: sequential number e.g. 55-LT-02
- Site Number, level transmitter, 2nd instrument in that area.

17. **LAYERING CABLES IN PREPARED TRENCHES**

Before the cables are laid, the bottom of the trench shall be covered with a 75mm layer of earth which shall have been passed through a sieve with a maximum mesh of 4mm.

The cables shall be laid on the prepared bed carefully to avoid cuts and damage. Dragging along the ground shall be avoided wherever practicable. Cable rollers shall be used.

Where more than one cable is laid in a trench, the cables shall be spaced apart at a nominal 75mm centres, and in straight run trenches, cable crossing shall not be permitted except where cables may have to branch from the main run. At every draw-in point or joint box, the cables shall be snaked.

The trench shall be back-filled as soon as possible after cable has been laid. To prevent theft and possible damage, long lengths of cable shall not be left exposed in an open trench overnight.

Water shall not be allowed to accumulate at any part of the works. The Electrical Contractor shall ensure that no cable laying is carried out until the trenches are free from water.

All side channels, sumps or temporary excavations for dewatering purposes shall be filled in after use.

Cables shall be covered with a layer of 75mm min. depth of earth which shall have been passed through a sieve with maximum mesh of 4mm.
Figure 6: Prepared Trench

Cables shall be concrete encased, 2 meters from ground exit points.

Where cables run up or over a reservoir they should be neatly encased in concrete with no parts visible.
Trenches shall be a minimum of 600mm deep and 400mm wide.

Unless otherwise noted, all cables shall be covered with a light-yellow plastic warning sheet of approved design with the skull and cross bones insignia together with the words "DANGER, GEVAAR, INGOZI" printed in black at regular intervals. The warning shall be placed 300mm above the top of the cable.

18. 10 WAY DISTRIBUTION BOARD

One light fitting shall be installed on the ceiling of the Telemetry room and wired back to the local DB in PVC conduit.

A one lever one-way light switch

One double 16 Amp socket outlet shall be installed within one meter of the Telemetry panel at a height of 1.2 meters above FFL.

All lights and plugs shall be wired using GP wire in 20mm PVC conduit in accordance to SANS 10142-1.

All circuits must be clearly marked on the DB face panel.
The Telemetry panel shall be supplied by a 6A CB which is not on Earth Leakage.

The incoming supply shall be fitted with a Surge Protection unit.

19. **INTRUDER ALARM**

The contractor shall supply and install a dual technology Microwave and PIR motion detector in the Telemetry Room or Pump Station building mounted between 2 – 3 m on the wall facing the access door. The motion detector must have a 180-degree detection beam with a minimum range of 10 (ten) metres. The power supply for the detector shall be 24 V DC with a dry contact alarm output.

20. **EQUIPMENT LIST**

To list all equipment supplied on any one site. The list shall include a detailed description of the type of equipment supplied, the make, model and serial number as well as forming an index to loop diagrams and data sheets.

21. **INSTRUMENT DATASHEETS**

To gather and co-ordinate all information from process, mechanical and electrical disciplines related to a particular instrument. This document shall be used for procurement purposes as well as by the RTU/Scada programmers, Commissioning personnel and maintenance personnel. Each Instrumentation and equipment shall have a data sheet.

22. **HOOK UP DRAWINGS**

Each type of instrument shall have a typical drawing showing installation details including the termination of cables and process connections. This shall also list the instrument tag numbers that are applicable to the specific hook-up as well as all the materials required for installation.

23. **SITE NETWORK DIAGRAM**

This shall show the overall site network design including all telemetry, HMI, PLC, standalone controllers, motor control centres, fibre optic converters, masters and all nodes on the network.

24. **INSTRUMENT LOCATION DRAWING**

This as-built site layout drawing shall be generated by the Contractor to physically locate all field instruments, junction boxes, control panels, and cable trenching routes.

25. **CABLE BLOCK DIAGRAMS**

This is used to allocate instruments to junction boxes/equipment and lay out the flow of signals between components. This document shall show all equipment as well as cabling.
26. **CABLE SCHEDULES**

This is to list all cables, cable types, sizes and number of cores. This shall also indicate from where and to where the cable runs as well as the length of the cable run. The contractor shall develop the as-built schedule from the tender cable schedule provided.

27. **INPUT OUTPUT SCHEDULES**

This is a list of all the inputs and outputs to the RTU’s listed according to type and arranged per I/O card. This shall be for use by the panel manufacturers for panel construction as well as by the RTU programmers. The contractor shall develop the as-built schedule from the tender IO list provided.

28. **TELEMETRY PANEL GA**

This document shall be used for manufacturing the Telemetry Panel and shall include sufficient detail for the manufacturing together with the back plate lay out and assembly. All materials and equipment shall be fully itemized and listed on the drawing together with quantities.
29. **WIRING Diagrams**

Instrument wiring diagrams shall provide detailed information of all wiring contained within a panel or junction box and shall include such things as RTU I/O, 24V DC and 220V AC power, relays and any other auxiliary equipment wiring. The diagrams shall be comprehensible enough to fully construct and test the equipment.

30. **Loop Diagrams**

The instrument loop diagram shall be used as a maintenance and fault-finding document. Various bits of information for a particular loop shall be summarized onto a single document. The contractor shall be responsible for the development of the as-built loop drawings.
Figure 10: Transducer wiring

<table>
<thead>
<tr>
<th>FIELD</th>
<th>INSTRUMENT</th>
<th>JUNCTION BOX</th>
<th>TELEMETRY ROOM</th>
<th>TELEMETRY PANEL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RESERVOIR LEVEL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 11: Pressure TX Loop Diagram

<table>
<thead>
<tr>
<th>FIELD</th>
<th>INSTRUMENT</th>
<th>JUNCTION BOX</th>
<th>TELEMETRY ROOM</th>
<th>TELEMETRY PANEL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RESERVOIR INLET</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
31. CONTROL SYSTEM OPERATION MANUAL

This document shall define the actions which the operator is required to take to fully utilise the control system to operate the pump station and/or reservoir. The operator manual is intended to document how to use the control system and not as a manual for running the pump station. A separate Operations Manual shall be produced by the mechanical system designers depending on the type of equipment.

32. RETURN OF REDUNDANT EQUIPMENT TO EWS STORES

All existing equipment that becomes redundant because of site upgrades shall be properly documented and handed over to a person designated by EWS at a location designated by EWS. The format of the documentation and detail contained therein shall be agreed with the designated EWS representative before work starts.
C3.4.4 PS PU - BUILDING WORK

PU BUILDING WORK

PU.1 SCOPE

This section of the Specification deals specifically with all the building work associated with the Works.

Concrete work, steelwork, cladding, pipelaying, mechanical and electrical equipment, etc. forming part of or to be housed in a building erected in terms of this specification shall conform to the requirements of the relevant standardised or particular specifications referred to in the Project Specification.

PU.2 INTERPRETATIONS

The relevant SANS 1200 Standardised Specifications such as Site Clearance, Earthworks, Earthworks (Pipe Trenches), Concrete (Structural), Low Pressure Pipelines, Bedding (Pipes), Sewers and Stormwater drainage shall also apply to the work under this section.

PU.3 MATERIALS

All materials used for the Building Works shall, where such mark has been awarded for a specific type of material, bear the SANS mark.

PU.3.1 Brick and Plasterwork

PU.3.1.1 Cement

Cement shall conform to the requirements of SANS 1200 G-Concrete (structural)

PU.3.1.2 Sand

Sand or plaster and mortar shall comply with the requirements of SANS 1090, whereas the aggregates for normal and granolithic floor screeds shall comply with the requirements of BS 1199 and BS 1201 respectively.

PU.3.1.3 Water

Water shall conform to the requirements of SANS 1200 G-Concrete (structural).

PU.3.1.4 Cement Mortar

Unless otherwise described, cement mortar shall be composed of six parts by volume of sand to one part by volume of cement. The materials are to be mixed dry until the mixture is of a uniform colour and then clean water is to be added gradually through a fine hose and the mixture turned over until the ingredients are thoroughly incorporated.
Cement mortar must be mixed in small quantities and must be used within one hour of mixing, as the use of cement mortar that has commenced to set will not be permitted.

**PU.3.1.5 Plaster**

Plaster on brick walls shall be mixed one part cement to six parts sand.

Plaster on concrete ceilings, beams, columns etc. shall be mixed one part cement to three parts sand.

Plaster shall be mixed as specified in Clause PU 3.1.4

**PU.3.1.6 Bricks**

Bricks shall be of the best quality sound hardburnt pressed bricks or in the absence of clay bricks, concrete bricks, even in size and shape and equal to a sample submitted to and approved by the Engineer prior to commencement of work.

Clay bricks shall conform with the requirements of SANS 227 and concrete bricks to SANS 987.

**PU.3.1.7 Wall Ties**

Wall ties shall be the galvanised, crimped, single-wire type with a 3.5 mm diameter, and shall comply with the requirements of SANS 28.

**PU.3.1.8 Damp Proof Courses**

Damp proof courses, unless otherwise described, shall be an asphaltic damp proof course with a base of fibre felt, and complying with the requirements of SANS 248 Horizontal Damp Proof Courses, and with a mass of 3.25 kg/m² or a plastic damp proof course of 15 micron thickness as Type B, complying with the requirements of SANS952.

**PU.3.2 Fascias, Barge Boards and Window Sills**

**PU.3.2.1 Fascias and Barge Boards**

Asbestos cement fascias and barge boards, where specified, shall be 12 mm pressed sheets, 200 or 225 mm wide, free from cracks, twists, blemishes or other defects and complying with the requirements of SANS 685.

**PU.3.2.2 Window Sills**

Internal fibre reinforced cement sills (NUTEC) shall be single lengths cut between reveals, fitted with fixing lugs and solidly bedded in 3:1 cement mortar with a slight projection beyond the finished wall face below. Sills shall be pressed reinforced cement of approved manufacture 152 x 15 mm thick set level.
PU.3.3 Paintwork

PU.3.3.1 Primers

Plastered surfaces must be cleaned down and have one coat alkali resisting primer of an approved brand applied in strict accordance with the manufacturer's instructions, before any undercoats are applied.

Galvanized metal surfaces must be treated with one coat Metal Etch Primer complying with the requirements of SANS 723.

Steel surfaces and doors and steel door frames, before being built in, must have all loose primer together with all rust spots, dirt, etc. removed and be treated with one coat red oxide zinc chromate primer complying with the requirements of SANS 909.

Wood surfaces to receive paint finish must be cleaned down, all knots treated with knotting and be primed with Type I Wood Primer externally and Type III Wood Primer internally, both complying with the requirements of SANS 678.

PU.3.3.2 Emulsion paint for interior use must be Grade I Emulsion paint complying with the requirements of SANS 663. Emulsion paint for exterior use must be of the Synthetic Polymer Base Type complying with the requirements of SANS 634.

PU.3.3.3 High Gloss Enamel Paint shall be used on all surfaces other than specified above. High Gloss enamel paint must be Grade I paint complying with the requirements of SANS 630 for decorative High Gloss Enamel Paints with a Non-Aqueous Solvent Base, for interior and exterior use.

Undercoats for paints, except Emulsion paints, must be Type I undercoat Paint complying with the requirements of SANS 681.

PU.3.4 Doors, Windows and Glazing

PU.3.4.1 Solid Hardwood Doors

Unless indicated otherwise on the drawings, all doors shall be solid hardwood doors, manufactured from hardwood complying to SANS 1099.

PU.3.4.2 Wooden Door Frames

All wooden door frames shall be of solid hardwood, complying to SANS 1099. Frames shall be fitted with suitable tie bars and braces at bottom and lugs for building in, three to each jamb of frames without fanlights and four to each jamb of frames with fanlights. All doors shall be provided with locks to the requirements of SANS 4 and each lock shall be provided with a duplicate key.
PU.3.4.3 Pressed Steel Door Frames

Pressed steel door frames shall comply with SANS 1129 and shall be manufactured from 1,6 mm thick mild-steel sheeting, pressed to the required shapes, properly mitred, welded and reinforced, with all welding neatly cleaned off.

Frames shall be of the widths required to suit the thickness of the walls into which they are built and shall be fitted with suitable tie bars and braces at the bottom. Three lugs to be built into the brickwork shall be provided on each jamb.

Rebates in frames and transom for doors shall be of the widths required to suit thicknesses of the doors and shall be fitted with a pair of approved steel butt hinges set flush into recesses in the frames. 4,5 mm thick reinforcing plates shall be welded to the backs of the frames at hinge positions.

PU.3.4.4 3CR12 Door Frames

The same conditions as specified in clause PU3.4.3 shall apply for 3CR12 Door Frames except that 1,6 mm thick 3CR12 sheetings shall be used.

PU.3.4.5 Windows

Steel windows must be of approved manufacture and design, constructed of rolled mild steel sections, properly mitred and welded at angles with welding cleaned off smooth on all faces and complying with the requirements of SANS 727. Window types and sized shall be as specified on the drawings.

PU.3.4.6 Aluminium Window Frames

Standard aluminium window frames shall be manufactured from aluminium extruded section with anodised finish.

PU.3.4.7 Winblock Window Systems

Precast concrete window systems shall be winblock window systems as supplied by Winblock Transvaal, Tel: (011) 444 6996/444 4887 or similar approved.

Standard Winblock surrounds shall be supplied as indicated on the drawings. The surrounds shall be manufactured from unreinforced low permeability, 30 MPa concrete and shall conform to the specification of Wintec in all respects.

Where direct glazing is specified, the glazing shall be fixed to the winblock surround in accordance with the instructions of the manufacturer.

