

NEC3 Engineering and Construction

Short Contract (ECSC3)

A contract between **Eskom Rotek Industries SOC Ltd**
(Reg No. 1990/006897/30)

and **XXXXXXXXXXXX**
(Reg No. XXXX)

for **CONSTRUCTION OF PCD, CULVERTS & FENCE AT
MEDUPI POWER STATION**

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Documentation prepared by: ERI Contracts Management

C1 Agreements & Contract Data

Article I. C1.1 Form of Offer and Acceptance

Section 1.01 Offer

The *Employer*, identified in the Acceptance page signature block on the next page, has solicited offers to enter into a contract for the procurement of:

CONSTRUCTION OF PCD, CULVERTS & FENCE AT MEDUPI POWER STATION

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

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

The offered total of the Prices exclusive of VAT is	R 0.00
Value Added Tax @ 15% is	R 0.00
The offered total of the Prices inclusive of VAT is	R 0.00
(in words).	

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

Signature(s)

Name(s)

Capacity

**For the
tenderer:**

(Insert name and address of organisation)

Name &
signature of
witness

Date

Tenderer's CIDB registration number:

Section 1.02 Acceptance

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

The terms of the Contract, are contained in:

Part 1 Agreements and Contract Data, (which includes this Form of Offer and Acceptance)

Part 2 Pricing Data

Part 3 Scope of Work: Works Information

Part 4 Site Information

and drawings and documents (or parts thereof), which may be incorporated by reference into the above listed Parts.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules as well as any changes to the terms of the Offer agreed by the tenderer and the *Employer* during this process of Offer and Acceptance, are contained in the Schedule of Deviations attached to and forming part of this Form of Offer and Acceptance. No amendments to or deviations from said documents are valid unless contained in this Schedule, which must be signed by the duly authorised representative(s) for both parties.

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

Notwithstanding anything contained herein, this Agreement comes into effect on the date when the tenderer receives one fully completed and signed copy of this document, including the Schedule of Deviations (if any) together with all the terms of the contract as listed above.

Signature(s)

Name(s)

Carol Sigudu

Capacity

ERI Construction Services General
Manager

**for the
Employer**

Eskom Rotek Industries SOC Limited
Lower Germiston Road
Rosherville

Name &
signature of
witness

Date

Note: If a tenderer wishes to submit alternative tender offers, further copies of this document may be used for that purpose, duly endorsed, 'Alternative Tender No. _____'

Section 1.03 Schedule of Deviations

Note:

1. To be completed by the *Employer* prior to award of contract. This part of the Offer & Acceptance would not be required if the contract has been developed by negotiation between the Parties and is not the result of a process of competitive tendering.
2. The extent of deviations from the tender documents issued by the *Employer* prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender.
3. A tenderer's covering letter must not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid be the subject of agreement reached during the process of Offer and Acceptance, the outcome of such agreement shall be recorded here and the final draft of the contract documents shall be revised to incorporate the effect of it.

No.	Subject	Details
1		
2		
3		
4		
5		
6		
7		

By the duly authorised representatives signing this Schedule of Deviations below, the *Employer* and the tenderer agree to and accept this Schedule of Deviations as the only deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules, as well as any confirmation, clarification or changes to the terms of the Offer agreed by the tenderer and the *Employer* during this process of Offer and Acceptance.

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

(i) For the tenderer:

(ii) For the Employer

Signature _____

Name _____

Capacity _____

On behalf
of _____

Name &
signature
of witness _____

Date _____

Carol Sigudu

ERI Construction Services General Manager

Eskom Rotek Industries SOC Limited
Heritage Office Park
Lower Germiston Road
Rosherville
Johannesburg
2022

Article II. C1.2 Contract Data

Section 2.01 Data provided by the *Employer*

Section 2.03 Statement of Intent		Section 2.04 Data
Section 2.05 General		Section 2.06
10.1	The <i>Employer</i> is (Name):	Eskom Rotek Industries SOC Limited (Reg. 1990/006897/30), a state-owned company incorporated in terms of the company laws of the Republic of South Africa
	Address	Eskom Rotek Industries SOC Limited Heritage Office Park Lower Germiston Road Rosherville Johannesburg 2022
10.1 & 14.4	The <i>Employer's</i> representative to whom the <i>Employer</i> in terms of clause 14.4 delegates his actions ¹ is (Name):	Patricia Modiba
	Address	Eskom Rotek Industries SOC Limited Heritage Office Park Lower Germiston Road Rosherville Johannesburg 2022
	Tel No.	+27 11 629 8000
	E-mail address	ModibaPM@eskom.co.za
11.2(11)	The <i>works</i> are	• Construction of Pollution Control Dams. • Construction of storm water management infrastructure. • Construction of culvert infrastructure. • Security Fence
11.2(13)	The Works Information is in	the document called 'Works Information' in Part 3 of this contract.
11.2(12)	The Site Information is in	the document called 'Site Information' in Part 4 of this contract.
11.2(12)	The <i>site</i> is	Medupi Power Station.
30.1	The <i>starting date</i> is.	01 September 2025
11.2(2)	The <i>completion date</i> is.	30 November 2026
13.2	The <i>period for reply</i> is	one (1) week
40	The <i>defects date</i> is	fifty-two (52) weeks after Completion.

¹ Except those actions which can only be done by the *Employer* as a Party to the contract.

41.3	The <i>defect correction period</i> is	two (2) weeks. If the Defect is such a nature that it cannot reasonably be repaired in two weeks, the <i>Contractor</i> promptly notifies the <i>Employer's</i> representative and submits a plan for correcting the defect.
50.1	The <i>assessment day</i> is the	25th day of each successive month.
50.5	The <i>delay damages</i> are	R2 500 per day up to 10% of the Prices at the Contract Date.
50.6	The retention is	0% of the Prices at the Contract Date
51.2	The interest rate on late payment is	the publicly quoted prime rate of interest (calculated on a 365-day year) charged by from time to time by the Standard Bank of South Africa Limited (as certified, in the event of any dispute, by any manager of such bank, whose appointment it shall not be necessary to prove) for amounts due in Rands.
80.1	The <i>Contractor</i> is not liable to the <i>Employer</i> for loss of or damage to the <i>Employer's</i> property in excess of	the amount of the deductibles relevant to the event
	Does the United Kingdom Housing Grants, Construction and Regeneration Act (1996) apply?	No
93.1	The <i>Adjudicator</i> is	The referring Party selects two (2) persons from the panel of NEC Adjudicators set up by the ICE-SA Division (or its successor body) of the South African Institution (see www.icesa.org.za) and whose availability he has confirmed to act as the Adjudicators. The other Party selects (one) 1 of the (two) 2 nominees to be the Adjudicator within (four) 4days, failing which the person chosen by the first party will be the Adjudicator. The parties appoint the selected Adjudicator under the NEC3 Adjudicator's Contract. If the Parties do not agree on an Adjudicator, the Adjudicator will be appointed by the Arbitration Foundation of Southern Africa (AFSA).
93.2(2)	The <i>Adjudicator nominating body</i> is:	the Chairman of ICE-SA a joint Division of the South African Institution of Civil Engineering and the London Institution of Civil Engineers. (See www.ice-sa.org.za) or its successor body
93.4	The <i>tribunal</i> is:	arbitration.
	The <i>arbitration procedure</i> is	the latest edition of Rules for the Conduct of Arbitrations published by The Association of Arbitrators (Southern Africa) or its successor body.
	The place where arbitration is to be held is	Johannesburg, South Africa

The person or organisation who will choose an arbitrator.

- if the Parties cannot agree a choice or
 - if the arbitration procedure does not state who selects an arbitrator, is
- the Chairman for the time being or his nominee of the Association of Arbitrators (Southern Africa) or its successor body.**

The conditions of contract are the NEC3 Engineering and Construction Short Contract (April 2013)²³ and the following additional conditions Z1 to Z11 which always apply:

Z1 Cession delegation and assignment

- Z1.1 The *Contractor* does not cede, delegate, or assign any of its rights or obligations to any person without the written consent of the *Employer*.
- Z1.2 Notwithstanding the above, the *Employer* may on written notice to the *Contractor* cede and delegate its rights and obligations under this contract to any of its subsidiaries or any of its present divisions or operations which may be converted into separate legal entities as a result of the restructuring of the Electricity Supply Industry.

