Eskom	Scope of Work	Technology

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1. INTRODUCTION

The Medupi Ash Washdown System is a supplementary system that is designed to collect and clean up spilled ash, coal and oil from the Boiler House floor, the Fabric Filter Plant (FFP), Ash Conveyers and other areas. The six de-gritting sumps, one in each boiler house, collect the overflow from the Submerged Scraper Conveyor (SSC) as well as the boiler house and FFP floor wash down. From the de-gritting sump (Wet Sump) the slurry gets pumped to the primary treatment plant.

Water and slurry from the degrit sump are conveyed to the primary clarifiers conveyed to dams and pump station. The primary clarifier consists of an agitator rake to agitate the settled coal and ash particles, a pump to allow for back and forward flush on the lines. During backward and forward flushing of the lines and flushing of the pump, a series of valves are to be open and closed manually which requires one Operator to be on-site and communicate with an Operator at the Balance of Plant (BOP) control room via a radio for instructions. The BOP Operator controls the agitator rake, the pump and knife gate while the operator on site manually operates the valves which isolates during back flush, forward flush, pump flushing and slurry pumping. This was found to be an unsafe working environment for the Operator and very complicated and thus a reason to automate.

1. SUPPORTING CLAUSES

1.1 SCOPE

This scope applies to the Ash Washdown system (Primary and Secondary Clarifiers plant and the ash conveying sump plant).

a. The scope includes the replacement of the existing diaphragm valve with either butterfly or gate valves. The replaced valves are to be supplied and installed with electrical actuators while others will be free issued.

b. In addition, the scope includes the modification to allow strainer flush into clarifier, forward wash and pump flush. The actuation of the valves will allow for operation from the control room.

c. The scope includes the replacement of damaged equipment on the boiler house degrit sumps for unit 1-6, Transfer House 7 and upgrades on Transfer House 8. Emergency mobile pumps.

d. The scope includes the replacement of the slurry delivery pipe work on the Primary Clarifier 1, 2, 3 & 4 while for the flushing system, the pipework will be reused.

e. Design, Procure, Supply, and Install a new Oil Separation system on Clarifier 3 and 4 (80 Cube Drizzt oil separator.

f. Upgrade the Centrifuge system for the Primary and Secondary Clarifiers.

g. Replacing of flooded equipment in the Primary and Secondary Clarifiers pits.

1.1.1.1 Purpose

The purpose is to detail the requirements for the procurement, manufacturing, supply and construction of the *works* as detail in the scope of work.

1.1.1.2 Applicability

This document shall apply to Medupi Power Station Ash Washdown Plant and systems.

1.2 NORMATIVE/INFORMATIVE REFERENCES

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs. Caveat: listed documents are not exhaustive.

1.2.1 Normative

GENERAL

[1] Occupational Health and Safety Act (Act 85 of 1993) with associated Regulations
[2] 200-35208 - Environmental Management Plan
[3] National Environmental Management Act, 1998 (Act 107 of 1998)
[4] National Environmental Management Waste Act, 2008 (Act 59 of 2008)
[5] National Water Act,1998 (Act 36 of 1998)
[6] Government Notice 704, National Water Act 1998
[7] The Environmental Conservation Act (Act No 73 of 1989)
[8] South African National Standards (SANS), relevant and applicable
[9] National Building Regulations and Building Standards Act No. 103 Of 1977
[10] 240-53113685 - Design review procedure
[11] 200-1689 - Medupi Quality Specifications
[12] 240-86973501 - Engineering Drawing Standards – Common Requirements
[13] SSZ_45-17 - Medupi Power Station Corrosion Protection Specification
[14] ISO 9001 Quality Management Systems.
[15] SANS 10142-Part 1 - The Wiring of Premises Part 1: Low-voltage installations
[16] 0.84-17600 SHEET 1 MH0048-0.84-17600 REV 8 CARS TH8 Sump
[17] 0.84-26142-Sheet 1 J26182-A-ASH-02-01-05 Rev 11 Boiler House Sumps Unit 1
[18] 0.84-26143-Sheet 1 J26182-A-ASH-02-01-05 Rev 11 Boiler House Sumps Unit 2
[19] 0.84-26144-Sheet 1 J26182-A-ASH-02-01-05 Rev 11 Boiler House Sumps Unit 3
[20] 0.84-26145-Sheet 1 J26182-A-ASH-02-01-05 Rev 11 Boiler House Sumps Unit 4
[21] 0.84-26146-Sheet 1 J26182-A-ASH-02-01-05 Rev 11 Boiler House Sumps Unit 5
[22] 0.84-26147-Sheet 1 J26182-A-ASH-02-01-05 Rev 13 Boiler House Sumps Unit 6
[23] 0.84-26150-SHEET 2 J26182-A-ASH-07-02-06-01 REV 7 Secondary Treatment Plant-Centrifuges
[23] 348-390359_1_1-0.84-28173 J26182-A-ASH-01-01-03-05-00 SHEET 1 REV 2 Boiler House Sumps
[24] Pipework Detail Sump No 6
[25] 348-390392_0_1-0.84-39092 SHEET 1 J26182-A-ASH-01-01-03-06-03 REV 0 Ash Washdown and
[26] Collection Boiler House Sumps
[27] 348-390392_0_1-0.84-39092 SHEET 2 J26182-A-ASH-01-01-03-06-03 REV 0 Ash Washdown and
[28] Collection Boiler House Sumps
[28] 348-390402_2_1-0.84-28173-SHEET 5 J26182-A-ASH-01-01-03-05-04 REV 3 Boiler House Sumps
[29] Pipework Detail Sump No 6
[30] 348-390528_17_1-0.84-26150-SHEET 1 J26182-A-ASH-07-02-06-00 REV 17 Ash Washdown
[31] Collection and Treatment Secondary Treatment Plant
[32] 348-390838_19_1-0.84-26148-SHEET 1 J26182-A-ASH-03-02-06 REV 20 Ash Washdown
[33] Collection and Treatment Primary Treatment Plant
[34] 348-391082_2_1-0.84-28173-SHEET 4 J26182-A-ASH-01-01-03-05-03 REV 3 Boiler House
[35] Sumps Pipework Detail Sump No 6
[36] 348-391248_12_1-0.84-26152-SHEET 1 J26182-A-ASH-09-01 REV 12 Ash Washdown Collection
[37] and Treatment Transfer House No7 Sump P&ID
[38] 348-391448_2_1-0.84 34659 SHEET 2 J26182 A ASH 01 01 01 11 01 REV 2 Boiler House Sumps
[39] Flush Water Pipework Detail Sump No 6
[40] 348-391849_7_1-0.84-26148-SHEET 2 J26182-A-ASH-03-02-06-01 REV 9 Secondary Treatment
[41] Plant-Centrifuges

[42] 348-392474_2_1-0.84-28168-SHEET 1 J26182-A-ASH-01-01-03-00-06 REV 2 Ash Washdown and
[43] Collection Boiler House Sumps Sump 1-6 Benching in Wet Sumps
[43] 348-392481_4_1-0.84-28173-SHEET 3 J26182-A-ASH-01-01-03-05-02 REV 5 Boiler House Sumps
[44] Pipework Detail Sump No 6
[45] 348-393877_6_1-0.84-26149-SHEET 1 J26182-A-ASH-04-01-06 REV 6 First Flush Diversion
[46] Works
[47] 240-49230046 Failure Mode and Effects Analysis Guideline
[48] 240-52844017 System Reliability, Availability and Maintainability Analysis Guideline
[49] 240-55410927 - Cyber Security Standard for Operational Technology
[50] 240-56227443 Control and Power Cables
[51] 240-56355466 - Alarm Management System Guideline
[52] 240-56355535 Process Calibration
[53] 240-56355541 C&I Computer and Equipment Rooms Civil and General Building Requirements
[54] 240-56355728 Human Machine Interface Design Requirements Standard (Rev 2)
[55] 240-56355729 - Plant Control Modes Guideline
[56] 240-56355731 - Environmental Conditions for Process Control Equipment
[57] 240-56355754 - Field Instrument Installation Standard
[58] 240-56355815 - Junction Boxes and Cable Termination Standard
[59] 240-56355843 - Pressure Measurement Systems Installation Standard
[60] 240-56355888 - Temperature Measurement Systems Installation Standard
[61] 240-56737448 Fire Detection and Life Safety Design Standard
[62] 240-56737654 Inspection Testing and Maintenance of Fire Detection System
[63] 240-61379718 Instrument Schedule
[64] 240-61379755 drive and Actuator Schedule
[65] 240-72344339 Virtual Signal List
[66] 240-72344727 C&I Control System Architecture Guideline
[67] 240-72350241 Panel Interface List
[68] 240-129014618 Cyber Security Guidelines
[69] 348-393877_6_1-0.84-26149-SHEET 1 J26182-A-ASH-04-01-06 REV 6
[70] C&I documentation description
[71] Cold Commissioning Report Template
[72] 240-113413710 Impact Assessment Template
[73] 200-46525 Operating Philosophy
[74] 240-55714363 Coal Fired Power Stations Lighting and Small Power Installation Standard
[75] 240-56227443 Electrical Cabling Works and Cable Racking Standard.
[76] 240-55714363 Coal Fired Power Stations Lighting and Small Power Installation Standard.
[77] 240-56356396 Earthing and Lightning Standard
[78] 348-389211 Ash Washdown - Collection Treatment Operating Philosophy
[79] GIBB-J26182-MM-01 Degrit Sump Maintenance Manual
[80] 348-390301 Instrument Schedule
[81] 348-394606 Equipment Schedule
[82] 200-94117 Control Logic
[83] 240-86973501 Eskom Drawing Standard
[84] GGR0992 Plant Safety Regulations
[85] 240-114967625 Operations Regulations of High Voltage Systems
[86] 348-880042 Medupi Concrete specification for structural concrete (84CIVL053)
[87] 240-56364545 Structural Design and Engineering Standard
[88] 240-53114026 Generation Project Engineering Change Management Procedure
[89] 240-57127951 Standard for the Execution of Site Investigations
[90] 240-57127955 Geotechnical and Foundation Engineering Standard

[91] 240-85549846 Standard for Design of Drainage and Sewerage Infrastructure

1.2.2 Informative

GENERAL

[1] ISO 9001 Quality Management Systems
[2] ISO 14001:2015 Environmental Management Systems
[3] Occupational Health and Safety Management Systems Requirements (OHSAS 18001)
[4] 200-46362 - Site Inspections Procedure
[5] 200-15406 - Issue Takeover Certificate
[6] 200-11303 - Medupi Occupational Health, Safety and Management Policy
[7] 32-421 - Eskom Life Saving Rules
[8] 348-9979102 ECP Primary and Secondary Clarifiers Valves Automation
[9] 240-103414344 - Summary of corporate identity manual

STRUCTURAL & CIVIL

[10] SANS 3001-C03-1 Part CO3-1: Concrete durability index testing — Preparation of test specimens
[11] SANS 3001-C03-2 Part CO3-2: Concrete durability index testing — Oxygen permeability test
[12] SANS 3001-C3-3 Part CO3-3: Concrete durability index testing — Chloride conductivity test
[13] Policy ESK PB AAQ 3 - Interior Specifications for Eskom

CONFIGURATION MANAGEMENT

[14] ISO 10007 Configuration Management
[15] VGB – B 106 E Part A– KKS Application Commentaries Part A – General
[16] VGB – B 106 E Part B1 – KKS Application Commentaries Part B1_ Mechanical Engineering
[17] VGB – B 106 E Part B2 – KKS Application Commentaries Part B2 - Civil Engineering
[18] VGB – B 106 E Part B3 - KKS Application Commentaries Part B3_Electrical and C&I Engineering
[19] VGB-S-811-01-2018-01-EN (eBook -VGB-OM)

1.3 GENERAL DEFINITIONS

Definition	Description
Automation	The use of machinery, software, and other technologies to perform tasks that were previously done manually by workers.
Clarifier	Settling tank built with mechanical means for continuous removal of solids being deposited by sedimentation. A clarifier is used to remove solid particulates or suspended solids from liquid for clarification and/or thickening.
Dirty Beds	aid in separating solids from wastewater, reducing volume and facilitating disposal.
Centrifuge	A device that uses centrifugal force to separate components of a mixture based on their density or size
Sump	A pit or reservoir designed to collect and hold liquids, particularly in drainage or circulation systems
Separator	A system installed to treat wastewater (trade effluent) from industrial processes, vehicle washing, cleansing of oil covered parts or other sources, for example petrol station forecourts, to treat oil-contaminated rainwater
Valve	A mechanical device that regulates or controls the flow of liquids, gases, or slurries by opening, closing, or partially obstructing a passageway.

