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| <h2 style="margin: 0;">CIVIL DESIGN</h2> <h3 style="margin: 0;">2.1 DETAILED SPECIFICATION AND QUALITY ASSURANCE</h3> | | | | |
|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------|-----|----------|
| Project Description: | MAKHATHINI 132/22-kV SUBSTATION: 2 x 3MVAr 22kV CAPACITOR BANK C-TYPE FILTER ESTABLISH | | | |
| Project No.'s: | ID | ET-STM-1712-4442-01 | WBS | CDE05363 |
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| Department: | Civil Design | | | |
| Project Category: | Strengthening | | | |
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| Compiled by: | | Authorised by: | |
|--------------|----------------|----------------|----------------------|
| Name: | Phutheho Moabi | Name: | PRESHNEE CHETTY |
| Designation: | Civil Designer | Designation: | Civil Design Manager |
| Date: | 31/10/2024 | Date: | 31/10/2024 |
| Signature: | PAM | Signature | PDC |

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FOREWARD

This document is the Detailed Specification for the **Makhathini 22-kV Cap Bank Establish** and covers the Civil (Power Plant) specifications. This document is to be read in conjunction with the General Specification for the Civil and Electrical works.

TEMPLATE REVISION HISTORY

| REV | Date | Compiler | Comment |
|-----|------|-----------|-------------------------------------------------------|
| 0 | 2016 | P Chetty | Original template |
| 1 | 2019 | P.A Moabi | Change to the latest date of Authorisation and review |
| 2 | 2024 | P.A Moabi | Change to the latest date of Authorisation and review |

DOCUMENT REVISION HISTORY

| REV | Date | | Comment |
|-----|------------|-----------|----------------------------------------------------|
| 1 | 30/10/2024 | P.A Moabi | Updating for scope due to site conditions changing |
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1. INTRODUCTION

The scope of work under this project shall be carried out in full accordance with this detailed specification, all Standard Drawings (refer addendum 2.4), Project Specific Drawings (refer addendum 2.5) and the Standards and Specifications Index (refer addendum 2.6) included in the package. These specifications shall be read in conjunction with the General Specifications and Works Information for the Civil and Electrical Works.

This project shall conform in all instances to the Occupational, Health and Safety Act and Regulations, No. 85 of 1993, and any amendments thereto, including the Safety Specification referred to in Regulation 4 of these statutory requirements.

The contractor shall provide a Health and Safety Plan in compliance with the Occupational, Health and Safety Act and Regulations, No. 85 of 1993, based upon but not limited to the Health & Safety Specification included in this package.

Compliance with the schedule of hold points in Annexure 1 shall be mandatory. All project time schedules shall include these hold points for quality inspection by the Design Engineer and/or Clerk of Works.

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2. PROJECT SPECIFICATIONS

STATUS

The Project Specification forms an integral part of the contract and supplements the Standard Specifications.

This Part contains a general description of the works, the site and the requirements to be met.

In the event of any discrepancy between a part or parts of the Standardised 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 Engineer before the execution of the work under the relevant item.

PROJECT DESCRIPTION

The project comprises the following:

- Construction of the Makhathini SS 22kV Capacitor Bank Bays and associated equipment
- Install the Bundwall wall, its foundation and floor slab.

OVERVIEW AND DETAILS OF CONTRACT

This civil contract includes in brief the following scope of work:

- Extend the substation terrace on the 22kV yard on top end by performing cut operation & compaction requirements to enable the installation of the MV capacitor bank requirements.
- Extend the substation earth mat, kerbing & fencing for the above.
- Establishment of equipment (Reactor and Capacitor bank) foundations.
- Rehabilitation of the substation site as per the Environmental Management Plan.

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Also see the details on the drawings.

