| Eskom Rotek Industries | Scope Of Work | Constructing Services |
|---|---|---|

Title: **Construction of PCD, Culvert & Security Fence At Medupi Power Station**

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## Content

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# 1. INTRODUCTION

Construction Services' Civils division is undertaking the Construction of PDC and Culvert related works projects. These projects require the Construction of PDC and Pipe Jacking. In view of that ERI Construction Services wants to enter enabling contracts with service providers to Installation and Supply of a security fence on an as when required basis.

# 2. SUPPORTING CLAUSES

## 2.1 BACKGROUND

Eskom Rotek Industries Construction Services is responsible for the Construction of Roads, Dams, Coal stock yards, Substations, Buildings, Transmission lines, Distribution network and Cable construction in various Projects.

These operations are on a nine hours (9) shift per day, five (5) days per week basis.

**Pollution Control Dams**

Eskom's Medupi Power Station is a six (6) unit dry cooled, coal fired power plant that produces a total of 4 788 MW of energy and came into operation in 2015. Exxaro's Grootegeluk mine is located within 5 km from Medupi and is likely to supply power station coal to Medupi over its expected 50-year life time.

Ash is formed from the coal burning process and is transported to the Ash Disposal Facility (ADF) to the west of the Power Station by means of conveyor systems. The ADF forms an integral part of the power station's infrastructure and requires continuous monitoring and management. The operation of the facility involves controlling the geometry of the ash facility and managing storm water and concurrent rehabilitation on it, while ensuring that adverse effects on the environment are minimised. The ADF is currently in its first phase of operation and is a lined waste management facility.

Two new pollution control dams will be required over the life of the ash facility: Dam D3 Complex (consisting of 3 compartments) and Dam D3B.

An Excess Coal Stockyard has also been constructed and operated within the ash facility footprint. The stockyard has been lined to the same requirements as the ash facility with



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the assumption that the coal will be reclaimed before the ash facility reaches the stockyard footprint and the liner will be still intact for deposition of the ash stack.

The ash facility has been divided into 4 areas. Area 1 covers the 0 to 4 year footprint constructed. The remaining area between this and the Excess Coal Stockyard has been divided into Area 2 and Area 3. The Excess Coal Stockyard then forms Area 4. Each area is separated into two phases namely Phase 1 and Phase 2 for sequencing purposes to ensure optimisation between commissioning, operating and construction. However, due to time constraints Area 2 has been divided into sections that will be prioritised for construction – these sections can be seen in Figure 1. This document is for the Dam 3 Complex and the culvert construction.

The aim of the design is to create a barrier from contamination by means of a composite system of combining bentonite enhanced soil (BES) with a high density polyethylene (HDPE) geomembrane in intimate contact. The final geometry of the ash facility has been revised to consider a 500m buffer on the Sandloop spruit that is located in the region to the south west of the site. This includes a 12m lift of the ash facility to counter the loss of volume from the buffer

## 2.1 Employer's Objectives and Purpose of the works

The objective of this project is to extend the volume capacity of the ash facility while meeting all environmental requirements.

The Employer is currently going through the process of licensing the extension of the ash facility in terms of environmental authorisation and will need to update the water use licence for the additional usage and storage of water.

The requirements of the authorisations are that the ash facility, as well as the associated Pollution Control Dams (PCDs), needs to be lined according to the current regulations.

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## 2.2 SCOPE OF WORKS

The works include the following:

- Construction of Pollution Control Dams.
- Construction of storm water management infrastructure.
- Construction of culvert infrastructure.
- Security Fence

Project Plan:

**The expected project duration for the construction of the Dam Complex and the Culvert is Fifteen (15) months from the expected start date.**

Pollution Control Dam

The liner system in the pollution control and rehabilitation dams includes the following layers from excavation level upwards:

Substrate preparation layer: The substrate will be ripped and re-compacted to 95% MOD AASHTO with a moisture content of 0 to +2% of optimum moisture content.

Under Drainage Layer: A network of herringbone drains consisting of separation geotextile wrapped stone surrounding HDPE drainage pipes, reporting to low points and exiting to a manhole at the side of the footprint.

Primary impermeable layer: 2 x 150 mm layers of site sand blended with 5% bentonite by mass compacted to 98% Standard Proctor with a moisture content of 0 to +2% of optimum moisture content in order to have a permeability co-efficient (k) of less than 1 x 10-7 cm/s.

Primary geomembrane layer: 1.5 mm HDPE double textured geomembrane layer.

A ballast layer consists of a 250 mm thick layer of screened site sand stabilised with 8% cement by mass. On the side slopes, this cement stabilised screened site sand will be placed in 250 mm high geocells and a geogrid is required between the geomembrane and geocells.

The area north of Compartment 2 and 3 and west of Compartment 3 of Dam Complex D3 will need to be shaped to fall towards the west temporary access road where 160 mm



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diameter HDPE pipes (PE100, PN25, SDR 7.4) will be placed at about 100 m centres to allow for clean storm water to drain into the temporary clean diversion canal.

Storm Water Trenches

Storm water generated from the dirty area will report to the perimeter trenches, which will convey the water to one of the existing or proposed dams.

The main components for the storm water trenches are:

- Stripping topsoil 300 mm deep, stockpile and maintain.
- Normal excavation for trenches to required line and forming of berms where required. Berms to be constructed of selected site sand placed in 150 mm thick layers, compacted to 95% MOD AASHTO with a moisture content of -2 to +2% of optimum moisture content.
- The preparation layer: The layer will be ripped and re-compacted to 95% MOD AASHTO with a moisture content of -2 to +2% of optimum moisture content.
- Supply and installation of a primary geomembrane layer: 1.5 mm HDPE double textured geomembrane layer.
- Supply and installation of a protection geotextile Type GRI-GT12(a), 1080 g/m2, between the geocells and the liner.
- Construction of erosion lining system, comprising of 100 mm geocells in-filled with 15 MPa concrete, as indicated on the drawings.
- Construction of a 1 m high clean storm water diversion berm at the northern and western perimeter of the Compartment 2 and 3 of Dam Complex D3. This berm is to be constructed of selected fill G7 material compacted to 95% MOD AASHTO density with a moisture content of -2 to +2% of optimum moisture content, in layers not exceeding 150 mm, including final trimming of slopes.
- General shaping around canals and traffic management during construction.

Pipe jacking will be required to install a portion of the stormwater culvert pipe under the railway line while the railway line remains operational. The main components for the canal construction are:

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- Undertaking a pre-construction survey along the footprint of the canal prior to undertaking any work. The survey must be submitted to Engineer for review before work commences.
- Clear and grub along the canal footprint.
- Removal of topsoil and existing topsoil stockpiles, except in areas where topsoil has already been removed such as along existing borrow areas.
- Excavate to form canal and fill localised low spots along canal to drain stormwater towards the canal.
- Construct erosion protection using geocells filled with mass concrete where specified.
- Excavate for the pipe culvert and inlet and outlet headwalls.
- Jacking a portion of the stormwater pipe culvert under the railway line.
- Constructing a Class B bedding and backfilling the excavation back to natural ground using selected material compacted to a minimum of 93% modified AASHTO maximum density at OMC. Where road layer works are removed these should be reinstated. Placing topsoil over unconstructed areas to facilitate the re-establishment of vegetation.
- Constructing the reinforced concrete headwalls.
- Shaping the canal outlet to daylight.

Security Fence

A portion of the existing security fence installed along the southern side of the property needs to be removed where new infrastructure will be constructed. A new security fence will be constructed along the Eskom southern property boundary. It is required that fence material recovered from the removal of the existing fence be re-used as much as possible to reduce the quantity of new fence that must be procured. The main components for the fence construction are:

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- Undertaking a pre-construction survey along the footprint of the new fence prior to undertaking any work. The survey must be submitted to the design engineer for review before work commences.
- Prepare the area by removing localized high points and filling low spots.
- Install fence using new and previously removed material. New security fence must connect to existing security fence.
- Install gates.

### 2.2.1 PURPOSE

The purpose of this scope is to ensure the construction of the PDC, Culvert and Security Fence.

This document shall apply to the site with attached addendums.
This document shall be effective from the authorisation date.

## 2.3 NORMATIVE/INFORMATIVE REFERENCES

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs and additional site-specific ones.

### 2.3.1 NORMATIVE

[1] ISO 9001 Quality Management Systems
[2] OSHAS 1800 Safety Management Systems
[3] Occupational Health and Safety Act and Regulations (85 of 1993)
[4] 240-62196227_Eskom Life Saving Rules
[5] 32-95_Environmental, Occupational Health and safety Incident Management Procedure

### 2.3.2 INFORMATIVE

[6] Criminal Procedures Act 51 of 1977
[7] Labour Relations Act 66 of 1995
[8] Basic Conditions of Employment Act 75 of 1997

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## 2.4 DEFINITIONS

| Description | Definition |
|---|---|
| **Appointed Supplier** | Means a supplier appointed by the principal contractor. |
| **Baseline Risk Assessment** | (32-520) baseline operational risks refer to the health and safety risks associated with all standard processes and routine activities in the business |
| **Contractor** (includes appointed contractor) | means an employer as defined in section 1 of the Act who performs contract work and includes principal contractors |
| **Competent Person** | (OHS Act) means any person having knowledge, training, experience, and qualifications, specific to work or task being performed, provided that, where appropriate, qualifications and training are registered in terms of the South African Qualifications Authority Act, 1995 (Act No. 58 of 1995). |
| **Danger/Dangerous** | Means a condition/substance that constitutes a risk of personal injury, impairment of health, or death |
| **Employee** | (OHS Act) means, subject to the provisions of subsection (2), any person who is employed by or works for an employer and who receives remuneration or who works under the direction or supervision of an employer or any other person. |
| **Employer** | (OHS Act) means, subject to the provisions of subsection (2), any person who employs or provides work for any person and remunerates that person or expressly or tacitly undertakes to remunerate him/her, but excludes TES (ex. labour broker) as defined in section 1(1) of the Labour Relations Act. |
| **Lifesaving Rules** | (240-62196227) a rule that, if not adhered to, has the potential to cause serious harm to people. |
| **Permit To Work** | Means the printed form containing sections entitled application, permits to work, suspension, suspension revocation, clearance and revocation, and used for the authorisation of all work to be carried out in terms of these regulations. |
| **Plant** | Means structure, machinery, low voltage electrical equipment or equipment which does not fall within the scope of the Operating Regulations for High-voltage Systems, and excludes, mobile, portable lifting equipment, domestic circuits, appliances and tools. |
| **Responsible Person** | Means a person who has been authorised in terms of these regulations to be responsible for ensuring that the work is covered by a permit to work can be carried out and executed taking health and safety precautions into account and within the terms of 36-681_Generation Plant Safety Regulation |
| **Safe/Safely/Safety** | Means a condition not posing any danger, an activity that can be carried out without danger, or protection against danger. |



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| | |
|---|---|
| **Shall and should** | The word “shall” be understood as mandatory and “should” as recommended. |
| **Skilled Person** | Means a person who has been trained, has adequate knowledge for the task at hand and declared competent in writing. |
| **Supervision/Supervise** | Means to oversee the actions of a person(s) to such an extent as to prevent any dangerous act, as far as reasonably practicable. Such a supervisor must be trained in risk assessment techniques and be able to understand the dangers / hazards associated with the task and who has the authority to ensure that precautionary measures taken are implemented. |
| **Visitor** | Any person visiting a workplace with the knowledge of, or under the supervision of, an employer. |

### 2.5 ABBREVIATIONS

| Abbreviation | Explanation |
|---|---|
| RA | Risk Assessment |
| AP | Appointed Person |
| CSY | Coal Stock Yard |
| LAR | Limited Access Register |
| ERI | Eskom Rotek Industries |
| OHSACT | Occupational Health and Safety Act |
| OEM | Original Equipment Manufacturer |
| RP | Responsible Person |
| PPE | Personal Protective Equipment |
| PTW | Permit To Work |
| H&S Rep | Health and Safety Representative |

## 2.6 MATERIAL SPECIFICATION AND WORK EXECUTION

**Material:**

All materials required to be supplied in meters and a per no. required and as specified in the BOQ, any other form of delivery should be agreed with site before delivery.

The delivery plan should be accepted by the Project Manager before delivery on site.



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**Delivery Trucks:**

- Oil and fuel spillages from delivery trucks must be cleared within an hour alternatively, Eskom Rotek Industries shall source at whatever costs other service providers to clean the spillage, and costs shall be for the Eskom Rotek Industries.
- Broken items will not be accepted on site, will be sent back with truck at the supplier's cost.

**Delivery Driver:**

The following is necessary for the delivery driver:

- Professional Driving Permit
- Valid Medical Certificate

**Required PPE (Specification to be supplied under SHEQ)**

- Overalls-specific to activity
- Safety boots
- 3-point chin strap hard hat
- Gloves
- Safety goggles
- Shin guards
- Dust masks
- Cloth masks

## Facilities provided by Contractor

### 2.6.1.1 Contractor's Yard, Offices, Workshops and Stores

It is required, for the proper co-ordination and execution of the works that the Contractor has an office on Site for the duration of the contract.

The Contractor includes in his establishment rates for all further treatment of the yard areas that he considers necessary for his entire operation throughout his period of occupation and under all weather conditions. The Contractor also includes for all security fencing, security and access arrangements. The yard will be always kept clean and tidy, this will include all workshops and storage areas under the control of the Contractor. Maintenance of the yard is the Contractors responsibility and is for the Project Managers acceptance.

Outfall drainage of all surface run-off drains is constructed by the Contractor to the acceptance of the Project Manager to minimise erosion and to effect control of



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contaminated water. The Contractor's plan for the layout of his yard area is accepted by the Project Manager prior to occupying the yard and the Contractor does not occupy any site area other than that allocated to him. The Contractor's plan states fully what measures are taken regarding removal and storage of topsoil, stabilisation of eroded areas and further loss of topsoil.

The Contractor complies with the environmental policy given in the Site Regulations. The Contractor provides, erects and maintains for his own use adequate size office accommodation and stores together with such drainage, lighting, heating, and hot and cold-water services as may be required. Provision is also made for adequate parking and a turning area adjacent to all the aforesaid structures. The Supervisor prior to commencement of any work on Site accepts all designs and layouts for these provisions.

The Contractor provides office accommodation for the designer / engineer including two offices for their use.

The Contractor dismantles and clears the yard of all such temporary structures and associated foundations and infrastructure at the direction of the Supervisor on Completion of the whole of the works. No such dismantling and clearance work is carried out without prior acceptance from the Supervisor.

The Contractor shall make provision for carrying out of all quality control testing required in terms of the works involved. This shall include, but is not limited to, the following:

- Soil grading analysis from 0.075 mm up to 100 mm as per TMH 1 A1a) and A5;
- Soil testing for Atterberg limits as per TMH 1 A2-A4;
- Soil density testing (nuclear and sand replacement as per TMH 1 A10);
- Soil testing for moisture content;
- DCP testing.

The Contractor shall either provide a laboratory on site or may make use of approved external laboratories and/or laboratories of other contractors on site subject to the approval of the Supervisor.Results of permeability testing will only be accepted if carried out by an accredited laboratory.

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### 2.6.1.2 Telecommunications

Neither a network point nor a telephone is available on site. Should the Contractor require one, he is to make his own arrangements with relevant authorities. Arrangements may also be made to use the telephones of the station if they are available. Calls from these will be charged for at prevailing GPO rates.

Should the Contractor wish to use radio communication equipment on site, he will make his own arrangements with the relevant authorities. In this case, he is requested to liaise with the head of security at the station to ensure that there is no interference with existing channels or equipment.

### 2.6.1.3 Sanitary Facilities and Refuse

The Contractor is to supply own sanitary facilities at his contractor's yard. A refuge control system will be established by the Contractor. All waste and refuge will be collected and disposed of as directed by the Project Manager, at the Power Station refuse disposal site.