1.4 ABBREVIATIONS

No.	Abbreviation	Description
1	AHP	Ash Handling Plant
2	ECP	Engineering Change Proposal
3	URS	User Requirements Specifications
4	FFP	Fabric Filter Plant
5	SSC	Submerged Scraper Conveyor
6	DB	Distribution board
7	LV	Low Voltage
8	BOP	Balance Of Plant
9	C&I	Control and Instrumentation
10	DCS	Distributed Control System
11	LoSS	Limits of Supply and Services
12	IO	Inputs and Outputs
13	POC	Point of Connection
14	CMBS	Consolidated Building Management System
15	VDSS	Vendor Document Submittal schedule

1.4.1 Disclosure Classification

a. **Controlled disclosure:** controlled disclosure to external parties (either enforced by law, or discretionary).

1.5 GENERAL ROLES AND RESPONSIBILITIES

1. The following roles and responsibilities apply:

Person	Technical Responsibility
a. *Contractor*	an entity who performs construction work on behalf of client.
b. Engineering Design Work Lead (EDWL)	He/she co-ordinates the design work provided by the discipline Design Engineering roles and integrates this work into a final integrated design product. He/she is the custodian of the requirements set, and the interface register between packages and part of his/her role is to maintain this information. He remains responsible for the integrity of the engineering product and is accountable for the overall management of interfaces and delivery of an integrated product.
a. Lead Discipline Engineer (LDE)	The role of the Lead Discipline Engineering role is to manage the technical integrity of the design and be accountable for the management of the interfaces within their specific engineering domain
b. *Project manager*	The *Project manager* is the delegated authority from the *Employer* representing the *Employer* to manage the defined scope of work. The *Project manager* coordinates the execution of the Works to achieve the required cost, schedule, and quality objectives. The *Project manager* is Eskom's representative that officially communicates with the *Professional Service Provider*

1.6 PROCESS FOR MONITORING

As per the Eskom Design Review Procedure 240-53113685

1.7 RELATED /SUPPORTING DOCUMENTS

Not Applicable

1.7.1 Project Programme

The programme for the project is split as follows:
The estimated duration for preconstruction period is 6 months from the appointment of the Contractor at which four (2-4) months is for design and which involves for the tender documentation, and procurement, including tender evaluations and approvals.

The estimated duration of construction period is 12 (1 Year) months upon the appointment of the construction Contractor.

A programme for the performance of the *Contractor / Service Provider* shall be submitted by the *Contractor* to the *Project Manager* within a period of two (2) weeks following the project briefing meeting. The programme will be the result of the coordination of all appointed *Contractor's* inputs and shall be in sufficient detail describing key milestones, events, and activities linked to the fastest realistic timeframes in which the service can be delivered. Milestones and events are to be listed based on the scope of services described in the scope of service document. No milestones may, at the coordination stage, be extended beyond the timeframes outlined in the project programme without acceptable reasons.

1.7.2 Target Dates and Times

The *Contractor* will be expected throughout to give preference to the execution of the work involved in this commission. The work of all service providers will be coordinated by the *Project Manager.*

1.7.3 Information available from Eskom

All necessary information needed by the *Contractor* regarding the project may be received from *Project Manager* on request, if available.

2. SCOPE OF WORK

2.1 MECHANICAL WORK

The works shall include the procurement, manufacturing, supply, installation and commissioning of the mechanical works listed below.

2.1.1 Clarifiers Valves Actuation

The works include the installation and commissioning the actuated valves listed in Table 1, 2, 3 & 4 for the Primary and Secondary Clarifiers. The works include supply and pulling of cabling (both power and control) as well as the termination of such cables. The preferred selection of actuators is to ensure there is no additional support required (weight of the actuator on the valve) and where supports are deemed required, piping, the contractor is to supply and install. The actuators shall be subjected for compliance to Eskom C&I and Electrical Standards.

Below is a Table 1 showing a list of valves to be actuated for clarifier 1, clarifier 2, clarifier 3 and clarifier 4. Each clarifier valve set has different plant coding (KKS names). Refer to P&IDs (0.84/26148 SHT 1 and 0.84/26150 SHT 1 for more details. These items are to be free issued to the Contractor.

Table 2 shows actuated valves that still needs to be procured, installed and commissioned on the Primary and Secondary Clarifiers.

Table 1: Actuators with knife gate and butterfly valves for clarifiers to be free issued.

Item	Clarifier 1, 2, 3& 4
DN 50 Knife Gate valves	4
DN 65 Knife gate Valves	20
DN 50 Butterfly valves	12
DN 65 Butterfly Valves	10

Table 2: knife gate valves for secondary clarifiers to be procured.

Item	Clarifier 3	Clarifier 4
Knife Gate Valves (50NB) with multi turn Actuator (SA 0.72-0.76)	7	7
Manual Knife gate Valves (50 NB)	6	7
Manual Knife gate Valves (65 NB)	6	7

2.1.2 Flushing Modification

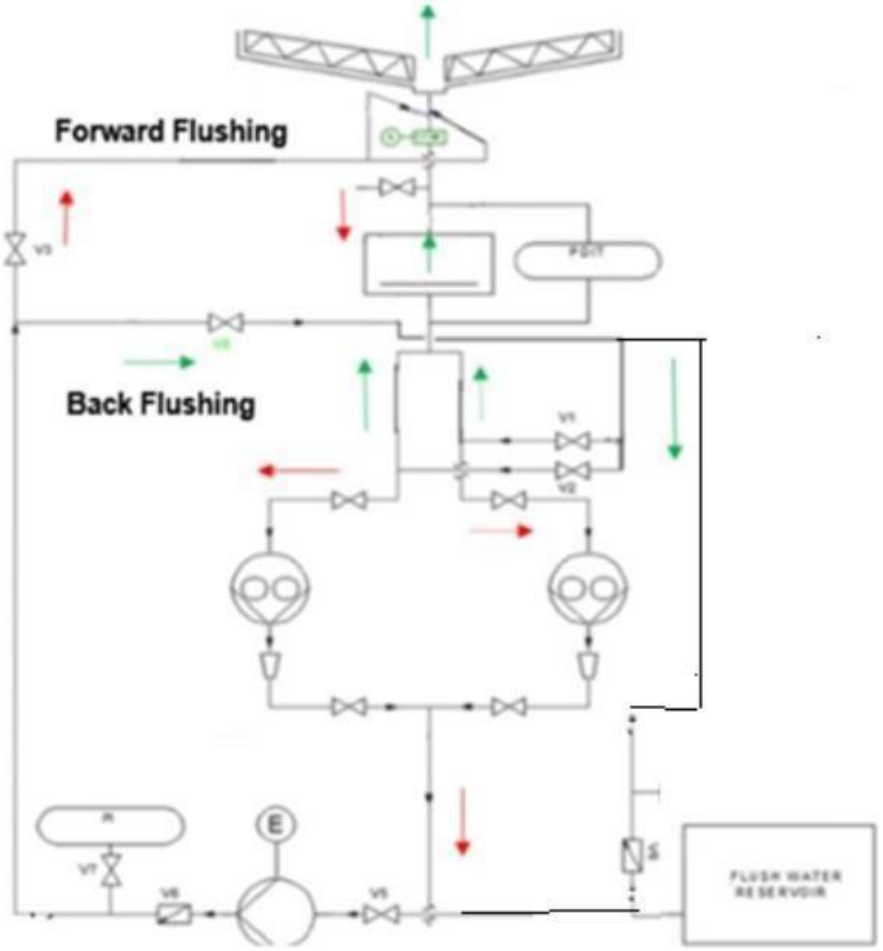

Figure 1: Flushing Modes Schematic.

The current design is comprised of three flushing modes. Each mode is achieved by opening or closing of certain valves. The following are the existing flushing modes:

- Flushing of the pipework from the sludge pump back to the clarifier.
- Flush forward through the sludge pump to the centrifuges.

Flushing modifications shall be retrofitted into all the clarifiers (Clarifier 1-4). The Contractor shall supply re-use the old flushing pipes and install modifications to the flushing line as a retrofit to existing plant.

The flushing line shall have isolation valves and NRV that will be linked to the operation of the clarifiers to allow forward and backward flushing. The valves shall be actuated using automation process from an Operator desktop. Figure 1 shows the two flushing modes that are being proposed for the system to function properly without complexity. The strainer is to have plate that divides into 2 compartments as this will aid agitation during flushing and to avoid directly feeding on to the running sludge pumps.

2.1.3 Screw Pump Station

All the dirty water processed from the dirty water primary clarifiers and other parts of the station is fed to the to the pump station by gravity and then via the screw pumps positively displaces the water to the level of the secondary clarifier inlets. Currently this plant is manually operated; the plant is to be updated to reflect and to be observed via DCS as well as to provide warning alarms prior to startups. Equip with level indicators.

2.1.4 Oil Skimmer/Oil removal system (Clarifier 3 and 4 only)

The oil collected by the clarifiers is normally of the floating limited volume. The old design requires the oil to be decanted by a rolling decant pipe once every rotation of the scrapper. The decanted oil normally contains a large proportion of water, which then is transferred to the oil separator via gravity. The oil from the separator is then “skimmed” from the separator water surface using a multi-disc oil skimmer at a rate of 5 m^3/hour. However, this system was inefficient.

The oil skimmer/oil removal system in the secondary clarifiers previous design was not fit for purpose. From previous consultation with a specialist company in environmental pollution control by the name of Drizit, it was recommended that Oil/Water separator 80 cubic meters was required to reduce on the oil contaminations in expected in the secondary clarifiers.

The works include:

a) all requirements (civil, mechanical, electrical, control and instrumentation) to ensure a functional, safe operating and automated oil removal system is employed.

b) The new oil skimmer is to be a floating oil skimmer type, the floating oil skimmer should be capable of removing all the oil in the clarifier system.

c) The new oil skimmer shall seamlessly tie into the existing oil recovery system, which consists of pumping system that transfer the skimmed oil into drums for collection.

2.1.5 Degrit Sump Equipment

The works include the supply, installation and commissioning of the equipment listed below.

Table 3: Degrit Sump Equipment to be Free Issued.

	Unit 6	Unit 5	Unit 4	Unit 3	Unit 2	Unit 1
Pumps	Pumping Length-260m. Flow rate-20.7 l/s. Static Head-10.7m. **2 Pumps, 22 KW**	Pumping Length-371.7m. Flow rate-21.3 l/s. Static Head-10.7m. **2 Pumps, 30 KW**	Pumping Length-483.5m. Flow rate-21.0 l/s. Static Head-10.7m. **2 Pumps, 37KW**	Pumping Length-655.2m. Flow rate-30.6 l/s. Static Head-10.7m. **2 Pumps, 37 KW**	Pumping Length-706.9m. Flow rate-31.3 l/s. Static Head-10.7m. **2 Pumps, 55KW**	Length-818.6m. Flow rate-31.1 l/s. Static Head-10.7m. **2 Pumps, 55KW**
Level transmitter	2 X Level transmitters (Wet and Dry sump)	2 X Level transmitters (Wet and Dry sump)	2 X Level transmitters (Wet and Dry sump)	2 X Level transmitters (Wet and Dry sump)	2 X Level transmitters (Wet and Dry sump)	2 X Level transmitters (Wet and Dry sump)
Submersible pump(Dry Sump)	1 X 1.3 kw	1 X 1.3 kw	1 X 1.3 kw	1 X 1.3 kw	1 X 1.3 kw	1 X 1.3 kw
Knife Valves + Actuator	5	5	5	5	5	5
Butterfly Valve + Actuators	2	2	2	2	2	2

Table 4: Degrit Sump Equipment listing to be Procured.