Z2 Change of Broad Based Black Economic Empowerment (B-BBEE) status

- Z2.1 Where a change in the *Contractor's* legal status, ownership or any other change to his business composition or business dealings results in a change to the *Contractor's* B-BBEE status, the *Contractor* notifies the *Employer* within seven days of the change.
- Z2.2 The *Contractor* is required to submit an updated verification certificate and necessary supporting documentation confirming the change in his B-BBEE status to the *Employer* within thirty days of the notification or as otherwise instructed by the *Employer*.
- Z2.3 Where, as a result, the *Contractor's* B-BBEE status has decreased since the *starting date* the *Employer* may either re-negotiate this contract or alternatively, terminate the *Contractor's* obligation to Provide the Works.
- Z2.4 Failure by the *Contractor* to notify the *Employer* of a change in its B-BBEE status may constitute a reason for termination. If the *Employer* terminates in terms of this clause, the procedures on termination are those stated in Clause 91.1 and the amount due on termination includes amounts listed in Clause 92.1 less a deduction of the forecast additional cost to the *Employer* of completing the *works*.

Z3 Confidentiality

- Z3.1 The *Contractor* does not disclose or make any information arising from or in connection with this contract available to others except where required by this contract. This undertaking does not, however, apply to information which at the time of disclosure or thereafter, without default on the part of the *Contractor*, enters the public domain or to information which was already in the possession of the *Contractor* at the time of disclosure (evidenced by written records in existence at that time). Should the *Contractor* disclose information to others where required by this contract the *Contractor* ensures that the provisions of this clause are complied with by the recipient.
- Z3.2 If the *Contractor* is uncertain about whether any such information is confidential, it is to be regarded as such until notified otherwise by the *Employer*.

² If June 2005 Edition applies, delete April 2013 and insert June 2005

³ State whether attached as a 'PDF' file in terms of Eskom's licence, or to be obtained from Engineering Contract Strategies Tel 011 803 3008, Fax 086 539 1902 or www.ecs.co.za.

- Z3.3 In the event that the *Contractor* is, at any time, required by law to disclose any such information which is required to be kept confidential, the *Contractor*, to the extent permitted by law prior to disclosure, notifies the *Employer* so that an appropriate protection order and/or any other action can be taken if possible, prior to any disclosure. In the event that such protective order is not, or cannot, be obtained, then the *Contractor* may disclose that portion of the information which it is required to be disclosed by law and uses reasonable efforts to obtain assurances that confidential treatment will be afforded to the information so disclosed.
- Z3.4 The taking of images (whether photographs, video footage or otherwise) of the *works* or any portion thereof, in the course of Providing the Works and after Completion, requires the prior written consent of the *Employer*. All rights in and to all such images vests exclusively in the *Employer*.
- Z3.5 The *Contractor* ensures that all his subcontractors abide by the undertakings in this clause.

Z4 Waiver and estoppel: Add to clause 12.2:

- Z4.1 Any extension, concession, waiver or relaxation of any action stated in this contract by the Parties or their delegates or the *Adjudicator* does not constitute a waiver of rights and does not give rise to an estoppel unless the Parties agree otherwise and confirm such agreement in writing.

Z5 Health, safety, and the environment

- Z5.1 The *Contractor* undertakes to take all reasonable precautions to maintain the health and safety of persons in and about the execution of the *works*. Without limitation the *Contractor*:
- accepts that the *Employer* may appoint him as the "Principal Contractor" (as defined and provided for under the Construction Regulations 2014 (promulgated under the Occupational Health & Safety Act 85 of 1993) ("the Construction Regulations") for the Site;
 - warrants that the total of the Prices as at the Contract Date includes a sufficient amount for proper compliance with the Construction Regulations, all applicable health & safety laws and regulations and the health and safety rules, guidelines and procedures provided for in this contract and generally for the proper maintenance of health & safety in and about the execution of *works*; and
 - undertakes, in and about the execution of the *works*, to comply with the Construction Regulations and with all applicable health & safety laws and regulations and rules, guidelines and procedures otherwise provided for under this contract and ensures that his Subcontractors, employees and others under the *Contractor's* direction and control, likewise observe and comply with the foregoing.
- Z5.2 The *Contractor*, in and about the execution of the *works*, complies with all applicable environmental laws and regulations and rules, guidelines and procedures otherwise provided for under this contract and ensures that his subcontractors, employees and others under the *Contractor's* direction and control, likewise observe and comply with the foregoing.

Z6 Provision of a Tax Invoice and interest. Add to clause 50

- Z6.1 The *Contractor* provides the *Employer* with a tax invoice in accordance with the *Employer's* procedures stated in the Works Information, showing the correctly assessed amount due for payment.
- Z6.2 If the *Contractor* does not provide a tax invoice in the form and by the time required by this contract, the time by when the *Employer* is to make a payment is extended by a period equal in time to the delayed submission of the correct tax invoice. Interest due by the *Employer* in terms of clause 51.2 is then calculated from the delayed date by when payment is to be made.

- Z6.3 The *Contractor* is required to comply with the requirements of the Value Added Tax Act, no 89 of 1991 (as amended) and to include the *Employer's* VAT number 4740101508 on each invoice he submits for payment.

Z7 Notifying compensation events

- Z7.1 Delete from the last sentence in clause 61.1, "unless the event arises from an instruction of the *Employer*."
- Z7.2 Add to core clause 62.3 "The *Employer's Representative* reply which is an acceptance of a quotation for a compensation event may require the due authority of the *Employer*."
- Z7.3 Add core clause 62.6 "The *Employer's Representative* extends the time allowed for:
- the *Contractor* to submit quotations for a compensation event and
 - the *Employer's Representative* to reply to a quotation.

The *Employer's Representative* notifies the *Contractor* if the *Employer's* authority is required and includes in his notification any extension to the period within which he is required to reply to the *Contractor's* quotation.

Z8 *Employer's* limitation of liability; Add to clause 80.1

- Z8.1 The *Employer* liability to the *Contractor* for the *Contractor's* indirect or consequential loss is limited to R0.00 (zero Rand).

Z9 Termination: Add to clause 90.2, after the words "or its equivalent":

- Z9.1 or had a business rescue order granted against it.

Z10 Addition to Clause 50.5

- Z10.1 If the amount due for the *Contractor's* payment of *delay damages* reaches the limits stated in this Contract Data (if any), the *Employer* may terminate the *Contractor's* obligation to Provide the Works.

If the *Employer* terminates in terms of this clause, the procedures on termination are those stated in Clause 91.1 and the amount due on termination includes amounts listed in Clause 92.1 less a deduction of the forecast additional cost to the *Employer* of completing the *works*.

Z11 Ethics

For the purposes of this Z-clause, the following definitions apply:

Affected Party means, as the context requires, any party, irrespective of whether it is the *Contractor* or a third party, such party's employees, agents, or Subconsultants or Subcontractor's employees, or any one or more of all of these parties' relatives or friends,

Coercive Action means to harm or threaten to harm, directly or indirectly, an Affected Party or the property of an Affected Party, or to otherwise influence or attempt to influence an Affected Party to act unlawfully or illegally,

Collusive Action	means where two or more parties co-operate to achieve an unlawful or illegal purpose, including to influence an Affected Party to act unlawfully or illegally,
Committing Party	means, as the context requires, the <i>Contractor</i> , or any member thereof in the case of a joint venture, or its employees, agents, or Subcontractors or the Subcontractor's employees,
Corrupt Action	means the offering, giving, taking, or soliciting, directly or indirectly, of a good or service to unlawfully or illegally influence the actions of an Affected Party,
Fraudulent Action	means any unlawfully or illegally intentional act or omission that misleads, or attempts to mislead, an Affected Party, in order to obtain a financial or other benefit or to avoid an obligation or incurring an obligation,
Obstructive Action	means a Committing Party unlawfully or illegally destroying, falsifying, altering or concealing information or making false statements to materially impede an investigation into allegations of Prohibited Action, and
Prohibited Action	means any one or more of a Coercive Action, Collusive Action Corrupt Action, Fraudulent Action or Obstructive Action.

- Z11.1 A Committing Party may not take any Prohibited Action during the course of the procurement of this contract or in execution thereof.
- Z11.2 The *Employer* may terminate the *Contractor's* obligation to Provide the Services if a Committing Party has taken such Prohibited Action and the *Contractor* did not take timely and appropriate action to prevent or remedy the situation, without limiting any other rights or remedies the *Employer* has. It is not required that the Committing Party had to have been found guilty, in court or in any other similar process, of such Prohibited Action before the *Employer* can terminate the *Contractor's* obligation to Provide the Services for this reason.
- Z11.3 If the *Employer* terminates the *Contractor's* obligation to Provide the Services for this reason, the amounts due on termination are those intended in core clauses 92.1 and 92.2.
- Z11.4 A Committing Party co-operates fully with any investigation pursuant to alleged Prohibited Action. Where the *Employer* does not have a contractual bond with the Committing Party, the *Contractor* ensures that the Committing Party co-operates fully with an investigation.

Z12 Insurance

Z_12.1 Replace core clause 82 with the following:

Insurance cover 82

- 82.1 When requested by a Party, the other Party provides certificates from his insurer or broker stating that the insurances required by this contract are in force.
- 82.2 The *Contractor* provides the insurances stated in the Insurance Table A, from the *starting date* until the earlier of Completion and the date of the termination certificate.