2.2.1 Stage 1

The first stage of the project shall involve mainly civil works which shall be undertaken by the Contractor. The scope of work in this phase shall include:

- a) Establish the terrace, access road and drainage and extend the existing earthmat for the capacitor bank 1 yard.
- b) The terrace for capacitor bank 2 is existing.
- c) Establish foundations with earthing, steelwork and equipment for 2 x 22kV capacitor bank bays (busbar isolator and combo breaker with surge arrester) 1 & 2.
- d) Establish all conductors (jumpers) for 22kV capacitor bank bays 1 and 2.
- e) Establish foundations for the capacitor banks and associated equipment. Foundation details is to be confirmed by the supplier at tender stage but designed by Eskom.
- f) Establish 1.8m wire mesh safety fencing around each capacitor bank with its associated reactor and resistor.
- g) Establish an oil bund for each capacitor bank with its associated reactor and resistor.
- h) Establish a concrete yard for each capacitor bank with its associated reactor and resistor for prevention of weeds and ease of maintenance.
- i) Supply and install 100mm thick yard stones for 22kV capacitor bank 1
- j) Supply and top up yard stones for 22kV Capacitor bank 2
- k) Rehabilitating of the site in accordance with the Environmental Management Plan.

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DESCRIPTION OF SITE AND ACCESS

Makhathini 132/22kV Substation is situated in the Empangeni Sector and is maintained by Jozini Customer Network Centre. The substation is located north of KZN 5km from the centre of Jozini town. Substation is not accessible using the newly constructed main tarred road as the two levels between Eskom access road and P499 Road are at least 500mm different in terms of height. therefore, low bed or any vehicle will not be able to access. The site may be accessed through the back tarred road (D9) from Jozini to Makhathini and Eskom Access Road will tee off from this tarred road (D9), this new access road may need to be upgraded to meet the requirements of the Lowbed should it be necessary however it is fairly in good condition for normal trucks and vehicle, not for low bed or Abnormal vehicles or trucks.

3. GEOLOGY AND SOILS

3.1. Geology and Soils

3.2. Topography and Surface Drainage

The topography is relatively steep with about 5% fall from SW to NE of the substation and draining towards the main tar road, substation yard and covered with few vegetation in the form of shrubs and grass.

3.3. Regional Geology

(As per environmental scoping report see DESD)

There is boulders/rock at approximately 100mm below ground care should be taken when working around this area of the substation site.

3.4. Substation site Geology

The Makhathini substation site is underlain by loam soil with soft to medium dense soils and rock boulders are a possibility at maybe 0.1m below ground. The average depth concluded by the visual geotechnical investigation such as dongas, cuts and excavation in and around the substation undertaken by Eskom's Civil Engineering Department, revealed just under 0.1m depth contains such material and below 0.1m is base like rock. The soils at the substation site have been classified as Type 1 based on the above and as per Eskom's Classification criteria, with a bearing pressure range of over 150kPa. It should be noted that

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the foundations will need to be excavated more than the 0.6m in depth and this will require breaking the boulder rocks or base rock at least a minimum of about 0.8m.

4. Excavation Requirements

It is anticipated that the materials to an average depth of about 1 metre below existing ground level, will require Medium to Hard Excavation and below 0.6mm will require rock breaking (SANS1200) particularly on the top side of the Substation where the Substation will be extended to accommodate Capacitor bank 1.

5. Site Investigation/Survey

All designs and design levels were calculated based on the survey provided by Eskom's Land Development Department. All setting out data will be referenced from the survey and its control points / benchmarks provided.

6. Services (Read with SANS 1921 - 1: 2004 clause 4.17)

The Contractor shall make himself acquainted with the position of all existing services before any excavation or other work likely to affect the existing services is commenced. It should be noted that there may be a water pipe running across the area to be extended. Should this be found to be the case then it should be diverted accordingly.

The Contractor will be held responsible for any damage to known existing services caused by or arising out of his operations and any damage shall be made good at his own expense. Damage to unknown services shall be repaired as soon as possible and liability shall be determined on site when such damage should occur.

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6.1 Water

The contractor himself shall make arrangements for procuring, transporting, storing, distributing and applying the water needed for construction and other purposes, except where otherwise specified. No direct payment will be made for providing water, the cost of which shall be included in the rates tendered for the various items of work for which water is needed.

Only clean water free from undesirable concentrations of deleterious salts and other materials shall be used. All water sources shall be subject to the engineer's approval.

7. Earthworks (Refer drawings: ER-00024-17-01-07)

All excavation work shall be subject to the requirements of the Occupational Health and Safety Act (Act 85 of 1993 and amendments). The Contractor shall ensure that working conditions are safe and that excavations are kept free of water at all times.

No blasting is allowed on this project, therefore other method of breaking the rock should be explored, the excavation and backfilling within the substation shall be undertaken by the use of mechanical or power equipment where it is necessary and is deemed safe by the engineer.