### 2.6.1.4 Equipment/Appliances

Any electrical Equipment, or appliances, used by the Contractor conforms to the applicable OHS Act safety standards and is maintained in a safe and proper working condition. The Project Manager has the right to stop the Contractor's use of any electrical Equipment, or appliance, which, in the opinion of Project Manager, does not conform to the foregoing. Inspection of equipment/appliance will be done as required by OSH Act.

The Employer may assist the Contractor with the off-loading of equipment, plant and material but the responsibility for off-loading remains with the Contractor. Any special tools and equipment to be used on site for the execution of the works is the responsibility of the Contractor.

### 2.6.2 Survey control and Setting Out of the *Works*

The Project Manager designates the working area boundary limits and assigns for the Contractor's use access roads, parking areas, storage areas, existing facilities areas and construction areas. The Contractor does not trespass in or on areas not designated for his work.

The Contractor is responsible for keeping Contractor's personnel out of areas not designated for Contractor's use, except, in the case of isolated work located within such areas for which the Contractor is authorised to do so.The control points will be established by the Contractor. Land surveys will be done by the Contractor before and after clear and



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grub, before and after topsoil strip and after final excavation before construction commences.

The Contractor will ensure that application for excavation permit is done well in advance before any excavation work can start in an area. The Employer will need the drawings of the work to be conducted in the area to show the Excavation authorised person of Medupi the drawings so that an excavation permit can be issued. A copy of the excavation permit with the drawings will be handed to the Employer for record keeping.

In addition, the survey information is to be according to the National LO co-ordinate grid system and is to be provided in digital format (either YXZ format or preferably in Model Maker file system ver. 7 or above). The following survey information is additionally required to approve construction works executed. This list is intended to give an indication of some of the survey work required and is not intended to be an exhaustive list of all the surveys that will be required.

- A detailed ground pre-construction survey of the footprint of the infrastructure prior to undertaking any works. The survey must be submitted to design engineer for review prior to commencement of the work.
- Detailed bottom of excavation survey, before placement of any layer works, clearly showing toe and crest lines of the basin excavation and embankment walls (for all works).
- Survey of invert level of Dam 3 Complex (as per drawings) underdrainge, leachate collection and outlet pipes to verify falls and length of pipes installed.
- Detailed survey of final HDPE liner surface, clearly showing toe and crest lines of the facility.
- As-built surveys of the bottom and top of primary and secondary Bentonite Enhanced Sand layers to verify liner thickness, as well as of the final surface of the ballast layer and leachate collection layer, will be required.
- Inverts levels of storm water trenches.
- Any extensions to stockpile areas.

Final As-Built survey information must be given to the Supervisor in the same format as what the setting out was given in the drawings. Completion will not be processed before this survey information has been evaluated and verified using a DTM package.

### 2.6.3 Control of Noise, Dust, Water and Waste

The Contractor maintains a high standard of cleanliness during the conduct of his activities at Medupi Power Station. This includes areas allocated for storage of materials, site offices



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etc. to the satisfaction of the Project Manager. The Contractor keeps these areas clean and free from accumulation of waste materials and refuse regardless of the source.

The Contractor ensures during sweeping and dusting, that a minimum amount of dust is liberated into the atmosphere. Cleaning by vacuum cleaners is preferred and the use of compressed air for cleaning is prohibited.The Contractor is responsible for the prompt removal of all waste to a designated disposal area. The disposal area will be on or in the vicinity of the Power Station and be indicated by the Project Manager.

For the purpose hereof, “waste” any matter, whether liquid or solid or any combination thereof, which is a by-product, emission, residue or remainder of any process or activity carried out in connection with the works and which is not reused on the Site in the in the ordinary course of carrying out the works within seven days of production.

The Contractor provides an adequate number of marked bins and containers at offices, in yards, at workshops and on the Site for the temporary storage of waste. These bins and containers are subject to approval by the Project Manager. The Contractor is required to segregate certain items of waste by type as designated by the Project Manager.

Bins and containers are emptied, and waste removed to the designated area at least once a week. All the waste removed to the designated area at least once a week. All the temporary storage areas for bins and containers are kept tidy and must not constitute a nuisance to others. The Contractor takes all required steps to avoid spillage of waste alongside the bins and containers during removal and disposal thereof.

All waste that cannot be contained in either a bin or container is placed on a temporary waste site, which the Project Manager identifies. The waste is removed as soon as possible but, in any event, at least once a week. No burning of waste is allowed at the Power Station.

Hazardous waste is dealt with in accordance with the safety, health and/or environmental requirements of the works and the Contractor is solely responsible for the proper disposal thereof. Hazardous waste will be disposed of at an authorised landfill site. Waste manifest will be kept for record keeping and hand over at the end of the Project.

Controlling water from excavations is done as required by the Environmental legislation and only after a method statement to this regard has been accepted by the Project Manager.

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The Contractor must ensure that adequate pumping capacity is provided for the continual pumping of water from excavations. Water may be contaminated and should not be discharged into the environment unless tested.

### 2.6.4 Sequences of Construction or Installation

The Contractor is responsible for the construction and installation of the equipment according to the Contractor's construction and installation plans. The Contractor complies with the Employer's Work Co-ordination Process.

Without derogating from the provisions of the Conditions of Contract, the Work Co-ordination Process is used by the Project Manager to monitor and manage activities on the Power Station and to facilitate the integration and co-ordination of the various works by Others.

If not included in the contract, the Project Manager will notify the Contractor of the requirements of the Work Co-ordination Process prior to the date of site establishment by the Contractor.

### 2.6.5 Giving Notice of Work to be covered up

The Contractor provides a notice of work to be covered up to the Supervisor.

### 2.6.6 Hook ups to Existing Works

The adjacent plant and equipment may not be modified without written permission from the Project Manager. The Contractor complies with Eskom Life Saving Rules and will report any non-conformance.

## 2.7 Completion, Testing, Commissioning and Correction of Defects

### 2.7.1 Work to be done by the Completion Date

On or before the Completion Date the Contractor shall have done everything required to provide the Works. The Project Manager cannot certify Completion until all the work has been done and is also free of Defects which would have, in his opinion, prevented the Employer from using the works and Others from doing their work.

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### 2.7.2 Use of the *Works* before Completion has been certified

Eskom Rotek Industries to add requirements here.

### 2.7.3 Materials Facilities and Samples for Tests and Inspections

The sub-contractor will be responsible for the testing and inspections of all the areas that need inspection with using a reliable laboratory.

### 2.7.4 Start-Up Procedures required to put the *Works* into Operation

The Contractor gives the Project Manager written notice that the works are ready for operation. Such notice will suit the requirements of the Employer but will not, unless otherwise agreed, be less than 48 hours or more than fourteen (14) calendar days.

No alterations or adjustments will be made to the works after functional checks are done without the Project Manager's written permission.

At this stage the following must have been achieved:

a) Construction is to be completed.

b) Testing report and the associated certificates received.

c) Signed erection and safety clearance certificates.

d) Final Draft of the Technical, Operating, Maintenance plans delivered.

e) All Quality Control Plan (QCP) documentation received.

### 2.7.5 Take Over Procedures

Refer to the Employer's Procedure, Commissioning and Completion of Power Station Projects, 240-85416341.

### 2.7.6 Access given by the *Employer* for correction of Defects

Clause 43.4 requires that the Project Manager arranges for the Employer to allow the Contractor access to and use of a part of the works which has been taken over if needed to correct a Defect.

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### 2.7.7 Performance Tests after Completion

The Contractor shall carry out necessary tests after completion to demonstrate that the performance of the Plant is in accordance with the Employer's Works Information requirements. The Contractor will be required to provide a detailed method statement on how this verification will be achieved and any instrumentation/equipment required shall be part of the system provided by the Contractor.

**Training of Maintenance Personnel**

Maintenance personnel will be trained in all components and functions of the Plant i.e. Method of maintenance, fault finding, correction, routine maintenance. Training will include familiarisation with documentation (maintenance plan, procedures etc.).

**Training of Maintenance Operators**

Operators will be trained and declared competent on the new systems. This will include familiarisation with documentation including drawing configuration logic, as well as operator interface familiarisation e.g. operational functions, alarms etc. The Contractor makes provision for training of all operators, for every shift.

**Engineering Training**

Formal engineering training will be provided on basic Plant design, capabilities and procedures upfront, prior to design freeze. Thereafter, training will be on-job training throughout the design process. The overview design and control/interface functions will be covered by this training. The engineering team should be trained sufficiently to enable them to work as part of the implementation team on and off site.

**Training Documentation**

The course material is in English and includes all third-party documentation. A copy of the training documentation is supplied for each trainee with an additional 3 master sets for the Employer's library and training department.

The training dates are included and shown in the Accepted Programme. The supply of drafts, pre-print proofs and printed copies of training documentation is planned by the Contractor in such a way that the required training is complete before commissioning of the Plant.

Training manuals are continuously updated by the Contractor up to the date of issue of the Defects Certificate for the whole of the works.



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## Operational Maintenance after Completion

It is not applicable to this Employer's Works Information.

List of Reference Procedures, Standards and Specifications

The Contractor complies with all standards, specifications and regulations as listed within this Works Information:

General

**Table 14: General National/International Standards**

| | SANS and other applicable International Standards | |
|---|---|---|
| No | Document No | Description / Title |
| 1 | OHSA | Occupational Health and Safety Act South Africa No 85 and amendments |
| 2 | SANS 1200A | General |
| 3 | SANS 1200C | Site Clearance |
| 4 | SANS 1200D | Earthworks |
| 5 | SANS 1200DA | Earthworks |
| 6 | SANS 1200DB | Earthworks |
| 7 | SANS 1200DE | Small Earth Dams |
| 8 | SANS 1200DG | Concrete (Structural) |
| 9 | SANS 1200DK | Gabions & Pitching |
| 10 | SANS 1200DM | Earthworks (Roads, Subgrade) |
| 11 | SANS 1200G | Concrete (Structural) |
| 12 | SANS 1200GA | Concrete (Small Works) |
| 13 | SANS 1200H | Structural Steelwork |
| 14 | SANS 1200L | Medium Pressure Pipelines |
| 15 | SANS 1200LB | Bedding (Pipes) |
| 16 | SANS 1200LE | Stormwater Drainage |
| 17 | SANS 1200LG | Pipe Jacking |
| 18 | SANS 1200M | Roads (General) |
| 19 | SANS 1200ME | Subbase |
| 20 | SANS 1200MF | Base |
| 21 | SANS 1200MM | Ancillary Roadworks |



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| | SANS and other applicable International Standards | |
|---|---|---|
| No | Document No | Description / Title |
| 22 | SANS 1200MJ | Segmented Paving |
| 23 | ASTM D 4354 | Standard Practice For Sampling Of Geosynthetics For Testing |
| 24 | ASTM D 4437 | Practice For Determining The Integrity Of Field Seams Used In Joining Flexible Polymeric Sheet Geomembranes |
| 25 | ASTM D 4873 | Standard Guide for Identification, Storage and Handling of Geosynthetic Rolls |
| 26 | ASTM D 5641 | Standard Practice For Geomembrane Seam Evaluation By Vacuum Chamber |
| 27 | ASTM D 5747 | Standard Practice For Tests To Evaluate The Chemical Resistance Of Geomembranes To Liquids |
| 28 | ASTM D 5820 | Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes |
| 29 | ASTM D 6365 | Standard Practice For The Non-Destructive Testing Of Geomembrane Seams Using The Spark Test |
| 30 | GRI Test Method GM14 | Selecting Variable Intervals For Taking Geomembrane Destructive Seam Samples Using The Method Of Attributes. |
| 31 | GRI Test Method GM19 | Seam Strength And Related Properties Of Thermally-Bonded Polyolefin Geomembranes |
| 32 | SANS 1526, Ed 2 – 2015 | Thermoplastics Sheeting For Use As A Geomembrane |
| 33 | SANS 10409 Ed 2 - 2020 | Design, Selection And Installation Of Geomembranes |
| 34 | SANS 10221 – Ed 1.2 – 2007 | Testing Of Geotextiles |
| 35 | GRI Test Method GT12 | Test Method And Properties For Nonwoven Geotextiles Used As Protection (Or Cushioning) Materials |
| 36 | GRI Test Method GT13 | Test Method And Properties For Geotextiles Used As Separation Between Subgrade Soil And Aggregate |
| 37 | GRI GM13 | Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes |
| 38 | SANS/ISO 4427-1:2008 | Plastics Piping Systems - Polyethylene (PE) Pipes And Fittings For Water Supply - Part 1: General |

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| | SANS and other applicable International Standards | |
|---|---|---|
| No | Document No | Description / Title |
| 39 | SANS/ISO 4427-2:2008 | Plastics Piping Systems - Polyethylene (PE) Pipes And Fittings For Water Supply - Part 2: Pipes |
| 40 | SANS/ISO 4427-3:2008 | Plastics Piping Systems - Polyethylene (PE) Pipes And Fittings For Water Supply - Part 3: Fittings |
| 41 | SANS/ISO 4427-5:2008 | Plastics piping systems - Polyethylene (PE) Pipes And Fittings For Water Supply - Part 5: Fitness For Purpose Of The System |
| 42 | ISO 21307: Edition 2 (2011) | Butt Fusion Jointing Procedures For PE Pipes And Fittings Used In The Construction Of Gas And Water Distribution Systems |
| 43 | SANS 10268-10:2009 | Welding Of Thermoplastics - Welding Processes Part 10: Weld Defects |
| 44 | SANS 2001 – DP2:2008 | Construction Works Part 2: Medium Pressure Pipelines |
| 45 | SANS 1217 | The Production Of Painted And Powder Coated Steel Pipes |
| 46 | SANS Method 769 | Cleanliness Of Blast-Cleaned Steel Surfaces For Painting |
| 47 | SANS Method 772 | Profile Of Blast-Cleaned Steel Surfaces For Painting |
| 48 | SANS ISO 2808 | Determination Of Film Thickness |
| 49 | SANS ISO 8501-1 | Preparation Of Steel Substrates Before Application Of Paints And Related Products |
| 50 | BSS EN ISO 12944 | Protective Coating Of Iron And Steel Structures Against Corrosion |
| 51 | SANS ISO 9000 | Model For Quality Assurance In Production And Installation |
| 52 | SANS 1117 | Plastic Wrappings For The Protection Of Steel Pipelines |
| 53 | SANS 10129 | Plastics Tape Wrapping Of Steel Pipelines |
| 54 | SANS ISO 8501-1 | Preparation Of Steel Substrates Before Application Of Paints And Related Products |
| 55 | SANS ISO 1461 | Steel Protection By Hot-Dip Galvanizing |
| 56 | SANS 200 | Copper alloy ingots and casting |
| 57 | SANS 664 | Cast iron gate valves for water works |
| 58 | SANS 1123 | Steel Pipe Flanges |
| 59 | SANS 1128 | Fire Fighting Equipment, Part I: Components Of Underground And Above-Ground Hydrant Systems |