	Unit 6	Unit 5	Unit 4	Unit 3	Unit 2	Unit 1
Manual Butterfly Valve (100NB)	1	1	1	1	1	1
Flow meters (H8049120000)	1 X Slurry discharge flowmeter with cabling & 1 X flush flowmeter	1 X Slurry discharge flowmeter with cabling & 1 X flush flowmeter	1 X Slurry discharge flowmeter with cabling & 1 X flush flowmeter	1 X Slurry discharge flowmeter with cabling & 1 X flush flowmeter	1 X Slurry discharge flowmeter with cabling & 1 X flush flowmeter	1 X Slurry discharge flowmeter with cabling& 1 X flush flowmeter
Agitator motor	1 X 37Kw motor, test and if not ok refurbish	1 X 37Kw motor, test and if not ok refurbish	1 X 37Kw motor, test and if not ok refurbish	1 X 37Kw motor, test and if not ok refurbish	1 X 37Kw motor, replace	1 X 37Kw motor, test and if not ok refurbish
Agitator Gearbox (Mixtec series 400 0, Model 4006)	Service gear oil, filters & breather, replace if it is not working	Service gear oil, filters & breather, replace if it is not working	Service gear oil, filters & breather, replace if it is not working	Service gear oil, filters & breather, replace if it is not working	Service gear oil, filters & breather, replace if it is not working	Service gear oil, filters & breather, replace if it is not working
Actuato + Knife Gate Valves (SA0.72-76 utli turn, 100NB knife gate valve)	2	2	2	2	2	2
SPRAY NOZZLE ("FULLJET" BRASS SPRAY NOZZLE DESIGNATION: B1 - HH - BRASS - 12)	6	6	6	6	6	6

2.1.5.1 **Slurry Pumps**

Slurry pumping should be selected based on the following.

a. The pumps shall fit and be compatible with existing configuration of pipes and valves in the degrit sumps, supply all missing spool pieces and new modifications. See Table 5.

Works on Degrit sump shall also include:

a. Breaking up of bricks (about 100mm X 300mm X 3 m x 3 (sides), each unit) covering the openings into the wet sump,
b. Cleaning, dewatering and removing of ash slurry from all the drainage trenches around the boiler floor (This may require use of a vacuum truck together with manual labour),1. from the DHP deep trench, 2 on the trenches closest to the wet sump)
c. This works should include continuous cleaning (pumping, draining of water and slurry, disposal) until handover, removing as well as transport to the ash dump of ash slurry in both the wet and dry sumps.
d. Due to some of the equipment being submerged for a long time, the cabling on the equipment may need to be replaced.
e. The equipment listed in Table 3 are mainly for the dry sump and do not include the 3 actuators that are above the sump. It is assumed that these should still be functional as they were not flooded. The Contractor is required to re-use these actuators.
f. The valves on the final slurry discharge line and the wet sump level transmitter flush line need replacing on all units.
i. Preparation of the base at the bottom of the sump will be required for the pumps mentioned.
j. Introduce temporary means to stop water ingress into the degrit sump so that the wet sump can be cleaned.
k. Replacement of 6 nozzles per degrit sump.

Table 5: Missing Spool pipe pieces and spares.

Medium	Description	Quantity
Slurry	100 NB Straight Pipe, FBE 149 mm long	6
Flushing Water	100 NB Straight Pipe, FBE 1694 mm long	2
Flushing Water	100 NB Straight Pipe, FBE 286 mm long	8
Flushing Water	100 NB Straight Pipe, FBE 690 mm long	2
Slurry	100NB Equal T-piece, flanged, equal FBE (300mm long side)	12
Slurry	100NB Straight Pipe, FBE 319 mm long	12
Slurry	100NB Straight Pipe, FBE 447 mm long	6
Flushing Water	100NB Sweeping T-piece, flanged, FBE (400mm long side),200mm	8
Flushing Water	100NB, 90 degrees elbow long radius, Flanged	6
Slurry	100NB, 90 degrees elbow, Radius 200mm	24
Slurry	100NB, 90 degrees elbow, R 200mm, 453mm (15 mm socket welded 200 mm) X 313 mm	2
Dirty water	40 NB Fllexible Pipe, TBE 1200 mm long +Clamps	4
Dirty water	40 NB Straight Pipe, FBE 444 mm long	4
Dirty water	40 NB Straight Pipe, FBE 444 mm long	4
Dirty water	40NB, 90 degrees elbow long radius,	4
Dirty water	40NB, 90 degrees elbow long radius, Flanged special (300mm long side)	4
Slurry	Reducer 75 NBX100NB,248 mm FBE	4

Flushing Water	100 NB Straight Pipe, FBE 1000 mm long	2
Slurry	Reducer 80 NBX100NB,231mm FBE	4
Slurry	Reducer 100 NBX80NB,360mm FBE	4

2.1.6 Transfer House 7 Sump Equipment

The works include the refurbishment or supply, and commissioning of the equipment listed below. The equipment listed below was removed and some sent for refurbishment. The equipment must be tested, installed and commissioned.

Table 6: TH7 Sump Equipment listing

Item	Equipment	Status
Pump motors	Slurry Pumps 2x15 kW, Pumping Length-260m. Flow rate-20.7 l/s. Static Head-10.7m.	supply
Submersible Pump	1.3-1.75 kW	Free issue
Motors (Agitators)	22 kW	supply
Agitator Gearbox (Mixtec series 1000, Model 1137)	Service gear oil, filters & breather, replace if it is not working	supply
Actuated Knife gate valves	5 X (Actuators (SA0.72-0.76 multi-turns) &Knife gate valves (100NB) unit set).	supply
Level transmitters	2 X (rod type: 1m and 3m)	supply
Flowmeters((H8049120000))	2 X (Slurry discharge + flushing flowmeter with cabling)	supply
Actuated Butterfly Valves	2 X (Actuators (SA0.72-0.76 Quarte-turns /SQ05) & 100NB butterfly valves unit set).	supply
Spray Nozzle (1/8” NPT ORBSPT (M))(Type HH)	6	supply

The Contractor will be responsible for the full commissioning of this equipment.

a. This works should include continuous cleaning (pumping, draining of water and slurry with vacuum trucks) until plant handover, removing as well as transport to the ash dump of ash slurry in both the wet and dry sumps.

b. Configure the existing pumps with pipes and valves.

c. Agitation rake and drive unit to be checked and if defective, should be replaced or refurbished.

d. 2X level transmitter missing (Probe versions need to be used instead of Radar).

e. Replacement of the nozzle at the bottom of the wet sump.

2.1.7 Transfer House 8 Sump Equipment

The works include the supply, installation and commissioning of the equipment listed below. The equipment listed below was removed and some sent for refurbishment. The equipment must be tested, installed and commissioned.

work includes the procurement, supply, installation and commissioning of the equipment listed below.

a. Pumps shall be capable to handle lumps of up to 25mm diameter.

b. Pumped slurry shall on occasion contain up to 50% solids by volume and the relative density of the pumped slurry is 1.25

c. The pumps are fitted with pressure devices on suction and discharge (pressure transmitters on the discharge)

d. The chosen pumps shall be able to meet the pump duty as specified in the table below.

Table 7: TH8 Sump Equipment Listing.

Items	Equipment	Status
Submersible pumps	2 X Upgrade from 11KW to 20-30 KW, 14-20 m Head, 20 l/s	Supply
Actuated Knife gates valves	2 X Actuators (SA0.72-0.76 Multi-turns) &Knife gate valves (100NB) unit set.	Supply
Pressure Indicators	Flanged Type	Free issue
Level Transmitters	2 x Level Transmitters (rod type: 1 m and 2.5 m),	Supply
Actuated butterfly Valves	1 X Actuators (SA0.72-0.76 quarter turns) & butterfly valve (50NB) unit set.	Supply
Pipe work	100 NB galvanized steel Pipe 600 m, from TH8 sump to Primary Clarifiers running along the length of the Overland Link Conveyor. 50 NB pipe x 10 m for flushing pipe with nozzle sprays (8). U-bolts (>200) supports and pipe support (>10 with plinths) where applicable	Supply

a. This works should include continuous cleaning (pumping, draining of water and slurry with vacuum truck and TLB) until, removing as well as transport to the ash dump of ash slurry in both the wet and dry sumps.

b. New electrical cables are to be pulled from the nearest substation (30m away) while C&I will remain the same.
c. Paving of the surrounding area (50 m X 50 m) and overland ash conveyor temporary wash bay to improve the drainage of wastewater into the TH08 sump.
d. Floor Cracks at the TH08 Sump.
e. Cracks on the top surface of Transfer House 8.

2.1.8 Centrifuge Station

The control system for the Primary and Secondary clarifiers was designed to have an interface between the mechanical equipment as well the Distributed Control System (DCS). To achieve this the OEM supplied centrifuges that interface with a DCS via a Junction Box. The centrifuges are currently not working due to being exposed to elements.

The work includes the supply and installation of the following replacement equipment. The equipment shall be compatible with existing equipment on site.

a. 6 X CPU set to be replaced

b. 6 X HMI panels to be replaced with simpler designs.

c. 75m of Cat5e cables need to be replaced.

The works include the supply and installation of sheeting around the centrifuge station to protect the equipment against the elements as well as against the surrounding environment and steel floor plates. The works include interfacing with existing equipment.

2.1.9 Clarifier 1 & 2 Damaged Equipment (Primary)

The works include the refurbishment or supply (see below Table), and commissioning of the equipment listed below. The equipment listed below was removed and some sent for refurbishment. The equipment must be tested, installed and commissioned. The equipment is to be verified during clarifications and confirmed at site (See Table 7 and 8).

work includes the procurement, supply, installation and commissioning of the equipment listed below.

a. 4 X installation Sludge Bredel model 65 pumps, 4 X fluid drive and 4 X motors and 4 X additional flushing pumps and drive units.

b. Replacement of old pipework 50 NB discharge lines from sludge pumps to decanter and dirty beds to 65 NB piping, see Table 8 which is to be supplied and installed by contractor.

c. Modification on old flushing pipework (with 2 X butterfly valve and 2 X NRV on the flushing system).

d. Install 23 automated knife valves & butterfly valves and 13 manual controlled knife valves upstream the pumps to decanter and dirty beds.

e. Repairs of cracks on the Clarifier concrete floor and Walls.

f. Procuring 2X sump pumps for draining water from the Clarifier pits.

g. Pulling and termination of Power supply cables from Panel boxes to the flooded equipment points. Pulling and termination of C&I cables from Junction boxes to the flooded equipment points

h. Replacement of all flow switches and pressure transmitters.

i. VSD inspection, testing and replacement if damaged.

j. Damaged equipment to be verified.

k. Supply of labour to monitor and pump the Clarifiers constantly.

l. Installation of 2 X lednova beka lights or similar lighting per clarifier pit.

m. Modification to strainer or Supply of new one fitting the intended designs.

n. This works should include continuous cleaning (pumping, draining of water and slurry) until handover, removing as well as transport to the ash dump of ash slurry in both the wet and dry sumps.

Table 7 Primary Clarifier Flooded equipment to be procured

Items	**Manufacturer**	**Quantity**
Cerabar S PMP75, PMP75-26CE5/101(PMP75-ABA1KB1B31BU+Z1)	Endress +Hauser	8
Levelflex FMP51, FMP51-4DX82/125(FMP51-AAACCABAA4GGJ+AAF4JALAPBZ1	Endress +Hauser	8
Bredel65 - Peristaltic hose pump Bredel65 with 2 oil level switches per pump	S&A PUMP PRECIZION (PTY) LTD	5
MOTOR 5.5KW 2P 380V B3 WEG W20 CI, COUPLING F60 HF 24X38, BASEPLATE 950X400X100 TOPHAT	KSB	5
200 NB knife Gate valve + multi turn actuator 0.72-0.76	Clarkson + Auma	5
2X 50 NB non return valve		3
please note quantities were increased by 1 to create room for spares which will be issued to Medupi Power Station		

Table 8: Pipework for the Primary Clarifier Sludge pumps.