The following procedure for the construction of general fill is given as follows:

- All vegetation and shrubs should be cleared from the areas over which the platforms are to be constructed before any cutting or filling activity on site. 150mm of topsoil should be removed and spoiled.
- Cut to the required levels as per ER00024-17-01-07 and spoil as per EMP requirements.
- The upper 150mm of the insitu subgrade should be ripped and re-compacted to minimum 90% MDD before fills are placed.

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- Fills should be placed in layers not exceeding 150mm loose thickness and compacted to a minimum of 90% Modified AASHTO maximum dry density. Boulders larger than 60mm in maximum dimension should not be included in the fill material.
- Fills should be placed in layers not exceeding 200mm loose thickness and compacted to a minimum of 90% Modified AASHTO maximum dry density. Boulders larger than 60mm in maximum dimension should not be included in the fill material.

N.B. Soil Poisoning in accordance with SANS 0124 is required

7.1. Extended Terrace Establishment

The Extended terrace by the Capacitor bank 1 shall be formed as follows:

- Remove the 150mm topsoil and stockpile
- Cut to spoil the excess material and shape to the required levels on the capacitor bank side
- Rip and Re-compact 150mm subgrade to 90% MOD AASHTO
- Import G4 material base layer for both sides and compact to 95% MDD
- Site for spoiling to be discussed and confirmed by the contractor and the Environmental officer assigned to the project.

Special attention must be made to the method and specification requirements when the soils are compacted to establish the yard terrace - refer SANS 1200-D.

- N.B. Soil Poisoning and Pesticide Poisoning together with certificates to be provided prior to laying the yard stones.

“**Hold Point 1**” - Refer to annexure 1

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7.2. Capacitor Bank Bund walls (ER00024-20-09 and ER00024-20-10).

Install New Capacitor Bank 1&2 Bund-walls according to the specifications below:

New bund walls and containment areas shall be constructed for the Capacitor bank according to the referenced drawings (ER00024-20-09 and ER00024-20-10).

Bricks shall have a compressive strength of 35MPa with a 2-hour fire rating and shall comply with SANS 227. Apply 20Mpa, 100mm thick concrete to the bund area floor as per minimum slope of 1:200, given in the drawing to achieve drainage path to the outflow tap.

8. Access Road

Fairly in good condition for normal trucks and vehicle, not for low bed or Abnormal vehicles or trucks.

9. Storm water Drainage:

The overall storm-water will be managed with the aid of Concrete Cut off Drain with a trapezoidal shape on the top side/NW of the substation to culminate at Depressed Manhole inlet (See ER00024-17-01-07 and ER00024-20-11) and flows within the 450mm Dia, 50D Class Concrete Stormwater pipe and dissipater at the outlet, as shown on the "Site, level and Drainage plan" to protect the substation site from getting flooded by the catchment area. The pipe outlet consists of a Reinforced Concrete Headwall with wings, an Apron Slab and Concrete Splinter blocks, as well as stilling basin (see ER00024-20-06-01). The Size of the trapezoidal Cut Drain off will be 72m long x 0.5m deep and will have the slope of 1:50.

The concrete pipe Length will be 18m Long, 450mm Dia, 50D Class and will be sloped at 1:70 or 1:80. The Pipe trench will be 1.1m wide and 0.8m depth on average, it will consist of a Class C Bedding, due to the rocky conditions it is preferable to use compacted fine granular material as a bedding. it should be noted that they will be a rock close to the surface.

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Install new Dissipator (3m Dia. x 0.3m deep), by the outflow of existing Subsoil Drain as per the Site, level and drainage Plan (ER00024-17-01-07 and ER00024-20-06-01). The outlet of the existing subsoil will have a headwall consisting of stone pitched with 1:5 cement, and sand mixed above the pipe outlet.

Completion of primary drainage at the substation site shall be a priority activity, i.e., after the completion of earthworks. If deemed necessary, additional temporary diversions of existing drains and temporary cut-off drains shall be installed adjacent to any stockpiled topsoil to prevent this material being washed away, should heavy rain occur.

“**Hold Point No. 2**” shall be applicable to this section (**See Annexure 1**)

10. Fencing and Gates (Refer drawing ER00024-17-04-05)

The substation security fence is currently of the steel palisade type and manufactured and installed in accordance with the Eskom approved drawings. Install New Steel palisade fence type on the extended yard for capacitor Bank 1 and install in accordance with the Eskom approved drawings.