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| | SANS and other applicable International Standards | |
|---|---|---|
| No | Document No | Description / Title |
| 60 | SANS 1551 | Check Valves (Flanged And Wafer Type), Parts 1 And 2 |
| 61 | DWS 1130 | Standard Specification for the manufacture and supply of steel pipes, specials and fittings for duties up to 4.6 MPa design pressure |
| 62 | SANS 62 | Steel pipes and fittings up to 150mm nominal bore |
| 63 | SANS 1700-5-1 | Fasteners Part 5 : General requirements and mechanical properties |
| 64 | SANS 1700-7-1 | Fasteners – Part 7: External drive hexagon bolts and screws – Section 1: Hexagon head bolts – Product grades A and B |
| 65 | SANS 1700-7-3 | Fasteners – Part 7: External drive hexagon bolts and screws – Section 3: Hexagon head bolts - Product grade C |
| 66 | SANS 1700-14-2 | Fasteners – Part 14: Hexagon nuts – Section 2: Hexagon nuts, style 2 – Product grades A and B |
| 67 | SANS 1700-14-3 | Fasteners – Part 14: Hexagon nuts – Section 3: Hexagon nuts, – Product grade C |
| 68 | SANS 1117 | Plastic Wrappings For The Protection Of Steel Pipelines |
| 69 | SANS 1130 | Glass Fibre Reinforcing Material For Pipe Wrapping |
| 70 | SANS 1700-16 | Fasteners – Part 16: Washers |
| 71 | SANS 1217 | Production Of Painted And Powder-Coated Steel Pipes |
| 72 | SANS 1223 | Fibre-Cement Pressure Pipes And Couplings |
| 73 | SANS 2553 | Welded, Brazed And Soldered Joints - Symbolic Representation On Drawings |
| 74 | SANS 15607 | Specification And Qualification Of Welding Procedures For Metallic Materials - General Rules |
| 75 | SANS 9606-1 | Approval Testing Of Welders - Fusion Welding Part 1: Steels |
| 76 | SANS 15609-1 | Specification And Qualification Of Welding Procedures For Metallic Materials - Welding Procedure Specification Part 1: Arc Welding |
| 77 | SANS 15614:1 | Specification And Qualification Of Welding Procedures For Metallic Materials - Welding Procedure Test Part 1: Arc And Gas Welding Of Steels And Arc Welding Of Nickel And Nickel Alloys |
| 78 | SANS 10044-1 | Welding Part 1: Glossary Of Terms |



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| | SANS and other applicable International Standards | |
|---|---|---|
| No | Document No | Description / Title |
| 79 | SANS 719 | Electric Welded Low Carbon Steel Pipes For Aqueous Fluids |
| 80 | BS-CP 2010 | Code Of Practice For Pipelines Design And Construction Of Steel Pipelines In Land |
| 81 | BS 143 | Malleable Cast Iron And Cast Copper Alloy Screwed Pipe Fittings For Steam, Air, Water, Gas And Oil |
| 82 | BS EN 10241:2000 | Wrought Steel Pipe Fittings |
| 83 | BS EN 598 | Cast Iron Flanged Pipes And Flanged Fittings |
| 84 | BS 2633 | Class I Arc Welding Of Ferritic Steel Pipe Work For Carrying Fluids |
| 85 | BS EN 1092 | Flanges And Bolting For Pipes, Valves And Fittings |
| 86 | BS 5500 | Unfired Fusion Welded Pressure Vessels |
| 87 | BS 6076 | Tubular Polyethylene Film For Use As Protective Sleeving For Buried Iron Pipes And Fittings |
| 88 | BS EN 10311 | Specification For Steel Pipes, Joints And Specials For WaterAnd Sewage |
| 89 | BS EN 14161 | Pipelines |
| 90 | SIS 055900 | Standard For Welding Pipelines And Related Facilities (American Petroleum Institue) |
| 91 | TBC | Specifications for Medupi Power Station Northern Ash Disposal Facility Project Area 2 Development |
| 92 | ASTM D6747-15 | Standard Practices for selection of techniques for electrical leak location of leaks in geomembranes |
| 93 | ASTM D7007-16 | Standard Practices for electrical methods for locating leaks in geomembrane covered with water or earthen materials |
| 94 | ASTM D8265-19 | Standard Practices for electrical methods for mapping leaks in installed geomembranes |



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## Table 15 Eskom Project Management and Project Controls Specifications

| Applicable Eskom Specifications | | |
|---|---|---|
| No | Document No | Description / Title |
| 1 | 240-83561037 | Reporting Data Requirements for Contractors |
| 2 | 240-91688868 | Emergency Management Response Instruction |
| 3 | Regulations 16 | Site regulation number 16 for use, conveyance and storage of Radioactive sources |
| 4 | TBA Once registered | Gx Coal Refurbishment Projects Safety, Health and Environmental Specification |
| 7 | TBA Once registered | Environmental Management Plan |
| 9 | 32-365 | Completion of Power Plant Projects, Commissioning, Take-over from Contractors and Hand-over to the Generation Business |
| 10 | 240-76992014 | Project / Plant Specific Technical Documents and Records Management Work Instruction |
| 11 | 240-76992014 | Technical Documents and Records Management Work Instruction |
| 12 | 36-943 | Engineering Drawing Office and Engineering Documentation Standard |
| 13 | 240-53114026 | Eskom Project Engineering Change Procedure |
| 14 | 240-53113685 | Design Review Procedure |
| 15 | 240-44175132 | Eskom PPE Specification |
| 17 | 32-95 | The Reporting and Investigation of Incidents |
| 18 | 240-96953168 | Eskom's Safety Health and Environmental Specification |
| 20 | 240-101861550 | Gx Medupi PS Waste Management Plan |
| 21 | 240-100259162 | Gx Coal Area 1 Environmental Rehabilitation Plan |
| 23 | 240-49230111 | Eskom HAZOP Guideline |
| 24 | 240-49230046 | Eskom FMEA Guideline |
| 25 | 32-1034 | Application of the Broad Based Black Economic Empowerment Codes of Good Practice within Eskom |

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## Civil engineering and structural works

### SANS Specifications

The latest revisions of the SANS codes of practice and standardized specifications at the time of contract shall apply to this contract, copies not provided by the Employer.

### SPECIFICATIONS - SANS 1200 (applicable codes only as per the table below)

| SANS 1200 TITLE | NUMBER | REV | DATE |
|---|---|---|---|
| GENERAL | A | 3 | 30-07-2002 |
| SITE CLEARANCE | C | 1A | 01-08-1982 |
| EARTHWORKS | D | 3 | 30-07-2002 |
| EARTHWORKS (SMALL WORKS) | DA | | |
| EARTHWORKS (Pipe trenches) | DB | 3 | 30-07-2002 |
| SMALL EARTH DAMS | DE | | |
| CONCRETE (STRUCTURAL) | DG | | |
| GABIONS & PITCHING | DK | | |
| EARTHWORKS (Roads, Subgrade) | DM | | |
| CONCRETE (STRUCTURAL) | G | | |
| CONCRETE (SMALL WORKS) | GA | 2 | 30-07-2002 |
| STRUCTURAL STEELWORK | H | | |
| MEDIUM PRESSURE PIPELINES | L | | |
| BEDDING (Pipes) | LB | 2 | 30-07-2002 |
| STORMWATER DRAINAGE | LE | | |



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| | | | |
|---|---|---|---|
| PIPE JACKING | LG | | |
| ROADS (General) | M | | |
| SUBBASE | ME | | |
| BASE | MF | | |
| ANCILLARY ROADWORKS | MM | | |
| SEGMENTED PAVING | MJ | | |

All references to Standard Specifications are to the latest amendment to such specifications.

A SABS 1200 series specification or other standard not listed above and referred to in the Bill of Quantities and Pricing Data, a SABS 1200 series specification and/or the Drawings shall by such reference be deemed to form part of the contract documentation.

## Changes to SANS Specifications

This section is to be read in conjunction with the SANS 1200 Standardised Specifications for Civil Engineering Construction. Should any requirements of this section conflict with any requirements of the standardised or specifications, the requirements of the contract shall prevail.

In certain clauses the standard, standardized and 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 2 PLANT (Clause 4)

### PSA 2.1 Add the following clause:

"4.3 **Contractor's Constructional Plant**

If during the Contract, the Supervisor considers that any item or items of constructional plant are in any way inefficient or inadequate to complete the works within the contract period, or do not meet the required safety standards, he shall have the right to call on the Contractor to either:



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Put the constructional plant in order, or

Remove such constructional plant and replace it with other efficient and/or safe plant, or

Provide additional similar plant or plant of greater capacity.

The Employer shall have the right to stop all or part of the works where construction plant not complying with required safety standards is being used until such time as the plant has been made safe or replaced with approved plant.

No additional payment will be made to the Contractor for expenses incurred in complying with any or all of the above."

## PSA 2.2 Laboratory Facilities (Clause 7.2)

The following sub-clause shall be added to this clause:

Should the Contractor provide a laboratory on site the following shall apply.

The Contractor shall provide a laboratory with sufficient suitable equipment to carry out all routine tests required by the specifications and for carrying out any other tests which he may deem necessary for the proper quality control of the works.

Where specialised equipment for carrying out the tests referred to above is required, the Contractor may plan for carrying out the tests with a commercial laboratory approved by the Supervisor.

The Contractor's laboratory shall be staffed by experienced technicians conversant with the methods to be used for carrying out the routine tests.

If in the opinion of the Supervisor, the Contractor's laboratory is inadequately equipped or the standard of expertise of the technicians is unsatisfactory, then the Supervisor shall have the right to order the Contractor to cease work until such time as the Supervisor is satisfied that these deficiencies have been rectified. The cost resulting from such stoppage shall be to the Contractor's account.

The laboratory and equipment shall be made available to the Supervisor for the purpose of carrying out check tests on materials and construction. The costs attendant on making the laboratory facilities available to the Supervisor shall be included in the Contractor's tendered prices.

## PSA 2.3 Add the following clause:

### "4.4 Facilities for The Engineer

The sub-contractor will liaise with an engineer will work .

## PSA 3 CONSTRUCTION



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## PSA 3.1 Watching, Barricading, Lighting and Traffic Crossings (Clause 5.2)

Further to the provisions of this clause, every excavation which is accessible to the public, including other Contractor's or the Employer's personnel, or which is adjacent to public roads or thoroughfares, or whereby the safety of persons may be endangered shall be:

protected by a hard barrier, as directed by the Supervisor; or fence consisting of not less than two ropes, or wires, stretched at heights of 600 mm and 1 200 mm between poles or standards, of strength adequate to safely contain pedestrians and as close to the excavation as practicable; and to comply with OHS act and the Construction Regulations.

The Contractor shall, where necessary, so arrange his work that flow of the Employer's vehicular and pedestrian traffic can be always maintained.

## PSA 3.2 Protection of Overhead and Underground Services (Clause 5.4)

Further to the provisions of this sub-clause, the Contractor shall before commencing work, arrange with the Supervisor or the Employer to point out any underground or overhead services which may be affected by construction activities. Where necessary the Contractor shall excavate trenches by hand under direction of the Supervisor or Employer to establish the exact location of services. The Contractor shall be solely responsible throughout the contract period for the safety and protection of services. Repair of known services damaged by the Contractor shall be to his account. Any deviation of services affected by construction, whether carried out by the Contractor or other authority will be paid for by the Employer.

## PSA 3.3 Dealing with water (Clause 5.5)

The Contractor shall be responsible for handling all surface and sub-surface water in such a way that construction can proceed with minimum of cost and at no time shall normal drainage flows be blocked. The Contractor shall also take particular care to ensure the safety of the works against damage by flooding. An item has been included in the bill of quantities for dewatering of the works.

## PSA 3.4 Pollution (Clause 5.6)

The Contractor shall provide adequate containers with lids for the disposal of refuse. Containers shall be provided at the site office. The Contractor’s refuse is their own responsibility and is to be removed from site at the Contractor’s cost. Construction waste shall be collected and spoiled by the Contractor at locations approved by the Supervisor.

## PSA 3.5 Safety (Clause 5.7)



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If the work in connection with the contract is to be done on property subject to the OCCUPATIONAL HEALTH AND SAFETY ACT No. 85 OF 1993, the Contractor shall nominate a competent person (within the meaning of the Regulations under the OHS Act) who shall be appointed in writing by the Contractor as subordinate manager to assist in the control, management and direction of the works in terms of the provisions of the said Regulations. This appointment shall remain in force until practical completion of the works has been effected.

All equipment, constructional plant, temporary works and materials used by the Contractor and the work carried out by the Contractor's personnel are always subject to the safety regulations of the Employer and thereby also subject to the inspection and acceptance by their officials. Cost for transport to and treatment at a hospital will be to the Contractor's account.

## PSC SITE CLEARANCE

### PSC 1 DISPOSAL OF MATERIAL (Clause 3.1)

Material resulting from clearing site and surplus excavated material shall be removed to or stockpiled at a designated area. Under no circumstances will the burning of combustible material be permitted.

### PSC 2 CONSERVATION OF TOPSOIL (Clause 5.6)

Where overburden or material resulting from site clearance is acceptable for use as topsoil, it shall be stockpiled as indicated on the drawings. The height of the topsoil stockpile will be limited to 2.0m high.

## PSD EARTHWORKS

This section references to SANS 1200 Part D Earthworks.

### PSD 1 CONSTRUCTION

### PSD 1.1 Earth Embankments

Areas where fill is to be placed are to be ripped and recompacted to 95% Mod. AASHTO at a moisture content of between -2% and +2% of optimum moisture content. Cut and fill construction of earth embankment layers shall be to the lines and grades established on the drawings, or as modified in the field by the Engineer. The fill layers shall be constructed in layers not exceeding 200mm after being compacted. The fill shall be compacted to 95% Mod. AASHTO at a moisture content of between -2% and +2% of optimum moisture content. The compacted surface of any layer is to be scarified and wetted before any new layer is placed, if said layer is too dry or smooth to bond with the subsequent lift.

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## PSD 2 CLASSIFICATION FOR EXCAVATION PURPOSES (Clause 3.1)

The provisions of sub-clauses 3.1.2(b), 3.1.2(d) and 3.1.2(e) shall not be applicable to this contract. Classification of material for excavation purposes shall be either "soft" or "hard rock". Hard rock excavation shall be as defined in sub-clause 3.2.1(c) with the addition that boulders or rocks with at least a dimension of 0.3m will be classed as hard rock excavation. Soft excavation shall be excavation in all materials other than rock excavation. Blasting will not be permitted unless permission is given in writing by the Supervisor.

## PSD 3 MATERIAL SUITABLE FOR BACKFILL (Sub-clause 3.2.3)

In general, material from excavation elsewhere than in rock and topsoil, or indicated by the Engineer, will be suitable for backfill. When backfilling, material shall be returned to the excavation in the reverse order to which it was excavated.

## PSD 4 SPECIFICATION FOR FILL

### PSD 4.1 Scope

This specification covers the minimum requirements of the compaction and testing of fill.

### PSD 4.2 Supervision

The construction of fill shall always be under the supervision of a responsible person, approved by the Engineer, with adequate knowledge of the compaction of earthworks.

### PSD 4.3 Records and approval

No material shall be placed on a previous layer before such layer has been approved by the Supervisor. The Contractor shall submit to the Supervisor a duplicate copy of all tests results. One copy shall be kept by the Supervisor and one copy, duly signed and approved, if acceptable, shall be returned to the Contractor who shall keep the same as a record. No material shall be placed in excavations before the excavation has been approved by the Supervisor.

## PSD 5 PRECAUTIONS (Clause 5.1)

### PSD 5.1 Explosives (Sub-clause 5.1.1.3)

The use of explosives will not be permitted unless expressly agreed to by the Supervisor.

### PSD 5.2 Existing Services (Sub-clause 5.1.2)



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The Contractor shall not commence any excavation until given permission to do so by the Employer or Supervisor in writing and the existence and location of services has been checked by exploratory trenching or other approved means.

**(Refer PSA 3.2)**

### PSD 5.3 Detection, location and exposure (Sub-clause 5.1.2.2)

Notwithstanding the definition provided, it is the contractor's responsibility to hire a specialist/equipment to detect underground services not specified on any drawings. This will include detection of services e.g. underground power cables, communication, other underground pipelines and other service that must be avoided during the construction phase. With the detection of these services, the contractor needs to issue the following:

Drawing indicating route "travelled" and all the located services. A list of all the located services completes with a coordinate list.Peg out on site.

### PSD 5.4 Excavated Material not to be a Hazard (Sub-clause 5.1.4.3)

Material excavated shall be placed in the area designated by the Supervisor. The material shall be spread evenly over the area as the work proceeds in such a manner that its surface remains free draining. Any dumping which occurs outside the designated area will be removed to the proper area at the Contractor's cost. Material suitable for backfilling where required shall be stockpiled separately for later re-use.