Where opening windows are specified top-hung Winvents shall be supplied with factory glazing. The frame shall be manufactured from aluminium extruded sections with anodised finish. Weather seals the wool pile. Friction stays to be manufactured from stainless steel and handles from glass reinforced nylon (GRP)
PU.3.4.8  **Fixed Louvre Windows**

Fixed louvre windows shall be standard louvres to the sizes indicated on the drawings as manufactured by HH Robertson (Africa) Pty Ltd or similar approved and shall have a dark blue chromodek finish.

Fixed louver windows shall be provided with a vermin proof screen manufactured from Mentis Type 362 Flatex screen as manufactured by Andrew. Mentis (Pty) Limited or similar approved welded to a 75 x 50 x 20 x 2.5 lipped angle frame, sized to fit into the wall opening as indicated on the drawings. The frame shall be provided with four lugs and fixed to the masonry work with four 8 mm x 50 mm expansion bolts.

PU.3.4.9  **Glazing**

Sheeting glass for glazing, unless otherwise specified, must be flat drawn clear glass of the thickness indicated below and comply to SABS 0400, Part N. For safety glazing refer to NN3.1.

For panes not exceeding 0.65 m$^2$ : 3 mm  
For panes exceeding 0.65 m$^2$ and not exceeding 1.5 m$^2$:4 mm  
Where obscured glass is specified, 4 mm thick  
Specific pattern glass shall be used.

PU.3.5  **Tiling**

**PU.3.5.1 Adhesive and Grouts**

(a)  **Wall adhesive**  
Wall adhesive shall be a grey, cement-based thin bed, wall tile powder adhesive for fixing tiles to walls.

(b)  **Floor adhesive**  
Floor adhesive shall be a grey, cement-based thick bed, floor tile powder adhesive for fixing heavy tiles to floors or walls.

(c)  **Bonding agent**  
Bonding agent shall be a latex modified for use with adhesives and grouts to improve water resistance.

**PU.3.5.2 Tiles**

Tiles shall be of first grade quality, white in colour, and of minimum thickness of 5 mm and shall be glazed ceramic tiles (unless specified to the contrary).

**PU.3.6 Floor Finishes**

**PU.3.6.1 Vinyl Floor Tiles and Accessories**
Vinyl floor tiles shall be semi-flexible vinyl floor tiles, 300 mm x 300 mm x 2.5 mm thick to the colours specified. The colour scheme shall be approved by the Engineer before any tiles are ordered - irrespective whether colours have already been specified on the drawings.

Skirtings shall match the colour of the floor tiles and shall reach 100 mm up against the wall.

**PU.3.6.2 Epoxy Floor Coatings**

**PU.3.6.2.1 Self Levelling Coatings**

Self levelling and self smoothing epoxy coatings shall be solvent free, epoxy overlay systems in general 4 – 6 mm thick. However the epoxy coating shall be applied to the thickness specified strictly in accordance with the manufacturers instructions. Before application the concrete shall be prepared and primed in accordance with the manufacturers instructions.

**PU.3.7 Electrical Connection**

Electrical wiring and fittings are to comply with the requirements laid down by:

(i) The latest issue of the “Standard Regulations for wiring of premises” issued by the South African Institute of Electrical Engineers.

(ii) The Factories, Machinery and Building Works Act of 1941.

(iii) The local authorities By-laws and any special requirements of the Local Supply Authority.

**PU.3.8 Sanitary Equipment**

**PU.3.8.1 Pedestal Water Closet Pans**

Pedestal water closed pans shall be of wash-down type approximately 450 mm high, of white glazed fireclay or vitreous china, complying with the requirements of the relevant SANS specification.

Pans shall be bedded on the floors in 3:1 cement mortar. Pans shall be fitted with approved wooden seats with double flap of size and shape required to fit the pans and each attached to pan with two non-ferrous metal fixing bolts.

**PU.3.8.2 Flushing Cisterns**

Closed coupled vitreous china cisterns, no less than 12 mm thick in any part, shall be provided complying with the relevant SANS specification and shall have a capacity of not more than 9 litres and shall be of the valveless symphonic type of approved manufacture.
PU.3.8.3 Hand Wash Basins

Hand wash basins shall be of the bracket type of white vitreous china, complying with the requirements of the relevant SANS specification and having overflow, fitted with chromium plated grid.

Unless otherwise specified, basins shall be size 585 x 430 mm each fitted with 38 mm plug and chromium-plated chain, and with 12 mm chromium-plated brass easy clean pattern screw down pillar taps.

Basins shall be fixed on concealed wall hangers fixed to walls with 6mm brass bolts, 150 mm long.

PU.4 PLANT

Plant, equipment, tools, scaffolding, etc. utilised in building work shall be of suitable capacity, condition and design to ensure the satisfactory and timeous completion of the Works within the specified period and in terms of these specifications and good building practices.

Only registered artisans (e.g. plumbers, electricians, etc) shall be employed on any work where this is compulsory building practice.

PU. 5 CONSTRUCTION

PU.5.1.1 Normal Brick Walls

Brickwork, wherever practicable, and not otherwise described must be built in Stretcher bond. Half brick walls, walls in two skins an cavity walls must have separate skins built in stretcher bond. No false headers are to be used and none but whole bricks except where legitimately required to form bond. The bricks are to be well wetted (saturated in hot weather) with water before being laid and the course of bricks last laid is to be well wetted before bedding fresh bricks upon it. All perpends and angles are to be kept plumb. The brickwork is to have the joints flushed up at every course solid throughout the whole width of the course, and each course is to be laid on a solid bed of mortar. Pointing is to be done as the work proceeds.

The joints of all walls to be plastered or tiled are to be raked out 15 mm as the work proceeds to form a key for plaster or screed. All walls are to be built up in regular and horizontal courses and carried out so that no part built is more than 1,2 m higher than any adjoining walls. Mortar beds generally are not to exceed 12 mm thickness.

PU.5.1.2 Face Brick Walls

In all face brickwork the bond must be set out on the first level course of brickwork, at floor level internally and two courses below ground level externally. The bond, if necessary, is to be broken in the centre of panels under windows or to piers between windows. All perpends must be kept true and all courses must be built to gauge rods. Facings must be carefully protected from damage, mortar droppings, paint splashes, etc. during the whole period of the Contract, and facing on completion will not be allowed.
PU.5.1.3 Cavity Walls

Cavity walls are to be built with two brick skins with a cavity between the skins and the two skins tied together with wire ties, four to the metre square, carefully laid and in no case to fall inwards towards the inner skin of the wall.

Care must be taken to keep the cavity free of mortar droppings or other matter by movable boards or other means, and temporary openings must be left at plinth level through which any such droppings, etc. can be removed, and the openings made good on completion.

At door, windows and other openings, the cavities shall be stopped 102,5 mm back from heads, jambs and sills of openings.

PU.5.1.4 Reinforced Brick Lintols

Brick lintols are to be built of normal, sound, well burnt, good quality building bricks, similar to the facings where exposed properly bonded longitudinally and bedded and pointed in cement mortar as described. Special care must be taken to ensure solid bedding, particularly where the reinforcement occurs.

The lintols are to be reinforced with straight continuous mild steel rods of the size and number scheduled. The rods must each extend 300 mm on each side of the opening and are to be evenly spaced across its thickness in the first horizontal joint above the soffit.

Brick lintols in cavity walls must have all rods placed below the solid sections of the walls, excepting for those specifically scheduled to occur below the cavity.

Cavity walls must be built solid for the number of courses scheduled above the lintols soffit. This solid section must extend the full width of the opening, plus 300 mm on each side. Combined brick and concrete lintols may have the reinforcement divided proportionately between brick and the concrete skins. Where two or more openings are less than 600 mm apart, the lintol shall be continuous over all such opening and such openings and dividing piers, plus 300 mm bearing at each extreme end as before, shall have such height and reinforcement as scheduled for widest opening spanned.
### Span in mm

<table>
<thead>
<tr>
<th>Span in mm</th>
<th>Min Height of Lintols above soffit course, in brick courses</th>
<th>Reinforcement per half-brick thickness of wall above for solid walls</th>
<th>Additional reinforcement for cavity, placed below cavity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No of rods</td>
<td>Dia mm</td>
<td>No of rods</td>
</tr>
<tr>
<td>600</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>900</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>1200</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>1500-1800</td>
<td>4</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>2100-2400</td>
<td>5</td>
<td>3</td>
<td>10</td>
</tr>
</tbody>
</table>

### PU.5.1.5 Damp Proof Courses

The sheeting is to be cut into strips of the required width and laid on all foundation walls to the full thickness of the walls and without any longitudinal joints. At ends, angles and intersections the sheeting must be lapped 150 mm and sealed. In cavity walls the sheeting must be laid across the full width of the wall, including the cavity, and must be stepped up one course in the cavity, over a cement triangular fillet, so that the sheeting under the inner skin of the wall is higher than that under the outer skin of the wall.

Under all window sills exposed to the weather, the sheeting must be laid on the brickwork in the first joint immediately below the sill and turned up with an easy bend and tucked into window frame.

Over reinforced brick lintols exposed to the weather, the sheeting must be laid to form damp proof course as detailed above for solid walls and cavity walls.

### PU.5.1.6 Reinforcing in Brick Walls

Reinforcing (brickforce) of an approved manufacture shall be placed on every fifth course in all brick walls. In halfbrick and cavity walls 80 mm wide reinforcing mesh shall be used and 150 mm wide mesh in the case of the one-brick walls.

Except where otherwise described, all external plaster is to be finished with a wooden float and all internal plaster is to be finished with steel trowel, all to perfectly true and even surfaces, free from tool marks and other defects on completion.

All finished surfaces are to be protected from injury. All joints in brickwork are to be well raked out all surfaces, brickwork and concrete, to be plastered must be brushed down to remove all dirt and dust and be thoroughly wetted directly before plastering. Concrete surfaces must be roughened or hacked as necessary to give a proper key for plaster. The surfaces must then be sloshed with a course cement grout before plastering commenced. Plaster must be returned into reveals and soffit of openings and all angles and edges must be true and straight. All plaster surfaces must be free from blemish and any cracks, blisters, or other defects must...
be cut out and made good and the whole left perfect at completion. Plaster on walls must not be less than 12 mm or more than 20 mm in thickness, and plaster on concrete work must be not less than 10 mm or more than 15 mm in thickness, except where specifically otherwise described.

**PU.5.1.8 Slip Joints**

Slip joints shall be provided between brickwork and concrete slabs and beams by levelling up and steel trowelling smooth the bearing surfaces of brickwork with 3:1 mortar and covering the bearing surface before concrete is cast with 2 layers of 500 µm (five hundred micron) black general purpose sheeting membrane.

The ends and sides of beams and edges of concrete slabs shall be separated from the brickwork with 12 mm polystyrene placed vertically against the brickwork before the concrete is cast.

**PU.5.1.9 Beam Filling**

Unless otherwise specified, beam filling shall be half brick, built in cement mortar, cut in between roof timbers and carried hard up to underside of roof covering and flushed up in mortar with a groove formed between covering and mortar to the satisfaction of the Engineer.

**PU.5.1.10 Securing of Roofs**

Roof plates shall be fixed to walls with bands of 1.6 mm thick galvanised hoop iron, 32 mm wide, built six (6) courses deep into brickwork or embedded 300 mm deep into concrete, and not exceeding 1.5 metre centres, and well lapped and spiked to plates and to roof trusses where adjacent, otherwise taken up to and lapped round the nearest purlin and well spiked thereto. A layer of brickforce shall be provided at each alternate course above the building in of the hoop iron to fix the roofs.

**PU.5.2 Rain-Water Goods**

All gutters, downpipes and flashings shall be 0.6 mm thick galvanised sheet iron. Rates for sheet iron eaves gutter and rainwater pipes shall include for short lengths and for lapped, riveted and soldered joints. Eaves gutters are to be screwed or welded to fascia boards or roof timbers/beams with 38 X 3 mm galvanised steel gutter brackets at approximately 900 mm centres, or as otherwise described. Rainwater pipes are to be fixed with sheet iron ears to and including 25 C 76 X 150 mm wrought and chamfered hardwood blocks, plugged to brickwork or concrete and oiled, or with 38 X 14 gauge galvanised hoop iron straps built into walls not more than 2 metres apart, bent around pipe and bolted at back.

Flashings shall be properly cut, lapped and shaped to render a waterproof finish. Flashings turned up against walls must be finished with cover flashings bent to shape, dressed over the underflashing and with top edge wedged into joint of brickwork and pointed or secured by other approved means.

Fibre-cement fascias and barge boards shall be secured with screws or bolts. Where joints occur in the length they are to be covered with two channels 40 mm girth with web to suit thickness of plates formed from 0.5 mm thick galvanised sheet iron cut to shape, bent as
required and with the webs riveted together back to back. Tongues 15 mm wide by 15 mm long must be left projecting at both ends of flanges and clamped down over edges of fascias or barge board when in position.

**PU.5.3 Paintwork**

All surfaces not being painted, such as face brickwork, sills, floors and stained woodwork, must be covered up and protected against paint and distemper spots before any painting is commenced. All floors must be swept clean and walls dusted down before any paintwork is commenced and no sweeping or dusting must be done while painting is in progress.

All plastered wall; ceiling and similar surfaces must be perfectly dry and in a fit state to receive the finishings, before the work is put in hand.

All coats of paints, etc must be thoroughly dry before subsequent coats are applied, and rubbed down where necessary.

All work must be finished to colours approved by the Engineer.

The tints of undercoats must approximate those of the finishing colour and in order to indicate the number of coats applied and to avoid misses when applying a succeeding coat a slight difference shall be made in the tint of each coat.