Medium	ITEM NO	QTY	DESCRIPTION
Slurry	CLA/1/AP/2	2	65NB SWEEPING T-PIECE, FLANGED
Slurry	CLA/1/AP/4	2	65NB STRAIGHT PIPE (238MM) JOINED TO 65NB 90 LONG RADIUS BEND (3D), FLANGED
Slurry	CLA2/AP/2	2	65NB SWEEPING T-PIECE, FLANGED
Slurry	CLA2/AP/4	2	65NB STRAIGHT PIPE (238MM) JOINED TO 65NB 90 LONG RADIUS BEND (3D), FLANGED
Slurry	CLA1/CDB/1	6	REDUCER (65x50)
Slurry	CLA1/CDB/2	2	65NB 90 LONG RADIUS BEND
Slurry	CLA1/CDB/4	2	65NB STRAIGHT PIPE (1340MM)
Slurry	CLA1/CDB/5	11	65NB 90 LONG RADIUS BEND
Slurry	CLA1/CDB/6	2	65NB STRAIGHT PIPE (1320MM)
Slurry	CLA1/CDB/7	1	65NB T-PIECE
Slurry	CLA1/CDB/8	1	65NB SWEEPING T-PIECE
Slurry	CLA1/CDB/9	1	65NB STRAGHT PIPE (10780MM)
Slurry	CLA1/CDB/10	12	65NB STRAGHT PIPE (6480MM)
Slurry	CLA1/CDB/11	2	65NB STRAGHT PIPE (3280MM)
Slurry	CLA1/CDB/12	4	65NB 45 LONG RADIUS BEND
Slurry	CLA1/CDB/13	2	65NB STRAIGHT PIPE (7110MM)
Slurry	CLA1/CDB/14	2	65NB STRAIGHT PIPE (16290MM)
Slurry	CLA1/CDB/15	1	65NB T-PIECE
Slurry	CLA1/CDB/16	4	65NB STRAIGHT PIPE (2570MM)
Slurry	CLA1/CDB/17	4	65NB STRAIGHT PIPE (9110MM)
Slurry	CLA1/CDB/18	4	65NB STRAIGHT PIPE (6680MM)
Slurry	CLA1/CDB/19	4	65NB STRAIGHT PIPE (6210MM)
Slurry	CLA1/CDB/20	1	65NB STRAIGHT PIPE (24860MM)
Slurry	CLA1/CDB/21	1	65NB STRAIGHT PIPE (6680MM)
Slurry	CLA1/CDB/22	1	65NB STRAIGHT PIPE (1190MM)
Slurry	CLA1/CDB/23	1	65NB T-PIECE
Slurry	CLA1/CDB/24	1	65NB STRAIGHT PIPE (600MM)
Slurry	CLA1/CDB/25	1	15MM SAUNDERS VALVE FOR PIT
Slurry	CLA2/CDB/1	2	REDUCER (65x50)
Slurry	CLA2/CDB/2	2	65NB 90 LONG RADIUS BEND
Slurry	CLA2/CDB/4	1	65NB STRAIGHT PIPE (148MM)
Slurry	CLA2/CDB/5	12	65NB 90 LONG RADIUS BEND
Slurry	CLA2/CDB/6	2	65NB STRAIGHT PIPE (1320MM)
Slurry	CLA2/CDB/7	1	65NB T-PIECE
Slurry	CLA2/CDB/8	1	65NB SWEEPING T-PIECE
Slurry	CLA2/CDB/9	12	65NB STRAIGHT PIPE (7580MM)
Slurry	CLA2/CDB/10	10	65NB STRAIGHT PIPE (6480MM)
Slurry	CLA2/CDB/11	2	65NB STRAIGHT PIPE (3180MM)

Slurry	CLA2/CDB/12	4	65NB 45 LONG RADIUS BEND
Slurry	CLA2/CDB/13	2	65NB STRAIGHT PIPE (6970MM)
Slurry	CLA2/CDB/14	2	65NB STRAIGHT PIPE (16210MM)
Slurry	CLA2/CDB/15	1	65NB T-PIECE
Slurry	CLA2/CDB/16	2	65NB STRAIGHT PIPE (2370MM),
Slurry	CLA2/CDB/17	2	65NB STRAIGHT PIPE (7900MM),
Slurry	CLA2/CDB/18	2	65NB STRAIGHT PIPE (6680MM),
Slurry	CLA2/CDB/19	2	65NB STRAIGHT PIPE (6210MM),
Slurry	CLA2/CDB/20	2	65NB STRAIGHT PIPE (24260MM),
Slurry	CLA2/CDB/21	2	65NB STRAIGHT PIPE (6680MM),
Slurry	CLA2/CDB/22	2	65NB STRAIGHT PIPE (1600MM),
Slurry	CLA2/CDB/23	2	65NB STRAIGHT PIPE (600MM),
Slurry	CLA2/CDB/24	1	15MM SAUNDERS VALVE FOR PIT
Slurry	CLA2/CDB/870	1	65NB STRAIGHT PIPE (1070MM)
Slurry	CLA2/CDB/400	1	65NB STRAIGHT PIPE (900MM)
Slurry	CLA2/CDB/90	1	65NB STRAIGHT PIPE (7780MM)
Slurry	CLA2/CDB/100	1	65NB STRAIGHT PIPE (6680MM)
Flushing Water	CLA1/FW/400	4	65NB STRAIGHT PIPE (755MM)
Flushing Water	CLA1/FW/140	4	65NB STRAIGHT PIPE (190MM)
Flushing Water	CLA1/FW/240	4	50NB STRAIGHT PIPE (800MM)
Flushing Water	CLA1/FW/14	2	50NB STRAIGHT PIPE (190MM)

2.1.10 Clarifier 3 & 4 Damaged Equipment (Secondary)

The *works* include the refurbishment or supply (see below Table), and commissioning of the equipment listed below. The equipment listed below was removed and some sent for refurbishment. The equipment must be tested, installed and commissioned. The equipment is to be verified during clarifications and confirmed at site (See Table 9 and 10).

work includes the procurement, supply, installation and commissioning of the equipment listed below.

a. Refurbishment / replacing of 4 X Hose pumps and their relative fluid drives and motors.

b. 4 X replacing Sludge Bredel model 50 pumps, 4X fluid drive and 4X motors and 4X additional flushing pumps and drive units.

c. Replacement of old pipework 50 NB discharge lines from sludge pumps to decanter and dirty beds with new one 65 NB pipelines, see Table 10 which is to be supplied and installed by contractor.

d. Modification on old flushing pipework (with 2 X butterfly valve and 2 X NRV on the flushing system).

e. Install 23 automated knife valves & butterfly valves and 13 manual controlled knife valves upstream the pumps to decanter and dirty beds.

f. Repairs of cracks on the Clarifier concrete floor and Walls.

g. Procuring 2 X sump pumps for draining water from the Clarifier pits.

h. Pulling and termination of Power supply cables from Panel boxes to the flooded equipment points. Pulling and termination of C&I cables from Junction boxes to the flooded equipment points

i. Replacement of all flow switches and pressure transmitters.

j. VSD inspection, testing and replacement if damaged.

k. Damaged equipment to be verified.

l. Installation of 2X lednova beka lights or similar lights per clarifier pit.

m. Supply of labour to monitor and pump the Clarifiers constantly.

n. Modification to strainer or supply of new one fitting the intended designs.

o. This works should include continuous cleaning (pumping, draining of water and slurry) until handover, removing as well as transport to the ash dump of ash slurry in both the wet and dry sumps.

Table 9: Secondary Clarifier Flooded Equipment to be procured.

Item	Manufacturer	Quantity
Cerabar S PMP75, PMP75-26CE5/101(PMP75-ABA1KB1B31BU+Z1)	Endress +Hauser	8
LevelflexmFMP51, FMP51-4DX82/125(FMP51 AAACCABAA4GGJ+AAF4JALAPBZ1	Endress +Hauser	8
Bredel50 - Peristaltic hose pump Brede50 with 2 oil level switches per pump	S&A PUMP PRECIZION (PTY) LTD	5
MOTOR 5.5KW 2P 380V B3 WEG W20 CI, COUPLING F60 HF 24X38, BASEPLATE 950X400X100 TOPHAT	KSB	5
200 NB knife Gate valve + multi turn actuator 0.72-0.76	Clarkson + Auma	5
2X 50 NB non return valve		3
please note quantities were increased by 1 to create room for spares which will be issued to Medupi Power Station		

Table 10: Pipework for the Secondary Clarifier Sludge pumps.

Medium	ITEM NO	QTY	DESCRIPTION
Slurry	CLA3/CDB/1	2	50NB STRAIGHT PIPE (218 MM)
Slurry	CLA3/CDB/2	10	50NB 90 LONG RADIUS BEND
Slurry	CLA3/CDB/3	2	50NB STRAIGHT PIPE (760MM)
Slurry	CLA3/CDB/5	2	50NB STRAIGHT PIPE (200MM)
Slurry	CLA3/CDB/6	2	50NB STRAIGHT PIPE (1474MM)
Slurry	CLA3/CDB/7	1	50NB STRAIGHT PIPE (198MM)
Slurry	CLA3/CDB/8	1	50NB T-PIECE
Slurry	CLA3/CDB/9	1	50NB STRAIGHT PIPE (350MM)
Slurry	CLA3/CDB/10	1	50NB SWEEPING T-PIECE
Slurry	CLA3/CDB/11	1	50NB STRAIGHT PIPE (14648MM)
Slurry	CLA3/CDB/12	1	50 NB STRAIGHT PIPE (6870MM)
Slurry	CLA3/CDB/13	2	50NB STRAIGHT PIPE (6571MM)
Slurry	CLA3/CDB/14	4	50NB 45 LONG RADIUS BEND
Slurry	CLA3/CDB/15	2	50NB STRAIGHT PIPE (4028MM)
Slurry	CLA3/CDB?16	2	50NB STRAIGHT PIPE (27367MM)
Slurry	CLA3/CDB/17	3	50NB OFF-SET
Slurry	CLA3/CDB/18	1	50NB STRAIGHT PIPE (11132MM)
Slurry	CLA3/CDB/19	1	50NB STRAIGHT PIPE (3112MM)
Slurry	CLA3/CDB/20	1	50NB STRAIGHT PIPE (12894MM)
Slurry	CLA3/CDB/21	1	50NB STRAIGHT PIPE (24395MM)
Slurry	CLA3/CDB/22	1	50NB SWEEPING T-PIECE