### PSD 6 EXCAVATION (Sub-clause 5.2.2)

Where concrete is to be cast against the excavation face, the face shall be trimmed such that there are no projections into the excavation profile which will result in a reduction to the specified concrete cover to reinforcement.

No overbreak occurring outside the limits of the specified lateral working space or below the specified profile on the bottom of rock excavation nor re-instatement of such overbreak will be measured for payment.

### PSD 6.1 Final Grading (Sub-clause 5.2.4.1)

Add the following:

"All earthworks shall be trimmed to the lines and levels shown on the Drawings or directed by the Engineer. The quality of finish for all slopes flatter than 1:3 shall be that normally attainable with a motor grader operated by an experienced operator. Slopes steeper than 1:3 shall be shaped and finished to a uniform grade and appearance, the quality of finish being that normally attainable by mechanical shovel operations attainable by a blade fitted to a mechanical shovel bucket".

### PSD 7 COMPACTED CLAY LINER



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## PSD 7.1 Clay Material

Sand (Hillwash) blended with Bentonite.The compacted liner shall consist of site sand (Hillwash) blended with 5% bentonite by mass and be constructed to the lines and the grades shown on the drawings.The ash facility and PCD soil bentonite liner shall be 2 x 150 mm thick layers in the primary composite liner. The layers shall be compacted to a density of 98 % of maximum dry density according to the Standard Proctor density test with a moisture content of between 0% and +2% of optimum moisture content.

**See PARTICULAR SPECIFICATION F for the soil/bentonite specification (PF).**

## PSD 7.2 Clay Material Tolerance (Clause 6.1)

POSITION, DIMENSIONS, LEVELS, ETC

Add the following sub-clauses:

(c) (1) Final excavated and backfilled surfaces for canal inverts, berms, crests etc. Permissible deviations from design on position (X, Y) will be 100 mm. Permissible deviation for Z will be -0 to +50 mm (Refer also PSD-5.2.4.1)

(2) Trimming and preparation of final slopes to specification. Permissible deviations from design will be 50 mm (Refer also PSD-5.2.4.1)

## PSD 8 TESTING

## PSD 8.1 Taking and Testing of Samples (Clause 7.2)

Density control shall be either by the sand replacement method or by an approved nuclear density meter. The use of the nuclear density meter will be subject to the following provisions:

1. The tests will not be valid if performed within 1 m of concrete structures or in material containing rocks in excess of 50 mm nominal size.

2. For each 10 nuclear density meter tests carried out on the embankments, a minimum of 1 corresponding sand replacement test shall be performed.

3. For each 10 nuclear density meter tests carried out on the clay layers, a minimum of 2 corresponding sand replacement tests shall be performed.

4. The accuracy of any nuclear density meter shall be proved by performing at least five comparative nuclear density and sand replacement tests on each type of soil used in the embankment and clay liner before the results of the nuclear density meter will be accepted as valid. Thereafter the correlation between the nuclear density meter and sand replacement tests shall be reviewed on a fortnightly basis.

5. Each nuclear density meter shall be required to have a certificate provided by the supplier of the machine stating that the machine is in good working order. Each density meter shall



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be re-calibrated by the supplier at least twice a year. Certificates of proof of re-calibration will be required.

In the event of disagreement on the quality of compaction, results of sand replacement tests shall be accepted in preference to nuclear density meter test results. The minimum testing frequency on field density and optimum moisture content (OMC) that will be required from the Contractor shall be one test per 300 cubic meter or part thereof with a minimum of 4 tests per production lot.

A production lot shall be taken to mean a portion of fill in a particular zone of the embankment placed and compacted in one process, using material from a single zone in the excavation. If production continues uninterrupted, a production lot will usually be taken as the product of one day's work and shall not exceed two days production. A production lot of reduced quantity will be assumed, if: The fill material being used shows abnormal variation in quality, an area is obviously of lesser quality than the rest, A very high production rate is maintained.

Density tests shall be carried out within twenty-four (24) hours of completion of compaction on the layer concerned. The results thereof shall be submitted to the Supervisor without delay, in any case not later than 24 hours after these become available.

**For control testing the following procedure will be followed for each production lot:**

a) Sample material at the centre of each of the four quadrants of the production lot area;

b) Carry out Proctor Maximum Dry Density or Modified AASHTO Maximum Dry Density and Optimum Moisture Content tests as well as in-situ moisture content tests on all four samples and obtain average values for Proctor M.D.D. or MOD AASHTO M.D.D. and O.M.C.;

c) Adjust field moisture of material to the required range (based on average in-situ moisture content and average O.M.C.);

d) Compact and carry out eight in-situ density and in-situ moisture content tests;

e) Obtain average in-situ density and average in-situ moisture content;

f) Production lot passes if the average in-situ density is 98% of average Proctor M.D.D. and moisture content is between +1% and +3% of average O.M.C for clay liners; or

Production lot passes if the average in-situ density is 90% - 95% of average Modified AASHTO M.D.D. (MOD AASHTO) and moisture content is between -2% and +2% of average O.M.C for fill layers as stated in table below; or

Production lot passes if the average in-situ density is 95% of average Proctor M.D.D. and moisture content is between -4% and 0% of average O.M.C for cement stabilized liners.

g) If production lot does not conform to the above criteria re-compact or adjust moisture content and re-compact until the above criteria are met.

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**The acceptance criteria for density test results for fill and in-situ compaction shall be as follows:**

| Specified Density % of STD | Minimum Average Density for Number of Tests | | | | | | Minimum Value of any Single Test in a lot of: | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 4 | 5 | 6 | 7 | 8 | 9+ | 4 | 5 | 6 | 7 | 8 | 9+ |
| 90 | 90.1 | 90.4 | 90.6 | 90.7 | 90.9 | 91.0 | 86.4 | 86.2 | 86.0 | 85.9 | 85.8 | 85.7 |
| 93 | 93.1 | 93.4 | 93.6 | 93.7 | 93.9 | 94.0 | 89.4 | 89.2 | 89.0 | 88.9 | 88.8 | 88.7 |
| 95 | 95.1 | 95.4 | 95.6 | 95.7 | 95.9 | 96.0 | 91.4 | 91.2 | 91.0 | 90.9 | 90.8 | 90.7 |
| 98 | 98.1 | 98.4 | 98.6 | 98.7 | 98.9 | 99.0 | 94.4 | 94.2 | 94.0 | 93.9 | 93.8 | 93.7 |

A minimum of one Maximum Dry Density test, either modified AASHTO or Proctor as the case may be, per two production lots shall be carried out provided the material is obtained from one source and is uniform. The Supervisor may instruct that more tests be carried out if the material varies in quality.

Density and moisture quality test results on the final surface of the Sand (Hillwash) layers blended with Bentonite will only be valid for 48 hours for covering with geomembrane before new tests will be required to confirm that the layers are still within specification.

The minimum testing frequency on field density and OMC that will be required from the Contractor shall be in intervals of one test every 50m of pipeline installed and done on each of the three compaction layers e.g. the bedding, cradle and blanket layers.

The Engineer may order testing at smaller intervals, as mentioned above, if:

the fill material being used shows abnormal variation in quality

an area of fill material is obviously of less quality than the rest

## PSD 9 TRANSPORT FOR EARTHWORKS (Sub-clause 5.2.5)

### PSD 9.1 This sub-clause shall be replaced by the following:

**"5.2.5.1 Free haul**



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All transport of material obtained from designated borrow pits or essential excavations as shown on the drawing for use in construction of the works or that must be disposed of as spoil shall be subject to a free haul to the Contractor's stockpile.

**"5.2.5.2 Overhaul**

Haulage of excavated material more than free haul will be regarded as overhaul. The overhaul distance shall be the haul distance along the shortest practicable route from the place of excavation to the place of off-loading less free haul distance. The Contractor shall not incur overhaul expenses except were authorised in writing."

**PSD 9.2 Scheduled Items**

**Sub-clause 8.3.1.2**

Remove topsoil to nominal depth of 150mm (or other stated depth) stockpile and maintain…… Unit: m2 or m3

**Add the following:**

"Should the unit be m3, the volume will be computed as specified in Clause 8.2.2 the depth shall be the depth ordered by the Engineer to be stripped and the last paragraph of 8.3.1.2 shall not apply."

Add the following:

**Sub-clause 8.3.2 (c)**

Extra over (item indicated) above for dozing of material to temporary stockpile outside the restricted area under power lines **Unit: m3**

The rate shall cover the additional cost of the operations enumerated in 8.2.3(a) above for dozing of material from restricted areas under power lines to a temporary stockpile before loading and transporting to designated areas."

**Sub-clause 8.3.3 (a)**

**Restricted excavation Unit: m3**

Add the following:

"The rate for the excavation of gabions and rip-rap shall include the use of hand excavation to ensure that excavation dimensions are exact and that no backfilling is required around gabions / rip-rap."

**Sub-clause 8.3.6 - Overhaul - shall be replaced by the following:**

**"Overhaul" Unit: $m^3km$**



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This item shall only be applicable where the overhaul has been authorised in writing. Volumes will be calculated as specified in 8.2.1 and 8.2.2. No allowance will be made for bulking, regardless of the means of transport used; overhaul will be measured from the end of the specified free haul to the nearest 0,1 km in one direction only by the shortest practical route to the place of off-loading.

**Sub-clause 8.3.8.1 Location**

Add the following:

**"d) Detection of particular services (refer to PSD-5.1.2.2) Unit: Provisional Sum**

The Rate shall include for the supply, hiring and use of specialised equipment for the detection of all existing services and submitting details to the Engineer as specified in PSD-5.1.2.2 including any possible hand excavation to expose these services. The rate shall cover the cost of delays and disruption of the progress of the work caused by the search for the particular service, in addition to the cost of searching for it."

**Sub-clause 8.3.14 Reinstate borrow areas**

**"Reinstate borrow areas (describe method) Unit: m3**

The unit of measurement shall be the volume of overburden excavated from the borrow pit prior to borrowing material which is again spread across the borrow pit to rehabilitate it.

The rate shall cover the cost of loading overburden at the temporary stockpile, placing and spreading material evenly over the floor, sides or backfilled quarry / borrow pit area to ensure free drainage, when borrowing is complete."

The contractor shall before he commences with rehabilitating the borrow pit, submit his design of the proposed reinstatement to the Engineer for approval.

A separate item is scheduled and measured under SABS 1200 D to cover the cost of additional excavation required (over and above normal shaping) to ensure free drainage as indicated and approved by the Engineer on the proposed reinstatement.

## PSDE SMALL EARTH DAMS

References in this section are to SABS 1200 Part DE Small earth dams (1984)

## PSDE 1 SCOPE

Add following:

This specification does not only cover the construction of small earth dams but also the construction of embankments, berms with their associated elements (i.e. anchor trenches) and ramps.

## PSDE 8 MEASUREMENT AND PAYMENT

## PSDE 8.3 Scheduled Items



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### PSDE 8.3.3 Material unsuitable for Embankments

Replace “spoil dumps in the dam basin” with “stockpile areas outside ADF footprint”.

### PSDE 8.3.5 Forming Embankment

Additional sub-items may be added to suit the material specified. These items will be numbered the same in each process and sub-process block, commencing with i), j), k), .etc.

**i) Site selected sand** **Unit: m3**

The rate shall cover the cost of selecting material from stockpile, haulage, spreading, adding water or drying, processing, compacting and final grading into the relevant area.

**j) G7 material from screening** **Unit: m3**

The rate shall cover the cost of selecting material from stockpile obtained by crushing and screening, haulage, spreading, adding water or drying, processing, compacting and final grading into the relevant area.

**k) G7 material from commercial source** **Unit: m3**

The rate shall cover the cost of selecting material from stockpile obtained from commercial source, haulage, spreading, adding water or drying, processing, compacting and final grading into the relevant area.

**l) Clean stone** **Unit: m3**

The rate shall cover the cost of selecting material from stockpile obtained from commercial source, haulage, spreading, adding water or drying, processing, compacting and final grading into the relevant area.

**m) 5% bentonite enhanced soil by mass (site sand) from stockpile** **Unit: m3**

The rate shall cover the cost of selecting material from stockpile, haulage, adding bentonite to given application rate and processing as per section PF, compacting and final grading into the relevant area. The cost of the supply of bentonite is covered under PF8.

**n) (Percentage %) cement stabilised screened site sand by mass from stockpile** **Unit: m3**

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The rate shall cover the cost of selecting material from the screened stockpile, haulage, adding cement to given application rate and processing, compacting and final grading into the relevant area including all quality control tests required. The cost of the supply of cement is covered under SABS 1200 ME payment reference 8.3.8.

**o) Screened site sand** **Unit: m3**

The rate shall cover the cost of selecting material from the screened stockpile, haulage, spreading, adding water or drying, processing, compacting and final grading into the relevant area.

**p) Screened coarse ash** **Unit: m3**

The rate shall cover the cost of collecting the material at the units in the power station, transporting it to the top of the ash dump, screening it to remove all particles larger than 5mm, haulage to the footprint under construction, spreading, adding water or drying, processing, compacting and final grading into the relevant area.

## PSG CONCRETE (Structural)

### PSG 1 SUB-CLAUSE 3.2.1

Cement shall conform to SANS 50197-1 or EN 197-1 and have a Strength Class of 42.5. Cement extenders shall conform to SANS 1491: parts 1, 2 and 3.

The following cement extenders are allowed but limited as follows:

Fly Ash: 30% maximum. Including

Ground Granulated Blast furnace Slag: 50% maximum

The following cement types are acceptable

Cem I 42,5 – Portland Cement (If available)

Cem II 42,5/A-S, B-S, A-V, B-V or A-M – Blended Cements.

### PSG 2 SUB-CLAUSE 3.2.3 STORAGE OF CEMENT (Add)

Cement shall not be kept in storage for longer than three months without the Engineer's permission.

### PSG 3 SUB-CLAUSE 3.4

The maximum size of the coarse aggregate shall be 20mm unless otherwise indicated on the drawings.



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The parent rock from which the coarse aggregate and crusher sand is derived from shall be approved by the Project Manager.

Sub-Clause 3.4.3 Storage of Aggregates

Modify clause to include:

contamination by chemicals spilled on the ground or which may settle out of the atmosphere is prevented. The storage areas are well drained to prevent the accumulation of water.

## PSG 4 SUB-CLAUSE 3.5.1

Admixtures will not be permitted without written approval from the Project Manager.

## PSG 5 SUB-CLAUSE 3.5.2

Air entraining agent will not be permitted without written approval from the Project Manager.

## PSG 6 SUB-CLAUSE 3.6

Mild steel: Type A.

High tensile reinforcement shall be type C or D class 2, grade 1. Contractor to confirm suitability of all reinforcing supplied

## PSG 7 SUB-CLAUSE 3.9 SEALANTS (Additional Clause)

Where polysulphide sealants are specified, these shall be two-part polysulphides complying with the requirements of SANS 110:2011

PSG 8 SUB-CLAUSE 5.1.1 BENDING

Clause 5.1.1.3

Replace clause with: “Bars may not be bent hot”.

Clause 5.1.1.4

Delete sub-clause (no longer applicable)

PSG 9 SUB-CLAUSE 5.1.2

Welding shall not be permitted, unless approved by the Project Manager in writing, beforehand.

## PSG 10 SUB-CLAUSE 5.1.3 COVER

No metal supports, spacers or wire ties used for holding reinforcement in position shall be in contact with formwork nor shall it have less cover to outside concrete faces than is specified for the steel reinforcement. Exposure conditions shall be assumed as severe.

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The minimum cover over the reinforcement of concrete in foundations and other structural members where the concrete is cast directly against the ground shall be 75 mm. If after the removal of the formwork, concrete surfaces are to be in contact with the ground, the cover to reinforcement shall not be less than 50 mm, irrespective of the class of concrete. Structures that require fire protection shall have a cover over reinforcement of at least 50 mm.