The Contractor must provide all necessary dust sheets, covers, etc and shall exercise all necessary care to prevent marking the surfaces of joinery, walls, floors, glass and electrical fitting, etc. and must keep all parts of the works perfectly clean and free at all times from spotting, accumulation of rubbish, debris or dirt arising from the painting operations. Any surface disfigured or otherwise damaged must be completely renovated or replaced as necessary, by the Contractor at his own expense. The premises must be left clean and fit for occupation at the completion of the Work.

**PU.5.4 Floor Finishes**

Where a floated concrete floor finish is specified on the drawings, the requirements of SANS 1200G or GA whichever is relevant shall apply.

Granolithic finish to floors, treads and risers of steps, thresholds, landing etc. must be composed of two parts hard stone chippings : half part sand and one part cement, steel trowelled to a true and even surface. The granolithic must be laid before the concrete surface bed has matured, otherwise the surface of the concrete must thoroughly cleaned with a wire brush and a coat of neat cement grout applied immediately before the granolithic is laid. The granolithic must be laid in panes not exceeding 6 m² in areas, and jointed to lines of panels and lined into smaller square as directed with sunk V-joint. The joints between the panels should coincide with joints in the concrete surface bed, where these occur. No dusting on of colouring pigment will be allowed.

Vinyl floor tiles shall be fixed on to a screed of thickness at least 25 mm. The screed shall have a wood floated finish and shall be smooth with no obstruction greater than 3 mm protruding and with the screeded surface level in such a way that no gap greater than 5 mm would show underneath a 3 m straight-edge or part thereof.
Vinyl tile adhesive shall carry the same product name as the vinyl tiles and adhesives shall be applied as stipulated by the supplier.

The acceptable tolerance of the final tiled floor shall be similar to the specified for the screeded surface underlying the tiles.

**PU.5.5 Tiling Work**

The area to be tiled, shall first be plastered as described under plasterwork leaving a wood float finish. The plastered surface shall be left for two weeks to cure before any tiling may start.

Tiles shall only be cut by approved tungsten tile cutters, or for irregular shapes by approved tile saws. The use of nibblers shall not be permitted.

A tiled panel shall be planned beforehand to minimise cuts. An initial perpendicular tiling configuration shall be laid against perpendicular fixed battens. A clear space of 1 to 2 mm shall be left between tiles by inserting positive temporary spacers.

Prior to the application of any adhesive the rendering shall be vacuum cleaned. Adhesive shall be mixed with a bonding agent and not with water. The mixing proportions shall be as specified by the supplier. Adhesives shall be applied within a 15 minute period after mixing, with those adhesives not used during such time to be thrown away.

Adhesives shall be applied in a solid bed, some 6 mm thick and then struck with an approved serrated steel trowel. Adhesives shall not be applied by “the fire point tiling method”.

Grouting of the joints shall only start 48 hours after tiled section has been completed. The grout shall also be mixed with the bonding agent as specified by the supplier. The grout shall be worked off leaving a neat superficial rut in the joint centre. All tile faces shall be cleaned directly after grouting.

No tiling shall be done over a structural joint. In large tiled panels, a movement joint shall be left every 3 meters in the horizontal and vertical direction as detailed. At a structural joint (contraction or expansion joint) the rendering, adhesives and tiles shall be interrupted over the joint and the joint sealed at the surface.

The permissible deviation on the final surface shall be a maximum gap of 3 mm measured under a 3 m straight edge or part thereof.

**PU.6 TOLERANCES**

Where tolerances are not specified in the clauses above those generally accepted at representing good workmanship in the building trades shall apply.

**PU.7 TESTING**

The Engineer reserves the right to order any tests, whether at place of manufacture or on site, necessary to evaluate the quality of the work and to ensure the finished building conforms to all the specified requirements.
MEASUREMENT AND PAYMENT

Schedule items

Brickwork

Brickwork, if measured as a separate item, shall be measured in square metre of the nett brickwalled area (with the wall width and type of brick-finish, indicated). No additions will be made for small openings such as air bricks, etc. The tendered price square metre of brickwork shall include for the following, if such items are not listed separately:

(a) Plasterwork as indicated
(b) Damp proofing
(c) Brick forcing (every fifth layer)
(d) Reinforcing of lintols
(e) Miscellaneous items built into brickwork shown on the drawings such as air bricks.

Wall, Ceiling, Roof and Floor Finishes

Cement plaster on walls and ceilings, roof screeds, floor screeds, paint and any other finish described or specified, shall if measured as a separate item, be measured in square metres of the nett surface area. No deductions shall be made for small openings nor shall additions be made for small protrusions and reveals. No separate payment shall be made for the processes involved and material supplied for the complete painting of all fixtures and fittings, as specified herein and the costs hereof shall be included in the tendered price for the supply, manufacturing and erection of all such items to be erected.

Miscellaneous

(a) Doors and windows shall be measured per unit of door or window complete with door frame, lock keys, glazing, painting, etc. for each type and size of door or window or as a lump sum payment for all doors and windows included in the door and window schedule of the Works.

(b) Other items of building work, fixtures and fittings, shall be measured and paid for in the units of the measurement listed in the Schedule of Quantities.
REPORT TO
BIGEN AFRICA SERVICES
ON THE RESULTS OF A
GEOTECHNICAL INVESTIGATION
FOR THE PROPOSED NEW ADAMS
MISSION RESERVOIR 6 UPGRADE

Reference
18/N8508/1

Prepared By
A. P. Krebs/ C. J. Ross

Date
October 2018
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DRAWINGS  18/N8508/1  Site Plan showing Field Test Positions
                18/N8508/2  Electrical Resistivity Profile
1. **TERMS OF REFERENCE**

Davies Lynn and Partners (Pty) Limited (DLP) were appointed by Bigen Africa Services (Pty) Ltd, to undertake the geotechnical investigation for the proposed new Adams Mission Reservoir 6 upgrade.

This Report documents the findings of a detailed geotechnical investigation carried out at the site of the proposed new Adams Mission Reservoir 6.

2. **INFORMATION SUPPLIED**

The following information was provided by Bigen Africa Services:

- Google KMZ files showing the proposed location of the Adams Mission reservoir site.

3. **SITE DESCRIPTION**

3.1 **Topography**

The site of the proposed Adams Mission Reservoir 6 is located at the approximate latitude 29°59′59.79″S and longitude 30°48′8.12″E near the town of Umbumbulu. The site of the proposed reservoir is located on appreciably level ground, with the topographical relief typically varying between approximately 335m and 336m above MSL.

3.2 **Vegetation**

The existing vegetation comprises predominantly short grasses with shrubs, bushes and isolated trees.
4. FIELD INVESTIGATION

The geotechnical field investigation carried out across the site of the Adams Mission Reservoir 6 site comprised a shallow subsurface geotechnical investigation involving the excavation of Inspection Pits with the performance of Dynamic Cone Penetrometer (DCP) tests located immediately adjacent to each Inspection Pit.

The fieldwork for the project included the following:

i. Excavation, profiling and backfilling of Inspection Pits (IP’s) across the proposed reservoir site. During the investigation, Nine (9No.) Inspection Pits (IP’s) were excavated by TLB to depths ranging between 1.3m and 3.7m below existing ground levels for the purpose of geotechnical profiling and material sampling. The logs of the Inspection Pits are presented in Figures 1.1 through 1.9 in Appendix 1 of this Report.

ii. Nine (9No.) Dynamic Cone Penetrometer (DCP) tests were performed immediately adjacent to the nine (9No.) Inspection Pits. The DCP tests were undertaken adjacent to the Inspection Pits in order to assess and correlate the relative densities of the subsurface materials across site with the profiled descriptions from the IPs. The DCP tests were performed to depths of refusal or to a maximum depth of 3m below existing ground levels. The DCP test results are presented together with the IP logs in Figures 1.1 to 1.9 in Appendix 1 of this report.

iii. Material sampling of representative subsoils was undertaken from the Inspection Pit excavations and were transported to a commercial soil testing laboratory in Durban for Sieve analyses, Hydrometer analyses, Atterberg Limits, Natural Modified AASHTO maximum dry density compaction tests and California Bearing Ratio (CBR), Collapse Potential and Chemical tests. The results of the Laboratory Tests are presented in Appendix 1 of this report with a brief summary in section 5 of this report.

iv. Electrical resistivity testing was conducted across the proposed platform in order to identify any potentially hazardous fault zones or unfavourable jointing which may compromise the foundations of the proposed new reservoir.
The locations of the various in-situ tests in relation to the proposed approximate position of the proposed new reservoirs are indicated on the Geotechnical Site Plan Dwg. No. 18/N8508-01 enclosed.

5. LABORATORY TESTING

The laboratory testing comprised the following:

- Sieve Analyses,
- Hydrometer Analyses,
- Atterberg limits,
- Natural Mod. AASHTO maximum dry density compaction tests;
- California Bearing Ratio (CBR) tests;
- Collapse Potential
- Chemical Testing

5.1 MECHANICAL & CHEMICAL ANALYSIS

In total five (5No) foundation indicator samples were tested, three (3No.) bulk disturbed samples were taken for MOD, CBR and Collapse Potential Testing and two (2No) samples were retrieved for chemical testing.

The results of the laboratory testing confirm the characteristics of the two predominant soil horizons encountered on site. The upper colluvial material (SS1, SS2, SS5) classifies as a slightly clayey SAND with Plasticity Index varying from 8 to 11 percent and linear shrinkage values ranging from 3.5 to 5 percent. The upper colluvial material exhibits a poor CBR value from 90% to 93% compaction with better CBR values increasing with greater compaction.

The residual Natal Group Sandstone horizon (SS3, SS4) comprises of a silty SAND to a medium to coarse grained SAND. The Plasticity Index ranges from 10% to Slightly Plastic (Negligible) with linear shrinkage values ranging from 5% to Slightly Plastic (Negligible). In contrast to the colluvial samples the residual material exhibits far greater CBR values at a lower compactive effort indicating that the residual material will be useful as backfill material during construction related activities.
Chemical testing of the colluvial and residual material was undertaken in order to assess the corrosivity of these materials found on site. The Langelier Saturation index incorporates the testing of several chemical characteristics in order to produce a rating of the corrosivity of the soil. Accordingly, the Langelier Saturation Index for both soil horizons indicates that this material has the potential to be **highly corrosive** and therefore consideration for corrosion prevention of steel pipelines and related structures should be considered during the construction process.

6. **SUBSURFACE CONDITIONS**

On the basis of the subsurface profiles exposed by the Inspection Pits, the subsurface conditions are outlined below:

6.1 **Fill Material**

Fill material consisting of *Dry, pale yellow brown, very loose to loose, slightly clayey SAND* can be found consistently occurring from IP1 to IP 9 in depths ranging from 0.2m near IP 7 and IP 8 to deeper deposits of up to 1.5m between IP 4 and IP5 below existing ground level.

6.2 **Upper Colluvial Horizon**

The upper colluvial horizon comprises of *Slightly moist to moist, dark brown, loose to medium dense, intact, slightly clayey silty SAND to medium to coarse grained SAND* ranging in depth from 0.9m to 2.3m below existing ground level.

6.3 **Residual Natal Group Sandstone**

The residual material derived from the weathered bedrock material consists of *Moist, Pale yellow brown to pale pinkish brown, medium dense to very dense, intact, silty SAND to medium to coarse grained SAND* ranging in depths from 2m to 2.8m below existing ground level.
6.4 **Weathered Bedrock (Natal Group Sandstone)**

The Natal Group Sandstone underlies the site entirely and can be described as *W5, Pale yellowish brown to purple pinkish brown, completely weathered, medium bedded, soft to medium to hard rock SANDSTONE* ranging on depths from 0.5m near IP7 and IP8 to depths of 3.7m in IP1 to IP6.

6.2 **Groundwater Elevation**

No groundwater seepage was recorded during the excavation of any of the Inspection Pits to depths of at least 3.7m below ground levels. Owing to its elevation, this portion of the site is considered to be well drained. Nevertheless, the soil profile and jointing of the underlying bedrock makes the area susceptible to the development of localized perched water tables, particularly at the interface of the residual soil and weathered bedrock, after heavy rain.

7. **EXCAVATABILITY AND BULK EARTHWORKS**

In terms of SANS 1200 DA criteria, excavations within the colluvial and residual subsoils beneath the site are considered to classify as ‘very soft to soft excavation’, completely weathered fine grained sandstone/siltstone is expected to classify as ‘intermediate’ in terms of the SANS 1200 DA criteria. Whilst excavations into the weathered bedrock should be classified as ‘intermediate to hard excavations’. Depending on the joint spacing, excavations into bedrock at depths greater than 3.7m is likely to result in the excavatability becoming hard to very hard, and this may require the potential for heavy ripping machinery particularly near IP7, IP8 and IP9.

7.1 **ELECTRICAL RESISTIVITY TESTING**

In order to provide further analysis of the underlying bedrock structure Electrical Resistivity (ER) traverses were conducted in order to identify any possible fault zones or joint spacings which may compromise the foundations of the proposed new reservoir structures.

The results of the investigation indicate that the Natal Group Sandstone is predominantly horizontally bedded with no major fault zones identified during the
investigation. The ER results do however indicate that bedding of this nature will result in excavatability being classified as hard to very hard as depth increases to that of 4m or greater. The results of the traverses are attached in drawing 18/N8508/2 of this report.

8. GEOTECHNICAL RECOMMENDATIONS AND CONSIDERATIONS RELATING TO FOUNDING OF THE STRUCTURE

8.1 Structure

According to Bigen Africa Services the Adams Mission Reservoir is anticipated to comprise a 8 ML to 10 ML Concrete Reservoir structure.