The fencing for the capacitor banks within the SS yard is to be of the diamond mesh type & its own gate and earthed as per the applicable drawing.

Any temporary fences that may need to be installed during the construction phase of the project, e.g., used for barricading sections of the yard, or for safe storage of materials, shall be supplied by the contractor. Any such fence shall also be bonded to the main substation earth mat, where applicable. Such fence shall be removed after construction and the site rehabilitated as per the Environmental Management Plan or as instructed by the Environmentalist.

11. Yard Stones and Kerbing

Supply and install 100mm thick yard stones for 22kV capacitor bank 1. Supply and install Precast Kerbing of Fig 6 Type.

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12. Foundations

12.1. Steelwork and Equipment

All applicable foundations shall be established to a uniform strength of 25MPa at 28 days throughout and constructed in strict accordance with the relevant drawings and specifications associated with each item.

- **22kV Capacitor bank Foundations**

Establish 2 x 22kV capacitor bank foundations as per ER00022-17-03-05 and DDT 5205/1 drawing.

- **22kV Kiosk Breaker Foundations**

Establish 2 x 22kV Kiosk Breaker foundations as per ER00022-17-03-05 and DDT 5216/BR6 drawing.

- **22kV Isolator Foundations**

Establish 2 x 22kV Isolator foundations as per ER00022-17-03-05 and DDT 5205/AR9 drawing

- **22kV Neutral CT Foundations**

Establish 2 x 22kV Isolator foundations as per ER00022-17-03-05 and DDT 5042 drawing

- **22kV Reactor Foundations**

Establish 2 x 22kV reactor foundations and shall be established as per ER00022-17-03-05 drawing.

Please note that this foundation will have no reinforcement (Mass concrete).

- **22kv Capacitor Bank and Reactor Oil Bund Walls**

Establish Oil bund wall around the capacitor bank and reactor with its concrete floor.

Also establish a 20mpa 100mm thick concrete floor slab within the capacitor bank and reactor yard for prevention of weeds and ease of maintenance.

“Hold Point 3” shall apply to these activities. (**Annexure 1**)

NB. Once all foundations have been cast, but prior to any steelwork being erected, a further inspection must be undertaken by the Clerk of Works, to ensure all associated design criteria has been adhered to in the construction of all foundations, as detailed in ‘Hold Point No. 4. Only after completion of this inspection shall the work be, approved accordingly.

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The standard specifications on which the civil works in this contract is based on are the **Standards South Africa's Standardized Specifications for Civil Engineering Construction SANS 1200 or 2001 which is the latest revision.**

Although not bound in nor issued with this Document, the following Sections of the Standardized Specifications of SANS 1200 or latest Revision of 2001 shall form part of this Contract:

- SANS 1200 AA (1986) - GENERAL (SMALL WORKS)
- SANS 1200 C (1982) - SITE CLEARANCE (as amended)
- SANS 1200 D (1990) - EARTHWORKS
- SANS 1200 GA (1981) - CONCRETE WORKS (MINOR)
- SANS 1200 LE (1982) - STORMWATER DRAINAGE
- SANS 1200 MK (1983) - KERBING AND CHANNELLING
- SANS 1200 MM (1984) - ANCILLARY ROADWORKS

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 1921 (2004) - Construction and Management Requirements for Works Contracts
Part 1 General Engineering and Construction Works; and Part 2

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13. MAIN SUBSTATION EARTHING (Refer to drawing ER00024-17-04-05)

- 13.1.** Depending on the tender requirements for the project, the installation of the main substation earth mat should be completed by the civil contractor before the final layer is laid.
- 13.2.** All information regarding the earth mat design is to be treated as preliminary. Earth resistivity measurements will be taken again after clearance and preparation of the substation terrace and the detail earth mat design will be adjusted accordingly.
- 13.3.** The main substation earth mat is designed on safe ground potential rise (GPR<5kV) and safe step and touch potentials. The substation earth mat design and design parameters are available on request.
- 13.4.** The main substation earth mat shall be laid one meter (1m) below finished ground level with 10mm diameter round copper bar installed concurrently with the earth works to avoid disturbance of the final formed and compacted terrace.
- 13.5.** All new equipment will be connected to the main earth mat using 50mm x 3mm flat copper earth straps.
- 13.6.** Any joints, crossings and connections to the earth mat conductors shall be undertaken using the silbralloy brazing method for proper electrically connections.
- 13.7.** The earth mat shall extend 1m beyond the security fence and must connect to the terminal tower. The corners of the most outer earth rod forming the perimeter of the earth mat must be formed with slow bends to avoid high voltage gradients.