**PSG 11 SUB-CLAUSE 5.1.4 Splicing**

Modify clause to include: “Mechanical reinforcement couplers may only be used with prior approval from the Project Manager”

**PSG 12 SUB-CLAUSE 5.1.6 Handling (new clause)**

Each bundle of reinforcement bars, straight or bent, shall be metal tagged to identify the drawing number, the structure, mark number, bar size and quantity.

**PSG 13 SUB-CLAUSE 5.1.7 Corrosion protection (new clause)**

The reinforcement in structures containing chloride salts shall be corrosion protected by galvanizing or epoxy coating.

Protection of reinforcement in other corrosive environments shall be approved by the Project Manager.

**PSG 14 SUB-CLAUSE 5.1.8 Corrosion protection (new clause)**

The reinforcement in structures containing chloride salts shall be corrosion protected by galvanizing or epoxy coating.

Protection of reinforcement in other corrosive environments shall be approved by the Project Manager.

**PSG 15 SUB-CLAUSE 5.2.1**

20 x 20 mm rebates or fillets are to be provided at all corners of concrete work unless stated otherwise on the drawings.

**PSG 16 SUB-CLAUSE 5.2.5.6 CONSTRUCTION LOADS (Additional Sub-clause)**

The Contractor shall not impose any construction loads which over-stress the ground slabs, slabs or beams, allowing for the age of the concrete at the time of loading and the design loads as shown on the drawings. Where necessary, propping shall be carried through more than one floor with the props placed vertically above each other through the required floors.

**PSG 17 SUB-CLAUSES 5.5.1.5**

The minimum cement content and maximum water/cement ratio (by mass) shall be:

300 kg/m3 and 0.66 for un-reinforced concrete;



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375 kg/m3 and 0.55 for reinforced concrete;

400 kg/m3 and 0.5 for pre-stressed concrete and for concrete of strength greater than or equal to Grade 40 MPa.

Concrete that has an air-dry density in the range 2 000 kg/m3 to 2 600 kg/m3 shall contain entrained air and conform to the air-content limits given in the table below, as determined in accordance with SANS 6252

| Nominal maximum size of coarse aggregate mm | Total air content as a volume fraction % |
|---|---|
| 9.5 | 6 to 10 |
| 13.2 | 5 to 9 |
| 19 | 4 to 8 |
| 37.5 | 3 to 6 |

Where required in terms of the specification data, concrete made to have an air-dry density that does not exceed 2 000 kg/m3 shall contain 6 % ± 2 % total air when the nominal maximum size

of aggregate exceeds 9,5 mm, or 7 % ± 2 % total air when the nominal maximum size is 9,5 mm or less. Proportions shall be so selected that a characteristic strength of 20 MPa or more is attained

## PSG 13 STRENGTH CONCRETE (Additional)

The requirements for the various grades of concrete specified on the drawings are listed below:

| Concrete Grade | Specified Concrete Strength MPa | Maximum Nominal Size Coarse Aggregate mm |
|---|---|---|
| 15/19 | 15 | 19 |
| 35/19 | 35 | 19 |

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## PSG 14 APPROVAL OF STRENGTH MIXES (Additional Sub-clause)

Not less than two weeks before the start of any concrete work on the site, the Contractor shall submit to the Supervisor, for his information and subject to his approval, a statement of mix proportions. This statement shall provide the following information:

**For each class of concrete:**

Mix proportions and types,

Slump,

Target strength,

Aggregate type,

Admixtures,

Cement/ Binder Type

W/C ratio

**For all concrete:**

Method to be adopted for adjusting the amount of water added, to compensate for variation in moisture content of the aggregate. The statement shall be accompanied by evidence in the form of either a statement from an approved laboratory of the results of trial mixes, or an authoritative report previous use and experience, establishing that concrete made with the materials in the proportions proposed will have the properties specified.

## PSG 15 SUB-CLAUSES 5.5.3.2 TESTING

Test results obtained by a ready-mix production facility as part of its quality control system will not be acceptable for evaluation in terms of 7.3. All concrete shall be sampled at the point of placing and test cubes made in accordance with the relevant methods.

Samples are to be obtained across various trucks to obtain a representative sample spread for the cast. Slump cone tests are to be conducted at the point of placing for each batch and are to be within +/ 15 mm of the mix design target.

## PSG 16 SUB-CLAUSES 5.5.5.1

Concrete may not be placed before the Supervisor's approval has been given in writing and a minimum written notice of 24 hours prior to pouring is required for each part of the structure.

## PSG 17 SUB-CLAUSES 5.5.7

All kickers are to be cast monolithically with the base element. All joints are to be scabbled to remove laitance to expose stone aggregate. Proprietary bonding compounds between old



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and new concrete may be used provided they are applied in accordance with the manufacturer's instructions and approved by the Project Manager.

## PSG 18 SUB-CLAUSES 5.5.8

The method of curing and protection shall be to the Supervisor’s approval.

## PSG 19 SUB-CLAUSES 5.5.9.4

**Blast furnace slag in cold temperatures (new sub-clause):**

When the ambient air temperature falls below 10°C, the Contractor shall immediately advise the Project Manager of the event and replace any blast furnace slag in the concrete mix with ordinary cement in any concrete being batched.

## PSG 20 SUB-CLAUSES 5.5.10

Unless otherwise noted all exposed unformed surfaces are to have a wood-float finish.

## PSG 21 SUB-CLAUSES 5.5.13

Unless otherwise specified, the compressive strength of 50mm mortar cubes of grout shall not be less than 30 MPa at 7 days and 40 MPa at 28 days. Grout shall be completely free of calcium chloride. It shall be used in the semi-dry state, where the water/cement ratio does not exceed 0,4. Where the space to be filled is inaccessible and/or were directed by the Supervisor non-shrink liquid grout shall be used. All approved proprietary grouts shall be used in accordance with the manufacturers or Supervisor’s instructions. Unless specifically noted the grout shall not extend above the underside the base plate. Heat resistant grout shall be used where so directed on drawings.

## PSG 22 SUB-CLAUSE 6.2.3(h) TOLERANCES ON THE POSITIONING OF CAST-IN ITEMS

The permissible deviation of any bolt or bolt sleeve in a related group of bolts relative to any other bolt in the group shall be ± 2,0 mm.

The permissible deviation of any bolt or bolt sleeve from its designated location in plan shall be ± 4mm.The permissible deviation of any bolt from its designated location in elevation shall be ± 10mm.The permissible deviation of other cast-in items from their designated locations shall be ± 10mm, save that where the designated location is a concrete face and the item is to be cast flush with the face it shall be cast within 2mm of the face.

## PSG 23 SUB-CLAUSE 7.3



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Where more than three valid test results for a particular grade of concrete become available the average strength of all the available results for the grade shall not be less than the required average strength given below. If the average strength is less than that given below the mix design shall be adjusted to ensure compliance with the required average strength.

**(Refer to clause 14.3.3 of SANS 0100 - 2)**

| No. of Sets (of three test cubes) | Required Average Strength |
|---|---|
| 4 | Specified strength + 3,0 MPa |
| 5 | Specified strength + 4,5 MPa |
| 6 | Specified strength + 5,0 MPa |
| 10 | Specified strength + 6,0 MPa |
| 20 | Specified strength + 7,0 MPa |
| 30 or more | Specified strength + 8,0 MPa |

**MEASUREMENT AND PAYMENT**

**PSG 24 SUB-CLAUSE 8.1.2 Reinforcement**

**Sub-clause 8.1.2, Reinforcement, shall be deleted and replaced with the following:**

Steel bar reinforcement shall be measured by the metric ton (or kg for small quantities) calculated from the cutting lengths shown on the drawings and using the tabulated mass per linear metre for the nominal diameter of the bar.

| Bar Diameter [mm] | Mass per linear metre [kg] |
|---|---|
| 6 | 0,222 |
| 8 | 0,395 |
| 10 | 0,616 |
| 12 | 0,888 |
| 16 | 1,579 |
| 20 | 2,466 |
| 25 | 3,854 |
| 32 | 6,313 |



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Welded steel mesh shall be measured in metric tons based on the nominal mass per square metre or in nett square metres for each mesh reference. Allowance to be made for laps.

Payment shall include for the supply of all material, labour and plant for fixing the reinforcement in position and shall include for cutting, bending, rolling margin, waste, cover blocks, wire ties and in the case of welded mesh for all waste due to laps and for maintaining the reinforcement in the position shown on the drawings during concreting. If the mass of steel bar reinforcement used for approved chairs (excluding those listed in the bending schedule) exceeds 1% of the total mass of reinforcement fixed, the excess will be paid for at the appropriate rates in the Bill of Quantities.

Payment shall distinguish between mild steel and high tensile steel bar reinforcement and shall where so itemised in the schedules further distinguish between bars of different diameter.

## PSH STRUCTURAL STEEL

### PSH 1 SUB-CLAUSE 3.1 Structural Steel

Unless noted otherwise, all steelwork shall be Grade S355JR.

### PSH 2 SUB-CLAUSE 3.3 Steel used for cold-formed sections

Cold-rolled hollow steel section profiles shall conform to the design requirements of SANS 10162-2. The manufacturer shall supply sufficient test certificates to establish that the minimum yield strength of cold formed sections after forming is greater than 230 MPa.

### PSH 3 SUB-CLAUSE 5.1 Fabrication

### PSH 4 SUB-CLAUSE 5.1.2 Contractor Provides Shop Details

The Contractor shall prepare all shop drawings including marking plans. He shall provide material lists for all the work indicating part number, detailed drawing number and arrangement drawing number. Two prints of all shop drawings (including marking plans) must be submitted for approval, in principle only, by the Supervisor. The design drawings will be issued to the Contractor on commencement of the project.

### PSH 5 SUB-CLAUSE 5.2 Fabrication

### PSH 6 SUB-CLAUSE 5.2.3 Cutting

Where it is necessary to flame cut plates, edges of plates shall be ground smooth.



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### PSH 7 SUB-CLAUSE 5.2.4 Holes for Fasteners

Flame cutting of holes will in general not be permitted. Where permission is given in writing, the hole shall be burnt to a diameter at least 5mm smaller than the required diameter and then reamed to the correct size.

### PSH 8 SUB-CLAUSE 5.2.6 Structural Hollow Sections

All structural hollow sections shall be sealed against the ingress of moisture. All holes through structural hollow sections shall be fitted with spacer sleeves welded into position. The minimum wall thickness of the sleeve shall be 2mm.

### PSH 7 SUB-CLAUSE 5.3Assembly

Shop connections shall be welded wherever possible.

### PSH 8 SUB-CLAUSE 5.3.4 Welding

Welders must have proof of passing the appropriate tests in SABS 10044.

The following documents shall be available for inspection by the Project Manager:

a) Welding procedure specifications.

b) Welder and welding operator qualification tests.

c) Welding release certificate.

d) Records of stress relieving of welds, when stress relieving is specified.

e) Radiographs when radio graphing is specified.

f) Eskom welding specification

### PSH 9 SUB-CLAUSE 5.3.8 Marking

Steelwork shall be marked with the item number, general arrangement drawing number and order number by both hard stamping (10 mm letter size) and by means of waterproof paint. The hard stamping shall be ringed with white paint.

Marking must be done in such a way as to not damage the steelwork.

Computer program generated numbers can be used for marking.

Elements to be hot-dipped galvanized shall be marked by hard stamping or welded lettering.

Water-based paint or an appropriate marking pen shall be used for any temporary marks on steel before galvanizing.

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## PSH 10 SUB-CLAUSE 5.3.9 Protective Treatment

Protective treatment shall comply with the requirements of SABS 1200 HC and the relevant project specification clauses.

## PSH 11 SUB-CLAUSE 5.5.1 Procedure

Erection procedures are to be submitted for approval.

Materials shall be packed and shipped in sequence with the erection schedule.

Shipping inventory lists in a waterproof package shall accompany each shipment of structural steel.

Small components, such as nuts, bolts and washers shall be placed in clearly marked containers and shipped with the first lot of structural steel.

Loose base plates and other components may be wired to large parts and shipped with the steel for which they are required.

Rail and road trucks shall be loaded and cribbed in a manner that will ensure easy off-loading.

Machined surfaces, bolt threads and bevelled plate edges exposed to corrosion shall be coated with a corrosion inhibitor.

## PSH 12 SUB-CLAUSE 5.5.2 Storage and handling

Add the following:

The size of fabricated assemblies shall be subject to the limits imposed by mass, carriers, cranes, route clearances and legislation.

The Contractor shall make his own arrangements for loading, off-loading, handling, transporting and storing of structural steelwork and materials.

Damaged or defective materials shall be set aside for inspection by the Project Manager who will decide on the course of action. The Contractor shall bear the cost of repairing, replacing and handling defective materials.

## PSH 13 SUB-CLAUSE 5.5.3 Safety during erection (new clause)

Add the following:

Attachments to facilitate erection may not remain as part of the permanent structure.

Add the following:



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## PSH 14 SUB-CLAUSE 5.5.6 Expansion Bolts

Expansion bolts and chemical anchor bolts for fixing steelwork to concrete elements shall be installed in accordance with the manufacturer's recommendations for hole diameter, depth of embedment and tightening torque.

## PSH 15 SUB-CLAUSE 5.7.1 Floor Plates

Replace clause with:

Floor plates shall have self-draining raised patterns formed by the hot rolled process. The raised patterns shall not be considered to from part of the floor plate thickness. Drain holes 15 mm in diameter shall be provided for each 1.5 m2 surface area with a minimum of one hole per floor panel. Floor plates shall be galvanized to SANS 121.

## PSH 16 SUB-CLAUSE 7.2Inspection

The Contractor shall advise the Supervisor as soon as materials and fabricated parts are ready for inspection. The Supervisor may require that portions of the work be reassembled at the fabricator's works to check the accuracy of the work.

## PSH 17 SUB-CLAUSE 7.3Inspection and testing of welds

The Contractor may be required to carry out non-destructive tests on the welds, including but not limited to the Dye Penetration test.

The Project Manager reserves the right to inspect the steel during fabrication and erection, and to employ outside inspection authorities for inspection of materials, methods and workmanship.

## PSH 18 SUB-CLAUSE 8.3.1.2 Supply and Fabrication of Steelwork

The rate shall also cover the cost of supplying grade 4.6 and grade 8.8 bolts including nuts and flat and/or tapered washers, the mass of which will not be measured.

## PSHC CORROSION PROTECTION OF STRUCTURAL STEELWORK

## PSHC 1 SUB-CLAUSE 3.2 Inspection and release (new clause)

All structural steel delivered to site shall be accompanied by an acceptable and legible painting and galvanising inspection and release certificate, clearly identifying the party and person who undertook the inspection and authorised the release from the shop. If this is not provided, the Project Manager may refuse to accept the delivery and not allow the steel to be offloaded

## PSHC 2 SUB-CLAUSE 3.2 C5.7 Coating System



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Where reference is made to “duplex” coating the following specification shall be adhered to:

- Hot dip galvanizing to conform to the requirements of the SANS 121 (ISO 1461:2009) specification. The galvanizer shall not quench the galvanized steel in a passivating solution containing sodium dichromate should painting be carried out immediately following the zinc coating process. Passivation will be required in a humid hot environment and where the top painting process is to be carried at a later date.

Once galvanized, the following painting procedure must take place:

1. Prepare all galvanized surfaces thoroughly with the aid of a galvanized iron cleaner or alternatively by means of sweep blasting. In the case of a galvanized iron cleaner, once brush applied, allow to stand for between 20 to 30 minutes. Followed by a clean water wash to remove all traces of white rust, contaminants and cleaning chemicals. This is best achieved by using a high-pressure hose and clean water.

The alternative zinc surface preparation is to use sweep blasting (not shot blasting). Sweep blasting is used to clean and provide a surface profile to key the paint primed to the galvanizing. For details of both methods of zinc surface preparation refer to specifications (HDGASA 01-Rev1:2014 and HDGASA 02-Rev1:2014).