8.2 Founding Conditions

The fill, colluvial subsoils and residual Sandy Soils cover the entire site to depth ranging between approximately 2m and 2.8m below existing ground levels. These subsoils are considered highly collapsible.

Underlying the abovementioned sequences, medium to coarse grained sandstone/siltstone bedrock was encountered at IP7, IP8 and IP9, at depths ranging from 0.5m to 1.6m and at IP 1 to IP6 at depths ranging between 2m and 2.8m below existing ground levels. The location of this reservoir is expected to be founded on appreciably level ground and therefore no slope stability concerns are expected. However, deep excavation sidewall stability measures will need to be implemented.

8.3 Founding Recommendations

The results of the geotechnical investigation show that the subsoil profile comprises an upper mantle of collapsible material which overlie completely weathered Sandstone/Siltstone. In order to provide adequate founding for the proposed reservoir the following founding recommendation is proposed:
Nominally reinforced concrete ring beam foundation

It is recommended that the platform supporting the Reservoir be created in cut at a level of greater than 4m below existing ground level to take advantage of the weathered Sandstone/Siltstone bedrock that occurs at this level for founding purposes.

The foundations for the Reservoir should be keyed into the weathered bedrock at this level.

Should any isolated pockets of soft residual material be exposed during excavation it is recommended that this material be boxed out to intact bedrock level and replaced with mass concrete infill.

A net allowable bearing pressure of 150kN/m$^2$ is considered applicable for foundations located in this intact, albeit weathered bedrock.

8.4 EXCAVATION SIDEWALL STABILITY

Excavation for the proposed reservoirs are anticipated to exceed 4m below existing ground level.

The upper 2m of subsoil material exposed in the excavation sidewall should be battered to 1:1.5 during the excavation process. The lower 2m where intact bedrock is exposed should be battered to 1:1 (45°) provided no adverse jointing occurs within the bedrock.

Should space limit this operation, during excavation, lateral support methods will be required to support the collapsible sidewalls and prevent any potential failure of the sidewalls while exposed.
9. **GENERAL**

9.1 **Stormwater**

Stormwater collected from all hardened surfaces should be collected and piped into a stormwater retention and soakaway facilities. Impermeable perimeter aprons sloping away from the buildings are recommended to prevent ponding against the structure. Exposed soils should be vegetated as soon as possible in order to impede surface runoff and inhibit erosion of the surface soils.

9.2 **General Earthworks**

The site is generally very gently sloping and therefore only very limited earthworks are anticipated. Where earthworks and / or embankment construction is proposed, it is recommended that these operations be carried out in accordance with the current SANS 1200 series. In this regard, general fill for the formation of embankments or terraces should adhere to the following general precautions:

- Topsoil should be removed and stockpiled for later use.
- Rock fragments greater than 150mm in size, if encountered, should be screened out.
- Any unsuitable clay materials should not be placed within 500mm of structures.
- The placement of fill materials should be placed in layers not exceeding 100 to 150mm, each layer individually compacted to at least 93% Mod. AASHTO maximum dry density.

9.3 **General Backfill Material Assessment**

In general, the insitu materials present on the site are suitable for use as general backfill e.g. for pipe trenches, etc. However, the following precautions are advised:

- Topsoil should be removed and stockpiled for other use.
- Materials should not contain more than 10% rock or hard fragments greater than 50mm in size.
- Clay should not be placed within 500mm of structures i.e. materials high in clay content are not suitable for fill against structures or beneath floor slabs.
The placement of fill materials should be in layers not exceeding 100 to 150mm, each layer individually compacted at optimum moisture content to at least 93% Mod. AASHTO maximum dry density.

9.4 **NHBRC Site Class Designation**

The NHBRC Classification of the soils underlying the Adams Mission Reservoir 6 site, would be classified as R/C1/C2 in terms of the anticipated magnitudes and types of potential settlements for design purposes.

Written By:    Reviewed By:


Director    Director

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APPENDIX 1

Inspection Pit Logs
Laboratory Test Results
### Geotechnical Investigation for Adams Mission Reservoir 6

**MACHINE:** TLB  
**INSPECTION PIT NO.:** 1  
**LOCATION:** Adams Mission  
**DATE:** 21st August 2018  
**LOGGED BY:** A. Krebs  
**ELEVATION:**

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**WATER TABLE:** None  
**REFUSAL:** None

The equivalent CBR values above are provided as an indication only.

---

*The content reflects the geotechnical investigation results as detailed in the document.*
**PROJECT:** Geotechnical Investigation for Adams  
**MACHINE:** TLB  
**MISSION:** Adams Mission  
**LOCATION:** Adams Mission  
**DATE:** 21st August 2018  
**LOGGED BY:** A. Krebs  

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**WATER TABLE** None  
**REFUSAL** None

The equivalent CBR values above are provided as an indication only.
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<tr>
<td>1.5</td>
<td></td>
<td>3</td>
<td>W5, pale pinkish brown, completely weathered, medium bedded, soft to medium hard rock Natal Group Sandstone</td>
</tr>
</tbody>
</table>

The equivalent CBR values above are provided as an indication only.
## Geotechnical Investigation for Adams Mission Reservoir 6

**MACHINE:** TLB  
**LOCATION:** Adams Mission  
**DATE:** 21st August 2018

**EXCAVATION PIT NO.:** 4

**LOGGED BY:** A.Krebs  
**ELEVATION:**

### Depth vs. DCP Blow Count and E.O.V. CBR

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>DCP Blows/100mm</th>
<th>E.O.V. CBR</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>2</td>
<td>2</td>
<td>Fill material consisting of Dry, pale yellow brown, slightly clayey medium to coarse grained SAND</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>4</td>
<td>8</td>
<td>Slightly moist, dark brown, loose, intact, slightly clayey fine to medium grained SAND (Colluvium)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>10</td>
<td>25</td>
<td>Moist, pale yellow brown mottled pinkish brown, dense, intact, moderately clayey SAND with a clay seam at 1.7m to 2.4m</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>10</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18</td>
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<td>18</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>18</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>3,5</td>
<td>3.7m</td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td>4,0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>4,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>5,0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WATER TABLE:** None  
**REFUSAL:** None

The equivalent CBR values above are provided as an indication only.
## Geotechnical Investigation for Adams Mission Reservoir 6

**MACHINE:** TLB  
**DATE:** 21st August 2018  
**LOCATION:** Adams Mission  
**LOGGED BY:** A. Krebs  

### Inspection Pit No. 5

**DATE:** 21st August 2018  
**LOCATION:** Adams Mission  
**ELEVATION:**

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>DCP Blows/100mm</th>
<th>EOV CBR</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>2</td>
<td>4</td>
<td>Fill material consisting of Dry, pale yellow brown, slightly clayey medium to coarse grained SAND</td>
</tr>
<tr>
<td>2.0</td>
<td>10</td>
<td>22</td>
<td>Slightly moist, dark brown, loose to medium dense, intact, slightly clayey fine to medium grained SAND (Colluvium)</td>
</tr>
<tr>
<td>2.5</td>
<td>12</td>
<td>36</td>
<td>Moist, pale pinkish brown, medium dense to dense, intact, medium to coarse grained SAND (Residual Sandstone)</td>
</tr>
<tr>
<td>3.0</td>
<td>18</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td>18</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>22</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WATER TABLE** None  
**REFUSAL** None

The equivalent CBR values above are provided as an indication only.
Slightly moist, dark brown, loose to medium dense, intact, slightly clayey fine to medium grained SAND (Colluvium)

Slightly moist, pale pinkish brown, medium dense to dense, intact, medium to coarse grained SAND (Residual Sandstone)

W5, pale pinkish brown, completely weathered, medium bedded, soft to medium hard rock Natal Group Sandstone

The equivalent CBR values above are provided as an indication only.
**PROJECT:** Geotechnical Investigation for Adams Mission Reservoir 6  
**MACHINE:** TLB  
**INSPECTION PIT NO.:** 7  
**LOCATION:** Adams Mission  
**DATE:** 21st August 2018  
**LOGGED BY:** A. Krebs

<table>
<thead>
<tr>
<th>ELEVATION</th>
<th>LOCATION: Adams Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCP EQV.</td>
<td>0.5 Blows/100mm</td>
</tr>
<tr>
<td>CBR.</td>
<td>10, 15, 8, 2</td>
</tr>
</tbody>
</table>

### Data Table

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>DCP Blows/100mm</th>
<th>EOV. CBR.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>10</td>
<td>10, 15, 8, 2</td>
<td>Fill material consisting of Dry, pale yellow brown, slightly clayey medium to coarse grained SAND</td>
</tr>
<tr>
<td>1.0</td>
<td></td>
<td></td>
<td>W5, pale pinkish brown, completely weathered, medium bedded soft to medium hard rock Natal Group Sandstone</td>
</tr>
<tr>
<td>1.5</td>
<td></td>
<td></td>
<td>Refusal on Natal Group Sandstone</td>
</tr>
<tr>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Water Table

- None

**REFUSAL:** Refusal @ 1.3m

The equivalent CBR values above are provided as an indication only.
## Geotechnical Investigation for Adams Mission Reservoir 6

**DATE:** 21st August 2018  
**LOGGED BY:** A. Krebs

### DEPTH (m) | DCP Blows/100mm | EOV CBR. | DESCRIPTION
--- | --- | --- | ---
| | | | Fill material consisting of Dry, pale yellow brown, slightly clayey medium to coarse grained SAND  
| 0.5 | 8 | 17 |  
| | 10 | 22 |  
| | 15 | 36 |  
| | 5 | 10 |  
| | R | | 0.5m  
| | | | Water Table None  
| | | | Refusal None  
| 1.0 | | | W5, pale pinkish brown, completely weathered, medium bedded soft to medium hard rock Natal Group Sandstone  
| | | | 1.6m  
| | | | Refusal on Natal Group Sandstone  

The equivalent CBR values above are provided as an indication only.
### Geotechnical Investigation for Adams Mission Reservoir 6

**MACHINE:** TLB  
**DATE:** 21st August 2018  
**LOCATION:** Adams Mission  
**LOGGED BY:** A. Krebs  
**PROJECT:** Geotechnical Investigation  
**INSPECTION PIT NO.:** I.P. 9  
**ELEVATION:**

#### Data Table

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>DCP Blows/100mm</th>
<th>EOV CBR</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>10</td>
<td></td>
<td>Slightly moist, dark brown, loose to medium dense, intact, slightly clayey fine to medium grained SAND (Colluvium)</td>
</tr>
<tr>
<td>1.0</td>
<td>15</td>
<td></td>
<td>W5, pale pinkish brown, completely weathered, medium bedded soft to medium hard rock Natal Group Sandstone</td>
</tr>
<tr>
<td>2.0</td>
<td>20</td>
<td></td>
<td>Refusal on Sandstone</td>
</tr>
</tbody>
</table>

**WATER TABLE:** None  
**REFUSAL:** Refusal @ 2m  

The equivalent CBR values above are provided as an indication only.
Dear Sir/Madam,

Enclosed herewith, please find the original reports pertaining to the above-mentioned project.

<table>
<thead>
<tr>
<th>Date Received</th>
<th>21.09.2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Tested</td>
<td>25.09.2018 to 15.10.2018</td>
</tr>
<tr>
<td>Sample Location</td>
<td>Refer to Report</td>
</tr>
<tr>
<td>Sampling Method</td>
<td>N/A</td>
</tr>
<tr>
<td>Sample Condition</td>
<td>Moist</td>
</tr>
<tr>
<td>Sampling Environmental Condition</td>
<td>N/A</td>
</tr>
<tr>
<td>Sampler(s) Name</td>
<td>Client.</td>
</tr>
<tr>
<td>Total Number of Pages</td>
<td>24</td>
</tr>
</tbody>
</table>

**Test Carried Out**

- SANS3001 GR1
- SANS3001 GR10, GR12
- SANS3001 GR30
- SANS3001 GR40
- TMH1 Method A10(b)
- TMH1 Method A14app
- TMH1 Method A15d
- TMH1 Method A16T

<table>
<thead>
<tr>
<th>Test</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>✔️</td>
<td>LSi (Carrier 1965)#</td>
</tr>
<tr>
<td>✔️</td>
<td>Hydrometer Analysis - ASTM D422</td>
</tr>
<tr>
<td>✔️</td>
<td>Double Hydrometer – ASTM D422-1#</td>
</tr>
<tr>
<td>✔️</td>
<td>BS 1377-5:1990 (Crumb Test)#</td>
</tr>
<tr>
<td>✔️</td>
<td>BS EN 1018#</td>
</tr>
<tr>
<td>✔️</td>
<td>BS EN ISO 9963-1:1996#</td>
</tr>
</tbody>
</table>

- Tick denotes tests that were carried out.  
#Denotes non accredited methods

We would like to take this opportunity of thanking you for your continued support. Should you have any queries please do not hesitate to contact me.