Hold Points 4: Refer to schedule of hold points in **(Annexure 1)**

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14. GENERAL

14.1. QUALITY CONTROL

The latest revision of specification 'Quality checking of Distribution Substation Construction before handing over for Commercial Operation' shall be applicable to this project and must be completed in full by the Clerk of Works and returned to the Project Engineer with all the "as - built" documentation. Reference must also be made to Annexure 1 of this document, for a schedule of all the applicable hold points that have been identified as critical to the quality control process involved in the construction of this project, which are to be observed by the contractor(s) involved and enforced accordingly.

Furthermore, contractor "check lists" have been established for all the main activities involved in the construction of this project, to assist all affected parties in achieving a final quality product on completion of the project. Refer Part 4 'Project Management', item 4.5, of the overall Project Package.

The Contractor is further referred to SANS 1921: 2004: Construction and Management Requirements for Works Contracts, Part 1: General Engineering and Construction Works. These specifications shall be applicable to the contract under consideration and the Contractor shall comply with all requirements relevant to the project. Certain aspects however require further attention as described hereafter.

14.2. QUALITY ASSURANCE (QA) (Read with SANS 1921 – 1: 2004 clause 4.4)

The Contractor will be solely responsible for the production of work that complies with the Specifications to the satisfaction of the Engineer. To this end it will be the full responsibility of the Contractor to institute an appropriate Quality Assurance (QA) system on site. The Engineer will audit the Contractor's quality assurance (QA) system on a regular basis to verify that adequate independent checks and tests are being carried out and to ensure that the Contractor's own control is sufficient to identify any possible quality problems which could cause a delay or failure.

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Upon completion and submission of each portion of the Works to the Engineer for examination, the Contractor shall furnish the Engineer with the results of relevant tests, measurements and levels, thereby indicating compliance with the Specifications.

“Hold Point No. 5” – Furthermore, the contractor shall implement his own quality check system throughout the duration of this project. The contractor shall provide regular feedback on all aspects of quality control on the site, which shall constitute a pre-requisite to the final hand-over / take-over stage of the project.

14.3. TESTING (Read with SANS 1921 – 1: 2004 clause 4.11)

14.3.1. Process control

The Contractor shall arrange for all tests required for process control to be done by a laboratory acceptable to and approved by the Engineer.

The Contractor may establish his own laboratory on site or he may employ the services of an independent commercial laboratory. Whatever method is used, the Contractor must submit the results of tests carried out on materials and workmanship when submitting work for acceptance by the Engineer. The costs for these tests shall be deemed to be included in the relevant rates and no additional payment will be made for testing as required.

14.3.2. Acceptance control

The process control test results submitted by the Contractor for approval of materials and workmanship may be used by the Engineer for acceptance control. However, before accepting any work, the Engineer may have further control tests carried out by a laboratory of his choice. The cost of such additional tests will be covered by a provisional sum provided in the schedule of quantities, but tests that failed to confirm compliance with the specifications, will be for the account of the Contractor.

14.4. SURVEY BEACONS (Read with SANS 1921 - 1: 2004 clause 4.15)

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The Contractor shall take special precautions to protect all permanent survey beacons or pegs such as benchmarks, stand boundary pegs and trigonometrical beacons, regardless of whether such beacons or pegs were placed before or during the execution of the Contract. If any such beacons or pegs have been disturbed by the Contractor or his employees, the Contractor shall have them replaced by a registered land surveyor at his own cost.

14.5. EXISTING SERVICES (Read with SANS 1921 - 1: 2004 clause 4.17)

The Contractor shall make himself acquainted with the position of all existing services before any excavation or other work likely to affect the existing services is commenced.

The Contractor will be held responsible for any damage to known existing services caused by or arising out of his operations and any damage shall be made good at his own expense. Damage to unknown services shall be repaired as soon as possible and liability shall be determined on site when such damage should occur.