**NB. Once all the surfaces are cleaned and dried, and within 2 to 4 hours apply the zinc compatible paint primer. Do not allow the cleaned galvanized surface to be exposed to the environment for more than 4 hours without the initial paint primer.**

2. Apply the 1st coat of a zinc compatible epoxy primer with a DFT of between 50 microns (µm) to 75 µm.
3. Apply intermediate MIO epoxy coating to a DFT of 100 µm.
4. Apply top coat of UV resistant polyurethane colour coat to a DFT of 60 µm.

## PSHC 2 SUB-CLAUSE 7.3Testing by Supervisor

The Contractor shall provide, at his own expense, all samples of coatings that the Supervisor requires for test purposes.

## PSM ROADS (General)

## PSM 1 SOURCES OF MATERIAL (Sub-clause 3.2)

Selected material for filling and all selected layers will come from designated borrow areas or commercial source depending on definition in the schedule of quantities.



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Material that classifies as G5 or higher, as per TRH14 will be used in the wearing course and will be required to be sourced from a commercial source.

Material that classifies as G7 or higher, as per TRH14 will be used in the fill layers for the roads.

PSME CEMENT STABILISED MATERIAL

PSME 3.2.1 e) Replace 0.75 MPa with 2 MPa

Add the following item:

PSME 4.5 Only plant that will not risk damaging geomembrane layers below the cemented layer may be used if applicable.

PSME 5.4.4 Compaction requirements are defined on the drawings or nominal compaction is required.

PSME 5.5.1 The rate of application of cement is defined on the drawings or must be established in terms of 7.3.1.

Add the following after PSME 5.5.4.1

For cement stabilised material the soil, cement and water shall be mixed until an even colour is obtained without any visible streaks of cement or wet patches.

The size of the soil cement batches mixed will be such that all the material can be placed and compacted within two hours from time when the cement comes in contact with the soil. Compaction shall start 45-60min after the cement comes in contact with the soil.

Placement will be done early mornings and late afternoon when the membrane liners are smooth without any folds due to heat expansion as defined by the Engineer's representative on site.

The final compacted depth of the soil cement shall be measured within 4 hours of compaction to prevent break out of soil cement already set.

Change PSME 5.5.6 To the following:

The compacted material will be covered immediately as placement progress and cured for at least seven days.

Change 7.2.1 To the following:

The following set of testing is required per daily production lot:

One density test

One indicator test (grading analysis and Atterberg limits)

**One UCS test**

One binder content test



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Upon receiving test results that show consistently that the specification has been achieved, the Engineer may reduce the frequency of testing to a minimum of one set of tests per 10 daily production lots.

## Particular Specifications

The Particular Specifications below concerns the supply and placing/construction of:

PA: Geosynthetic Materials

PB: HDPE Piping And Fittings

PC: Corrosion

PD: Grassing

PE: Filter Material

PF: Soil Bentonite Liner

PG: Impact Compaction

PH: Crushing and Screening

PI: Steel Pipes And Fittings

PJ: Valves

**Note:**

In the Particular Specification Engineer refers to Project Manager of the Contract,

In the Particular Specification Contractor refers to Contractor of the Contract,

In the Particular Specification Lining Contractor and Earthworks Contractor refers to Contractor of the Contract

In the Particular Specification Engineer's Representative refers to Supervisor.



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## PARTICULAR SPECIFICATION PA: GEOSYNTHETIC MATERIALS

## GEOSYNTHETIC MATERIALS

### PA 1 SCOPE

This specification covers the supply and installation of the geomembrane liners below the ash facility and associated dams, as well as geotextiles, geogrids, erosion protection and geocells in the ash facility.

### PA 2 DEFINITIONS

For the purpose of this specification, the following definitions shall apply:

Manufacturing Quality Control (MQC): Refer SANS 1526. This definition shall be applicable to all geosynthetic materials.

Manufacturing Quality Assurance (MQA): Refer SANS 1526. This definition shall be applicable to all geosynthetic materials.

Construction Quality Control (CQC): A planned system of inspections that is used to directly monitor and control the quality of a construction project. Construction Quality Control shall be performed by the Lining Contractor or for natural soil materials by the Earthworks Contractor and is necessary to achieve quality in the constructed or installed system. Construction Quality Control refers to measures taken by the installer or Contractor to determine compliance with the requirements for materials and workmanship as stated in the Drawings and Project Specifications.

Construction Quality Assurance (CQA): A planned system of activities that provides the Employer, Engineer and Permitting Authorities assurance that the facility was constructed as specified in the design. Construction Quality Assurance includes inspections, verifications, audits and evaluations of materials and workmanship necessary to determine and document the quality of the constructed facility. Construction Quality Assurance refers to measures taken by the Engineer to assess if the Lining Contractor is in compliance with the Drawings and Project Specifications.

Lining Contractor: The Contractor / Sub-Contractor (as applicable) appointed to perform the supply and the installation of the geomembrane liners required for the project

Earthworks Contractor: The principal/main Contractor appointed to undertake the excavation, backfilling, compaction and surface preparation required by the Lining Contractor to allow for the installation of the geomembrane liners.

Normal temperature: A temperature between 15°C and 32°C.

Wrinkle, wave or fold: Undulation in the liner that is caused by installation methods, temperature fluctuations or activities like cover placement taking place on the liner.



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## PA 3 APPLICABLE STANDARDS

The following standards are applicable to this specification and can be obtained from the following sources:

GRI Standards: www.geosynthetic-institute.org/specs.htm

ASTM Standards: www.astm.org

SANS Standards: www.stansa.co.za

ASTM D 4354, Standard practice for sampling of geosynthetics for testing

ASTM D 4437, Practice for determining the integrity of field seams used in joining flexible polymeric sheet geomembranes

ASTM D 4873, Standard Guide for Identification, Storage and Handling of Geosynthetic Rolls

ASTM D 5641, Standard practice for geomembrane seam evaluation by vacuum chamber

ASTM D 5747, Standard practice for tests to evaluate the chemical resistance of geomembranes to liquids

ASTM, D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.

ASTM D 6365, Standard practice for the non-destructive testing of geomembrane seams using the spark test

ASTM D6747-15, Standard Practices for selection of techniques for electrical leak location of leaks in geomembranes

ASTM D7007-16, Standard Practices for electrical methods for locating leaks in geomembrane covered with water or earthen materials

ASTM D8265-19, Standard Practices for electrical methods for mapping leaks in installed geomembranes

GRI Test Method GM14, Selecting variable intervals for taking geomembrane destructive seam samples using the method of attributes.

GRI Test Method GM19, Seam strength and related properties of Thermally-Bonded Polyolefin Geomembranes.

SANS 1526, Ed 2 – 2015 , Thermoplastics sheeting for use as a geomembrane.

SANS 10409 Ed 2 - 2020 , Design, selection and installation of geomembranes

SANS 10221 – Ed 1.2 – 2007, Testing of geotextiles

GRI Test Method GT12 (a) – ASTM Version, Test method and properties for nonwoven geotextiles used as protection (or cushioning) materials

GRI Test Method GT12 (b) – ISO Version, Test method and properties for nonwoven geotextiles used as protection (or cushioning) materials



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GRI Test Method GT13 – ASTM Version, Test method and properties for geotextiles used as separation between subgrade soil and aggregate.

## PA 4 MATERIALS

The quantities set out in the schedule of quantities have been determined from data available at the time. However the liability shall rest entirely and solely with the Lining Contractor to determine before ordering, the required types and quantities of the various materials required for the completion of the Works in accordance with the specifications and the drawings issued to the Lining Contractor for construction purposes

Any reliance placed by the Lining Contractor on the estimated quantities stated in the Schedule of Quantities, or measurements made by the Lining Contractor from the drawings shall be entirely at the Lining Contractors risk and the Employer accepts no liability whatever in respect of materials ordered by the Lining Contractor on this basis.

All geosynthetic areas stated in the bill of quantities are net.

Material delivery and storage

The products shall be packaged, transported, unloaded and stored in accordance with the manufacturer's instructions, subject to the engineer's approval, and generally in accordance with ASTM Standard D 4873, "Standard Guide for Identification, Storage and handling of Geosynthetic Rolls"

The following are applicable to all geosynthetic materials:

The area where the material is to be stored shall be free of any protrusions, rocks and other sharp objects, which could damage the material. The Earthworks Contractor will clear an area of sufficient size for the storage of materials within 1km of the construction site next to the Earthworks Contractor's campsite.

The Lining Contractor is to provide the necessary plant and equipment to transport the materials to the works area.

The proper storage and handling of the geosynthetic materials shall be the responsibility of the material supplier (i.e. Earthworks Contractor in the case of geotextile separation layer or geopipes).

Materials delivered to site shall only be those as stated on the quality control sheets and lists previously disclosed to the Engineer.

All material deliveries shall be logged and a summary of this log presented to the Engineer no more than three (3) days after delivery to site for any particular material type.

The Engineer or his representative should be present, whenever possible, to observe the material delivery and unloading on Site. The Engineer or his representative will note any material received in damaged state.

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## PA 4.1 GEOMEMBRANE LINERS

### PA 4.1.1 MATERIAL

#### PA 4.1.1.1 Material Specifications

Double textured (both surfaces), geomembrane liner, 1.5 mm, thick, shall be supplied and installed by the Lining Contractor as detailed on the drawings and that conform to the requirements stated in the latest edition of SABS 1526 and GRI GM13 published at the date of tender/bid closure.

#### PA 4.1.1.2 Resin Type

All HDPE geomembranes and welding rods shall be manufactured from a hexene or octene base polymer. During installation all welding rods shall have the same base polymer and additives as the lining material. The base polymer supplied, combined with the master batch additives that make up the eventual liner material and welding rods, must comply with the specification in GRI GM13.

#### PA 4.1.1..3 Manufacturing Process

All liners will be manufactured using the flat-die extrusion process. Minimum panel widths for smooth material is 7.5m, and for textured material 5m.

#### PA 4.1.1.4 Deviations from GRI GM13 for SMOOTH AND TEXTURED MATERIAL

Thickness: minimum average shall be ≥ 1.5 mm, and the lowest individual value for any of the 10 values is to be -10% as per ASTM D5994

Texturing is to be embossed

Break elongation to be minimum 250% as per ASTMD6693 Type IV

Puncture resistance to be minimum 450 N for 1.5mm and 600 N for 2mm as per ASTM D4833

Rapid tensile strain test to be undertaken at a strain rate of 300 mm/minute to determine if the material exhibits any separation in plane issues. Separation in plane to be assessed more than 5mm from break and ends of test samples.

#### PA 4.1.1.5 DEVIATIONS FROM GRI GM19

GRI GM19 is applicable to field testing.

For trial welds, the following apply:

Five out of five samples tested in shear must meet or exceed values specified in Table 1(b) for the relevant geomembrane thickness and weld type being tested.



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Five out of five specimens must meet or exceed shear percentage elongation values specified in Table 1(b) for the relevant geomembrane thickness and weld type being tested.

Five out of five samples tested in peel must meet or exceed values specified in Table 1(b) for the relevant geomembrane thickness and weld type being tested.

Five out of five specimens must not exceed the values specified in Table 1(b) for peel separation. Five out of five specimens must result in acceptable locus of break patterns.

## PA 4.1.1.6 PERFORMANCE SPECIFICATION FOR TEXTURED GEOMEMBRANE INTERFACE

From stability analyses carried out during the design stage, the following peak shear strength envelope indicates the minimum shear strength required between the textured side of the geomembrane and the clay material; and textured side of the geomembrane and the site coarse ash envisaged for use on site to have a Factor of Safety of 1.5.

| Internal Shear Strength | Minimum Geomembrane vs Coarse Ash interface shear strength envelope | | | | |
|---|---|---|---|---|---|
| Normal Stress (kPa) | 0 | 100 | 250 | 500 | 750 |
| Shear Stress (kPa) | 0 | 75 | 180 | 323 | 487 |

| Internal Shear Strength | Minimum Geomembrane vs Bentonite enhanced soil interface shear strength envelope | | | |
|---|---|---|---|---|
| Normal Stress (kPa) | 0 | 150 | 500 | 700 |
| Shear Stress (kPa) | 0 | 93 | 205 | 278 |

The following minimum large displacement shear strength envelope is required.

| Internal Shear Strength | Minimum Geomembrane vs Coarse Ash large displacement interface shear strength envelope | | | | |
|---|---|---|---|---|---|
| Normal Stress (kPa) | 0 | 100 | 250 | 500 | 750 |
| Shear Stress (kPa) | 0 | 74.3 | 161.6 | 321.4 | 425.0 |



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| Internal Shear Strength | Minimum Geomembrane vs Bentonite Enhanced Soil large displacement interface shear strength envelope | | | |
|---|---|---|---|---|
| Normal Stress (kPa) | 0 | 150 | 500 | 700 |
| Shear Stress (kPa) | 0 | 92 | 202 | 275 |

The contractor is required to confirm that the geomembrane supplied will meet the interface shear strength required for the geomembrane clay interface.

Shear interface testing to verify conformance with this requirement will be carried out in parallel to geomembrane conformance testing (see Section PA 4.1.5) when the material arrives on site.

Notes on Friction Interface Testing:

Tests are to be carried out to ASTM D 5321: Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method as required in GRI GM 13

The interface should be the compacted clay at the density and moisture condition described on the drawings.

Standard Proctor Compaction as per ASTM D698-07. The D698 protocol shall be followed in terms of allowing the equilibrium/mellow time required.

Wetting condition of the interface: the interface should be flooded for a minimum of 24 hours before testing.The tests will need to be carried out under at least three normal stress conditions including a minimum stress of 150KPa, a medium stress of 500KPa and a maximum stress of 750KPa

Peak and large displacement (>75mm) shear strengths are required.

### PA 4.1.2 PLANT

All plant shall be in good repair, adequate for its purpose and operated by persons experienced in the type of equipment used. Welding machines that cause any on-going damage to geomembranes will be removed from site and replaced with equivalent functional units.

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## PA 4.1.3 CONSTRUCTION

The geomembrane liner will be installed, and the quality control carried out in accordance with the latest edition of SANS 10409 and GRI GM19 published at the date of tender/bid closure. Below follows additional requirements.

### PA 4.1.3.1 Submittals Prior To Construction

The following documentation shall be submitted to the Employer and his Employer's Agenting Contractor before commencement of the geomembrane installation:

Proposed layout drawings of the installation, showing panel location, seams and type thereof for each layer of synthetic material to be installed. All panels and seams must be numbered in sequence of intended installation. The layouts should be drawn to scale with the design outlines in the background. The drawings should be made available electronically upon request. Closure joints should also be shown. Offcuts shorter than 10m will not be permitted to be used in the installation unless shown in the original layout. The Contractor takes special note that any deviations from the initially Accepted panel layout drawing during construction, shall be subject to Acceptance by the Employer and his Engineering Contractor, prior to implementation of such changes.

Method Statement detailing the Lining Contractor's proposed construction procedure and Construction Quality Assurance (CQA) and Construction Quality Control (CQC) programme, compliant with SANS 10409, is to be submitted for the specific elements of the Works. No work related to such elements shall commence before the method statement has been submitted and approved. Particular mention must be made of the cover/protection layer placing procedure integrated with the geosynthetic deployment to ensure minimal fold/wrinkle development and propagation during such cover placement. Working hours must be specified and particular notice must be taken of the allowable folds in the liner to be placed as described under the tolerances section. Any and all costs (i.e. direct and indirect) resulting from the repairs on the folds not conforming to this specification, shall be for the Contractor's account.

Quality control documentation from the manufacturer to be submitted and approved prior to shipping of each type and gauge of geomembrane liner supplied for this project. Submittal shall include:

dates of manufacture.

resin supplier/type of resin.

batch numbers and roll numbers, length and width.

documentation of the manufacturer's quality control program, which shall test data indicating the actual test values, per roll or per batch, as may be applicable.