Yours faithfully

___________________
Technical Signatory,
Bradley Hariram for Geosure (Pty) Ltd.

This report may not be reproduced except in full, without written permission from Geosure (Pty) Ltd. While every care is taken to ensure the correctness of all tests and reports, neither Geosure (Pty) Ltd or its employees shall be liable in any way whatsoever for any error made in the execution or reporting of tests or any erroneous conclusions drawn there from or any consequence thereof. This report relates only to the sample/s tested.
### Laboratory and Head Office Address

| 122 Interise Avenue, Umgeni Business Park, Durban, 4091 |

### Laboratory Contact Info.

- Tel.: +27(0) 31 701 9732
- Fax: 086 684 9785
- Mobile: +27(0) 72 870 2621
- E-mail: lab@geosure.co.za

### Head Office Contact Info.

- Tel.: +27(0) 31 266 0458
- Fax: 086 689 5506
- Mobile: +27(0) 82 784 0544
- E-mail: geosure@iafrica.com

### Website

- www.geosure.co.za

---

**Client:** Davies Lynn & Partners  
**Project:** 18/N8508-1  
**Attention:** Mr A. Krebs  
**Date Tested:** 26.09.2018 to 10.10.2018  
**Date Reported:** 10.10.2018

---

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Field No.</th>
<th>Position in Field</th>
<th>Date Received: 20.09.2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>T12397</td>
<td>SS2</td>
<td>18/N8508-1</td>
<td></td>
</tr>
<tr>
<td>T12402</td>
<td>SS8</td>
<td>18/N8508-1</td>
<td></td>
</tr>
</tbody>
</table>

---

**Material Description**

- Light yellowish brown slightly clayey silty SAND with gravel
- Dark brown to dark orange brown silty SAND with gravel

---

**Sieve Analysis (Wet Preparation) - SANS3001 GR1 - Percent Passing Sieve Size**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>75.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>63.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>50.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>37.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>28.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>20.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>14.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>5.00 mm</td>
<td>99</td>
</tr>
<tr>
<td>2.00 mm</td>
<td>94</td>
</tr>
<tr>
<td>0.425 mm</td>
<td>54</td>
</tr>
<tr>
<td>0.250 mm</td>
<td>41</td>
</tr>
<tr>
<td>0.150 mm</td>
<td>35</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>30</td>
</tr>
</tbody>
</table>

---

**Hydrometer Analysis - ASTM - D422 - Percent Passing Particle Diameter (<0.425mm)**

<table>
<thead>
<tr>
<th>Particle Diameter (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.060 mm</td>
<td>25</td>
</tr>
<tr>
<td>0.050 mm</td>
<td>24</td>
</tr>
<tr>
<td>0.040 mm</td>
<td>24</td>
</tr>
<tr>
<td>0.026 mm</td>
<td>23</td>
</tr>
<tr>
<td>0.015 mm</td>
<td>22</td>
</tr>
<tr>
<td>0.010 mm</td>
<td>21</td>
</tr>
<tr>
<td>0.0074 mm</td>
<td>20</td>
</tr>
<tr>
<td>0.0050 mm</td>
<td>19</td>
</tr>
<tr>
<td>0.0020 mm</td>
<td>13</td>
</tr>
<tr>
<td>0.0015 mm</td>
<td>10</td>
</tr>
</tbody>
</table>

---

**Mechanical Analysis - SANS3001 GR1 - Percent of Soil Mortar (<2 mm) for Grain Size Range**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% 50</td>
<td>% 13</td>
<td>% 6</td>
<td>% 4</td>
<td>% 27</td>
<td>1.33</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>14</td>
<td>7</td>
<td>5</td>
<td>31</td>
<td>1.19</td>
</tr>
</tbody>
</table>

---

**Atterberg Limits - SANS3001 GR10, GR12 (<0.425mm)**

<table>
<thead>
<tr>
<th>Atterberg Limit</th>
<th>Liquid Limit</th>
<th>Plasticity Index</th>
<th>Linear Shrinkage</th>
<th>AASHTO Classification (Group Index)*</th>
<th>Unified Classification*</th>
<th>Moisture Content</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% 26</td>
<td>% 11</td>
<td>% 4.5</td>
<td>A-2-6 (0)</td>
<td>SC</td>
<td>% 8.9</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>15</td>
<td>8.0</td>
<td>A-2-6 (1)</td>
<td>SC</td>
<td>10.1</td>
</tr>
</tbody>
</table>

---

**Remarks:**

- Date Received: 20.09.2018
- Sampled by Client.

*Opinions expressed herein fall outside the scope of SANAS accreditation.

---

This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (PTY) LTD.
Client: Davies Lynn & Partners

Project: 18/N8508-1

Sample Number: T12397
Field No.: SS2
Sample Description: Light yellowish brown slightly clayey silty SAND with gravel

Equivalent PI: 5
Clay fraction of whole sample (% <2µ): 13

Reg.No.: 92/03145/07

POTENTIAL EXPANSIVENESS GRAPH

Clay fraction of whole sample (% <2µ)

PARTICLE SIZE DISTRIBUTION CHART

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Client: Davies Lynn & Partners
Job No.: 41470-1
Project: 18/N8508-1
Your Ref.No.: -
Date Tested: 26.09.2018 to 10.10.2018
Attention: Mr A. Krebs
Date Reported: 10.10.2018

Sample Number: T12402
Field No.: SS8
Sample Description: Dark brown to dark orange brown silty SAND with gravel
Equivalent PI: 8
Clay fraction of whole sample (% <2μ): 18

POTENTIAL EXPANSIVENESS GRAPH

PARTICLE SIZE DISTRIBUTION CHART

This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (PTY) LTD.
### Client Information
- **Client:** Davies Lynn & Partners
- **Project:** 18/N8508-1
- **Attention:** Mr. A. Krebs

### Project Details
- **Date Tested:** 26.09.2018 to 10.10.2018
- **Date Reported:** 10.10.2018

### Material Description
- **Light yellowish brown slightly clayey silty SAND with gravel**
- **Dark brown to dark orange brown silty SAND with gravel**

#### Sieve Analysis (Wet Preparation) - SANS3001 GR1

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>75.0</td>
<td>100</td>
</tr>
<tr>
<td>63.0</td>
<td>100</td>
</tr>
<tr>
<td>50.0</td>
<td>100</td>
</tr>
<tr>
<td>37.5</td>
<td>100</td>
</tr>
<tr>
<td>28.0</td>
<td>100</td>
</tr>
<tr>
<td>20.0</td>
<td>100</td>
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<td>14.0</td>
<td>100</td>
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<td>5.00</td>
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<td>0.425</td>
<td>54</td>
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<tr>
<td>0.250</td>
<td>41</td>
</tr>
<tr>
<td>0.150</td>
<td>35</td>
</tr>
<tr>
<td>0.075</td>
<td>30</td>
</tr>
</tbody>
</table>

#### Hydrometer Analysis - ASTM - D422

<table>
<thead>
<tr>
<th>Particle Diameter (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.060</td>
<td>20</td>
</tr>
<tr>
<td>0.050</td>
<td>17</td>
</tr>
<tr>
<td>0.040</td>
<td>14</td>
</tr>
<tr>
<td>0.026</td>
<td>10</td>
</tr>
<tr>
<td>0.015</td>
<td>7</td>
</tr>
<tr>
<td>0.010</td>
<td>6</td>
</tr>
<tr>
<td>0.0074</td>
<td>5</td>
</tr>
<tr>
<td>0.0050</td>
<td>3</td>
</tr>
<tr>
<td>0.0020</td>
<td>0</td>
</tr>
<tr>
<td>0.0015</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Mechanical Analysis - SANS3001 GR1

- **Coarse Sand:** 50, 44
- **Coarse Fine Sand:** 13, 14
- **Medium Fine Sand:** 6, 7
- **Fine Fine Sand:** 4, 5
- **Silt & Clay:** 27, 31

#### Atterberg Limits - SANS3001 GR10, GR12 (<0.425mm)

- **Liquid Limit:** 26, 35
- **Plasticity Index:** 11, 15
- **Linear Shrinkage:** 4.5, 8.0
- **AASHTO Classification (Group Index):** A-2-6 (0), A-2-6 (1)
- **Unified Classification:** SC, SC
- **Moisture Content:** 8.9, 10.1

### Remarks
- Date Received: 20.09.2018
- Sampled by Client.

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Client: Davies Lynn & Partners  
Job No.: 41470-1  
Project: 18/N8508-1  
Your Ref. No.: -  
Date Tested: 26.09.2018 to 10.10.2018  
Attention: Mr A. Krebs  
Date Reported: 10.10.2018  
Sample Number: T12397  
Field No.: SS2  
Sample Description: Light yellowish brown slightly clayey silty SAND with gravel  
Equivalent PI: 5  
Clay fraction of whole sample (% <2µ):  

**POTENTIAL EXPANSIVENESS GRAPH**

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Client: Davies Lynn & Partners
Project: 18/N8508-1
Your Ref. No.: -
Date Tested: 26.09.2018 to 10.10.2018
Attention: Mr. A. Krebs
Date Reported: 10.10.2018

Sample Number: T12402
Field No.: SS8
Sample Description: Dark brown to dark orange brown silty SAND with gravel
Equivalent PI: 8

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**Laboratory Contact Info.:**
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Mobile: +27(0) 31 701 9732  
e-mail: lab@geosure.co.za

**Head Office Contact Info.:**
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Fax: 086 689 5506  
Mobile: +27(0) 31 266 0458  
e-mail: geosure@iafrica.com

**Website:**
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---

**Client:** Davies Lynn & Partners  
**Project:** N8508  
**Our Ref.:** 41470  
**Your Ref.:** -

**Attention:** Mr A. Krebs  
**Date Tested:** 26.09.2018 to 10.10.2018  
**Date Reported:** 10.10.2018

| Sample No. | Field No. | Position in Field | Depth (m) | Material Description | Sieve Analysis (Wet Preparation) - SANS3001 GR 1 - Percent Passing Sieve Size | Hydrometer Analysis - ASTM - D422 - Percent Passing Particle Diameter (<0.425mm) | Mechanical Analysis - SANS3001 GR1 - Percent of Soil Mortar (<2 mm) for Grain Size range | Atterberg Limits - SANS3001 GR10, GR12 (<0.425mm) | Remarks:
---|---|---|---|---|---|---|---|---|---
| T12399 | S55 | 18/N8508-1 | - | Dark brownish dark grey slightly clayey silty SAND. Colluvium | | | | 
| T12403 | S51 | 18/N8508-1 | 0.5 | Dark brown slightly clayey silty SAND. Colluvium | | | | 
| T12405 | S52 | 18/N8508-1 | 1.8 | Dark brown slightly clayey silty SAND. Colluvium | | | | 
| T12406 | S53 | 18/N8508-1 | 1.7 | Light yellowish brown slightly clayey silty SAND | | | | 
| T12408 | S54 | 18/N8508-1 | - | Dark greyish brown silty SAND | | | | 

### Sieve Analysis (Wet Preparation) - SANS3001 GR 1 - Percent Passing Sieve Size

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>75.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>63.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>50.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>37.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>28.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>20.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>14.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>5.00 mm</td>
<td>100</td>
</tr>
<tr>
<td>2.00 mm</td>
<td>100</td>
</tr>
<tr>
<td>0.425 mm</td>
<td>100</td>
</tr>
<tr>
<td>0.250 mm</td>
<td>100</td>
</tr>
<tr>
<td>0.150 mm</td>
<td>100</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>100</td>
</tr>
</tbody>
</table>

### Hydrometer Analysis - ASTM - D422 - Percent Passing Particle Diameter (<0.425mm)

<table>
<thead>
<tr>
<th>Particle Diameter (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.060 mm</td>
<td>30</td>
</tr>
<tr>
<td>0.050 mm</td>
<td>30</td>
</tr>
<tr>
<td>0.040 mm</td>
<td>30</td>
</tr>
<tr>
<td>0.026 mm</td>
<td>29</td>
</tr>
<tr>
<td>0.015 mm</td>
<td>28</td>
</tr>
<tr>
<td>0.010 mm</td>
<td>27</td>
</tr>
<tr>
<td>0.0074 mm</td>
<td>22</td>
</tr>
<tr>
<td>0.0020 mm</td>
<td>18</td>
</tr>
<tr>
<td>0.0015 mm</td>
<td>14</td>
</tr>
</tbody>
</table>

### Mechanical Analysis - SANS3001 GR1 - Percent of Soil Mortar (<2 mm) for Grain Size range

<table>
<thead>
<tr>
<th>Grain Size Range</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Sand</td>
<td>22</td>
</tr>
<tr>
<td>Coarse Fine Sand</td>
<td>21</td>
</tr>
<tr>
<td>Medium Fine Sand</td>
<td>16</td>
</tr>
<tr>
<td>Fine Sand</td>
<td>10</td>
</tr>
<tr>
<td>Silt &amp; Clay</td>
<td>31</td>
</tr>
</tbody>
</table>

### Atterberg Limits - SANS3001 GR10, GR12 (<0.425mm)

<table>
<thead>
<tr>
<th>Atterberg Limit</th>
<th>% Passing</th>
</tr>
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<tbody>
<tr>
<td>Liquid Limit</td>
<td>21</td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>8</td>
</tr>
<tr>
<td>Linear Shrinkage</td>
<td>3.5</td>
</tr>
<tr>
<td>AASHTO Classification (Group Index)*</td>
<td>SC</td>
</tr>
<tr>
<td>Unified Classification*</td>
<td>SC</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>10.1</td>
</tr>
</tbody>
</table>

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---

**Version 06/09/2016**  
**Page 8 of 24**

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Client: Davies Lynn & Partners  
Job No.: 41470  
Project: N8508  
Your Ref.No.: -  
Date Tested: 26.09.2018 to 10.10.2018  
Attention: Mr. A. Krebs  
Date Reported: 10.10.2018

Sample Number: T12399  
Field No.: SS5  
Sample Description: Dark brownish dark grey slightly clayey silty SAND. Colluvium  
Equivalent PI:  6  
Clay fraction of whole sample (% <2µ): 16

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Client: Davies Lynn & Partners
Project: N8508
Attention: Mr. A. Krebs