Slurry	CLA3/CDB/23	1	15MM SAUNDERS VALVE FOR PIT
Slurry	CLA3/CDB/120	1	50NB STRAIGHT PIPE (7070MM)
Slurry	CLA3/CDB/110	1	50NB STRAIGHT PIPE (14848MM)
Slurry	CLA3/CDB/500	1	50NB STRAIGHT PIPE (140MM)
Slurry	CLA4/CDB/1	2	50MB STRAIGHT PIPE (218MM)
Slurry	CLA4/CDB/2	12	50NB 90 LONG RADIUS BEND (12)
Slurry	CLA4/CDB/3	2	50NB STRAIGHT PIPE (760MM)
Slurry	CLA4/CDB/5	2	50NB STRAIGHT PIPE (370MM)
Slurry	CLA4/CDB/6	2	50NB STRAIGHT PIPE (1522MM)
Slurry	CLA4/CDB/7	2	50NB STRAIGHT PIPE (200MM)
Slurry	CLA4/CDB/8	1	50NB T-PIECE
Slurry	CLA4/CD/9	1	50NB STRAIGHT PIPE (350MM)
Slurry	CLA4/CDB/10	3	50NB SWEEPING T-PIECE
Slurry	CLA4/CDB/11	1	50NB STRAIGHT PIPE (10950MM)
Slurry	CLA4/CDB/12	2	50NB STRAIGHT PIPE (6870MM)
Slurry	CLA4/CDB/13	2	50NB STRAIGHT PIPE (6510MM)
Slurry	CLA4/CDB/14	4	50NB 45 LONG RADIUS BEND
Slurry	CLA4/CDB/15	2	50NB STRAIGHT PIPE (4736MM)
Slurry	CLA4/CDB/16	2	50NB STRAIGHT PIPE (27180MM)
Slurry	CLA4/CDB/17	2	50NB STRAIGHT PIPE (12082MM)
Slurry	CLA4/CDB/18	2	50NB STRAIGHT PIPE (2915MM)
Slurry	CLA4/CDB/19	2	50NB STRAIGHT PIPE (550MM)
Slurry	CLA4/CDB/20	2	50NB STRAIGHT PIPE (12808MM)
Slurry	CLA4/CDB/21	2	50NB STRAIGHT PIPE (24395MM)
Slurry	CLA4/CDB/22	2	50NB SWEEPING T-PIECE
Slurry	CLA4/CDB/23	1	15MM SAUDERS VALVE FOR PIT
Slurry	CLA4/CDB/120	1	50NB STRAIGHT PIPE (7160MM)
Slurry	CLA4/CDB/110	1	50NB STRAIGHT PIPE (1200MM)
Slurry	CLA4/CDB/500	1	50NB STRAIGHT PIPE (310MM)
Slurry	CLA4/CDB/890	1	50NB STRAIGHT PIPE (770MM)
Slurry	CLA3/AP/2	2	50NB SWEEPING T-PIECE
Slurry	CLA3/AP/3	2	50NB STRAIGHT PIPE (200MM)
Slurry	CLA3/AP/4	2	50NB 90 LONG RADIUS BEND
Slurry	CLA4/AP/2	2	50NB SWEEPING T-PIECE
Slurry	CLA4/AP/3	2	50NB STRAIGHT PIPE (200MM)
Slurry	CLA4/AP/4	2	50NB 90 LONG RADIUS BEND
Slurry	CLA1/CDB/1	4	REDUCER (65x50)
Slurry	CLA3/FW/240	4	50NB STRAIGHT PIPE (800MM)
Slurry	CLA3/FW/14	2	50NB STRAIGHT PIPE (190MM)
Flushing Water	CLA3/FW/400	4	65NB STRAIGHT PIPE (755MM)
Flushing Water	CLA3/FW/140	4	65NB STRAIGHT PIPE (190MM)

2.1.11 E, C & I Cables for Degrit Sumps X 7, TH 7, TH8, Screw Pumphouse and Clarifiers X 4

The table below should the amount of Electrical, Control and Instrumentation cables that will need replacement if damaged and new installation.

Table 11:Project Cabling E, C &I cabling

Discipline	Cable Type	Length (m)
Electrical	BVV04DCM	14120
Electrical	BVX04CCM	990
Electrical	BVX02DCM	360
Electrical	BVX03ECM	350
C&I	UVG02ACM	7000
C&I	UVG16AEM	11500
C&I	UVG08ACM	2000

2.1.12 Configuration Management

The contractor shall complete KKS coding as per the KKS Key Part standard Rev.6 (348-694071), VGB guidelines and List of Abbreviations Rev.11 standard on the provided equipment list template, insert the codes on the drawings, label the plant following the KKS Coding and Labelling standard Rev.7 (348-630398) and apply for KKS inspections. Eskom will only review and accept the codes. The contractor shall remain liable for the codes provided by them even though Eskom has accepted the codes.

2.1.13 Commissioning

The Contractor will be responsible for the commissioning of the integrated plant. The Contractor shall provide the commissioning with relevant activities and supporting statements for a need of such activity.

The Commissioning Book shall record interventions for acceptance and rejection for a repetition of such failed activity. Eskom commissioning will provide support for interfacing disciplines and plant.

2.1.14 Remedial Works

a. Temporary works:
   i. Pumping water while working especially in the degrit sumps
   ii. Clearing of pipes that could be filled with ash
   iii. Temporary Power for the works

b. Pump Extraction house
   ii. Coverage for inspection, maintenance and/or replacement of equipment should there be any breakdown during commission

2.1.15 Plant Safety Regulations

The plant where the works will take place has already been safety cleared; the Contractor shall follow the Plant Safety Regulations and High Voltage Regulation to do any work. Thus, the Contractor shall have trained personnel for Mechanical, Electrical (both Low and High Voltage) as well Control and Instrumentation.

2.2 ELECTRICAL WORKS

The electrical contractor shall be responsible for the provision of all the electrical interface and ensure that work is done with good quality, and all new installation or modification must fit to the existing system or plant.

The electrical scope covers the following:

- Primary and Secondary Clarifier
- De grit sumps
- Transfer house 7 & 8
- Oil Skimmers

2.2.1 Primary clarifier 1 and 2 scope

The scope of works includes but not limit to the following:

- The contractor shall be responsible for the installation of 23 free issued actuated valves,
- Upon receiving the free issued actuated valves the contractor shall submit power requirements using an Aux power schedule to the Project manager for acceptance by the Engineer,
- Post acceptance of the Aux power, the contractor shall submit termination, cable, load list and load schedule for all the loads to be supplied.
- POC will be allocated by the employer, in areas where MCB are required, the contractor will install MCB on the existing 400V Switchgear as communicated by the employer adhering to the Low Voltage switchgear and control assembly standard 240-56227516.
- The employer will provide details of the switchgear together with the POC details.
- The contractor shall design, supply and install cables racks to the respective loads, this should be inline with Requirements for Control and Power Cables for Power Stations Standard (240-56227443)
- The contractor must use existing routing or racks to run their cables, unless agreed with the employer for any secondary racking.
- The contractor shall supply all associated tools and equipment to earthing installation and testing in line with Eskom Earthing and Lightning Protection Standard (240-56356396).

- Testing of cables, racking and earthing and shall be conducted with respect to SANS and Eskom Standard, all tests conducted (earthing, insulation resistance etc.) shall be submitted to the employer for approval and will form part of the data books
- All equipment shall be labelled in line with Eskom KKS standard, this included labelling on the existing switchboard where additional cables have been added.
- Where new cables have been pulled, the contractor shall reseal any damage fireproofing.
- Safety clearance of all electrical equipment (Cabling, earthing, racking, DB's, LV switchgear) shall be followed and results will build up the data book for submission.
- In areas where lighting will be replaced due to flooding, the contractor shall replace lights with similar or better light fitting, if design is changed, the contractor will need to submit data sheet of the new lights together with illuminance test result.
- Lux survey must be conducted in line with SANS 10114 and the Occupational health and safety act of 93.
- The contractor to test and certify the VFD panels and issue out a report. Refurbishment or replacement of the Variable Speed Drive for the sludge pumps. There are 2x sludge pumps per clarifier. The supplier/will need to complete the VSD technical A& B schedule and submit to the employer prior to purchasing the VSD. VFD Technical A & B template (240-132875144).
- The contractor shall ensure that all additional works or new works is interfacing with all the other system.

2.2.2 Secondary clarifier 3 and 4 scope

- The contractor shall be responsible for the installation of 23 free issued actuated valves, Upon receiving the free issued actuated valves the contractor shall submit power requirements using an Aux power schedule to the Project manager for acceptance by the Engineer,
- Post acceptance of the Aux power, load list the contractor shall submit termination, cable and load schedule for all the loads to be supplied.
- POC will be allocated by the employer, in areas where MCB are required, the contractor will install MCB on the existing 400V Switchgear as communicated by the employer adhering to the Low Voltage switchgear and control assembly standard 240-56227516.
- Due to limited Connection point on the Secondary clarifier, the contractor shall modify the existing Electrical Switchgear and install buckets on unequipped spare circuits that will cater for all loads.
- A downstream Electrical distribution board to be installed to power all the 23 valves. The Electrical DB shall adhere to the Coal fired lighting and small power installation standard (240-55714363) together with the Filed instrument junction box standard (240-56355815)
- Upon completion with electrical DB, the contractor shall certify the DB and issue out a COC
- The contractor shall design, supply and install cables racks to the respective loads, this should be in line with Requirements for Control and Power Cables for Power Stations Standard (240-56227443)
- The contractor must use existing routing or racks to run their cables, unless agreed with the employer for any secondary racking.
- The contractor shall supply all associated tools and equipment to earthing installation and testing in line with Eskom Earthing and Lightning Protection Standard (240-56356396).
- Testing of cables, racking and earthing and shall be conducted with respect to SANS and Eskom

Standard, all tests conducted (earthing, insulation resistance etc.) shall be submitted to the employer for approval and will form part of the data books
- All equipment shall be labelled in line with Eskom KKS standard, this included labeling on the existing switchboard where additional cables have been added.
- Where new cables have been pulled, the contractor shall reseal any damage fireproofing.
- Safety clearance of all electrical equipment (Cabling, earthing, racking, DB's, LV switchgear, KKS cert etc.) shall be followed and results will build up the data book for submission.
- The contractor to test and certify the VFD panels and issue out a report. Refurbishment or replacement of the Variable Speed Drive for the sludge pumps. There are 2x sludge pumps per clarifier. The supplier/will need to complete the VSD technical A& B schedule and submit to the employer prior to purchasing the VSD. VFD Technical A & B template (240-132875144).
- The contractor shall ensure that all additional works made fit with the existing system.

2.2.3 Degrit sumps works

The contractor to ensure that the system is functional as per the employer's requirement.

- There are pumps and motors, the contractor shall assess all the electrical cable through a visual inspection, conducting insulation resistance and continuity test and provide a report to the employer for approval.
- The contractor shall also assess all the motors and provide a report
- The contractor to connect all power cables to the pumps and motors, safety clear the cables, install labelling, and earthing installation.
- The contractor shall ensure that the plant runs as per the design.
- Where earthing is corroded, the contractor shall repair and certify the earthing integrity in line with Eskom Earthing and Lightning Protection Standard (240-56356396).
- Data books to be submitted as agreed upon the employer and quality department.

2.2.4 Degrit temporally works (Emergency mobile pump).

The works are as follows:

- The contractor shall buy the required pumps as per section 3.1.3 (3 X (2X1.5B-AH) slurry pump (pumps set to remove 10-20l/s) type keeping the DOL panels for the 15 KW motor (rated at 380-400V).
- The contractor shall connect the pumps to the nearest welding socket onsite,
- Existing welding 63A, 400V welding are in strategic areas onsite, therefore it is the responsibility of the contractor to have enough cable slack to power the pumps whenever required.
- The contractor shall ensure that they system is functional.

2.2.5 Oil Skimmers works

The works are as follows:

- The contractor shall submit an Aux power schedule to the employer for approval.
- POC will be allocated by the Employers Engineer.
- Post acceptance of the Aux power, load list the contractor shall submit termination, cable and load schedule for all the loads to be supplied.
- POC will be allocated by the employer, in areas where MCB are required, the contractor will install MCB on the existing 400V Switchgear as communicated by the employer adhering to the Low Voltage switchgear and control assembly standard 240-56227516.
- Due to limited Connection point on the Secondary clarifier, the contractor shall modify the existing Electrical Switchgear and install buckets on unequipped spare circuits that will cater for all loads.
- A downstream Electrical distribution board to be installed to power all the loads The Electrical DB shall adhere to the Coal fired lighting and small power installation standard (240-55714363) together with the Filed instrument junction box standard (240-56355815).
- Upon completion with electrical DB, the contractor shall certify the DB and issue out a COC
- All supporting certificate (KKS, Earthing) to form part of the final inspection for the DB.
- The contractor shall install secondary racking where required.
- The contractor shall design, supply and install cables racks to the respective loads, this should be in line with Requirements for Control and Power Cables for Power Stations Standard (240-56227443).
- The contractor must use existing routing or racks to run their cables, unless agreed with the employer for any secondary racking.
- The contractor shall supply all associated tools and equipment to earthing installation and testing in line with Eskom Earthing and Lightning Protection Standard (240-56356396).
- Testing of cables, racking and earthing and shall be conducted with respect to SANS and Eskom Standard, all tests conducted (earthing, insulation resistance etc.) shall be submitted to the employer for approval and will form part of the data books.
- The Contractor shall dig half meter deep, +-10 m long trench from substation to the Tar Road before the cables enter the tunnel for both Armoured C&I and Electrical cables to Clarifiers.