Conformance testing - each type and gauge of geomembrane liner supplied are to be tested for conformance to the specifications and approved prior to shipping, by an external third party testing authority, see PA 4.1.5 for list of required conformance tests. The Contractor



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is to include the time allowed for this testing in the material delivery schedule. This conformance testing will not supplant the conformance testing to be carried out when the material arrives at site as required in PA 4.1.5.

### PA 4.1.3.2 Temporary Anchoring

The Lining Contractor shall supply and deploy double lined sandbags or other method Accepted by the Employer and his Engineering Contractor, to keep all material in place during the installation process. The bags are to be filled with sand of maximum particle size 5mm. Enough bags must be used to anchor the membrane on flat and sloped surfaces to prevent slippage and adequately restrain the geomembrane to prevent the formation of wrinkles, waves or folds and to secure the edges of the geomembrane liner to prevent wind uplift. The number and spacing of the bags are to be determined by the Lining Contractor.

### PA 4.1.3.3 Markings on Geosynthetics

All markings on the geosynthetics shall be made with a marker that will be clearly visible and that will not harm or impede the function of the geosynthetic. Only the Lining Contractor, 3rd Party Quality Controller and the Engineer and/or Employer will be allowed to make any markings on the geosynthetics.

### PA 4.1.3.4 Surface Preparation

The Earthworks Contractor shall be responsible for preparing and maintaining the subgrade or supporting surface in a condition suitable for installation of the liner. The Lining Contractor is responsible to ensure that the area to be lined is free from all protrusions, stones, roots, vegetation dry/loose soil, cracks and material and other objects that may be detrimental to the performance of the geomembrane/barrier system prior to commencing installation.

In instances where the geomembrane is to be placed over a previously installed geosynthetic layer, care shall be taken that no wrinkles or folds are entrapped, and that the placement of the geomembrane layer will be done such that the underlying geosynthetic is not damaged or disturbed.

A blinding layer consisting of sand and or fine gravel will only be used where specifically authorised by the Designer.

The Lining Contractor is to adopt the same working hours as the Earthworks Contractor to ensure interfacing of the construction activities. The Lining Contractor must supply its own labour force and plant to handle the rolls of geomembrane to ensure continuity of work.

### PA 4.1.3.5 Cover Placement

The geomembrane will be installed in such a way that it lies flat on the substrate below without any tensile forces (i.e. trampolining) present during the coldest period of the working day. Subsequent cover layers will be placed by the Earthworks Contractor when the



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geomembrane is in the condition described above. Covering of the geomembrane should therefore take place early in the morning and should be stopped once folds start to appear. If covering of the liner is carried out after normal working hours to prevent folds it is taken that this cost is included in the installation rates.

Equipment shall not be driven directly on the geomembrane. Equipment will only be allowed to traffic in a straight line on the already installed protection layer. Equipment to have an allowable ground pressure of < 35 kPa.

The Contractor shall at all times, employ pointsmen from the Lining Contractor at the interface where the cover layers are being deployed onto the geosynthetic materials. The purpose of these pointsmen being to monitor and ensure compliance to the Accepted method statement for cover layer placement, and to identify excessively coarse or angular particles in the cover material, for removal by these points-men, prior to incorporation into the cover layer.

### PA 4.1.3.6 Acceptable Weather Conditions

Welding of the geomembrane may only occur within the limits set below:

Ambient air temperature: >5 °C

Ambient air temperature above dew point: >3 °C

Geomembrane surface temperature: ≤75 °C

In order to achieve this, an electronic weather station must be provided that records temperature and humidity continuously. If no allowance is made in the BoQ for this item it must be included in the installation rates. Measurement of geomembrane surface temperature must be carried out using suitable thermometers, such as an infrared thermometer or surface thermocouple. Adjacent panels may not be seamed until their temperatures have normalised to within 5 °C of each other. Measurements must be recorded in the CQC documentation.

### PA 4.1.4 Tolerances

Verification of Permissible Deviations (PDs) are described in the table below:

Dimensions will be verified at normal temperature, measurements being made with a tape at normal temperature. For installation, at sunrise or at such time as when, in the opinion of the Employer and his Employer's Agenting Contractor, the effect of the sun is of no consequence.

All PDs will be rounded up to the next whole millimetre

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PA 4.1.4.1 Substrate flatness

The top layer of the subgrade layer shall be graded and compacted using a smooth drum roller by the Earthworks Contractor where it needs to be prepared for the placing of the

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| ITEM | PERMISSIBLE DEVIATION DEGREE OF ACCURACY (mm) | | |
| | III | II | I |
| Substrate | | | |
| Flatness of substrate | | See Note 6.1 below | |
| | | | |
| Anchor trenches | | | |
| Anchor trench Position on plan | * | +-75 | * |
| Anchor trench dimensions | * | -0 | * |
| Anchor trench surface in contact with membrane | * | 15 | * |
| | | | |
| Membranes | | | |
| Refer SANS 1526 for MQC | | | |
| Waves & Folds | | See Note 6.3 below | |
| | | | |
| Battens | | | |
| Flatness of concrete surface | | See Note 6.2 below | |
| | | | |
| Width of flange | | +-4 | |
| Thickness of flange | | -0 | |
| Warpage of flange | | Width/200 | |
| Flatness of web | | Width/120 | |
| | | | |
| Location of holding down bolt centre point in plan | | +-3 | |
| | | | |
| Thickness of Gasket | | -0 to +1 | |



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geomembrane and shall be finished such that no gap greater than 30mm can be measured beneath a 3m straight edge. No abrupt changes in falls or alignments will be allowed.

### PA 4.1.4.2 Concrete flatness

The concrete layer shall be floated with a steel float where it needs to be prepared by the Earthworks Contractor for the fixing of the geomembrane and shall be finished such that no gap greater than 1mm can be measured beneath a 200mm straight edge. No abrupt changes in the surface will be allowed.

### PA 4.1.4.3 Liner flatness

With cover: If the liner is placed with the intention of placing a cover layer over it one 20mm high x 100mm wide wave will be permitted every 10m per panel width. Propagation of waves by the placing of cover material will not be permitted.

**Without cover:** It the liner is placed with the intention of keeping it exposed the above requirement may be relaxed as agreed by the Employer and his Employer's Agenting Contractor.

**Along weld:** No folds or waves will be allowed along or across extrusion or wedge welds.

### PA 4.1.5 Testing

All Manufacturing Quality Control (MQC) and Construction Quality Control (CQC) testing and reporting are described in the supporting specifications and must be adhered to strictly.

In addition to the above quality control testing the following independent 3rd party conformance testing will be performed.

One set of tests will be carried out for each membrane thickness, surface texturing or resin base change, per 100,000 m2 or part thereof, by a 3rd party accredited laboratory prior to shipping as described in PA 4.1.3.1.d). The costs for this testing are to be included in the supply costs.

One 0.5 m wide strip across the width of a selected roll will be cut in the presence of the Employer and his Employer's Agenting Contractor once the material is delivered to site. This will be done for each membrane thickness, surface texturing or resin base change, per 100,000 m2 or part thereof, delivered to the site. From this strip, a set of ten 400mm x 400mm samples will be cut evenly spaced across its width. The samples will be cleaned and packaged and sent to an internationally accredited laboratory (which requires to be approved by the Engineer) for testing. Information on the specific roll numbers from which the samples are cut will be recorded, these are to be different than the rolls sampled before shipping. The cost of this testing will be for the Employer and will be paid under the allowance made in the Schedule of Quantities.

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### For shear interface testing:

One 0.5 m wide strip across the width of two selected rolls will be cut in the presence of the Employer and the Engineer once the material is delivered to site. From each strip, a set of ten 500mm x 500mm samples will be cut evenly spaced across its width. The samples will be cleaned and packaged and sent to an internationally accredited laboratory (which requires to be approved by the Engineer) for shear interface testing. Information on the specific roll numbers from which the samples are cut will be recorded. The cost of this testing will be for the Employer and will be paid under the allowance made in the Schedule of Quantities.

### Table of Conformance Test Properties

| Property | Test method |
|---|---|
| Thickness (10 spaced across a roll width) | |
| Smooth | ASTM D 5199 |
| Textured | ASTM D 5994 |
| Asperity height | ASTM D 7466 |
| Density | ASTM D 1505 |
| Tensile Properties | ASTM D 6693 Type IV |
| Tensile Properties at 300 mm/min strain rate | ASTM D 6693 Type IV |
| Puncture resistance | ASTM D 4833 |
| Stress Crack Resistance | ASTM D 5397 |
| Carbon Black Content | ASTM D 1603 |
| Carbon Black Dispersion | ASTM D 5596 |
| OIT – Standard Pressure | ASTM D 3895 |
| OIT – High Pressure | ASTM D 5885 |
| Oven Aging at 85°C Standard OIT 55% retained after 90 days<br>OR<br>Oven Aging at 85°C High Pressure OIT 80% retained after 90 days | ASTM D 5721, ASTM D 3895<br><br>ASTM D 5721, ASTM D 5885 |
| UV Resistance High Pressure OIT % retained after 1600 hrs | ASTM D 7238, ASTM D 5585 |
| Friction Interface Testing | ASTM D 5321: |



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## For Electric Leak Location (ELL):

The dipole geo-electric method according to ASTM D7007 and ASTM D8265 will be used to insure liner integrity and locate any geomembrane damage. For surveys with earthen materials on the geomembrane, the earthen materials shall have adequate moisture to provide a continuous path for electrical current to flow through the leak.

## The following requirements are needed for the ELL survey to be conducted:

The maximum cover, over the geomembrane to be tested, should not exceed 600mm thick and the cover material to be as homogenous as possible

Most Critical – The survey area must be electrically isolated, no exceptions.

Anchorage of the geomembrane - The lose end of the geomembrane to exit the anchor trench and form a flap after the trench has been backfilled. This is the best way to ensure complete isolation of the area to be tested.

Drainage material or any material covering the geomembrane to only be filled on the inner side of the anchor trench (no contact with in-situ soil).

No access ramps or internal berms to be constructed over the perimeter of the cell unless they are isolated by means of trenches or other isolation methods. Ideally any fill earthworks structures that continue outside the lined area of the cell should only be completed after the ELL survey. No fill over the geomembrane shall exceed 600mm before the test has been concluded.

If the cell is tying into an adjacent cell, an open trench in the cover material is to be left at the tie-in interface to allow isolation.

The protection geotextile over the geomembrane must be kept within the confined isolated area. Wet geotextiles become conductive so this must be considered during placement.

The in-situ soil conductivity and moisture content should be tested by an accredited laboratory. The results obtained from the ELL survey depends on the in-situ site conditions.

In climates were high rainfall or extreme rain events are expected, a rain flap on the geomembrane should be considered to prevent overflow of the runoff and hence maintain isolation.

Conductive paths such as metal pipes penetrations, pump grounds and batten strips on concrete should be isolated or insulted from the earthen material on the geomembrane whenever practical.

The lining contractor shall be available on site in the event that repairs are required. A water tanker must be available on site during each day of the ELL survey. If possible the tanker should be stationed inside the lined area of the cell to be tested. If not possible any connections from the water tank (hose pipes etc.) must be isolated (i.e. there should be no leaks in the hose and the hose material should be non-conductive).The electrical methods used for geomembrane electric leak location testing uses high voltage (up to 500v), resulting



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in the potential for electric shock or electrocution. Adequate safety measures must be taken to prevent potential incidents during the survey.

The cost of this testing will be for the Employer and will be paid under the payment item PA

**5.1.7.For Insitu liner system tensile strain testing:**

As per the Condition 2.1.15 of the Construction Approval of the Eskom Medupi Power Station Northern Ash Disposal Facility (Ref. no. 16/2/7/B400/B22/Z1/1) issued by the Department of Forestry, Fisheries and the Environment (DFFE), it is required to report of the total tensile strain development in the geomembrane.

The proposed test method is an in-situ strain determination test, using a test pad to measure strain resulting in the geomembrane from the anticipated peak load and the infield barrier construction prior to waste placement.

**The methodology listed below covers the works to be conducted to ensure successful tensile strain measurement in the primary geomembrane:**

a) An area for the construction of the test pad will be demarcated in a suitable location. A flat area of 5 x 10 m will be cleared and borrow material will be used as fill to level the area.

b) The base preparation layer (150 mm) shall be prepared by ripping the in-situ/fill material and compacting to 95% MOD AASHTO density at -2% to 2% of OMC.

c) For the entire length of the test pad, 2 x 150 mm thick layers of site sand (Hillwash) blended with 5% bentonite by mass will be placed and compacted to 98% STD Proctor with a moisture content at +0 to +2% of OMC. These layers will form the primary compacted clay liner. The in-situ moisture and density results from the nuclear density gauge testing, according to project specification PSD-7.2.1, should be recorded and included in the quality records.

d) An aluminium test specimen, provided by specialist subcontractor, with dimensions of 350 × 350 mm, will be placed on top of the bentonite enhanced site sand layers, in the centre of the test pad areas, using the builders line to centre the sheets.

e) Place a 1.5 x 1.5 m portion of the 1.5 mm thick double-textured HDPE primary geomembrane centrally over the aluminium sheet. Care is to be taken not to deform the aluminium sheet during the placement of the remaining layers.

f) Measurement of the geomembrane surface temperature should be done using a suitable thermometer, prior to covering the liner.

g) Place a wooden containment box, 1.3 x 1.3 m wide and 400 mm deep, centrally over the geomembrane.

h) Fill the wooden containment boxes with screened coarse ash to the required 300 mm depth. A dozer/grader/bobcat should be used to fill the box with the screened coarse ash. A ramp should be constructed alongside the wooden box. This ramp should then be used to push the screened coarse ash material into the wooden box. The action of the dozer pushing the screened coarse ash into the wooden box simulates the levelling of the material during construction. It is imperative to replicate the levelling as it would occur during construction, therefore no human interference should be adopted i.e. placement using shovels shall not be permitted. Subsequently, the tyre of a Bobcat should be rolled over the screened coarse



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ash to simulate subsequent traffic after placement, which aids in settling the material before pressure is applied.

i) Within the contained screened coarse ash layer, hand excavate a 500 mm x 500 mm square centrally, to a depth of 50 mm. This will result in a stone layer thickness of approximately 250 mm within the central area of the box.

j) Once the screened coarse ash has been removed from the 500 mm x 500 mm excavation, place a Class 2 separation geotextile within the excavated box in the screened coarse ash layer.

k) A sand bedding layer will then be placed above the separation geotextile to allow for better seating of the load plate and application of the load.

l) A 310 × 310 × 40 mm plate is to be placed on top of the bedding layer within the screened coarse ash, using the builder's line to centre the plate over the aluminium test specimen for both test areas.

m) A jack will be placed on the load plate and the design load of 800 kPa will be applied through jacking against the underside using a site provided vehicle. The design load should be applied normally as this is the most conservative approach that will result in the most strain experienced by the primary geomembrane.

n) The design load will be maintained for 24 hours before being unloaded. The pressure will be monitored during this period.

o) The load and lined layers will be removed, taking care not to apply any additional pressure over the area of the aluminium test specimen that may affect the results.

p) The areas with the worst indentation on the aluminium test specimen will be identified. These areas will be scanned and the resulting % strain calculated.

q) A report with a graphical representation of the results will be provided and analysed. The results will be included in the construction completion report.

The cost of this testing will be for the Employer and will be paid under the payment item PA 5.1.8.

## PA 4.2 GEOTEXTILES

The geotextiles as specified below shall be supplied and installed by either the Lining Contractor or the Earthworks Contractor, as may be the case, as detailed in the drawings. Installation by the Earthworks Contractor is to take place in consultation with the liner contractor where necessary.

Geotextile for Liner Protection

The protection geotextile shall be a minimum 1080 g/m2 non-woven, needle-punched, staple fibre or continuous filament, polypropylene, which complies with the specifications as set out in GRI-GT12 (a).