INSURANCE TABLE A

Insurance against	Minimum amount of cover or minimum limit of indemnity	Cover provided until
Loss of or damage to the works	The replacement cost where not covered by the <i>Employer's</i> insurance. The <i>Employer's</i> policy deductible as at contract date, where covered by the <i>Employer's</i> insurance	The <i>Employer's</i> certificate of Completion has been issued
Loss of or damage to Equipment, Plant and Materials	The replacement cost where not covered by the <i>Employer's</i> insurance. The <i>Employer's</i> policy deductible as at contract date, where covered by the <i>Employer's</i> insurance	The Defects Certificate has been issued
The <i>Contractor's</i> liability for loss of or damage to property (except the works, Plant and Materials and Equipment) and for bodily injury to or death of a person (not an employee of the <i>Contractor</i>) arising from or in connection with the <i>Contractor's</i> Providing the Works	<u>Loss of or damage to property</u> <u>Employer's property</u> The replacement cost where not covered by the <i>Employer's</i> insurance The <i>Employer's</i> policy deductible as at contract date where covered by the <i>Employer's</i> insurance <u>Other property</u> The replacement cost <u>Bodily injury to or death of a person</u> The amount required by the applicable law	
Liability for death of or bodily injury to employees of the <i>Contractor</i> arising out of and in the course of their employment in connection with this contract	The amount required by the applicable law	

82.3 The *Employer* provides the insurances as stated in the Insurance Table B

INSURANCE TABLE B

Insurance against or name of policy	Minimum amount of cover or minimum limit of indemnity
Assets All Risk	Per the insurance policy document
Contract Works insurance	Per the insurance policy document
Environmental Liability	Per the insurance policy document
General and Public Liability	Per the insurance policy document
Transportation (Marine)	Per the insurance policy document
Motor Fleet and Mobile Plant	Per the insurance policy document
Terrorism	Per the insurance policy document
Cyber Liability	Per the insurance policy document
Nuclear Material Damage and Business Interruption	Per the insurance policy document
Nuclear Material Damage Terrorism	Per the insurance policy document

Z13 Nuclear Liability

- Z13.1 The *Employer* is the operator of the Koeberg Nuclear Power Station (KNPS), a nuclear installation, as designated by the National Nuclear Regulator of the Republic of South Africa and is the holder of a nuclear licence in respect of the KNPS.
- Z13.2 The *Employer* is solely responsible for and indemnifies the *Contractor* or any other person against any and all liabilities which the *Contractor* or any person may incur arising out of or resulting from nuclear damage, as defined in Act 47 of 1999, save to the extent that any liabilities are incurred due to the unlawful intent of the *Contractor* or any other person or the presence of the *Contractor* or that person or any property of the *Contractor* or such person at or in the KNPS or on the KNPS site, without the permission of the *Employer* or of a person acting on behalf of the *Employer*.
- Z13.3 Subject to clause Z13.4 below, the *Employer* waives all rights of recourse, arising from the aforesaid, save to the extent that any claims arise or liability is incurred due or attributable to the unlawful intent of the *Contractor* or any other person, or the presence of the *Contractor* or that person or any property of the *Contractor* or such person at or in the KNPS or on the KNPS site, without the permission of the *Employer* or of a person acting on behalf of the *Employer*.
- Z13.4 The *Employer* does not waive its rights provided for in section 30 (7) of Act 47 of 1999, or any replacement section dealing with the same subject matter.
- Z13.5 The protection afforded by the provisions hereof shall be in effect until the KNPS is decommissioned.

Z14 Asbestos

For the purposes of this Z-clause, the following definitions apply:

AAIA	means approved asbestos inspection authority.
ACM	means asbestos containing materials.
AL	means action level, i.e. a level of 50% of the OEL, i.e. 0.1 regulated asbestos fibres per ml of air measured over a 4 hour period. The value at which proactive actions is required in order to control asbestos exposure to prevent exceeding the OEL.
Ambient Air	means breathable air in area of work with specific reference to breathing zone, which is defined to be a virtual area within a radius of approximately 30cm from the nose inlet.
Compliance Monitoring	means compliance sampling used to assess whether or not the personal exposure of workers to regulated asbestos fibres is in compliance with the Standard's requirements for safe processing, handling, storing, disposal and phase-out of asbestos and asbestos containing material, equipment and articles.
OEL	means occupational exposure limit.
Parallel Measurements	means measurements performed in parallel, yet separately, to existing measurements to verify validity of results.
Safe Levels	means airborne asbestos exposure levels conforming to the Standard's requirements for safe processing, handling, storing, disposal and phase-out of asbestos and asbestos containing material, equipment and articles.
Standard	means the <i>Employer's</i> Asbestos Standard 32-303: Requirements for Safe Processing, Handling, Storing, Disposal and Phase-out of Asbestos and Asbestos Containing Material, Equipment and Articles.
SANAS	means the South African National Accreditation System.
TWA	means the average exposure, within a given workplace, to airborne asbestos fibres, normalised to the baseline of a 4 hour continuous period, also applicable to short term exposures, i.e. 10-minute TWA.

Z14.1 The *Employer* ensures that the Ambient Air in the area where the *Contractor* will Provide the Services conforms to the acceptable prescribed South African standard for asbestos, as per the regulations published in GNR 155 of 10 February 2002, under the Occupational Health and Safety Act, 1993 (Act 85 of 1993) ("Asbestos Regulations"). The OEL for asbestos is 0.2 regulated asbestos fibres per millilitre of air as a 4-hour TWA, averaged over any continuous period of four hours, and the short term exposure limit of 0.6 regulated asbestos fibres per millilitre of air as a 10-minute TWA, averaged over any 10 minutes, measured in accordance with HSG248 and monitored according to HSG173 and OESSM.

Z14.2 Upon written request by the *Contractor*, the *Employer* certifies that these conditions prevail. All measurements and reporting are effected by an independent, competent, and certified occupational hygiene inspection body, i.e. a SANAS accredited and Department of Employment and Labour approved AAIA. The *Contractor* may perform Parallel Measurements and related control measures at the *Contractor's* expense. For the purposes of compliance the results generated from Parallel Measurements are evaluated only against South African statutory limits as detailed in clause Z14.1. Control measures conform to the requirements stipulated in the AAIA-approved asbestos work plan.

Z14.3 The *Employer* manages asbestos and ACM according to the Standard.

- Z14.4 In the event that any asbestos is identified while Providing the Services, a risk assessment is conducted and if so required, with reference to possible exposure to an airborne concentration of above the AL for asbestos, immediate control measures are implemented and relevant air monitoring conducted in order to declare the area safe.
- Z14.5 The *Contractor's* personnel are entitled to stop working and leave the contaminated area forthwith until such time that the area of concern is declared safe by either Compliance Monitoring or an AAIA approved control measure intervention, for example, per the emergency asbestos work plan, if applicable.
- Z14.6 The *Contractor* continues to Provide the Services, without additional control measures presented, on presentation of Safe Levels. The contractually agreed dates to Provide the Services, including the Completion Date, are adjusted accordingly. The contractually agreed dates are extended by the notification periods required by regulations 3 and 21 of the Asbestos Regulations, 2001.
- Z14.7 Any removal and disposal of asbestos, asbestos containing materials and waste, is done by a registered asbestos contractor, instructed by the *Employer* at the *Employer's* expense, and conducted in line with South African legislation.

Section 2.07 Data provided by the Contractor (the Contractor's Offer)

The tendering contractor is advised to read both the NEC3 Engineering and Construction Short Contract (April 2013) and the relevant parts of its Guidance Notes (ECSC3-GN)⁴ in order to understand the implications of this Data which the tenderer is required to complete. An example of the completed Data is provided on page 31 of the ECSC3 April 2013 Guidance Notes.

Completion of the data in full is essential to create a complete contract.

10.1	The Contractor is (Name):	XXXXXX
	Address	XXXXXX
	Tel No.	
	Fax No.	XXXXXX
	E-mail address	

63.2	The percentage for overheads and profit added to the Defined Cost for people is.	10%
	Note: The percentage for overheads and profit are applied to any change in the Defined Cost due to the compensation event. The percentage is required to cover all costs and overheads not included in the Defined Cost as well as an allowance for profit. This percentage is applied to Defined Cost for people.	

63.2	The percentage for overheads and profit added to other Defined Cost is.	10%
	Note: The percentage for overheads and profit are applied to any change in the Defined Cost due to the compensation event. The percentage is required to cover all costs and overheads not included in the Defined Cost as well as an allowance for profit. This percentage is applied to all Defined Cost except people.	