Sample Number: T12403
Field No.: SS1
Sample Description: Dark brown slightly clayey silty SAND. Colluvium
Equivalent PI: 

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Date Tested: 26.09.2018 to 10.10.2018
Attention: Mr A. Krebs
Date Reported: 10.10.2018

Sample Number: T12405
Field No.: SS2
Sample Description: Dark brown slightly clayey silty SAND. Colluvium
Equivalent PI: 5
Clay fraction of whole sample (% <2µ): 14

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Sample Number : T12406
Field No. : SS3
Sample Description : Light yellowish brown slightly clayey silty SAND
Equivalent PI : 10
Clay fraction of whole sample (% <2µ) : 19

POTENTIAL EXPANSIVENESS GRAPH

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Job No.: 41470
Project: N8508
Your Ref.No.: -
Date Tested: 26.09.2018 to 10.10.2018
Attention: Mr A. Krebs
Date Reported: 10.10.2018

Sample Number: T12408
Field No.: SS4
Sample Description: Dark greyish brown silty SAND
Equivalent PI: 12

POTENTIAL EXPANSIVENESS GRAPH

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**Laboratory and Head Office Address:**

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**Laboratory Contact Info.:**

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Fax: 086 684 9785  
Mobile: +27(0) 72 870 2621  
e-mail: lab@geosure.co.za

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Fax: 086 689 5506  
Mobile: +27(0) 82 784 0544  
e-mail: geosure@iafrica.com

**Website:**

www.geosure.co.za

### Client and Project Details

**Client:** Davies Lynn & Partners  
**Project:** 18/N8508-1

**Attention:** Mr. A. Krebs  
**Date Tested:** 26.09.2018 to 10.10.2018  
**Date Reported:** 10.10.2018

### Sample Information

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>T12409</th>
<th>T12410</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field No.</td>
<td>S56</td>
<td>S57</td>
</tr>
<tr>
<td>Position in Field</td>
<td>18/N8508-1</td>
<td>18/N8508-1</td>
</tr>
<tr>
<td>Depth (m)</td>
<td>1.0</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### Material Description

- **Light orange brown decomposed GRANITE**
- **Dark greyish brown slightly clayey silty SAND. Colluvium**

### Sieve Analysis (Wet Preparation) - SANS3001 GR1 - Percent Passing Sieve Size

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>75.0</td>
<td>100</td>
</tr>
<tr>
<td>63.0</td>
<td>100</td>
</tr>
<tr>
<td>50.0</td>
<td>100</td>
</tr>
<tr>
<td>37.5</td>
<td>100</td>
</tr>
<tr>
<td>28.0</td>
<td>100</td>
</tr>
<tr>
<td>20.0</td>
<td>100</td>
</tr>
<tr>
<td>14.0</td>
<td>100</td>
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<tr>
<td>5.00</td>
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<tr>
<td>0.425</td>
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<td>0.250</td>
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</tr>
<tr>
<td>0.150</td>
<td>26</td>
</tr>
<tr>
<td>0.075</td>
<td>23</td>
</tr>
</tbody>
</table>

### Hydrometer Analysis - ASTM - D422 - Percent Passing Particle Diameter (<0.425mm)

<table>
<thead>
<tr>
<th>Particle Diameter (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.060</td>
<td>22</td>
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<tr>
<td>0.050</td>
<td>22</td>
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<tr>
<td>0.040</td>
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<td>0.026</td>
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<td>0.015</td>
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<td>0.010</td>
<td>19</td>
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<tr>
<td>0.0074</td>
<td>18</td>
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<tr>
<td>0.0036</td>
<td>14</td>
</tr>
<tr>
<td>0.0020</td>
<td>10</td>
</tr>
<tr>
<td>0.0015</td>
<td>8</td>
</tr>
</tbody>
</table>

### Mechanical Analysis - SANS3001 GR1 - Percent of Soil Mortar (<2 mm) for Grain Size Range

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>55</td>
<td>13</td>
<td>6</td>
<td>3</td>
<td>23</td>
<td>1.34</td>
</tr>
</tbody>
</table>

### Atterberg Limits - SANS3001 GR10, GR12 (<0.425mm)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>%</th>
</tr>
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<tbody>
<tr>
<td>Liquid Limit</td>
<td>27</td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>11</td>
</tr>
<tr>
<td>Linear Shrinkage</td>
<td>5.0</td>
</tr>
<tr>
<td>AASHTO Classification (Group Index)*</td>
<td>A-2-4 (0)</td>
</tr>
<tr>
<td>Unified Classification*</td>
<td>SC</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>5.5</td>
</tr>
</tbody>
</table>

**Remarks:** Sampled by Client.

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Job No.: 41470-1  
Project: 18/N8508-1  
Your Ref.No.: -  
Date Tested: 26.09.2018 to 10.10.2018  
Attention: Mr A. Krebs  
Date Reported: 10.10.2018  
Sample Number: T12409  
Field No.: SS6  
Sample Description: Light orange brown decomposed GRANITE  
Equivalent PI: 4  
Clay fraction of whole sample (% <2µ): 10

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**Project:** 18/N8508-1  
**Job No.:** 41470-1  
**Your Ref. No.:** -  
**Date Tested:** 26.09.2018 to 10.10.2018  
**Attention:** Mr. A. Krebs  
**Date Reported:** 10.10.2018

**Sample Number:** T12410  
**Field No.:** SS7  
**Sample Description:** Dark greyish brown slightly clayey silty SAND. Colluvium  
**Equivalent PI:** 7  
**Clay fraction of whole sample (% <2μ):** 19

**POTENTIAL EXPANSIVENESS GRAPH**

**PARTICLE SIZE DISTRIBUTION CHART**

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### Test Report - SANS 3001

#### Sample No.
- Sample No. 1: T12397
- Sample No. 2: T12399
- Sample No. 3: T12402

#### Field No.
- Field No. 1: SS2
- Field No. 2: SS5
- Field No. 3: SS8

#### Position
- Position 1: 18/N8508-1
- Position 2: 18/N8508-1
- Position 3: 18/N8508-1

#### Method of Preparation
- Light yellowish brown slightly clayey silty SAND
- Dark brownish dark grey slightly clayey silty SAND. Colluvium
- Dark brown to dark orange brown silty SAND

### Sieve Analysis - Percent Passing Sieve Size

<table>
<thead>
<tr>
<th>Sieve Aperture (mm)</th>
<th>100.00</th>
<th>75.00</th>
<th>53.00</th>
<th>20.00</th>
<th>14.00</th>
<th>13.20</th>
<th>5.00</th>
<th>4.750</th>
<th>2.000</th>
<th>0.425</th>
<th>0.075</th>
</tr>
</thead>
<tbody>
<tr>
<td>% or Symbol</td>
<td></td>
<td></td>
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<tr>
<td>Coarse Sand</td>
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<td>44</td>
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<tr>
<td>Coarse-Fine Sand</td>
<td>13</td>
<td>21</td>
<td>14</td>
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<td></td>
</tr>
<tr>
<td>Medium-Fine Sand</td>
<td>6</td>
<td>16</td>
<td>7</td>
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</tr>
<tr>
<td>Fine-Fine Sand</td>
<td>4</td>
<td>12</td>
<td>5</td>
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<tr>
<td>Silt and Clay</td>
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<td>31</td>
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<td></td>
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</tr>
<tr>
<td>Atterberg Limits SANS 3001 on &lt;0.425 mm fraction</td>
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<td>35</td>
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</tr>
<tr>
<td>Plasticity Index</td>
<td>11</td>
<td>8</td>
<td>15</td>
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</tr>
<tr>
<td>Linear Shrinkage</td>
<td>4.5</td>
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<td>8.0</td>
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<td></td>
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</tr>
</tbody>
</table>

### Grading Modulus
- Coarse Sand: 1.33
- Coarse-Fine Sand: 0.94
- Medium-Fine Sand: 1.19

### Mechanical analysis - Percent of Soil Mortar (<2 mm) for Grain Size range

<table>
<thead>
<tr>
<th>Grain Size Range</th>
<th>2036</th>
<th>994</th>
<th>1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Dry Density (kg/m³)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimum moisture content (%)</td>
<td>9.6</td>
<td>8.9</td>
<td>10.8</td>
</tr>
</tbody>
</table>

### California Bearing Ratio

<table>
<thead>
<tr>
<th>Compaction</th>
<th>CBR @100% Compaction</th>
<th>%</th>
<th>CBR @ 98% Compaction</th>
<th>%</th>
<th>CBR @ 97% Compaction</th>
<th>%</th>
<th>CBR @ 95% Compaction</th>
<th>%</th>
<th>CBR @ 93% Compaction</th>
<th>%</th>
<th>CBR @ 90% Compaction</th>
<th>%</th>
<th>Swell @100% Compaction</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>49</td>
<td>28</td>
<td>36</td>
<td>19</td>
<td>31</td>
<td>15</td>
<td>23</td>
<td>10</td>
<td>17</td>
<td>6.9</td>
<td>11</td>
<td>3.8</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>90%</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### COLTO Classification (1998)**
- G7 (#) Cannot be Determined
- Cannot be Determined

### TRH 14 Classification (1985)**
- G7
- G10
- G10

### AASHTO Classification (Group Index)**
- A-2-6 (0)
- A-2-4 (0)
- A-2-6 (1)

### Unified Classification **
- SC
- SC
- SC

### Remarks:
- *Subject to further testing as required by TRH14.
- † Subject to further testing as required by COLTO. COLTO above uses only: Atterberg Limits (<0.425 mm fraction; not arithmetic mean), Nominal Max Size, Grading Curve, Coarse Sand Ratio, Grading Modulus, Strength (CBR), and Swell.
- * Check that Max Size <= 2/3 of compacted layer thickness.
- INTERIM

---

* Opinions and interpretations expressed herein are outside the scope of SANAS accreditation

Version 5.01 - 15 July 2014
Grading Curve for Sample T12397 – SANS 3001

Thick Red Line is the Grading Curve (COLTO Classification = G7 (#)) (TRH 14 Classification = G7)

<table>
<thead>
<tr>
<th>Grain Size (mm)</th>
<th>0.001</th>
<th>0.01</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
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<td>20</td>
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<td>20</td>
<td>20</td>
<td>20</td>
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<td>20</td>
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<tr>
<td>30</td>
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<td>30</td>
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</tr>
<tr>
<td>40</td>
<td>40</td>
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<td>40</td>
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<tr>
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</tr>
<tr>
<td>60</td>
<td>60</td>
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<tr>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>90</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

| Sieve Aperture Size | 0.075 | 0.150 | 0.250 | 0.425 | 2.00 | 4.75 | 5.00 | 13.20 | 14.00 | 19.00 | 20.00 | 26.50 | 28.00 | 37.50 | 50.00 | 53.00 | 63.00 | 75.00 | 100.00 |
|---------------------|-------|-------|-------|-------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Percentage Passing  | 25%   | 30%   | 35%   | 48%   | 94%  | 98%  | 100% | 100%  | 100%  | 100%  | 100%  | 100%  | 100%  | 100%  | 100%  | 100%  | 100%  | 100%  | 100%  | 100%  |
**Grading Curve for Sample T12399 – SANS 3001**

Thick Red Line is the Grading Curve (COLTO Classification = Cannot be Determined) (TRH 14 Classification = G10)

<table>
<thead>
<tr>
<th>Grain Size (mm)</th>
<th>0.001</th>
<th>0.01</th>
<th>0.1</th>
<th>1</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Passing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clay</td>
<td>0%</td>
<td>2%</td>
<td>7%</td>
<td>9%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Silt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>gravel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sieve Aperture Size

- 0.075
- 0.150
- 0.300
- 0.425
- 0.630
- 1.25
- 2.50
- 5.00
- 10.0
- 20.0
- 40.0
- 63.0
- 100

Percentage Passing

- 30%
- 41%
- 57%
- 77%
- 99%
- 100%
- 100%
- 100%
- 100%
- 100%
- 100%
- 100%
- 100%
Grading Curve for Sample T12402 – SANS 3001

**Thick Red Line is the Grading Curve (COLTO Classification = Cannot be Determined) (TRH 14 Classification = G10)**

<table>
<thead>
<tr>
<th>Sieve Aperture Size</th>
<th>0.075</th>
<th>0.150</th>
<th>0.250</th>
<th>0.425</th>
<th>2.00</th>
<th>4.75</th>
<th>5.00</th>
<th>13.20</th>
<th>14.00</th>
<th>19.00</th>
<th>20.00</th>
<th>26.50</th>
<th>28.0</th>
<th>37.5</th>
<th>50.0</th>
<th>53.0</th>
<th>63</th>
<th>75</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage Passing</td>
<td>30%</td>
<td>35%</td>
<td>41%</td>
<td>54%</td>
<td>96%</td>
<td>99%</td>
<td>99%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**ReportT12397.xls Page 20 of 24**
<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Field No. / Position</th>
<th>Description</th>
<th>Dispersion (%) @ 5µm</th>
<th>Category of Dispersion</th>
<th>Grade (Observations)</th>
<th>Degree of Dispersion</th>
</tr>
</thead>
<tbody>
<tr>
<td>T12397</td>
<td>SS2</td>
<td>Light yellowish brown slightly clayey silty SAND with gravel</td>
<td>15.8</td>
<td>D2</td>
<td>Grade 4</td>
<td>Dispersive</td>
</tr>
<tr>
<td>T12402</td>
<td>SS8</td>
<td>Dark brown to dark orange brown silty SAND with gravel</td>
<td>0.0</td>
<td>ND4</td>
<td>Grade 2</td>
<td>Non-Dispersive</td>
</tr>
</tbody>
</table>

**Hydrometer Test:**

**Pinhole Test:**

**Crumb Test Observations:**

<table>
<thead>
<tr>
<th>Grade 1</th>
<th>No reaction. Crumbs may slake or run out to form a shallow heap on the bottom of the beaker, but there is no sign of cloudiness caused by colloids in suspension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 2</td>
<td>Slight reaction. A very slight cloudiness can be seen in the water at the surface of a crumb.</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Moderate reaction. There is an easily recognizable cloud of colloids in suspension, usually spreading out in thin streaks at the bottom of the beaker.</td>
</tr>
<tr>
<td>Grade 4</td>
<td>Strong Reaction. A Colloidal cloud covers most of the bottom of the beaker, usually as a thin skin. In extreme cases all the water becomes cloudy.</td>
</tr>
</tbody>
</table>

**Remarks:**

NP - Non-Plastic, SP - Slightly Plastic

Sampled by Client.