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## Extract from GRI-GT12 (a) & (b)

| Property | Test Method | Unit | Value |
|---|---|---|---|
| GRI-GT12(a) | | | |
| Mass per unit area | ASTM D5261 | g/m2 | 1080 |
| Tensile Properties<br>Strength<br>Strain @ max load | <br>ASTM D4632<br>ASTM D4632 | <br>kN<br>% | <br>225<br>50 |
| Trapezoidal Tear Strength | ASTM D4533 | kN | 0.96 |
| CBR Puncture<br>Max force<br>Elongation @ max force | <br>ASTM D6241<br>ASTM D6241 | <br>kN<br>mm | <br>7.56 |

## Geotextile for Separation

The separation geotextile shall be a non-woven, needle-punched, staple fibre or continuous filament, polypropylene, which complies with the specifications as set out in GRI-GT13 Class 2 (moderate survivability).

Extract from GRI-GT13

Table 2 (b)-Geotextile Properties Class 2 (Moderate Survivability)

| Property | ASTM Test | Unit | Elongation ≥ 50% |
|---|---|---|---|
| Grab Tensile Strength | D4632 | N | 700 |
| Trapezoid Tear Strength | D4533 | N | 250 |
| CBR Puncture Strength | D6241 | N | 1400 |
| Permittivity | D4491 | Sec-1 | 0.02 |
| Apparent Opening Size | D4751 | Mm | 0.60 |



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| | | | |
|---|---|---|---|
| Ultraviolet Stability | D4355 | % Ret. @ 500 hrs | 50 |

Please note that the above is only given as a guide and that it will still be the responsibility of the contractor to become familiar with the full specification.

The ASTM specifications for GRI GT 12 and GT13 have been included as external conformance testing will be carried out at an internationally recognised laboratory approved by the Engineer. If suppliers data sheets are compiled in ISO format then the ISO versions of the GRI GT 12 and GT 13 specifications will be used to adjudicate initial compliance, however conformance testing and compliance to the specifications will be finalized on the ASTM values.

### PA 4.2.1 Testing

Conformance testing on all supplied geotextiles - each type and gauge of geotextile supplied is to be tested for conformance to the specifications and approved prior to shipping or transporting by an external third-party testing authority, see table further in specification for list of required conformance tests. The supplier is to include the time allowed for this testing in the material delivery schedule. This conformance testing will not supplant the conformance testing to be carried out when the material arrives at site as required.

The geotextiles shall be tested after arrival on site, or if taken from an existing stockpile, the procedure to be followed is:

Once material has been delivered to site, or identified in stockpile, the Engineer will cut samples and arrange for shipping and testing. A sample will be cut from any roll at random, but not the same roll as that tested prior to shipping.

A 300mm wide strip is to be cut along the total width of the roll. This is then to be subdivided into 300mm wide samples. Six (300mm ´ 300mm) samples as indicated by the Engineer will be sent to the testing facility.

**The geotextiles will be tested for the properties as listed below:**

| Property | Test Method |
|---|---|
| Thickness (Drainage geotextile) | ASTM D-1777 |
| In-plane permeability at 200kPa confining pressure (Drainage geotextile) | ASTM D 4491 |
| Mass per unit area | ASTM D 5261/ ISO 09864 |
| Tensile Properties | ASTM D 4632/ISO 10319 |
| Trapezoidal Tear Strength | ASTM D 4533/ISO 13434 |



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### PA 4.2.2 Storage and handling

All geotextiles shall be handled and stored as described in ASTM D 4873.

### PA 4.2.3 Installation

Geotextile fabric shall be placed as detailed on the drawings.

At the time of installation fabric shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation, or storage.

The area on which the fabric is to be placed shall be smooth and free of projections or depressions that may cause the fabric to be punctured.

Geotextile fabric shall be placed without stretching and shall lie smoothly in contact with the prepared surface. Fabric shall be placed with seams overlapping 150mm.

Edges of the material shall be sufficiently anchored during installation to prevent displacement by wind.

No geotextile shall be exposed to UV radiation for longer than 14 days without agreement from the Engineer, unless it is being used in a sacrificial application or is intended to be exposed as shown on the construction drawings.

Before handover (i.e. completion of an area of responsibility of the work) by the Lining Contractor to any other party, the Lining Contractor, the Engineer and the Third Party Controller shall conduct a detailed walk-through of the lined facility and visually check all seams and non-seamed areas of the geotextile for defects, holes, or signs of damage during installation.

## PA 4.3 GEOCELLS

The geocells, as specified below, will be supplied and installed by the Earthworks Contractor as detailed in the drawings where specified. Installation by the contractor is to take place in consultation with the lining contractor where necessary.

The geocells shall be a high tenacity polypropylene tape, coated with polyethylene and shall comply with the specifications shown below:

| Property: | Test Method: | Unit: | Value: | Note: |
|---|---|---|---|---|
| | | | | |
| Tensile strength | SANS 10221 | kN / m | 26 | Minimum (Warp & Weft) |
| Elongation | SANS 10221 | % | 12 | Maximum (Warp & Weft) |



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The geocells used are to be in a 200 x 200 mm grid and range from 100 to 250 mm high as shown on the drawings.

PA 4.3.1 Installation

At the time of installation fabric shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation, or storage.

The area on which the fabric is to be placed shall be smooth and free of projections or depressions that may cause the fabric to be punctured.

Lay the geocells over the prepared area ensuring that the top of the cells are level with the surrounding terrain and that the highest section of the panel is secured in a lock trench at the top of the embankment or slope.

Where the geocells are underlain by earth material, anchor the geocells to the prepared surface with inverted shepherd's crook shaped steel stakes made from 10 mm to 12 mm reinforcing rod, or similar. Every alternate cell should be staked along the edge of each section to ensure that the system is well secured.

Join and align the alternate cells of each section of geocells using cable ties to create a continuous cover over the site. Tension the cover from the highest to the lowest point of the slope by staking the bottom edge of the corner to ensure that the individual cells are fully open to receive the fill.

Fill the cells of the entire geocell cover with the selected material to give the required finish to the installation e.g. a filter sand to promote drainage or concrete which provides a smooth water resistant finish.

In the case where concrete is used as fill, the surface should be raked flush to the top of the cells.

Before handover (i.e. completion of an area of responsibility of the work) by the Lining Contractor to any other party, the Lining Contractor, the Engineer and the Third Party Controller shall conduct a detailed walk-through of the lined facility and visually check all seams and non-seamed areas of the geotextile for defects, holes, or signs of damage during installation.

### 2.7.8 Training and Technology Transfer

The Contractor provides training on the equipment and systems included as part of the works to the various categories of the Employer's technical staff (operators, maintenance and engineering personnel) for the duration of the works.

Training provided by the Contractor is directly applicable to the actual equipment supplied for the works. Generalised training based on similar equipment is not acceptable. The local facilities for training provided by the Employer is a suitably sized air-conditioned room, as



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well as trainee and trainer desks, an overhead projector and flipchart or white board. The number of personnel to be trained is as per the table below.

## 2.8 PROCESS FOR MONITORING

N/A

## 2.9 RELATED/SUPPORTING DOCUMENTS

N/A

# 3. MANAGEMENT STRATEGY AND START UP

## 3.1 THE SUPPLIER'S PLAN FOR MATERIAL DELIVERY

Schedule to be supplied by the Contractor after an agreement has been reached with Eskom Rotek Industries.

## 3.2 MANAGEMENT MEETINGS

No meetings scheduled.

## 3.3 INVOICING AND PAYMENT

Invoicing and payment turnaround time is 60 days. Invoices to be submitted after every delivery.

## 3.4 CONTRACT CHANGE MANAGEMENT

Task Order form to be used when work within the service is instructed to be carried out within a stated period. A task Order will be sent to the Supplier via an email. In the case of a compensation event, the Supplier must give the *Employer* an early warning and a quotation for the total costs, must be submitted electronically by the Supplier for that compensation event by email.



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## 3.5 RECORDS OF DEFINED COST TO BE KEPT BY THE SUPPLIER

All delivery notes by the Supplier will be done are to be approved by the *Employer.* Delivery notes will be submitted to and kept by the *Employer* on a weekly basis, and these will be used for assessment purposes.

## 3.6 TRAINING WORKSHOPS

- Induction will be provided by the employer for all personnel entering the site.

# 4. HEALTH, SAFETY, ENVIRONMENT AND QUALITY ASSURANCE

## 4.1 HEALTH AND SAFETY RISK MANAGEMENT

The Supplier shall always comply with the health and safety requirements prescribed by law as they may apply to the *service*s.

The Supplier shall, when coming on site always abide by the Lifesaving Rules and COVID-19 safety requirements. These will be provided by the *Employer* on the start of the contract. The Supplier shall also abide by Safety, Health and Environmental Specifications for Contractors Procedure, which will also be provided by the *Employer*.

The *Employer* follows an accident/ incident prevention policy that includes the investigation of all accidents/ incidents involving personnel and property. This is done with the intention of introducing control measures to prevent recurrence of the same incidents. The Supplier is expected to fully co-operate to achieve this objective. Refer to 32-95_Environmental, Occupational Health and safety Incident Management Procedure

The Supplier implements a safety plan and maintains the safety system until completion of the whole delivery. The plan, will as a minimum, contain PPE information, written safe work procedures, job specific risk assessments, safety meetings, etc. The plan will be to the *Employer*'s satisfaction and will be accepted prior to the commencement of any work.

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## 4.2 ENVIRONMENTAL CONSTRAINTS AND MANAGEMENT

The Supplier shall comply with ERI management system. This includes the identification, collection, storage, transportation, and disposal of waste. Hazardous waste shall be disposed of in line with the applicable environmental legislation. It is important to note that all oil and fuel spillages must be cleaned immediately and reported to the project manager as soon as possible. It is the responsibility of the polluter to clean all spillages and for the rehabilitation of the polluted land and the cost associated with that.

## 4.3 QUALITY ASSURANCE REQUIREMENTS

The Supplier implements a quality system and maintains the quality system until the completion of the whole of the whole delivery. Each delivery to be done as per bending schedule, requested quantity and to be accompanied by material certificate. Any deviations will be corrected to the *Employer*'s satisfaction.

The *Project Manager* has the right to stop the delivery if, in the opinion of *Project Manager*, does not meet the specifications and will have a detrimental effect on performance. The Supplier may only continue with work activities when all deficiencies have been corrected to the *Project Manager's* satisfaction. The Supplier shall have no claim against the *Employer* in respect of delay due to the above.

ERI to get samples of bentonite and lime for testing before delivery for confirmation of specification.

The Supplier will deliver according to the *Employer's* standards, specifications, guidelines and procedures. Where no standards, specifications, guidelines and procedures are available, the Supplier will work according to the Generation Quality manual and professional guidelines. Where possible, standards will be reflected in the Task Order.
The employer shall evaluate, control and monitor the performance and effectiveness of the Supplier.

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# 5. PROCUREMENT

## 5.1 SITE AND MATERIALS

### 5.1.1 CORRECTION OF DEFECTS

If there is part of work that the *Employer* is not happy with, this will be indicated to the Supplier and will have to be rectified by the Supplier immediately where reasonably possible or within 5 working days after the defect was reported.

### 5.1.2 *CONTRACTOR*'S PROCUREMENT OF PLANT AND MATERIALS

Any equipment, appliances or materials used by the Supplier must conform to the applicable OHSACT safety standards and is to be maintained in a safe and proper working condition. The Project Manager has the right to stop the Supplier*'s* use of any equipment/ cleaning material which, in the opinion of the Project Manager, does not conform to the foregoing.

# 6. WORKING ON THE AFFECTED PROPERTY

Under no circumstances will the Supplier do the work without proper PPE. The Supervisor on the Supplier*'s* side will make it his duty to make sure that this is properly addressed.

## 6.1 EMPLOYER'S SITE ENTRY AND SECURITY CONTROL, PERMITS, AND SITE REGULATIONS

**Access to site**

The Supplier*'s* access to site shall be in line with the Site access procedure. The Supplier shall be required to make an application for his employees to enter site for the duration of the contract, including defects period. The permits shall only be issued once the Supplier*'s* employees have attended the safety induction training and have undergone medical checks. The safety induction will be for the *Employer's* account. The medical checks will be for the Supplier*'s* account.



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## 6.2 PEOPLE RESTRICTIONS, HOURS OF WORK, CONDUCT AND RECORDS

The *Works* will be carried out on a site-specific basis.

## 6.3 RECORDS OF *CONTRACTOR*'S EQUIPMENT

The Supplier*'s* driver should keep record of all the delivery notes. The Supplier is responsible for the safe keeping of all their equipment.

## 6.4 WORKING HOURS

The Supplier should align deliveries to ERI site working hours.

Any late deliveries arrangements should be made with the Project Manager.

Office employees will work as per below hours:

**Office hours**

| | | |
|---|---|---|
| Monday to Thursday: | | 07H00 to 17H00 |
| Friday | : | 07H00 to 17H00 |
| Sat, Sun & P/H | : | As and when required |
| Lunch break | : | As and when required |

NB: Working hours shall remain flexible to alteration, if required

## 6.5 CONTROL OF NOISE, DUST, WATER AND WASTE

The Suppliers must supply their own dust masks and cloth masks as part of PPE. Drinking water is available on site as well as waste bins for disposing waste.



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## 6.6 LIST OF DRAWINGS

The following bending schedules will be submitted to the Supplier as and when required.

| Eskom Drawing Number | J&W Drawing Number | Revision | Title |
|---|---|---|---|
| 0.84/68564 | I935-300-001 | 0 | DAM 3 COMPLEX GENERAL ARRANGEMENT |
| 0.84/68565 | I935-300-002 | 0 | DAM 3 COMPLEX COMPARTMENT 1 - LAYOUT & TYPICAL SECTIONS |
| 0.84/68566 | I935-300-003 | 0 | DAM 3 COMPLEX COMPARTMENT 1 - RAMP AND SPILLWAY |
| 0.84/68567 | I935-300-004 | 0 | DAM 3 COMPLEX COMPARTMENT 2 - LAYOUT & TYPICAL SECTIONS |
| 0.84/68568 | I935-300-005 | 0 | DAM 3 COMPLEX COMPARTMENT 2 - RAMP AND SPILLWAY |
| 0.84/68569 | I935-300-006 | 0 | DAM 3 COMPLEX COMPARTMENT 3 - LAYOUT & TYPICAL SECTIONS |
| 0.84/68570 | I935-300-007 | 0 | DAM 3 COMPLEX COMPARTMENT 3 - RAMP AND SPILLWAY |
| 0.84/68571 | I935-300-008 | 0 | DAM 3 COMPLEX COMPARTMENT - UNDER DRAINAGE |
| 0.84/68591 | I935-300-011 | 0 | DAM 3 COMPLEX - PUMPING MANHOLE COVER DETAILS |
| 0.84/68583 | I935-500-010 | 0 | CLEAN DIVERSION CANAL CULVERT – CONCRETE LAYOUT DETAILS AND SECTIONS |
| 0.84/68589 | I935-600-001 | 0 | CLEAN DIVERSION CANAL CULVERT – REINFORCING DETAILS AND SECTIONS |
| 0.84/68590 | I935-600-002 | 0 | CLEAN DIVERSION CANAL CULVERT – BENDING SCHEDULE |
| 0.84/68574 | I935-500-001 | 0 | ROADS AND FENCE - GENERAL LAYOUT |

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## 6.7 ACCEPTANCE

This document has been seen and accepted by:

| Name | Designation |
|---|---|
| Thabo Nhleko | Portfolio Manager Civils |
| Terence Khumalo | Project Manager (Acting) |
| | |

## 6.8 REVISIONS

| Date | Rev. | Compiler | Remarks |
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## 6.9 DEVELOPMENT TEAM

The following people were involved in the development of this document:

## 6.10 ACKNOWLEDGEMENTS

None

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