11.2(9)	The Price List is in	the document called 'Price List' in Part 2 of this contract.
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11.2(10)	The offered total of the Prices is.	R 0.00 excluding VAT
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⁴ Available from Engineering Contract Strategies Tel 011 803 3008, Fax 086 539 1902 or www.ecs.co.za.

C2 Pricing Data

Article III. C2.1 Pricing assumptions

Entries in the first four columns in the Price List are made either by the *Employer* or the tendering *Contractor*.

If the *Contractor* is to be paid an amount for the item which is not adjusted if the quantity of work in the item changes, the tenderer enters the amount in the Price column only; the Unit, Quantity and Rate columns being left blank.

If the *Contractor* is to be paid an amount for the item of work which is the rate for the work multiplied by the quantity completed, the tenderer enters the rate which is then multiplied by the expected quantity to produce the Price, which is also entered.

All Prices are to be shown excluding VAT unless instructed otherwise by the *Employer* in Tender Data or in an instruction the *Employer* has given before the tenderer enters his Prices.

If there is insufficient space in the Price List which follows, state in which document the Price List is contained.

Article IV. C2.2 Price List

The Price List is as follows:

BOQ

BILL OF QUANTITIES						
BILL NO 1 PRELIMINARY & GENERAL						
ITEM NO	PAYMENT REFERENCE	DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
				0		R -
	SABS 1200 A	GENERAL		1		
				0		
	8.3	FIXED-CHARGE AND VALUE-RELATED ITEMS				
				0		
1/1	8.3.1	Contractual requirements	Sum	1	R -	R -
				0		R -
	PSA 8.3.2	<u>Establishment of facilities on the site</u>		0	R -	R -
				0		R -
				0		R -
	8.3.2.2	<u>Facilities for Contractor</u>		0		R -
1/2		a) Offices and storage sheds	Sum	1	R -	R -
1/3		b) Workshops	Sum	1	R -	R -
1/4		c) Laboratories	Sum	1	R -	R -
1/5		d) Living accommodation	Sum	1	R -	R -
1/6		e) Ablution and latrine facilities	Sum	1	R -	R -
1/7		f) Tools and equipment	Sum	1	R -	R -
1/8		g) Water supplies, electric power and communications	Sum	1	R -	R -
1/9		h) Dealing with water (see 5.5)	Sum	1	R -	R -
1/10		i) Access (see 5.8)	Sum	1	R -	R -
1/11		j) Plant (designated plant specifically identified)	Sum	1	R -	R -
				0	R -	R -
1/12	8.3.3	Other fixed-charge obligations	Sum	1	R -	R -

					R	R
					-	-
1/13	PA 5.1.6	Forward cover of geosynthetic supply	Sum	1	R	R
					-	-
					R	R
					-	-
1/14	8.3.4	Removal of site establishment	Sum	1	R	R
					-	-
				0		R
					-	-
	8.4	TIME-RELATED ITEMS			R	R
					-	-
				0		R
					-	-
1/15	8.4.1	Contractual requirements	Month	15	R	R
					-	-
				0	R	R
					-	-
	PSA 8.4.2	<u>Operation and maintenance of facilities on site, for duration of construction, except where otherwise stated</u>		0	R	R
					-	-
				0	R	R
					-	-
				0	R	R
					-	-
	8.4.2.2	<u>Facilities for Contractor</u>		0	R	R
					-	-
1/16		a) Offices and storage sheds	Month	15	R	R
					-	-
1/17		b) Workshops	Month	15	R	R
					-	-
1/18		c) Laboratories	Month	15	R	R
					-	-
1/19		d) Living accommodation	Month	15	R	R
					-	-
1/20		e) Ablution and latrine facilities	Month	15	R	R
					-	-
1/21		f) Tools and equipment	Month	15	R	R
					-	-
1/22		g) Water supplies, electric power and communications	Month	15	R	R
					-	-
1/23		h) Dealing with water (see 5.5)	Month	15	R	R
					-	-
1/24		i) Access (see 5.8)	Month	15	R	R
					-	-
		j) Plant (designated plant specifically identified)	Month	15	R	R
					-	-
				0	R	R
					-	-
1/25	PSA 8.4.3	Supervision for duration of construction	Month	15	R	R
					-	-
				0	R	R
					-	-
1/26	8.4.4	Company and head office overhead costs for the duration of the contract	Month	15	R	R
					-	-

				0	R	R
					-	-
1/27	8.4.5	Other time-related obligations	Month	15	R	R
					-	-
				0	R	R
					-	-
	8.5	SUMS STATED PROVISIONALLY BY ENGINEER				R
					-	-
				0	R	R
					-	-
1/28		a) For work to be executed by the Contractor and valued in terms of the "valuation of variations" clause in the conditions of contract	Sum	1	R	R
					-	-
				0	R	R
					-	-
1/29		b) (1) For work to be executed by the Employer or a nominated subcontractor		0	R	R
					-	-
1/30	PA 5.1.5	i) Geosynthetic materials testing for QA and QC	Prov Sum	1	R	R
					-	-
1/31	PA 5.1.5	ii) Liner interface testing or other testwork required for QA and QC	Prov Sum	1	R	R
					-	-
1/32		iii) Additional tests ordered as necessary	Prov Sum	1	R	R
					-	-
1/33		iv) Additional Survey Work	Prov Sum	1	R	R
					-	-
1/34		v) Additional geotechnical Investigations	Prov Sum	1	R	R
					-	-
1/35		vi) Independent laboratory audit	Prov Sum	1	R	R
					-	-
1/36	2.2.10	Plant and Infrastructure labelling (KKS)	Prov Sum	1	R	R
					-	-
1/37	2.4.4	Safety signage	Prov Sum	1	R	R
					-	-
		<u>(2) Overheads, charges and profit on (1) above</u>		0	R	R
					-	-
1/38		i) Geosynthetic materials testing for QA and QC	%	8%	R	R
					-	-
1/39		ii) Liner interface testing or other testwork required for QA and QC	%	8%	R	R
					-	-
1/40		iii) Additional tests ordered as necessary	%	8%	R	R
					-	-
1/41		iv) Additional Survey Work	%	8%	R	R
					-	-
1/42		v) Additional geotechnical Investigations	%	8%	R	R
					-	-
1/43		vi) Independent laboratory audit	%	8%	R	R
					-	-
1/44		Plant and Infrastructure labelling	%	8%	R	R
					-	-
1/45		Safety signage	%	8%	R	R
					-	-
					R	R
					-	-

	8.8.4	EXISTING SERVICES			R	R
				0	-	-
1/46		a) Supply or hire of specialist equipment or services for the detection of a particular service	Sum	1	R	R
				0	-	-
1/47		b) The use of equipment or services referred to in item (a) above	Sum	1	R	R
				0	-	-
1/48		c) Excavation by hand in soft material to expose existing services	m3	500	R	R
				0	-	-
1/49		d) Temporary protection of existing service	Sum	1	R	R
				0	-	-
TOTAL CARRIED TO FINAL SUMMARY					R	R
					-	-
Dam 3 Complex						
		PREPARATION				
	SABS 1200 D	<u>EARTHWORKS</u>				
3/1	8.3.10	<u>Topsoiling</u>				
		a) Area between the west temporary access road and the northern side of Compartment 2 and 3 and western side of Compartment 3 after reshaping	m ²	28656	R	R
					-	-
						R
						-
	SABS 1200 DE	<u>SMALL EARTH DAMS</u>		0		R
	8.3.1	<u>Site clearance</u>		0		R
						-
	8.3.1.1	<u>Clear and strip site</u>	ha	12.5	R	R
					-	-
3/2	8.3.1.2	Remove and grub large trees (complete with stumps) or stumps only (specify), of girth:		0		R
						-
3/3		a) 1 m and up to and including 2 m	No	100	R	R
					-	-
3/4		b) over 2 m and up to and including 3 m	No	50	R	R
					-	-
3/5		c) over 3 m	No	10	R	R
					-	-
	8.3.2	<u>Remove topsoil to nominal depth of 300 mm</u>		0		R
						-
3/6		a) Dam 3 complex footprint	m ³	37227	R	R
					-	-