14.6. MANAGEMENT OF THE ENVIRONMENT

The Contractor shall pay special attention to the following:

14.6.1. 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 Engineer 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.

14.6.2. 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

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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.

14.7. FEATURES REQUIRING SPECIAL ATTENTION

14.7.1. Control of Water

The Contractor shall at all times and in all respects be responsible for the handling of stormwater from higher-laying areas above the Works, and for the handling of any subsurface water that may affect the Works. No separate payment shall be made in this regard, as all costs related thereto shall be deemed to be included in the rates tendered for the various items of work that are included in the Schedule of Quantities.

14.7.2. Source of Material/Borrow pit

The contractor will be held responsible for locating sources of all materials complying with the relevant minimum requirements to be used in this contract. No separate payment shall be made for this, as all costs related thereto shall be deemed to be covered by the tendered rates. Where possible materials manufactured or produced locally shall be procured to promote local enterprise.

14.8. MANAGEMENT AND DISPOSAL OF WATER (Read With Sans 1921 - 1: 2004 Clause 4.6)

The Contractor shall pay special attention to the management and disposal of water and storm water on the site. It is essential that all completed works or parts thereof are kept dry and properly drained. Claims for delay and for repair of damage caused to the works as a result of the Contractor's failure to properly manage rain and surface water, will not be considered.

14.9. DISPOSAL OF SPOIL OR SURPLUS MATERIAL (Read with SANS 1921 - 1: 2004 clause 4.10)

The Contractor shall dispose all surplus and unsuitable material in legal spoil areas of his own choice. He shall be responsible for all arrangements necessary to obtain such spoil sites.

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14.9.1. Overhaul

No payment will be made for overhaul on this contract unless provision is made thereof in specific items.

14.10. REQUIREMENTS FOR ACCOMMODATION OF TRAFFIC

14.10.1. General

The Contractor will be responsible for the safe and easy passage of public traffic past and on sections of roads of which he has occupation or where work has to be done near traffic. The client will provide an alternative route for traffic, but the contractor will be responsible for the maintenance of this road.

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.

14.10.2. 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 Engineer 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.

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The Contractor shall construct and maintain all temporary drainage works necessary for temporary deviations.

The Contractor shall provide and grant access to persons whose properties fall within or adjoin the area in which he is working.

14.10.3. 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.

Items that may be considered for payment are specified in SANS 1200 Standardized Specifications and the related project specification

14.11. PROJECT RISK ANALYSIS

Refer to Health and Safety Specification

14.12. SAFETY SPECIFICATION

Refer to Health and Safety Specification

14.13. “AS BUILT” INFORMATION

The “as-built” drawings and associated information form a vital part of this project. Consequently this project will not be considered complete until the “as-built” package complete with all the associated civil related drawings have been submitted via the Project Co-coordinator, to the Civil Designer.

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| ANNEXURE 1: SCHEDULE OF HOLD POINTS | | |
|-------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hold Point No. | Item Ref. No. | Hold Point Detail |
| 1 | 7 | <p>At every 0.3m fill placement on the terrace and on completion of the Civil Engineer concerned must be given advance notice of at least a week, so that a visit to site can be arranged with the relevant people to assess terrace levels, compaction, etc.</p> <p>3 x Compaction test results per layer shall be submitted to the Project Manager/ Civil Engineer and Clerk of Works per 0.3 m heights of fill. No further work shall continue in, or on the terrace, until the completed formation has been approved in its entirety.</p> |
| 2 | 9 | <p>Before any drains, dissipaters, oil dam and manholes are constructed, or drainage pipes laid, the relevant excavation depths and associated invert levels must be checked and approved by the Project Engineer involved, or his designated representative.</p> <p>Completion of primary drainage at the substation site shall be a priority activity; If deemed necessary, additional temporary diversions of existing drains and temporary cut-off drains shall be installed adjacent to any stockpiled topsoil to prevent this material being washed away, should heavy rain occur.</p> |
| 3 | 12 | <p>Concrete cube and slump tests shall be carried out in accordance to SANS 5860, 586-1 to 3 and SANS 586-2. The test results shall be submitted to the Clerk of Works/civil designer within five days of pouring for acceptance and approval.</p> <p>Prior to any concrete being cast, the designated Clerk of Works shall be given satisfactory advance notice to inspect the setting out, excavations, foundation centres, levels, alignment, reinforcing, earth connections, etc. It is essential</p> |