Date Tested: 13.10.2018
Date Received: 20.09.2018

This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (PTY) LTD.

version 20/02/2014
Client: Davies Lynn & Partners
Project: 18/N8508-1
Attention: Mr A. Krebs

Sample No.: T12397
Method of preparation: N/A
Natural/Stabilised: Natural
Material Description: Lt.Yell.Br.Sl.clayey silty SAND with gravel

Field No.: SS2
Origin: 18/8508-1
Compaction Effort: Mod AASHTO

Maximum Dry Density (kg/m³) 2036
Optimum Moisture Content (%) 9.6

<table>
<thead>
<tr>
<th>Moisture (%)</th>
<th>7.4</th>
<th>8.4</th>
<th>9.4</th>
<th>10.4</th>
<th>11.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Density (kg/m³)</td>
<td>1912</td>
<td>1945</td>
<td>2031</td>
<td>2008</td>
<td>1959</td>
</tr>
</tbody>
</table>

Remarks: This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (Pty) Ltd.

Page 22 of 24

- 11 July 2014
**SANS 3001 Moisture/Density Relationship**

**Sample No.**: T12399  
**Method of preparation**: N/A  
**Natural/Stabilised**: Natural  
**Material Description**: Dk.Br.Dk.Gr.Sl.clayey silty SAND. Colluvium  
**Depth (m)**: -  
**Origin**: 18/8508-1  
**Compaction Effort**: Mod AASHTO  
**Field No.**: SS5  
**Project**: 18/N8508-1  
**Attention**: Mr A. Krebs  
**Date Reported**: 08.10.2018

**Maximum Dry Density (kg/m³)**: 1994  
**Optimum Moisture Content (%)**: 8.9

**Plotted Values:**

<table>
<thead>
<tr>
<th>Moisture (%)</th>
<th>7.0</th>
<th>8.0</th>
<th>9.0</th>
<th>10.0</th>
<th>11.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Density (kg/m³)</td>
<td>1886</td>
<td>1950</td>
<td>1993</td>
<td>1932</td>
<td>1893</td>
</tr>
</tbody>
</table>

**Remarks:** This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (Pty) Ltd.
Client: Davies Lynn & Partners  
Project: 18/N8508-1  
Attention: Mr A. Krebs  

Sample No.: T12402  
Method of preparation: N/A  
Natural/Stabilised: Natural  
Material Description: Dk.Br.Dk.Or.Br.silty SAND with gravel  
Field No.: SS8  
Depth (m): -  
Origin: 18/8508-1  
Compaction Effort: Mod AASHTO  

Maximum Dry Density (kg/m³) 1995  
Optimum Moisture Content (%) 10.8  

<table>
<thead>
<tr>
<th>Moisture (%)</th>
<th>Dry Density (kg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.7</td>
<td>1939</td>
</tr>
<tr>
<td>9.7</td>
<td>1961</td>
</tr>
<tr>
<td>10.7</td>
<td>1994</td>
</tr>
<tr>
<td>11.7</td>
<td>1972</td>
</tr>
<tr>
<td>12.7</td>
<td>1929</td>
</tr>
</tbody>
</table>

Remarks: This report relates only to sample(s) received. This report shall not be reproduced, except in full, without the prior consent of GEOSURE (Pty) Ltd.

- 11 July 2014
# TEST REPORT - PH, EC, TDS, AGGRESSION INDEX (*ASTM D4972, **D1125, ***D888, ***LSI (Carrier 1965), *****BS EN 1018, ******BS EN ISO 9963-1:1996)

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Field No.</th>
<th>Description</th>
<th>Sample Prep</th>
<th>Average PH</th>
<th>Average EC (µS/m)</th>
<th>Ca2+ (ppm)</th>
<th>HCO3- (ppm)</th>
<th>Langelier Saturated Index (LSI)</th>
<th>Indication</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T12397</td>
<td>SS2</td>
<td>Light yellowish brown slightly clayey silty SAND with gravel</td>
<td>&lt;0.425µm</td>
<td>5.584</td>
<td>69.9</td>
<td>237</td>
<td>&gt;200</td>
<td>-1.2</td>
<td>A</td>
<td>21.2</td>
</tr>
<tr>
<td>T12402</td>
<td>SS8</td>
<td>Dark brown to dark orange brown silty SAND with gravel</td>
<td>&lt;0.425µm</td>
<td>4.860</td>
<td>108.7</td>
<td>218</td>
<td>&gt;200</td>
<td>-2.0</td>
<td>A</td>
<td>21.1</td>
</tr>
</tbody>
</table>

**Remarks:**
- **Acronyms and Abbreviations**

<table>
<thead>
<tr>
<th>Average of 3 measurements taken for PH and EC</th>
<th>PH - Potential Hydrogen</th>
<th>EC - Electrical Conductivity</th>
<th>TDS - Total Dissolve Salts</th>
<th>Temp. - Temperature</th>
<th>DO - Dissolved Oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Prep</td>
<td>µS/m</td>
<td>ppm</td>
<td>mg/L</td>
<td>°C</td>
<td>g/L</td>
</tr>
<tr>
<td>Average</td>
<td>micro Siemens / metre</td>
<td>parts per million</td>
<td>milligram / litre</td>
<td>Degrees Celsius</td>
<td>grams per litre</td>
</tr>
</tbody>
</table>

**Indication**
- **Abbreviation**

<table>
<thead>
<tr>
<th>LSI (Carrier)</th>
<th>Indication</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0-2.5</td>
<td>Severe Corrosion</td>
<td>A</td>
</tr>
<tr>
<td>0.5&gt;0</td>
<td>Highly corrosion but non-scale forming</td>
<td>B</td>
</tr>
<tr>
<td>0.6&gt;&lt;0.5</td>
<td>Mildly scale forming and corrosive</td>
<td>C</td>
</tr>
<tr>
<td>0.5&lt;0.0</td>
<td>None to slight corrosion</td>
<td>D</td>
</tr>
<tr>
<td>0.5&lt;0.0</td>
<td>Slight to severe corrosion</td>
<td>E</td>
</tr>
</tbody>
</table>

**Units of Measurement**
- micro Siemens / metre
- parts per million
- milligram / litre
- Degrees Celsius
- grams per litre

---

**Technical Signatory**
Bradley Harram for Geosure (Pty) Ltd.

---

version 23/04/2018
Dear Sir/Madam,

Hereewith please find the test report(s) pertaining to the above project. All tests were conducted in accordance with prescribed test method(s). Information herein consists of the following:

<table>
<thead>
<tr>
<th>Test Carried Out / Test Description</th>
<th>Test Method(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidated-Drained Triaxial Compression Test With The Measurement Of Volume Change</td>
<td>BS 1377: Part8:1990</td>
</tr>
<tr>
<td>Consolidated-Undrained Triaxial Compression Test With The Measurement Of Pore Pressure</td>
<td>BS 1377: Part6:1990</td>
</tr>
<tr>
<td>Determination Of The Undrained Shear Strength In A Triaxial Compression Without Measurements Of Pore Pressure</td>
<td>BS 1377: Part7:1990</td>
</tr>
<tr>
<td>Determination Of Shear Strength By Direct Shear</td>
<td>BS 1377: Part7:1990</td>
</tr>
<tr>
<td>Determination Of The One-Dimensional Consolidation Properties</td>
<td>BS 1377: Part5:1990</td>
</tr>
<tr>
<td>Measurement Of Swelling Pressure</td>
<td>BS 1377: Part5:1990</td>
</tr>
<tr>
<td>Measurement Of Settlement On Saturation</td>
<td>BS 1377: Part5:1990</td>
</tr>
</tbody>
</table>

NB: All tests indicated above were performed in conjunction with BS1377 Part1:1990

Conducted Tests

---

**Sample Information**

<table>
<thead>
<tr>
<th>Laboratory Sample No.</th>
<th>Sample(s) Name</th>
<th>Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>1616 (12397)</td>
<td>SS2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specimen Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width (mm)</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Sample Description: Light yellowish brown slightly clayey silty SAND with gravel

**Sample Preparation**

<table>
<thead>
<tr>
<th>Undisturbed</th>
<th>Recompacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth within Sample (mm)</td>
<td>Depth within Sample (mm)</td>
</tr>
<tr>
<td>Sample Type</td>
<td>Projection Before Prep</td>
</tr>
<tr>
<td>Extruded</td>
<td>Trimmed</td>
</tr>
</tbody>
</table>

We would like to take this opportunity of thanking you for your continued support. Should you have any queries please do not hesitate to contact me.

Yours faithfully,

Bradley Hariram for Geosure (Pty) Ltd.

This report may not be reproduced except in full, without written permission from Geosure (Pty) Ltd. While every care is taken to ensure the correctness of all tests and reports, neither Geosure (Pty) Ltd or its employees shall be liable in any way whatsoever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or any consequence thereof. This report relates only to the samples tested.

Unless otherwise requested or stated, all samples will be discarded after a period of 3 months.

Deviations:
Measurement of Settlement on Saturation
BS 1377: Part 5: 1990

<table>
<thead>
<tr>
<th>Specimen Properties</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk Density (Mg/m³)</td>
<td>2.117</td>
</tr>
<tr>
<td>Dry Density (Mg/m³)</td>
<td>1.930</td>
</tr>
<tr>
<td>Natural Moisture Content (%)</td>
<td>9.7</td>
</tr>
<tr>
<td>Moisture Content After Test (%)</td>
<td>18.4</td>
</tr>
<tr>
<td>Initial Void Ratio (%)</td>
<td>0.378</td>
</tr>
<tr>
<td>Initial Degree of Saturation (%)</td>
<td>68.1</td>
</tr>
<tr>
<td>Specific Gravity (measured)</td>
<td>2.66</td>
</tr>
<tr>
<td>Average Temperature during test (°C)</td>
<td>22.3</td>
</tr>
<tr>
<td>Compaction achieved = 94.8%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Applied Pressure (kPa)</th>
<th>Temp (°C)</th>
<th>Dial Readings (Divisions)</th>
<th>Spec. Height (mm)</th>
<th>Stress Range (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22.3</td>
<td>2500</td>
<td>19.88</td>
<td>1-1</td>
</tr>
<tr>
<td>1</td>
<td>22.3</td>
<td>2495</td>
<td>19.87</td>
<td>1-1</td>
</tr>
<tr>
<td>25</td>
<td>22.3</td>
<td>2446</td>
<td>19.736</td>
<td>1-25</td>
</tr>
<tr>
<td>50</td>
<td>22.2</td>
<td>2349</td>
<td>19.536</td>
<td>25-50</td>
</tr>
<tr>
<td>100</td>
<td>22.2</td>
<td>2103</td>
<td>19.034</td>
<td>50-100</td>
</tr>
<tr>
<td>100</td>
<td>22.2</td>
<td>2091</td>
<td>19.01</td>
<td>100</td>
</tr>
</tbody>
</table>

Void Ratio (e) vs Pressure (kPa)

Collapse Potential: 0.13 %
**Test Report**

Dear Sir/Madam,

Hereewith please find the test report(s) pertaining to the above project. All tests were conducted in accordance with prescribed test method(s). Information herein consists of the following:

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<tr>
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<td>BS 1377: Part8:1990</td>
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<td>BS 1377: Part6:1990</td>
</tr>
<tr>
<td>Determination Of The Undrained Shear Strength In A Triaxial Compression Without</td>
<td>BS 1377: Part7:1990</td>
</tr>
<tr>
<td>Measurement Of Pore Pressure</td>
<td></td>
</tr>
<tr>
<td>Determination Of Shear Stress By Direct Shear</td>
<td>BS 1377: Part7:1990</td>
</tr>
<tr>
<td>Determination Of The One-Dimensional Consolidation Properties</td>
<td>BS 1377: Part5:1990</td>
</tr>
<tr>
<td>Measurement Of Swelling Pressure</td>
<td>BS 1377: Part5:1990</td>
</tr>
<tr>
<td>Measurement Of Settlement On Saturation</td>
<td>BS 1377: Part5:1990</td>
</tr>
</tbody>
</table>

NB: All tests indicated above were performed in conjunction with BS1377 Part 1:1990

---

**Sample Information**

<table>
<thead>
<tr>
<th>Laboratory Sample No.</th>
<th>Sampler(s) Name</th>
<th>Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>1618 (12395)</td>
<td>SSS</td>
<td></td>
</tr>
</tbody>
</table>

**Specimen Dimensions:**
- Width (mm) - 19.94
- Height (mm) -
- Diameter (mm) - 60.08

**Sample Description:** Light yellowish brown silty clayey SAND with Granite

---

**Sample Preparation**

<table>
<thead>
<tr>
<th>Depth within Sample (mm)</th>
<th>Block</th>
<th>Tube</th>
<th>Depth within Sample (mm)</th>
<th>Nominal size before prep (mm)</th>
<th>Nominal size after prep (mm)</th>
<th>Compaction Effort</th>
<th>Compaction (%)</th>
<th>MOD AASHTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undisturbed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recompacted</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Procedure:**
- Extruded
- Trammel
- Cling Wrapped

**Observations:**

We would like to take this opportunity of thanking you for your continued support. Should you have any queries please do not hesitate to contact me.