3/7		b) Area between the west temporary access road and the north of Compartment 2 and 3 and west of Compartment 3	m ³	8037	R -	R -
				0		R -
	PSDE 8.3.3	<u>Excavation</u>		0		R -
		a) Material unsuitable for embankment		0		R -
3/8		1) Compartment 1	m ³	127955	R -	R -
3/9		2) Compartment 2	m ³	137541	R -	R -
3/10		3) Compartment 3	m ³	161262	R -	R -
3/11		4) Spillway and spillway canal	m ³	1296	R -	R -
		c) Extra-over items		0		R -
		2) Hard rock material				R -
3/12		i) Compartment 1	m ³	111553	R -	R -
3/13		ii) Compartment 2	m ³	111458	R -	R -
3/14		iii) Compartment 3	m ³	104786	R -	R -
						R -
	8.3.4	<u>Preparation of exposed surfaces</u>				R -
		c) Area to be covered by dam wall and basin				R -
3/15		1) Compartment 1	m ²	43289	R -	R -
3/16		2) Compartment 2	m ²	40592	R -	R -
3/17		3) Compartment 3	m ²	42916	R -	R -
						R -
	PSDE 8.3.5	<u>Forming embankment</u>		0		R -
		i) Site sand		0		R -
3/18		1) Area between the west temporary access road and the northern side of Compartment 2 and 3 and western side of Compartment 3 to create a 1:200 fall	m ³	11965	R -	R -
		j) G7 material from crushing and screening		0		R -
3/19		1) Compartment 1 embankments	m ³	6706	R -	R -

3/20		2) Compartment 2 embankments	m ³	2330	R -	R -
3/21		3) Compartment 3 embankments	m ³	1525	R -	R -
3/22		4) Storwater diversion berm	m ³	2861	R -	R -
		k) G7 material from commerical source		0	R -	R -
3/23		1) Compartment 1 embankments	m ³	6706	R -	R -
3/24		2) Compartment 2 embankments	m ³	2330	R -	R -
3/25		3) Compartment 3 embankments	m ³	1525	R -	R -
3/26		4) Storwater diversion berm	m ³	2861	R -	R -
						R -
	PC	<u>PARTICULAR SPECIFICATION - GRASSING</u>		0		R -
3/27	PC 8.2	Grassing/hydroseeding	m ²	4364	R -	R -
		UNDER DRAINAGE				
	SABS 1200 D	<u>EARTHWORKS</u>		0		
	8.3.3	<u>Restricted excavation</u>		0		
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose		0		
3/28		i) Compartment 1 - corrugated, slotted and perforated HDPE drain pipes of 160 mm diameter	m ³	227	R -	R -
3/29		ii) Compartment 2 - corrugated, slotted and perforated HDPE drain pipes of 160 mm diameter	m ³	229	R -	R -
3/30		iii) Compartment 3 - corrugated, slotted and perforated HDPE drain pipes of 160 mm diameter	m ³	246	R -	R -
				0		R -
	SABS 1200 DB	<u>EARTHWORKS (PIPE TRENCHES)</u>		0		R -
	8.3.2	<u>Excavation</u>		0		R -
		a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material		0		R -
		(2) Over 125 mm and up to 700 mm dia pipes for depths		0		R -
		0 to 6 m		0		R -
3/31		i) Compartment 1 - Outlet drain pipe, 200 mm diameter HDPE	m	53	R -	R -

3/32		ii) Compartment 2 - Outlet drain pipes 200 mm diameter HDPE	m	48	R -	R -
3/33		iii) Compartment 3 - Outlet drain pipes 200 mm diameter HDPE	m	49	R -	R -
3/34		iv) 200 mm diameter HDPE pipes joining four manholes	m	219	R -	R -
						R -
	SABS 1200 DE	<u>SMALL EARTH DAMS</u>		0		R -
	PSDE 8.3.5	<u>Forming embankment</u>		0		R -
		I) Clean stone		0		R -
3/35		1) Compartment 1 - 13mm clean stone for under drainage from commercial source	m ³	227	R -	R -
3/36		2) Compartment 2 - 13mm clean stone for under drainage from commercial source	m ³	229	R -	R -
3/37		3) Compartment 3 - 13mm clean stone for under drainage from commercial source	m ³	246	R -	R -
						R -
	SABS 1200L	<u>MEDIUM-PRESSURE PIPELINES</u>		0		R -
	8.2.1	<u>Supply, lay and bed pipes complete with couplings</u>		0		R -
		a) Corrugated, slotted, perforated HDPE pipe, PE100		0		R -
3/38		1) Compartment 1 - 160 mm diameter drain pipes	m	943	R -	R -
3/39		2) Compartment 2 - 160 mm diameter drain pipes	m	954	R -	R -
3/40		3) Compartment 3 - 160 mm diameter drain pipes	m	1024	R -	R -
		b) HDPE pipe, PE100, PN16, SDR 11				R -
3/41		1) Compartment 1 - 200 mm diameter drain pipes	m	53	R -	R -
3/42		2) Compartment 2 - 200 mm diameter drain pipes	m	48	R -	R -
3/43		3) Compartment 3 - 200 mm diameter drain pipes	m	49	R -	R -
3/44		4) 200 mm diameter HDPE pipes joining four manholes	m	219	R -	R -
				0		R -
	8.2.14	<u>a) Manholes</u>		0		R -
3/45		(1) 1.8m diameter under drainage manholes, as in accordance to I935-300-008	No.	4	R -	R -
3/46		b) Extra-over (a) for manholes of depth exceeding 1,5 m as shown on the drawings	0.25 m	78	R -	R -

				0		R -
	PART SPEC	PARTICULAR SPECIFICATION PA: GEOSYNTHETIC MATERIALS		0		R -
	PA 5.2	<u>Geosynthetic supply and installation</u>		0		R -
3/47		a) Compartment 1 - Separation geotextile around under drainage stone, in accordance with I935- 300-008	m ²	2894	R -	R -
3/48		b) Compartment 2 - Separation geotextile around under drainage stone, in accordance with I935- 300-008	m ²	2928	R -	R -
3/49		c) Compartment 3 - Separation geotextile around under drainage stone, in accordance with I935- 300-008	m ²	3142	R -	R -
						R -
3/50		Provisional Sum for additional under drainage including excavation, HDPE pipe, 13mm stone and seperation geotextile	Prov Sum	1	R -	R -
				0		R -
		LINER SYSTEM				
	SABS 1200 DE	<u>SMALL EARTH DAMS</u>				
	PSDE 8.3.5	<u>Forming embankment</u>				
		m) 5% bentonite enhanced soil by mass (site sand) from stockpile, 2 x 150 mm thick layers in accordance with drawing I935- 101-006				
3/51		1) Compartment 1	m ³	10128	R -	R -
3/52		2) Compartment 2	m ³	9862	R -	R -
3/53		3) Compartment 3	m ³	10855	R -	R -
				0		R -
		n) 8% cement stabilised screened site sand by mass from stockpile				R -
3/52		1) Compartment 1	m ³	9414	R -	R -
3/53		2) Compartment 2	m ³	9177	R -	R -
3/54		3) Compartment 3	m ³	10067	R -	R -
				0		R -
	SABS 1200G	<u>CONCRETE (STRUCTURAL)</u>				R -

	8.4	<u>SCHEDULED CONCRETE ITEMS</u>				R
						-
	8.4.3	Mass concrete (Grade 15MPa/19mm)				R
						-
3/55		1) Compartment 1 - geocells infill on ramp	m ³	75	R	R
					-	-
3/56		2) Compartment 2 - geocells infill on ramp	m ³	65	R	R
					-	-
3/57		3) Compartment 3 - geocells infill on ramp	m ³	66	R	R
					-	-
				0		R
						-
	SABS 1200L	<u>MEDIUM-PRESSURE PIPELINES</u>				R
						-
	8.2.1	<u>Supply, lay and bed pipes complete with couplings</u>				R
						-
		a) HDPE pipe, PE100, PN25, SDR 7.4				R
						-
3/58		1) Overflow pipe between Compartment 2 & 3 - 315 mm diameter HDPE	m	62	R	R
					-	-
						R
						-
	SABS 1200 ME	<u>SUBBASE</u>		0		R
						-
	8.3.8	<u>Stabilizing agent</u>		0		R
						-
		b) Portland cement				R
						-
3/59		1) Compartment 1	t	1443	R	R
					-	-
3/60		2) Compartment 2	t	1406	R	R
					-	-
3/61		3) Compartment 3	t	1543	R	R
					-	-
						R
						-
	PART SPEC	<u>PARTICULAR SPECIFICATION PA: GEOSYNTHETIC MATERIALS</u>				R
						-
	PA 5.1.1	Supply 1.5mm double textured HDPE geomembrane				R
						-
3/62		1) Compartment 1	m ²	35862	R	R
					-	-
3/63		2) Compartment 2	m ²	34943	R	R
					-	-
3/64		3) Compartment 3	m ²	38389	R	R
					-	-
				0		R
						-
	PA 5.1.2	Install 1.5mm double textured HDPE geomembrane		0		R
						-
3/65		1) Compartment 1	m ²	35862	R	R
					-	-
3/66		2) Compartment 2	m ²	34943	R	R
					-	-