2.2.6 Transfer houses Works

2.2.6.1 Transfer House 8

There are 2 pumps that need to be upgraded from 11kW to 30KW, the electrical scope includes:

- Removal of existing pumps and installation of bigger pumps (30kW).
- Design and sizing of cables to power the new motors.
- Procurement and installation of the sized correct cables for bigger motors.
- Subsequently, all actuator pumps cables to be installed.
- Switchgear modification for installation of bigger circuits to accommodate bigger pumps
- POC will be allocated by the employer, the contractor will install the correct circuit on the 400V Switchgear as communicated by the employer adhering to the Low Voltage switchgear and control assembly standard 240-56227516
- The contractor shall ensure that new installation fit onto the existing system.
- Earthing installation and testing inline with the Earthing standard. The contractor shall also ensure that the earthing integrity of the system is still intact.
- Supporting document such as earth results to be submitted with the data and must be reviewed

prior by the Employers Engineers.

2.2.6.2 Transfer House 7

The works are as follows:

- The contractor shall assess the existing cables to the pumps and provide a report to the employer for approval.
- The contractor shall conduct cabling tests such as insulation resistance (Megger), continuity and provide the results to the employer for approval.
- The contractor shall reconnect all the cables and ensure that the is functional
- They shall also verify the earthing integrity and fix as required.
- Configure with existing DCS system.

2.2.7 Compliance with Electrical Standards and General requirements

The Contractor shall comply to the following electrical standards for execution of the electrical works, or any international standard stipulated in deviation schedule:

a) The electrical designs, manufacturing, construction, and installations are done in accordance with SANS 10142-1 (The wiring of premises part 1: Low voltage installation).
b) The power cables and cable racks are done in accordance with 240-56227443 (Requirements for Control and Power Cables for Power Stations Standard).
c) Earthing and lightning protection is done in accordance with the Earthing and Lightning Protection Standard (240-56356396).
d) LV Modifications shall be done in accordance adhering to the LV Switchgear control and assembly 240-56227516
e) Test the motors and provided certificates as per the procurement of power station low voltage motors specification 240-57617975.
f) Earthing and Lightning Protection Standard (240-56356396).
g) The high-level general scope of work for electrical includes:
    - Ensure new equipment is interfacing with all the other system requirements of the plant/installation.
    - Test the motors and provided a certificate as per the Procurement of Power Station Low voltage motors specification (240-57617975)
    - Conduct an earth continuity test and provide certification for quality controls.
    - Conduct insulation resistance and provide certification for quality records
    - Produce all documentation and drawings for approval by the employer

2.3 CONTROL AND INSTRUMENTATION WORKS

The C&I system forming part of the Works shall provide all information, alarms, protections, process interlocks, control and local control facilities to enable the operator (located in the Outside Plant

Control Room) to execute operating tasks safely, reliably and consistently. All C&I, protection system and control components supplied as part of the Works, shall be supported and maintainable for a minimum of 25 years. The Contractor's design shall provide for later expansion of the control and instrumentation system such that future changes and enhancements can be readily incorporated.

2.3.1 System Architecture

The C&I plant forming part of the Works shall be integrated into the Employer's C&I plant by Contractor.

2.3.2 SUMMARY DESCRIPTION OF C&I WORKS

i. The Contractor shall perform engineering, design, procurement, manufacturing, factory acceptance testing, delivery, off-loading at site, storage, installation, testing, commissioning, optimization and as-built documentation for the complete C&I plant and material. The limit of supply is as per Limit of Supply and Services (LoSS) Diagrams

ii. Contractor shall supply documentation and information as per the C&I VDSS – clarification of the referenced documents in the C&I VDSS can be found in the C&I Documentation Description document.

iii. The Contractor shall implement the operating and control of the plant in the Employer's Distributed Control System (DCS) based on the information provided by the Contractor as per C&I VDSS.

iv. The Plant shall be operated from the Employer's Outside Plant Control Room with HMI supplied by the Employer.

v. The Plant shall also be operated and controlled by C&I equipment supplied by the Contractor.

vi. The C&I system forming part of the Works shall provide all information, alarms, protections, process interlocks, control and local control facilities to enable the operator (located in the Outside Plant Control Room) to execute operating tasks safely, reliably and consistently.

vii. The Contractor shall integrate the C&I plant forming part of the Works to the Employer's C&I plant.

viii. The Contractor shall ensure that the C&I plant forming part of the Works is supplied and standardized as per Employer's requirements.

ix. The Contractor shall ensure that the C&I plant forming part of the Works meets the dynamic and static operation, reliability, availability and safety requirements and does not affect adversely the Employer's C&I plant performance.

x. All C&I, protection system and control components supplied as part of the Works, shall be supported and maintainable for a minimum of 25 years.

xi. The Contractor is fully responsible for integrating the operation, monitoring, control and process management of the C&I Works with existing installed C&I plant and material.

xii. The Contractor shall be responsible for obtaining all relevant information of plant and material outside their supply where it affects design or plant and material within the Contractor's scope of supply.

xiii. The Contractor shall provide proof and evidence of compliance to this specification for approval by the Engineer.

xiv. The Contractor shall use only proven technology with references accepted by the Employer prior to the commencement of the design phase.

2.3.3 Standards

i. The additional standards applicable to the C&I Works are listed in List of Additional Standards Applicable to C&I Works as per below table.

ii. The Contractor shall notify the Engineer of any conflict within this Specification with any referenced standards, specifications or technical guideline.

iii. Substitutions of any standards in Standards shall be approved by the Employer.

iv. Additional standards proposed by the Contractor shall be submitted for approval by the Employer.

2.3.4 BACKGROUND ON EMPLOYER'S CURRENT C&I SYSTEM DESIGN

i. The Employer's control system is based on the Alspa Series 6 Distributed Control System (DCS) supplied by Alstom

ii. The DCS Input-Output Functional Blocks as implemented by the Employer are as per IO Function Blocks.

iii. MFC3000 Controllers are used throughout the Balance of Plant (BoP).

iv. The Employer's DCS cubicles are distributed throughout the outside plant in C&I equipment rooms adjacent to electrical substations.

v. All field equipment is HART-enabled to allow for interfacing with Employer's Asset Management System.

vi. Go-switches are used in the place of proximity switches that are hardwired to the DCS.

2.3.5 STANDARDIZATION REQUIREMENTS

i. The Contractor shall standardize similar plant components with the rest of the power plant to ensure simplified operation and maintenance, and reduced lifecycle management costs.

ii. The system shall employ a uniform approach across all plant areas as per the rest of the power plant with respect to design philosophy, basic functional characteristics, system interfaces, documentation, standard function blocks and engineering tools.

iii. The requirements of standardization shall be applicable to all C&I plant and material including the PLCs. The Contractor shall supply a standardization strategy document for the Engineer's approval during concept engineering design phase.

2.3.6 SYSTEM PERFORMANCE REQUIREMENTS

i. The availability of the complete C&I system (including interfaces to DCS) consisting of the individual sub-systems over its life in percentage of time shall be 99,99% or greater. The availability shall include for all software updates and upgrades, and planned and unplanned maintenance, but exclude hardware upgrades. This would require an emphasis on on-line maintenance of all C&I system components.

ii. The availability of the complete protection systems over its life in percentage of time shall 99,999% or greater. The availability shall include for all software updates and upgrades, and planned and unplanned maintenance, but exclude hardware upgrades. This would require an emphasis on on- line maintenance of all protection system components, without putting the plant at risk.

iii. Field devices availability shall as a minimum match that of the C&I system forming part of the Works so that it does not constitute a weak link. This will require an emphasis on matching the MTTF and MTTR of the field device with that of the overall C&I system forming part of the Works, on-line maintenance of field device, functional distribution of equipment, and matching of redundancy philosophies with mechanical and electrical systems.

iv. All field instrumentation shall have a minimum MTTF of 100 years.

v. All transmitters shall have a minimum long-term stability of 0.15% drift in 6 years guaranteed for at least 6 years from the date of Taking-over. If, during the 6-year guarantee period the methodology for testing shows that the drift limit has been exceeded, the Contractor shall replace the device within 24 hours.

2.3.7 ENVIRONMENTAL CONSIDERATIONS

The Contractor shall guarantee the maximum sound power level (in watts) of each item of plant shall not exceed a noise level (sound pressure level) of 85 dB (A) according to SABS 083/1970, at 3m from any such item in its permanent location site. This guarantee applies to normal site

operating conditions with the item fitted with standard silencing equipment. For items of the Works that operate periodically, the guarantee applies to the time when they are operating.

2.3.8 C&I PLANT AND MATERIAL ENVIRONMENTAL AND HAZARDOUS LOCATION PROTECTION REQUIREMENTS

i. The Contractor shall provide equipment protection ratings and certificates for the Engineer's approval.

ii. Field equipment and devices shall be minimum IP65 rated.

iii. The equipment supplied by the Contractor shall be immune to electromagnetic interference according to internationally accepted EMC standards for power plant.

2.3.9 DOCUMENTS AND INFORMATION EXCHANGE

i. The Contractor shall supply all necessary documents or information to ensure proper design, operation and maintenance of the plant.

ii. The Contractor shall supply documentation and information as per the C&I VDSS and templates provided. A C&I documentation description document that clarifies the C&I documentation requirements is provided.

2.3.10 DCS ENGINEERING CONTRACTOR INVOLVEMENT REQUIREMENTS

i. The Contractor shall allow for involvement in the DCS software development phase through to commissioning phase to assure proper interfacing and implementation of the control and operating philosophy of the plant forming part of the Works in the DCS.

ii. The Contractor shall verify and approve the DCS interfacing and implementation of the Works' operating, and control philosophy as detailed in documents provided by the Contractor as per C&I VDSS.

2.3.11 CONTROL SYSTEM DETAILED REQUIREMENTS

i. The Contractor's control system shall be incorporated in the Balance of Plant control system. It is the Contractor's responsibility to develop a system architecture for the C&I Works that conforms to the Employer's Requirements.

ii. The control system should be structured such that the whole system forming part of the Works can be operated and controlled independent from the DCS if required.

iii. All control equipment and cubicles shall be housed in equipment rooms which meet the requirements and the conditions of the environment it is located in to ensure that the system meets the operating life expectancy of the plant.

iv. Where integrated field localized equipment is required, the equipment and its enclosures shall meet the requirements and the conditions of the environment it is located in to ensure that the system meets the operating life expectancy of the plant. The minimum requirements shall be as per enclosures prescribed but not limited by Eskom Standard.

v. All cubicles forming part of the Works shall be provided as follows:

- bottom cabling access.
- Floor mounted with suitable dust and vermin proofing.
- earthing (as per applicable Eskom Standards).
- front and rear access.
- remote temperature monitoring per cubicle.
- Powder coated RAL 7035.

vi. The integrity of all Binary input signals from field devices shall be checked and system shall have capability to detect wire break. All field contacts shall be interrogated using 24 V DC.

vii. All analogue and digital signals shall be continuously monitored for validity, whether used for operator information, control, protection, interlocking, calculations or plant history. Data validation shall include:

- signals monitored for wire break (change over contacts),
- out-of-range values,
- same measurement discrepancies,
- abnormal rate-of-change,
- contact bounce,
- invalid process operating ranges
- power supply failure,
- card removal,
- out-of-scan,
- simulated inputs,
- short circuit,
- pole disagreement (changeover binary contacts).

viii. The Contractor shall provide galvanic isolation between the source of the signal and the controller or at interfaces to other C&I systems.

ix. The Contractor's design shall provide for later expansion of the control and instrumentation system such that future changes and enhancements can be readily

incorporated. The spare capacity shall be demonstrated to the Engineer at design freeze. At design freeze, the Contractor shall provide for the following without the necessity for reconfiguring the design:

- 10% spare installed I/O of each type in the control and instrumentation system cubicles spatially distributed throughout the cubicle throughout the I/O modules.
- 20% reserve physical space in all cubicle racks (I/O, signal conditioning etc.), field panels, marshalling racks and cable racks.
- 10% spare installed terminals per cubicle.
- 20% spare installed capacity in all multi-core cables (rounded up)
- 20% reserve power availability at full load use per area.

x. The Contractor shall provide for the following at Completion without reconfiguring the design:

- The utilisation of all CPUs shall not exceed 45% loading during normal operation
- The Contractor must cater for full expandability range for bus loading
- 30% spare memory capacity for software expansions

xi. The Contractor shall provide a report on the control and instrumentation system expandability confirming each of the above parameters as tested by the Contractor before Taking-Over is certified.