Yours faithfully,

Bradley Hariram for Geosure (Pty) Ltd.

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Unless otherwise requested or stated, all samples will be discarded after a period of 3 months.

**Deviations:**
Measurement of Settlement on Saturation
BS 1377: Part5:1990

Specimen Properties

<table>
<thead>
<tr>
<th>Bulk Density (Mg/m³)</th>
<th>2.051</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Density (Mg/m³)</td>
<td>1.889</td>
</tr>
<tr>
<td>Natural Moisture Content (%)</td>
<td>9.1</td>
</tr>
<tr>
<td>Moisture Content After Test (%)</td>
<td>20.5</td>
</tr>
<tr>
<td>Initial Void Ratio (%)</td>
<td>0.404</td>
</tr>
<tr>
<td>Initial Degree of Saturation (%)</td>
<td>59.6</td>
</tr>
<tr>
<td>Specific Gravity (measured)</td>
<td>2.65</td>
</tr>
<tr>
<td>Average Temperature during test (°C)</td>
<td>22.3</td>
</tr>
</tbody>
</table>

Notes

Compaction Achieved = 94.73%

<table>
<thead>
<tr>
<th>Applied Pressure (kPa)</th>
<th>Temp (°C)</th>
<th>Dial Readings (Divisions)</th>
<th>Spec. Height (mm)</th>
<th>Stress Range (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22.3</td>
<td>2500</td>
<td>19.94</td>
<td>1-1</td>
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<td>19.882</td>
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</tr>
<tr>
<td>25</td>
<td>22.3</td>
<td>2443</td>
<td>19.786</td>
<td>1-25</td>
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<tr>
<td>50</td>
<td>22.2</td>
<td>2337</td>
<td>19.682</td>
<td>25-50</td>
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<tr>
<td>100</td>
<td>22.2</td>
<td>2307</td>
<td>19.504</td>
<td>50-100</td>
</tr>
<tr>
<td>100</td>
<td>22.2</td>
<td>2301</td>
<td>19.402</td>
<td>100</td>
</tr>
</tbody>
</table>

Void Ratio (e) vs Pressure (kPa)

Sample Inundated

Collapse Potential: 0.06 %
Dear Sir/Madam,

Hereewith please find the test report(s) pertaining to the above project. All tests were conducted in accordance with prescribed test method(s). Information herein consists of the following:

**Test Carried Out / Test Description** | **Test Method(s)**
--- | ---
Consolidated-Drained Triaxial Compression Test With The Measurement Of Volume Change | BS 1377: Part 8:1990
Consolidated-Undrained Triaxial Compression Test With The Measurement Of Pore Pressure | BS 1377: Part 8:1990
Determination of The Undrained Shear Strength In Triaxial Compression Without Measurement Of Pore Pressure | BS 1377: Part 7:1990
Determination of Shear Strength By Direct Shear | BS 1377: Part 7:1990
Determination Of The One-Dimensional Consolidation Properties | BS 1377: Part 5:1990
Measurement Of Swelling Pressure | BS 1377: Part 5:1990
Measurement Of Settlement On Saturation | BS 1377: Part 5:1990

NB: All tests indicated above were performed in conjunction with BS1377 Part 1:1990 | Conducted Tests

---

**Sample Information**

<table>
<thead>
<tr>
<th>Laboratory Sample No.</th>
<th>Sampler(s) Name</th>
<th>Specimen Dimensions</th>
<th>Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>1621 (12402)</td>
<td>SS8</td>
<td>Width (mm)</td>
<td>Depth within Sample (mm)</td>
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<tr>
<td>Sample Location / Position / Field No.</td>
<td>-</td>
<td>Height (mm)</td>
<td>Nominal size before prep (mm)</td>
</tr>
<tr>
<td>Depth</td>
<td>-</td>
<td>Diameter (mm)</td>
<td>Nominal size after prep (mm)</td>
</tr>
<tr>
<td>Sampling Method (if applicable)</td>
<td>-</td>
<td></td>
<td>Compaction Effort</td>
</tr>
<tr>
<td>Sampling Environmental Condition</td>
<td>-</td>
<td></td>
<td>Compaction (%)</td>
</tr>
<tr>
<td>Sample Condition on Receipt</td>
<td>-</td>
<td></td>
<td>MOD AASHTO</td>
</tr>
<tr>
<td>Sample Description</td>
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**Sample Preparation**

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<th>Depth within Sample (mm)</th>
<th>Undisturbed</th>
<th>Recompacted</th>
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</thead>
<tbody>
<tr>
<td>Sample Type</td>
<td>Block</td>
<td>Tube</td>
</tr>
<tr>
<td>Procedure</td>
<td>Extruded</td>
<td>Trimmed</td>
</tr>
<tr>
<td>Cling Wrapped</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Dark brown to dark orange brown silty SAND with Granite

We would like to take this opportunity of thanking you for your continued support. Should you have any queries please do not hesitate to contact me.

Yours faithfully

Bradley Hariram for Geosure (Pty) Ltd.

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Unless otherwise requested or stated, all samples will be discarded after a period of 3 months.

Observations
**Measurement of Settlement on Saturation**

BS 1377: Part 5: 1990

<table>
<thead>
<tr>
<th>Specimen Properties</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk Density (Mg/m³)</td>
<td>2.101</td>
</tr>
<tr>
<td>Dry Density (Mg/m³)</td>
<td>1.894</td>
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<tr>
<td>Natural Moisture Content (%)</td>
<td>10.9</td>
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<tr>
<td>Moisture Content After Test (%)</td>
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<tr>
<td>Initial Void Ratio (%)</td>
<td>0.394</td>
</tr>
<tr>
<td>Initial Degree of Saturation (%)</td>
<td>73.3</td>
</tr>
<tr>
<td>Specific Gravity (measured)</td>
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</table>

**Collapse Potential**

<table>
<thead>
<tr>
<th>Applied Pressure (kPa)</th>
<th>Temp (°C)</th>
<th>Dial Readings (Divisions)</th>
<th>Spec. Height (mm)</th>
<th>Stress Range (kPa)</th>
</tr>
</thead>
<tbody>
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<td>19.92</td>
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<td>2484</td>
<td>19.888</td>
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<td>2455</td>
<td>19.8</td>
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<td>2423</td>
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<td>22.2</td>
<td>2347</td>
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<td>100</td>
<td>22.2</td>
<td>2343</td>
<td>19.562</td>
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</tbody>
</table>

**Void Ratio (e) vs Pressure (kPa)**

Sample Inundated

Collapse Potential: 0.04%
DRAWINGS

18/N8508/1- Geotechnical Site Plan
18/N8508/2- Electrical Resistivity Results
LEGEND

- IP Positions
- Resistivity Traverse
GENERAL NOTES

This drawing is issued for Electrical purposes only, and should be read in conjunction with the Electrical Specification. Setting out of Electrical and Electronic accessories are to be as indicated on Architects details.

Refer to Architects and Structural Drawings for all building dimensions, latest building revisions and services.

Do not scale this drawing.

All work to comply with relevant Standards, Codes of Practice, Specification and Regulations.

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DRAWING NOTES

1. 1.8m copper earthrods interconnected with 70mm² BCEW spaced at 3m to achieve less than 1 Ohms

2. Earth resistivity testing to be undertaken at locations indicated

Consulting Engineer:
Approved on behalf of Bigen:
Engineer:
Date:

BLOCK D
ESSEX PARK
46 ESSEX TERRACE
WESTVILLE
WANDSBECK 3631
P.O. BOX 1692
TEL: +27 (031) 2667831
E-mail: ibuya@ibuya.co.za
FAX: +27 (031) 2667831
"EMPOWERING DEVELOPMENT"
IBU
A PROJECTS
Drawing Notes:
Light Switch @ 200mm below Chamber Door

Lighting Layout
Scale 1:20

Small Power Layout
Scale 1:20

Luminaire Schedule

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Installation</th>
<th>Lamps Type</th>
<th>Colour</th>
<th>Qty</th>
<th>Location</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Linear fluorescent, vapour and explosion proof ZONE 22. Electronic control gear. Emergency Battery Backup version where indicated with an &quot;a&quot;.</td>
<td>Stainless wire suspension / surface on soffit</td>
<td>2 x 56W FDH</td>
<td>Warm White</td>
<td>1</td>
<td>Chamber</td>
<td>Nordland JB, Supplied by Lighting Projects</td>
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</tbody>
</table>
INDICATIONS
ROUTE MARKER

WATER DESIGN BRANCH

ETHEKWINI MUNICIPALITY

LEGEND

Reflective yellow
(Non-slip road marking paint)

(Enamel post
office red)

(Enamel golden yellow)

(Enamel arctic blue)

NOTE: One coat of undercoat and two coats of required colour must be applied.
T
U

NGONYAMENI RES

Inset: Zoom in
of Reservoir 5 and 6
T
U

UMBUMBULU 13 RES

UMBUMBULU 13 RES

Legend

T
U

200

MADUNDUBE BPT

T
U
T
U
FOLWENI 2 EXT RES

T
U

ADAMS MISSION 5 RES

UMBUMBULU 11 RES

T
U

Reservoirs
Bulk
Retic

T
U
T
U

Local_Munics_2016
610

ADAMS MISSION 6 RES

T
U

U
T

FOLWENI 2 RES

FOLWENI 1 RES
250

Adams Mission Res 5&6

ENSIMBINI 1 RES

T
U
200

U
T

T
U

UMBUMBULU 10 RES
250

50

T
U

250

ADAMS MISSION 4 RES

UMLAZI 6 RES

T
U

T
U

450

50

610

250

50

50

63

ADAMS MISSION 3 RES
0
10

ADAMS MISSION 3 RES

110

ADAMS MISSION 2 RES
3
75 6

16
0

T
U

UMBUMBULU 4 RES
40

T
U

T
U
T
U

0
25
300

T
U
T
U

250

T
U

0

T
U

125

ADAMS MISSION 1 RES

T
U

50

600

350

160

50

KWAMAKHUTHA RES

225

UMBUMBULU 5 RES

0
50

T
U

250

0

UMBUMBULU 12 RES

16
0

160

200

FOLWENI 1 RES

200

ADAMS MISSION 6 RES

FOLWENI 2 RES

T
U
T
UFOLWENI 2 EXT RES

T
U
T
U
T
U

25
0

T
U
UMBUMBULU 3 RES

610

U
T
ADAMS MISSION 5 RES
20
0

U
T

UMBUMBULU 1&2 RES 1734

200

250

160

T
U UMBUMBULU 1&2 RES 1734
T
U
T
U

50

1 50

20

0

CLIENT

UMBUMBULU 9 RES

UMBUMBULU 6 RES

T
U

16

0

ADAMS MISSION 4 RES

T
U

250

CONSULTANT

T
U
125

ADAMS MISSION 3 RES

UMBUMBULU 7 RES

T
U

90

0

1 60

T
U
T
U
T
U ADAMS MISSION 3 RES

ADAMS MISSION 2 RES

0
15

20

T
U

UMBUMBULU 8 RES

110

25
0

PROJECT TITLE

250

T
U

11
0

0
50

63

Adams Mission 6
ADAMS MISSION 1 RES

350

T
U
MAP TITLE

Adams Mission
Locality Plan

DATE COMPLETED:
200

0
20

SMITHFIELD RES

T
U

0

850

3 400

4 00

1 700
Meters

µ

August 2018

20
0

500

75

250

160

450

450

450

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from various sources, as the best information, made available
to the consultants at the date of capture. No warranty,
expressed or implied, is made regarding the accuracy
or completeness of this information.
CONSULTANT MAP NO.

3168.00.AA.01.U001

Sheet 1


### ADAMS RESERVOIR - SUMMARY OF FITTINGS

<table>
<thead>
<tr>
<th>REVISION</th>
<th>REV COMMENTS</th>
<th>FITTING</th>
<th>TOTAL</th>
<th>DIA-LEFT (mm)</th>
<th>DIA-RIGHT (mm)</th>
<th>DIA BRANCH 1 (mm)</th>
<th>END LEFT</th>
<th>END RIGHT</th>
<th>END BRANCH 1</th>
<th>BEND ANGLE (Degrees)</th>
<th>BEND RADIUS (mm)</th>
<th>FITTING MATERIAL</th>
<th>INTERNAL LINING SPEC</th>
<th>EXTERNAL LINING SPEC</th>
<th>DRILL TABLE</th>
<th>ANCHELY DESCRIPTION</th>
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<td>FLANGED</td>
<td>90</td>
<td>150</td>
<td>STEEL</td>
<td>6mm</td>
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<td>150 DIA PIPE WITH BELL MOUTH</td>
</tr>
<tr>
<td></td>
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<td>FLANGED</td>
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<td>150</td>
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<td>STEEL</td>
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<td>150 DIA PIPE WITH BELL MOUTH</td>
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<tr>
<td></td>
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<td>FLANGED</td>
<td>90</td>
<td>150</td>
<td>STEEL</td>
<td>6mm</td>
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<td>150 DIA PIPE WITH BELL MOUTH</td>
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<tr>
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<td>6mm</td>
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<tr>
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Operational Pressure: 0-16 bar in & out