3/67		3) Compartment 3	m ²	38389	R	R
				0	-	R
	PA 5.1.3	Anchor trench				R
3/68		1) Compartment 1	m ³	195	R	R
3/69		2) Compartment 2	m ³	192	R	R
3/70		3) Compartment 3	m ³	205	R	R
					-	R
	PA 5.1.4	Penetration		0		R
2/71		1) Compartment 2	No.	1	R	R
2/72		2) Compartment 3	No.	1	R	R
					-	R
	PA 5.2	<u>Geosynthetic supply and installation</u>				R
		1) 250 mm high geocells as per specification				R
3/73		a) Compartment 1	m ²	14571	R	R
3/74		b) Compartment 2	m ²	12578	R	R
3/75		c) Compartment 3	m ²	13468	R	R
					-	R
		2) Geogrid as per specification				R
3/76		a) Compartment 1	m ²	15568	R	R
3/77		b) Compartment 2	m ²	13558	R	R
3/78		c) Compartment 3	m ²	14513	R	R
				0		R
		3) Protection geotextile over ramps		0		R
3/79		a) Compartment 1	m ²	305	R	R
3/80		b) Compartment 2	m ²	263	R	R
3/81		c) Compartment 3	m ²	266	R	R
				0		R
	PART SPEC	<u>PARTICULAR SPECIFICATION</u> <u>PF: SOIL BENTONITE LAYER</u>		0		R

	PF 8	Supply bentonite for use in the processing of bentonite enhanced soil				R -
3/82		1) Compartment 1	t	970	R -	R -
3/83		2) Compartment 2	t	945	R -	R -
3/84		3) Compartment 3	t	1040	R -	R -
						R -
		VALVE CHAMBER				
	SABS 1200 DE	<u>SMALL EARTH DAMS</u>		0		
	PSDE 8.3.3	<u>Excavation</u>		0		
		a) Material unsuitable for embankment		0		
3/85		1) Valve chamber	m ³	98	R -	R -
				0		R -
	SABS 1200 G	<u>CONCRETE (STRUCTURAL)</u>		0		R -
	8.2	<u>Formwork</u>		0		R -
	8.2.1	<u>Rough</u>		0		R -
		a) Vertical		0		R -
3/86		i) foundations / slabs	m ²	5	R -	R -
				0		R -
	8.2.2	<u>Smooth</u>		0		R -
		a) Vertical		0		R -
		(1) Walls	m ²	112	R -	R -
						R -
	8.2.6	<u>Box out holes/form voids</u>				R -
		a) Cast-in of DN 355 HDPE pipes	No.	2	R -	R -
				0		R -
	8.3	Reinforcement		0		R -
						R -
	8.3.1	<u>Steel bars</u>		0		R -
		-				R -

		a) Mild steel reinforcement	t	0.2	R -	R -
						R -
		b) High-tensile reinforcement	t	3	R -	R -
						R -
	8.4	<u>Concrete</u>		0		R -
	8.4.2	<u>Blinding layer</u>		0		R -
3/87		a) 50 mm minimum thickness grade 15/19 concrete	m ²	14	R -	R -
	8.4.3	<u>Strength Concrete : Grade 35/19</u>		0		R -
3/88		a) foundations / slabs	m ³	5	R -	R -
3/89		b) walls	m ³	22	R -	R -
3/90		c) plinth	m ³	1	R -	R -
				0		R -
	8.4.4	<u>Unformed surface finishes</u>		0		R -
3/91		a) Wood-floated finish	m ²	15	R -	R -
				0		R -
	8.7	<u>Grouting</u>		0		R -
3/92		a) non-shrink, cementitious grout under valves, base plates etc.	m ³	0.5	R -	R -
				0		R -
	8.8	<u>Miscellaneous metal work</u>		0		R -
3/93		(a) Rectagrid grating, RS40, 40 x 4,5 bearer bars, banded, including hinged panel. HD Galvanised. Minimum 4 saddle clamp fixings per panel	m ²	7	R -	R -
3/94		(b) Supply and fabricate, deliver and install/erect ot site the grating floor support beams, including all base/connection plates, bolts and anchors. All steelwork to be HD galvanised to SANS 121	t	1	R -	R -
3/95		(c) Supply and fabricate, deliver and install/erect on site the 50x50x5 cast-in angle for the grating floor, complete with fish-tail lugs. All steelwork to be HD galvanised to SANS 121	kg	280	R -	R -

3/96		(d) Supply and fabricate, deliver and install/erect at site the cat-ladder, including all bolts and anchors as detailed on I935-600-003. All steelwork to be HD galvanised to SANS 121	No.	2	R -	R -
3/97		(e) Supply and install hydrophilic seals around cast-in pipes as detailed on I935-600-003.	m	5	R -	R -
						R -
	PART SPEC	<u>PARTICULAR SPECIFICATION</u> <u>PI, PJ and PC: STEEL PIPES</u> <u>AND FITTINGS, VALVES and</u> <u>CORROSION</u>				R -
	PI 8, PJ 8 and PK 8	<u>STEEL PIPES AND FITTINGS,</u> <u>VALVES AND CORROSION</u> <u>PROTECTION</u>		0		R -
3/98		a) Item V01, DN355 HDPE PN10 Stub Flange Welded To DN355 HDPE PN10 Pipe, complete with steel backing flange to SANS 1123-1000/3	No.	3	R -	R -
3/99		b) DN350 Gate Valve PN10, According To SANS 664 with rising spindle: Flanges both ends to SANS 1123 Table 100/3 Valve to be provided with extended spindle to allow the handwheel to protrude at least 500mm above the chamber roof level.	No.	1	R -	R -
3/100		c) Item V03, DN350 non-return valve PN10: flanged both ends to SANS 1123 Table 1000/3.	No.	2	R -	R -
		CLEAN WATER MANAGEMENT NORTH OF DAM 3 COMPLEX				
	SABS 1200L	MEDIUM-PRESSURE PIPELINES				
	8.2.1	<u>Supply, lay and bed pipes</u> <u>complete with couplings</u>				
		a) HDPE pipe, PE100, PN25, SDR 7.4				
3/101		1) 160mm diameter to allow water from outside areas to drain into the spillway canal	m	296	R -	R -
						R -
	SABS 1200LB	BEDDING (PIPES)				R -
	8.2.2.2	<u>From borrow pits (provisional)</u>				R -
3/102		a) Selected granular material	m ³	30	R -	R -
		b) Selected fill material	m ³	101	R -	R -

		SPILLWAYS (TWO CONNECTING SPILLWAYS)				
	SABS 1200 D	<u>EARTHWORKS</u>				
	8.3.3	<u>Restricted Excavation</u>		0		
3/103		a) Excavate for restricted foundations, footings and structures in all materials and use for backfill or embankment or dispose. Excavation including 600mm working space, edges measured vertical, contractor responsible for excavation safety		0		
		1) For two spillways connecting the compartments	m³	1042	R -	R -
						R -
	SABS 1200 DE	<u>SMALL EARTH DAMS</u>				R -
	PSDE 8.3.5	<u>Forming Embankments</u>		0		R -
3/104		j) G7 material from crushing and screening, for construction of spillways	m³	613	R -	R -
3/105		k) G7 material from commercial source, for construction of spillways	m³	613	R -	R -
3/106		m) 5% bentonite enhanced soil by mass (site sand) from stockpile, 2 x 150 mm thick layers	m³	259	R -	R -
3/107		n) 8% cement stabilised screened site sand by mass from stockpile	m³	216	R -	R -
				0		R -
	SABS 1200 ME	<u>SUBBASE</u>		0		R -
	8.3.8	<u>Stabilizing agent</u>		0		R -
3/108		b) Portland cement	t	34	R -	R -
						R -
	PART SPEC	<u>PARTICULAR SPECIFICATION PA: GEOSYNTHETIC MATERIALS</u>				R -
3/109	PA 5.1.1	Supply 1.5mm double textured HDPE geomembrane	m²	1014	R -	R -
3/110	PA 5.1.2	Install 1.5mm double textured HDPE geomembrane	m²	1014	R -	R -
3/111	PA 5.1.3	Anchor trench	m³	29	R -	R -
						R -
	PA 5.2	<u>Geosynthetic supply and installation</u>				R -