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| | | that this stage be observed as a critical “hold point” and no further work shall continue on this phase of construction, until the necessary inspection has taken place and the work approved. Once all foundations have been cast, but prior to any steelwork being erected, a further inspection must be undertaken by the Clerk of Works, to ensure all associated design criteria has been adhered to in the construction of all foundations. Only after completion of this inspection shall the work is accepted accordingly. |
| 4 | 13 | Once all jointing is complete and before the earth mat is buried, it is essential that the Project Engineer / Clerk of Works concerned is notified well in advance, so that an inspection of the earth mat and all associated connections to it, is undertaken. The earth mat resistance measurement can be completed at the same time to ensure its acceptability |
| 5 | 14.2 | Furthermore, the contractor shall implement his own quality check system throughout the duration of this project. The contractor shall provide regular feedback on all aspects of quality control on the site, which shall constitute a pre-requisite to the final hand-over / take-over stage of the project. |
| NOTE | ALL | <p>It is essential that all “hold points” are observed as such by the contractor/s and no further work is to continue on each particular stage, until this has been inspected and approved by the Civil Engineer.</p> <p>An agreed time must be established between the contractor and the Civil Engineer and Clerk of Works for suitable notice to inspect. Failure to comply will put the contractor/s at risk of being removed from site.</p> |

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ANNEXURE 2: SPECIFICATION FOR THE CURING OF CONCRETE

GENERAL:

In general the longer the period of curing, the better will be the quality of the concrete. This applies not only to its compressive strength, but also to its durability, impermeability, resistance to wear, weathering and chemical attack, and to its freedom from shrinkage cracking.

It is desirable however to balance the requirements of quality with those of economy. For this reason the minimum period of curing should not be less than 7 days under average conditions with normal Portland cement, but better practice would call for an extension of this period to 10 days.

ACCEPTED METHODS OF CURING:

1. **Retaining forms in place** - If the formwork is of timber, then they should be sprinkled with water at frequent intervals to prevent their drying out.
2. **Ponding of water on exposed surfaces**
3. **Covering of the concrete with sand, earth, straw, sawdust, or mats made of a moisture retaining material, and the keeping of the covering continuously wet.**
4. **Sprinkling or spraying the surface with water at frequent intervals to keep the concrete continuously moist** – Care must be taken with this method of curing to avoid damage to the concrete through the use of heavy jets.
5. **Covering of the concrete with a waterproof or plastic sheeting firmly anchored at the edges.**
6. **The use of an approved curing compound applied in accordance with the manufacturer's instructions.**

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| ANNEXURE 3: GUIDELINES FOR STRIKING TIMES OF FORMWORK | | | | | | | | | |
|-----------------------------------------------------------------------------|--------------------------------------|------|------|------------------------------------------------------|------|------|-------------------------------|------|------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | Minimum Time, d | | | | | | | | |
| | Type of cement used | | | | | | | | |
| Type of structural member or formwork | Portland cement & Portland cement 15 | | | Rapid hardening Portland cement & Portland cement 15 | | | Portland blast furnace cement | | |
| | Weather | | | | | | | | |
| | normal | cool | cold | normal | cool | cold | normal | cool | cold |
| Beam sides, walls, and unloaded columns | 0.75 | | 1.5 | 0.5 | | 1 | 2 | | 4 |
| Slabs with props left under | 4 | | 7 | 2 | | 4 | 6 | | 10 |
| Beam soffits with props left under, and ribs of a ribbed floor construction | 7 | | 12 | 3 | | 5 | 10 | | 17 |
| Slab props - including cantilevers | 10 | | 17 | 5 | | 9 | 10 | | 17 |
| Beam props - including cantilevers | 14 | | 21 | 7 | | 12 | 14 | | 21 |

NOTES:

1. The above table serves as a guide only. The final striking times of formwork must be upon the authorization of the Engineer. This should be done in correlation with the designed concrete strengths verified from concrete cube tests at 7, 14 and 21 and / or 28 days.
2. In "normal weather", temperatures of the atmosphere adjacent to the concrete, as measured with a maximum and minimum thermometer, do not fall below 18 deg.C.
3. In 'cold weather", temperatures, measured similarly, vary between 5 and 10 deg.C.

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