2.3.12 Building or facility layout Design

All C&I cubicles shall be housed in C&I equipment rooms that comply to Eskom's environmental conditions as stipulated in Eskom standards.

2.3.13 C&I DESIGN

All C&I cubicles shall be supplied from reliable UPS feed.

2.3.14 CBMS Design

The substations and equipment rooms shall have Fire Detection System (FDS), Access Control System (ACS), HVAC and Closed-Circuit Television (CCTV) integrated to Employers CBMS.

The fire protection supplied shall also be interfaced to the CBMS.

2.4 CIVIL AND STRUCTURAL REQUIREMENTS

2.4.1 Overview of works

The following overview describes the civil and structural works for this project:

2.4.1.1 Investigation and testing:

a) General condition assessment of civil and structural existing works shall be carried out by the Contractor.
b) The condition assessment report and constructability report shall be submitted to indicate the needed modifications, assessment results, repairs, new designs that align to making the mechanical systems are automated, fit for purpose as well as increase the efficiency of existing systems within civil infrastructure as intended per Employers main objective through this SoW
c) The following areas (as a minimum) shall be investigated/assessed by the Contractor and included in the condition report and constructability analysis report.
   - Geohydrology in specific areas where ground water could be the potential source into certain existing structures.
   - Integrated systems, trenches and tunnels

   - Degrit sumps
   - TH7
   - TH8
   - Clarifiers

2.4.1.2 Design and Construction

Contractor shall execute design and construction of the works to ensure the newly designed/refurbished/installed and automated mechanical systems and supporting civil structures are fit for purpose.

a) General works and repairs,
   - Demolishing and cleaning works (as a minimum)
   - Contractor to make provision for repairs (brickwork, concrete, pressure washing cleaning, dewatering/pumping out, temporary works, reinstalling joints/sealants, grouting works, corrosion protection works, NDTs, checking and replacing of bolts or welds) to be executed by Contractor per Designers requirements.

b) Specific Modifications,
   - Where replacement of mechanical components requires breaking and/or modifying existing civil infrastructure, the needed civil and structural modification works shall be assessed (design analysis/verification) by the appropriate qualified Designer and reinstated/modified by Contactor under the per Designers requirements and supervision.

c) New Designs,
   - Designs shall require Contractor and Designer/s to comply with Eskom procedures, specifications, relevant ECSA code of conduct, ECSA Overarching code of practice, applicable SANS codes and all regulations set out in this document (as a minimum).

d) All new designs and design modifications shall be conducted in accordance with, but not limited to, the following Eskom standards:
   - 240-53113685 Design review procedure
   - 240-53114026 Generation Project Engineering Change Management Procedure
   - 240-56364545 Structural Design and Engineering Standard
   - 348-880042 Medupi Concrete specification for structural concrete (84CIVL053)
   - 240-57127955 Geotechnical and Foundation Engineering Standard
   - 240-85549846 Standard for Design of Drainage and Sewerage Infrastructure

2.4.1.3 Specialist Reporting and Inputs:

a) Provision for Specialist civil input/reporting/studies for the following (as deemed required on critical civil and structural aspects of the SoW):
   - Concrete testing.
   - Corrosion protection, protective coating and sealants.
   - Geotechnical investigations and Geotechnical report.
   - Geohydrological and hydrology studies.
   - Specifying of products (locally produced as far as possible)Submission of operational documentation and manuals: O&Ms to be created for life cycle checks as well as operational and maintenance aspects

- Reporting and creation civil and structural O&Ms by the relevant Designer/s

2.4.1.4 Execution, Construction Monitoring and Handover,

Contractor shall execute all works in accordance with the various aspects contained in this SoW document while integrating and fully complying with all specifications and regulations.

2.4.2 General requirements

a) Eskom/Generation policies, processes, standards and procedures to also be complied with as a minimum

b) The Contractor to consider but not be limited to adhering to the following legislative documents/standards during the designs of all water related infrastructure, namely The National Water Act (Act No. 36 of 1998), The Environmental Conservation Act (Act No. 73 of 1989), Government Notice 704, National Water Act 1998, the latest Medupi SHEQ, Environmental Procedures and Medupi Water Use license (01/A1042/ABCEFGI/5213).

c) Civil and Structural: The Contractor shall ensure all works comply (as a minimum) with 240-56364545, 240-107981296, all relevant SANS including SANS but not limited to 10 400 and Employer's Corrosion specification.

d) Architectural: The design and construction aspects of the building shall (as a minimum) be in accordance with the 84CIVL007 / 348-884646, 200-26680 / 348-361813, all relevant SANS including but not limited to SANS 10 400 (All parts of these standards). Additionally, the Contractor's architectural designer shall be responsible to ensure the design meets the requirements of SANS 10400 and follow the Architectural Profession Act No. 44 of 2000.

e) General Storm-Water and Drainage: The Contractor shall ensure that all works (as a minimum) comply with 240-85549846 and all relevant SANS including but not limited to SANS 10 400. The plant generated effluent drainage systems and storm water designs shall interface with all existing infrastructure and new designs for the roads and structures. Levels and positioning shall be considered to ensure that no flooding occurs in any existing and new buildings. The natural ground levels shall be assessed, and terracing or localised reshaping may be required to ensure that no ponding occurs in any of the affected areas.

f) General Earthworks and Road Design: The Contractor shall ensure that all works (as a minimum) comply with 240-84418186, 240-57127955, 240-57127951, 240-57127953, 200-6166 (348-355152), 240-57127955, 240-107981296, 240-144332407, SAICE Code of Practice for Geotechnical Investigations and all relevant latest SANS codes including but not limited to SANS 10 400.

g) KKS codification: The Contractor shall label the plant according to Medupi Power Station Plant coding which is KKS Plant Codification Standard – 200-94660. All documentation, drawings, diagram and lists shall refer to the area of plant by means of the required plant labelling in accordance to the Eskom plant labelling procedures and drawing standards.

h) Signage: Safety signage and escape routes shall be as a minimum be in accordance with Eskom Fire Protection and Life Safety Design Standard (240-54937450) and SANS 1186.

2.4.3 Civil and Structural Design and Construction Requirements

2.4.3.1 Surveying and scanning

a) The Contractor shall be responsible for providing surveying and scanning works. The Contractor shall make provision for, including but not limited to, pre-development surveys, pre-design topographical surveys, setting out of all works, post construction topographical surveys, surveys during construction, survey verification of existing infrastructure and interfaces, underground and above ground surveys of existing services, and all other required survey studies deemed necessary.

b) The Contractor shall be responsible for the accuracy, correctness, completeness and appropriate of all surveys and as built data submitted. The Contractor shall also appoint suitably qualified and compete Lead surveyor(s) registered with South African Council of Registered professionals.

c) The Contractor shall be responsible for the identification of local trig beacons and obtaining Surveyor General cadastral information which is included on the deliverable survey data.

d) The topographical survey requirements and associated activities shall include but are not limited to:

- Topographical survey for all works,
- Survey shall be conducted in 0.5m intervals,
- The survey shall be conducted using the WGS 84 coordinate system,
- All levels relate to the mean average sea level,
- The Contractor shall be responsible for the identification of local trig beacons and obtaining Surveyor General cadastral information, which is included on the deliverable survey data
- The Contractor shall be responsible for the survey and placement of additional control points as required.

e) The Contractor shall be responsible for providing the following (as a minimum):

- Coordinated electronic survey drawing incorporating all the above (Section 19.1.1) in MicroStation format including legend to identify point references and table of all survey beacons and trig beacons
- Drawings shall be submitted in native DGN format and PDF; and
- An XYZ file, incorporating all reference descriptions, relating to all the above requested survey data is submitted to the Employer
- A comprehensive full-scale marked-out survey including level, location and route of both conductive and non-conductive underground services. All detected services shall be easily identifiable by a legend or suitable description.

- Every point of detail shall be fixed in Y, X and Z and shall be presented on the drawings by standard feature descriptions. The density of the survey shall be adequate to enable cross-sections to be extracted at 0.5m intervals.
- Include the legend showing the abbreviations

2.4.3.2 Geotechnical

a) Contractor shall carry out geotechnical and geohydrological assessments as deemed required by the Designer, this may include but not be limited to conducting excavations, investigations, above or below ground tests/studies, test pits, sampling, laboratory testing (carried out by a South African National Accreditation System (SANAS) accredited laboratory).

b) All materials arising from demolition and site clearance work except materials specified for re-use or as otherwise specified via the Project Manager shall be removed from site as the work progresses and shall be disposed of and/or stockpiled for re-use. Disposal of material shall also align with the existing Medupi environmental and waste disposal procedures and requirements. Therefore, the Contractor shall be required to establish their own plans (including but not limited to Site establishment Plan, Environmental management plan (EMP), Project Quality Control Plan, Waste management plan and Site Disestablishment plan) that complies with Eskom and Medupi Procedures, legislation and regulations.

c) The Contractor shall submit the following, as a minimum, deliverables for the Geotechnical investigations:

- Geotechnical investigations proposal outlining all investigations required
- Drawing(s) indicating Test pit layout with co-ordinates.
- Laboratory and material testing schedule
- Comprehensive report on available construction
- Comprehensive Geotechnical Investigation report with including but not limited to field work, laboratory testing and results, discussions, evaluations, analysis, recommendations, slope stability, construction material sources, soil and rock logging, geological and geotechnical hazards:
- Appendices including all field data (raw data), detailed calculations, laboratory test results
- Borrow area licensing (where applicable) including cut/fill material balance.

2.4.3.3 Architectural

The Contractor shall indicate all necessary architectural details (including but not limited to colour) of all works on the appropriate architectural drawings. Additionally, the Contractor shall comply with the Medupi Architectural specification listed in the normative section of this document.

2.4.3.4 Painting and Corrosion Protection

a) The painting and corrosion protection requirements are to be included in the relevant design drawings and drawing notes to be produced by the Contractor. All of which should comply with the corrosion requirements stipulated in the Medupi Power Station Corrosion Protection Specification, SSZ_45-17 Revision 2 and Identification of the Contents of Pipelines and Vessels, 200-3583 (348-912995).

b) The Contractor Designers shall add all necessary design and construction notes to all drawings, O&Ms and ensure that all drawings for all works include associated product datasheets/specification.

2.4.3.5 Structural

a) The Contractor shall ensure that all conceptual, detailed and final construction drawings are approved as per Eskom's review processes prior to beginning construction and that compliance is maintained to all specifications for material grades that are fabricated and erected. This includes fabrication and erection tolerances, testing parameters and corrosion protection required for steel structures and their supporting elements. The Contractor is also required to submit to the Employer, steel grade certificates, fabrication drawings, welder's certificates and quality and test plans for review prior to fabrication.

b) All structural steel work must be manufactured and erected in accordance with relevant national standards and specifications.

c) All structural steel elements, metal grating, stair treads and fasteners are required to be hot dipped galvanized to SANS 121.

d) Only coded welders are to perform all welding works. Supporting welding documentation must be submitted to the Employer for review and acceptance prior to construction. Note: All welding is required to comply with AWS D1.1.

e) All welding joints are required to be inspected using visual aids and/or non-destructive tests as indicated below:

- Butt welds 100% ultrasonic NDT
- Fillet welds 20% MPI.