3/112		1) 250 mm high geocells as per specification	m ²	882	R -	R -
3/113		2) Geogrid as per specification	m ²	882	R -	R -
						R -
	<i>PART SPEC</i>	<u>PARTICULAR SPECIFICATION</u> <u>PF: SOIL BENTONITE LAYER</u>				R -
3/114	<i>PF 8</i>	Supply bentonite for use in the processing of bentonite enhanced soil	t	25	R -	R -
				0		R -
		<u>ANCILLARY ROADWORKS</u>		0		R -
	SABS 1200A			0		R -
	8.5	<u>b) (1) For work to be executed by the Employer or a nominated subcontractor</u>		0		R -
3/115		Provisional allowance for buoy lines and/or other safety equipment to be installed at the dam.	Psum	1	R -	R -
		<u>(2) Overheads, charges and profit on (1) above</u>		0		R -
3/116		Provisional allowance for buoy lines and/or other safety equipment to be installed at the dam.	%	10%	R -	R -
				0		
		SPILLWAY AND CANAL OUTLET				
	SABS 1200 C	<u>SITE CLEARANCE</u>		0		
	8.2.1	<u>Clear and grub</u>		0		
3/117		a) Canal footprint [only as instructed by Engineer]	m ²	280	R -	R -
	8.2.2	Remove and grub large trees with girth:		0		R -
3/118		a) over 1 m and up to and including 2 m	No.	20	R -	R -
3/119		b) over 2 m and up to and including 3 m	No.	5	R -	R -
3/120		c) over 3 m	No.	2	R -	R -
				0		R -
	SABS 1200 D	<u>EARTHWORKS</u>		0		R -
3/121	8.3.1.2	Remove topsoil to nominal depth 300 mm, stockpile and maintain	m ²	280	R -	R -
	8.3.3	<u>Restricted Excavation</u>		0		R -
				0		R -

		a) Excavate for restricted foundations, footings and structures in all materials and use for backfill or embankment or dispose.		0		R -
3/122		(l) Spillway and spillway outlet canal	m ³	190	R -	R -
				0		R -
	SABS 1200 DE	<u>SMALL EARTH DAMS</u>		0		R -
	PSDE 8.3.5	<u>Forming Embankments</u>		0		R -
3/123		j) G7 material from crushing and screening, for construction of canal	m ³	89	R -	R -
3/124		k) G7 material from commercial source, for construction of spillways	m ³	89	R -	R -
3/125		n) 8% cement stabilised screened site sand by mass from stockpile	m ³	37	R -	R -
						R -
	SABS 1200L	<u>MEDIUM-PRESSURE PIPELINES</u>		0		R -
	8.2.1	<u>Supply, lay and bed pipes complete with couplings</u>		0		R -
		a) HDPE pipe, PE100, PN25, SDR 7.4		0		R -
3/126		1) 160mm diameter to allow water from outside areas to drain into the spillway canal	m	22	R -	R -
						R -
	SABS 1200LB	<u>BEDDING (PIPES)</u>				R -
	8.2.2.2	<u>From borrow pits (provisional)</u>				R -
		a) Selected granular material	m ³	3	R -	R -
		b) Selected fill material	m ³	8	R -	R -
						R -
	SABS 1200 ME	<u>SUBBASE</u>		0		R -
	8.3.8	<u>Stabilizing agent</u>		0		R -
3/127		b) Portland cement	t	1	R -	R -
				0		R -
	PART SPEC	<u>PARTICULAR SPECIFICATION PA: GEOSYNTHETIC MATERIALS</u>		0		R -
3/128	PA 5.1.3	Anchor trench	m ³	5	R -	R -

				0		R -
	PA 5.2	<u>Geosynthetic supply and installation</u>		0		R -
3/129		1) Separation geotextile	m ²	377	R -	R -
3/130		2) 100 mm high geocells as per specification	m ²	377	R -	R -
CONTAMINATED STORMWATER SOUTHERN OUTFALL TRENCH						
	SABS 1200 C	<u>SITE CLEARANCE</u>				
	8.2.1	<u>Clear and grub</u>				
3/131		a) Canal footprint	m ²	8645	R -	R -
				0		R -
	8.2.2	<u>Remove and grub large trees with girth:</u>		0		R -
3/132		a) over 1 m and up to and including 2 m	No.	20	R -	R -
3/133		b) over 2 m and up to and including 3 m	No.	10	R -	R -
3/134		c) over 3 m	No.	5	R -	R -
				0		R -
	SABS 1200 D	<u>EARTHWORKS</u>		0		R -
	8.3.1	<u>Site preparation</u>		0		R -
3/135	8.3.1.2	Remove topsoil to nominal depth 300 mm	m ²	8645	R -	R -
				0		R -
	8.3.2	<u>Bulk excavation</u>		0		R -
3/136		a) Excavate in all materials and use for embankment or backfill or dispose, as ordered	m ³	1128	R -	R -
						R -
	SABS 1200 DE	<u>SMALL EARTH DAMS</u>		0		R -
	PSDE 8.3.5	<u>Forming Embankments</u>		0		R -
3/137		i) Selected site sand, for forming of the berms required for the outfall trench compacted to 95% mod AASHTO density in layers not exceeding 150 mm, including final trimming of slopes.	m ³	4819	R -	R -
						R -
	SABS 1200G	<u>CONCRETE (STRUCTURAL)</u>				R -

	8.4	<u>Concrete</u>				R -
3/138	8.4.3	Grade 15MPa concrete infill to geocells	m ³	527	R -	R -
						R -
	PART SPEC	<u>PARTICULAR SPECIFICATION PA: GEOSYNTHETIC MATERIALS</u>		0		R -
3/139	PA 5.1.1	Supply 1.5mm double textured HDPE geomembrane	m ²	4776	R -	R -
3/140	PA 5.1.2	Install 1.5mm double textured HDPE geomembrane	m ²	4776	R -	R -
				0		R -
	PA 5.2	<u>Geosynthetic supply and installation</u>		0		R -
3/141		1) Protection geotextile	m ²	4887	R -	R -
3/142		2) 100 mm high geocells	m ²	4887	R -	R -
						R -
						R -
TOTAL CARRIED TO FINAL SUMMARY						R -
		CULVERT CONSTRUCTION				
	SABS 1200 DB	<u>EARTHWORKS (PIPE TRENCHES)</u>				
	8.3.2	<u>Excavation</u>				
		<u>a) Excavate in all materials for trenches and in and out-let structures, backfill, compact and dispose off surplus material to a depth n.e 2m below NGL</u>				
#REF!		1) Not exceeding 2,0 m	m ³	115	R -	R -
#REF!		2) In excess of 3,0 m	m ³	522	R -	R -
#REF!		b) Extra over item (a) above for hard rock excavation	m ³	53	R -	R -
		-				
	SABS 1200G	<u>CONCRETE (STRUCTURAL)</u>				
		-				
	8.2	<u>Formwork</u>				
	8.2.1	<u>Rough</u>				
		a) Vertical				
#REF!		(1) Edge beams and floor slab sides	m ²	16	R -	R -
#REF!		(2) Face of mass concrete benching	m ²	7	R -	R -
	8.2.2	<u>Smooth</u>				

		a) Vertical				
#REF!		(1) Wing walls	m ²	49	R	R
					-	-
#REF!		(2) Head walls	m ²	47	R	R
					-	-
	8.2.6	<u>Box out holes/form voids</u>				
#REF!		a) Cast-in of 1200 ND Class 100D Interlocking precast pipes	No.	2	R	R
					-	-
	8.3	<u>Reinforcement</u>				
	8.3.1	<u>Steel bars</u>				
#REF!		a) Mild steel reinforcement	t	0.3	R	R
					-	-
#REF!		b) High-tensile reinforcement	t	2.9	R	R
					-	-
	8.4	<u>Concrete</u>				
	8.4.2	<u>Blinding Layer</u>				
#REF!		a) 50 mm minimum thickness grade 15Mpa/19mm concrete	m ²	34	R	R
					-	-
	8.4.3	<u>Mass Concrete</u>				
#REF!		a) Grade 15Mpa/19mm concrete for benching	m ³	26	R	R
					-	-
#REF!		b) Grade 15Mpa/19mm concrete for construction a beam at start of geocells	m ³	2	R	R
					-	-
#REF!		c) Grade 15Mpa/19mm concrete for construction of a beam under security fence at drift outlets	m ³	1	R	R
					-	-
	8.4.3	<u>Strength Concrete</u>				
#REF!		a) Grade 35Mpa/19mm in floor and edge beams	m ³	11	R	R
					-	-
#REF!		b) Grade 35Mpa/19mm in wing walls	m ³	6	R	R
					-	-
#REF!		c) Grade 35Mpa/19mm in head walls	m ³	7	R	R
					-	-
	8.4.4	<u>Unformed surface finishes</u>				
#REF!		a) Wood-floated finish	m ²	34	R	R
					-	-
	8.8	<u>HD bolts and miscellaneous metal works</u>				
#REF!		a) Supply, fabricate and install Security grid as detailed on drawing I935-500-010, Hot dipped galvanized, complete with fasteners/anchor bolts	No	1	R	R
					-	-
	SABS 1200 LB	<u>BEDDING (PIPES)</u>				

	8.2.2	<u>Supply only of bedding by importation from</u>				
		<u>a) Stockpiles within 1km freehaul</u>				
#REF!		1) Selected granular material	m ³	83	R	R
					-	-
#REF!		2) Selected fill material	m ³	100	R	R
					-	-
	SABS 1200 LE	<u>STORMWATER DRAINAGE</u>				
	8.2.1	<u>Supply and lay concrete pipe culverts on class B bedding</u>				
#REF!		<u>a) 600mmND Class 100D to SANS 677 IJ Pipes</u>	m	18	R	R
					-	-
#REF!		<u>b) 1200mmND Class 100D to SANS 677 IJ Pipes</u>	m	57	R	R
					-	-
		-				
		<u>PIPE JACKING</u>				
	SABS 1200A	-				R
					-	-
	8.5	<u>SUMS STATED PROVISIONALLY BY ENGINEER</u>		0		R
#REF!		a) For work to be executed by the Contractor and valued in terms of the "valuation of variations" clause in the conditions of contract for the: Pipe Jacking Establishment (SABS1200LG 8.2.1)	Sum	1	R	R
					-	-
	SABS 1200LG	-				
	8.2.2	<u>Supply of pipes to be jacked</u>				
#REF!		a) 1200mmND Class 100D to SANS 677 IJ Pipes	m	15	R	R
					-	-
		-				
	8.2.3	<u>Jacking of pipes</u>				
#REF!		a) 1200mmND Class 100D to SANS 677 IJ Pipes	m	15	R	R
					-	-
		-				
#REF!	8.2.4	Excavation for jacking in all materials (volume based on outside diameter and jacked length)	m ³	24	R	R
					-	-
		-				
	SABS 1200A					R
					-	-
	8.5	<u>SUMS STATED PROVISIONALLY BY ENGINEER</u>		0		R
#REF!		a) For work to be executed by the Contractor and valued in terms of the "valuation of variations" clause in the conditions of contract for the: Extra-over 8.2.4 for unforeseen rock or boulder (SABS1200LG 8.2.5)	Sum	1	R	R
					-	-

						R -
TOTAL CARRIED TO FINAL SUMMARY						R -

FENCING						
BILL NO 1 PRELIMINARY & GENERAL						
ITEM NO	PAYMENT REFERENCE	DESCRIPTION	UNIT	QUANTITY	RATE	AMOUNT
				0		R -
	SABS 1200 A	GENERAL		1		
				0		R -
	8.3	FIXED-CHARGE AND VALUE- RELATED ITEMS				R -
				0		
1/1	8.3.1	Contractual requirements	Sum	1	R -	R -
				0		R -
	PSA 8.3.2	<u>Establishment of facilities on the site</u>	Sum	1		R -
				0		R -
				0		R -
	8.3.2.2	<u>Facilities for Subcontractor</u>		0		R -
1/1		a) Offices and storage sheds	Sum	1	R -	R -
1/1		b) Living accommodation	Sum	1	R -	R -
1/1		c) Ablution and latrine facilities	Sum	1	R -	R -
1/1		d) Tools and equipment	Sum	1	R -	R -
1/1		e) Water supplies, electric power and communications	Sum	1	R -	R -
1/1		f) Dealing with water (see 5.5)	Sum	1	R -	R -
1/1		g) Access (see 5.8)	Sum	1	R -	R -
1/1		h) Plant (designated plant specifically identified)	Sum	1	R -	R -
1/1				0		R -

1/1	8.3.3	Other fixed-charge obligations contractor to list and specify obligations	Sum	1	R -	R -
1/1	8.3.4	Removal of site establishment	Sum	1	R -	R -
	8.4	TIME-RELATED ITEMS				R -
1/2	8.4.1	Contractual requirements	Sum	1		
				0		
	PSA 8.4.2	<u>Operation and maintenance of facilities on site, for duration of construction, except where otherwise stated</u>		0		
				0		
				0		
	8.4.2.2	<u>Facilities for Sub-Contractor</u>				
1/1		a) Offices and storage sheds	month	5	R -	R -
1/1		b) Living accommodation	month	5	R -	R -
1/2		c) Ablution and latrine facilities	month	5	R -	R -
#REF!		d) Tools and equipment	month	5	R -	R -
#REF!		e) Water supplies, electric power and communications	month	5	R -	R -
1/2		f) Dealing with water (see 5.5)	month	5	R -	R -
1/3		g) Access (see 5.8)	month	5	R -	R -
		h) Plant (designated plant specifically identified)	month	5	R -	R -
				0		R -
1/4	PSA 8.4.3	Supervision for duration of construction	month	5	R -	R -
						R -
1/5	8.4.4	Company and head office overhead costs for the duration of the contract	month	5	R -	R -
				0		R -
1/6	8.4.5	Other time-related obligations , Contractor to list and specify.	month	5	R -	R -
				0		R -
	8.5	SUMS STATED PROVISIONALLY BY SUBCONTRACTOR				R -
				0		R -

1/7		a) For work to be executed by the Contractor and valued in terms of the "valuation of variations" clause in the conditions of contract	sum	1	R -	R -
				0		R -
TOTAL CARRIED TO FINAL SUMMARY						R -
		SITE CLEARANCE				R -
		FENCING				R -
TOTAL CARRIED TO FINAL SUMMARY						R -

C3: Scope of Work

C3.1 Works Information

Article V. 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.

Article VI. SUPPORTING CLAUSES

Section 6.01 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 Grootegeeluk 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 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.

Section 6.02 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 1×10^{-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 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:

- 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:

- 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.

(a) 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.](#)

Section 6.03 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.

(a) 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

(b) INFORMATIVE

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

Section 6.04 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.
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.

Section 6.05 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

Section 6.06 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.

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**(i) 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 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.

(ii) 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.

(iii) Sanitary Facilities and Refuse

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

(iv) 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.

(b) 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 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) underdrainage, 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.

(c) 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 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 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.

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.

(d) 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.

(e) Giving Notice of Work to be covered up

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

(f) 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.

Section 6.07 Completion, Testing, Commissioning and Correction of Defects

(a) 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.

(b) Use of the Works before Completion has been certified

Eskom Rotek Industries to add requirements here.

(c) 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.

(d) 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.

(e) Take Over Procedures

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

(f) 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.

(g) 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.

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
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

SANS and other applicable International Standards		
No	Document No	Description / Title
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
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

SANS and other applicable International Standards		
No	Document No	Description / Title
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
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

SANS and other applicable International Standards		
No	Document No	Description / Title
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
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 Water And Sewage
89	BS EN 14161	Pipelines
90	SIS 055900	Standard For Welding Pipelines And Related Facilities (American Petroleum Institute)
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

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

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		
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:

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**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)

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.

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)

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

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 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.

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

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"

m³km

Unit:

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****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

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.

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. 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;

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

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 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 $\pm 2,0$ mm.

The permissible deviation of any bolt or bolt sleeve from its designated location in plan shall be ± 4 mm. The permissible deviation of any bolt from its designated location in elevation shall be ± 10 mm. The permissible deviation of other cast-in items from their designated locations shall be ± 10 mm, 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

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

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.

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 5.3 Assembly

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.

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:

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 form 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 7.2 Inspection

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 7.3 Inspection 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

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 7.3 Testing 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.

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

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.

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.

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

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.

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 ASTM D6693 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.

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

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.

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 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 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

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	

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: If 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.

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

Property	Test method
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 OR Oven Aging at 85°C High Pressure OIT 80% retained after 90 days	ASTM D 5721, ASTM D 3895 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:

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 loose 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 where 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 insulated 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 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 x 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 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 x 310 x 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).

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

Property	Test Method	Unit	Value
GRI-GT12(a)			
Mass per unit area	ASTM D5261	g/m ²	1080
Tensile Properties Strength Strain @ max load	ASTM D4632 ASTM D4632	kN %	225 50
Trapezoidal Tear Strength	ASTM D4533	kN	0.96
CBR Puncture Max force Elongation @ max force	ASTM D6241 ASTM D6241	kN mm	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
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

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)

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.

(h) 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 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.

Section 6.08 PROCESS FOR MONITORING

N/A

Section 6.09 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.

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.

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 *services*.

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.

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.

Article VII. 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.

Article VIII. 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.

Section 8.01 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.

Section 8.02 PEOPLE RESTRICTIONS, HOURS OF WORK, CONDUCT AND RECORDS

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

Section 8.03 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.

Section 8.04 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

Section 8.05 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.

Section 8.06 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
0.84/68585	I935-500-031	0	FENCE DETAILS A
0.84/68586	I935-500-032	0	FENCE DETAILS B

0.84/68587	I935-500-033	0	FENCE DETAILS C
0.84/68588	I935-500-034	0	FENCE DETAILS D

Section 8.07 ACCEPTANCE

This document has been seen and accepted by:

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

Section 8.08 REVISIONS

Date	Rev.	Compiler	Remarks

Section 8.09 DEVELOPMENT TEAM

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

Section 8.10 ACKNOWLEDGEMENTS

None

C4: Site Information

1. Topographical