- Or as directed by the Designer

f) The Contractor shall also submit construction method statements for acceptance by the Employer for all works, inclusive of risk assessments per area of construction.

2.4.3.6 Concrete

a) The Contractor shall submit the concrete and grout mix designs including but not limited to trial test cube results and all other required test results as indicated in the Medupi Power Station Specification for Structural Concrete (84CIVL053) prior to the placement of any concrete and grout.

b) The Contractor shall also submit detailed construction method statements and a quality and test plan to the Employer for review prior to the casting of concrete. All method statements shall also encompass risk assessment, environmental and waste management in compliance to the Employer procedures and applicable legislation/regulations.

c) The Contractor shall submit all inspection and test plans (ITP's) for acceptance. The Employer will indicate his\her hold and witness points on the ITP. All specified tests and required interventions to be itemized on the ITPs and should be easily linked/referenced to all other technical documents.

d) All of the above-mentioned documents, mix designs, material test results, material certificates and reports shall be submitted to the Employer for acceptance once approved by the Contractor's Designer. The Contractor's Designer shall discuss and submit necessary information, recommendations and/or possible solutions to the Project manager and Employer's team when test results are not within limits/thresholds specified within the relevant Eskom, Medupi, regulations and national specifications.

2.4.3.7 Material and Concrete Testing

a) The Contractor shall discuss and agree with the Employer regarding the frequency of all testing to be conducted. All test results to be submitted to the Employer for review in accordance with the specification. The Contractor shall submit a Quality Assurance and Quality Control plans and concrete mix design/s with trial mix test results for acceptance by the Employer.

b) In addition to the tests specified in the specification (84CIVL053) and all durability index tests shall be performed (SANS 3001-CO3-1, SANS 3001-CO3-2, SANS 3001-CO3-3), if required by the Employer, on already constructed concrete works to confirm the durability of concrete placed. The durability index tests are developed to assess the transport properties of the concrete cover zone. There are three durability tests, namely Oxygen Permeability Index, Chloride Conductivity test and

the Water Sorptivity test. Table below and on the next page provides the acceptance criteria for the three different test results as defined below:

Table 12: Acceptance criteria for durability index test results

Type of Index test / Result Rating	Oxygen Permeability Index	Sorptivity Index	Chloride Conductivity Index
Excellent	> 10	< 6	< 0.75
Good	9,5 - 10	6 - 10	0.75 - 1,5
Poor	9,0 -9,5	10 - 15	1,5 - 2,5
Very Poor	<9,0	>15	> 2,5

2.4.3.8 Adverse weather conditions

For clarity on the Medupi Power Station specification for structural concrete, rev 3, the Contractor shall note the following:

a) When ambient temperature is above 36 ºC, the temperature of the concrete when deposited/poured shall not be allowed to exceed 32 ºC and when ambient temperature is below 36 ºC, the temperature of the concrete when deposited shall not be allowed to exceed 35 ºC.

b) The Contractor should note that concrete works placed during hot weather conditions, exposed to direct sun and wind is particularly prone to undergoing plastic-shrinkage and the Contractor shall adapt construction processes and methods to prevent the occurrence of plastic-shrinkage cracks.

2.4.3.9 Exposure of concrete to aggressive environment conditions

a) All works constructed shall consider the aggressive site environment conditions. In particular, the design and construction of all concrete works shall ensure resistance to the aggressive environment the works are exposed to.

b) The Contractor shall ensure that concrete placed is of good quality, dense and well-compacted. As specified in Employer specifications and SANS codes, including but not limited to SANS 10100-1 structural concrete, exposed to aggressive environment, shall be designed and detailed to ensure concrete crack widths, under serviceability conditions, are limited to 0,004 times the nominal cover to the reinforcement.

c) The Contractor’s construction methods shall ensure plastic-shrinkage cracks are limited, that special precautions are taken to ensure crack widths are within acceptable limits and that placed concrete is of good quality.

2.4.3.10 Documentation, Construction Monitoring and Professional Engineering Certification

a) The Contractor shall take full professional accountability/responsibility for all the works set out in this scope document and shall submit the necessary proof of professional registration and experience, as well as submit a completed Competency Declaration form, for the professionally registered, accountable, and certifying Designer.

b) The Contractor shall produce and submit all information including a Master Document List (MDL), 3D model (in a format/software file that the Employer can open and review), layouts, calculations, detailed drawings, method statements, product specifications, risk assessment, constructability assessment, KKS Equipment lists, register and verification record templates for the various works (including QC/QA documentation) as well as a bill of quantities, all of which are required for the timely planning, design and construction of all outstanding and new civil and structural works.

c) Detailed drawings for construction shall be submitted timeously by the Contractor for Employer review prior to commencement of works. Contractor to note that all drawings shall also be submitted in the correct templates. CAD and PDF formats, all of which shall follow the Employers quality specifications and document control procedures

d) All review durations shall be agreed with Project Manager over and above the general contractual periods due to the nature and intricacy of this project.

e) Submission of consolidated detailed design and calculation reports signed by a Professional ECSA Registered Civil Engineer which includes all survey results, outcomes of geotechnical investigations, testing and sampling deemed necessary by Designer. Reports shall also include but not be limited to listing/detailing all Designer selected design criteria/parameters, specifications and standards used, loadings, assumptions, calculations results including detailed design calculations, design models, credible sources of information and any record of other information associated with the completed works.

f) The Contractor shall submit As-built data (inclusive of QC and QA databooks) for the entire scope. All As-built drawings produced for the completed works shall be submitted upon handover, this includes but is not limited to provision of all relevant certificates (inclusive of a PEC, COC's and project completion certificate). All data and records for the QC and QA databooks shall however be submitted progressively as works are carried out and in accordance with the Employer's Quality procedures.

g) All submitted design calculations and drawings shall be signed by an accountable Professional Civil Engineer with both ECSA registration number and signature.

h) Review and acceptance of all construction documentation (includes but is not limited to method statements, ITP's, material approvals and approval of all other quality verification records), as well as fabrication records shall be the responsibility of the Designer, prior to being submitted to the Employer for review per the relevant quality procedures.

i) The Contractor's designer shall perform the necessary construction monitoring, as required by the Construction Regulations (Act No. 85 of 1993), to ensure design intend is achieved

j) The Contractor shall issue the Professional Engineering Certificates for completed structures/buildings in line with National Building Regulations (Act No. 103 of 1977), SANS 10400 and Construction Regulations (Act No. 85 of 1993).

k) In the event where the Contractor's designer is not in a position to confirm that design intent, of works already constructed, was achieved during construction due to lack of information, test results, inspection records and\or professional declaration certificates; the designer shall submit a risk assessment and make recommendations to the Employer.

l) In cases where the Contractor is uncertain of which specifications are applicable to the execution of particular works defined in this scope of work, the Contractor is required to follow due processes to request clarification from Eskom prior to executing such works.

m) All investigations and required testing of existing and new works shall comply with the civil and structural specifications outlined this document. Additionally, the Contractor is expected to keep records of tests conducted and submit to Employer for review in line with Employer's quality procedures.

n) The Contractor's Designer shall provide all the necessary design integration, while ensuring that all works are inspected, constructed, and monitored in accordance with latest approved design drawings and as per the requirements outlined in this civil and structural section.

o) The Contractor's civil designer shall be responsible to ensure design intent is achieved during construction. Construction monitoring shall be done in accordance with the Construction Regulations (Act No. 85 of 1993), SANS 10400, ECSA Code of Conduct (Act No. 46 of 2000), environmental and legislative standards.

p) All method statements, reports, documentation, risk assessments, material certificates, planning, program schedules, resources and labour force from Contractor shall consider the following listed aspects, while also being in accordance with relevant Eskom specifications, procedures, SANS codes and regulations and submitted to the Employer for review:

- Construction/installation methods and plans
- Survey and Site clearance
- Demolition/removal requirements
- Building works
- Civil engineering and structural works
- Electrical & Mechanical engineering works
- Process control and IT works

- Welding requirements
- Material specifications
- Waste Management requirements
- Temporary works

2.4.4 Civil and Structural Deliverables

2.4.4.1 Investigation, Testing, Specialist Reporting and Design deliverables

a) Organogram for this project with confirmation letters of all resources and where applicable updates submitted formally to the Employer to review when requested by the Project manager.
b) Investigation and testing report (inclusive of all results, pre-condition assessments, NDT Contractor data and both reports, results from accredited service providers and Designer approved supporting documentation)
c) Comprehensive feasibility assessment report/s (where applicable)
d) Constructability report/s
e) Design calculation files and other design reports that cover the following as a minimum:
    - Alternative options considered supplemented by a high-level cost analysis and trade-off study to support the final design solution to be implemented.
    - Assessments and verification of existing systems, where such interface exists;
    - Assumptions made;
    - Calculation methodologies adopted;
    - Design criteria/ parameters used;
    - Design Philosophy;
    - Design results and calculations for all elements;
    - Loads and forces;
    - Materials used;
    - References/ sources of information, data and records of any other information associated with the completed works;
    - Software input and output files incl. design models (all models and calculations etc. must be submitted in their native file format as well as PDF); and
    - References to specifications, codes and standards used in the designs;
f) Site development plan
g) Concept, Detailed and “For Construction” drawings (signed and dated with ECSA Pr. number of the accountable Designer) as well as the drawings needed formats (PDF and DGN/DWG).
h) Concrete and grout mix design/s in accordance with the Medupi Specification for Structural Concrete (84CIVL053) [86]

i) Concrete testing results
j) Stormwater Management Plan and Philosophy (where applicable);
k) Detailed Stormwater management plan demarcating dirty and water catchments
l) Water balance model (if applicable), geohydrological studies and associated hydrology reports
m) Pre-construction material analysis
n) Approved Inspection Authority reports and documentation
o) Submit results of all surveys including the raw survey data, detailed contour survey plans, detailed as-built surveys of existing infrastructure, ASCII files, triangular data and a detailed survey report;
p) Submit results all geotechnical investigations including all raw data and geotechnical report;
q) Provide Terminal Point Data Sheets for each of the interfaces.
r) Detailed design report calculation file/ report documenting all:
    - Assessments and verification of existing systems, where such interface exists;
    - Assumptions made;
    - Calculation methodologies adopted;
    - Design criteria/ parameters/tolerances used;
    - Design Philosophy;
    - Design results and calculations for all elements;
    - Loads and forces;
    - Materials used;
    - References/ sources of information, data and records of any other information associated with the completed works;
    - Software input and output files incl. design models (all models and calculations etc. must be submitted in their native file format as well as PDF); and
    - References to specifications, codes and standards used in the designs.
s) Design specification(s) and technical data sheets
t) Operating and maintenance manuals
u) Works information describing the works
v) Construction quality assurance and control plans (QCPs) and Inspection and Test Plans (ITPs)
w) Comprehensive Method statements
x) Construction sequencing plans and updated bi-weekly schedule/program of works
y) Risk assessments and SHEQ file that encompasses all needed documentation for this project and all required updates as the project is carried out.
z) Master Document lists (MDL) that also aligns with the project VDSS

2.4.4.2 Fabrication, Manufacturing, Construction and Certification deliverables

a) Regularly updated Master Document List (MDL), Note: A minimum monthly submission.
b) All H1, H2 and H3 Databooks
c) All records and Quality Control Plans (QCPs) and Inspection and Test Plans (ITPs) for each phase of this project
d) Method statement including associated risk assessments
e) Material Quality Assurance records (Material approvals, data sheets, conformance test results approved by the Designer/s)
f) Construction Quality Control check sheets and quality verification records (QVRs)
g) All Test results and certificates (signed and approved by accredited service providers and relevant Designers)
h) Submit Data Books/Data Packs including providing sign off, where applicable. Data books shall include but are not limited to the following, as a minimum (where applicable):

- Approved Design Calculations And Data;
- Approved Drawings And As Built Data;
- Approved Non-Destructive Test (NDT) Procedures;
- Batch Plant Certificates;
- Bolt Grade Certificates;
- Calibration Certificates;
- Corrective Actions and Concessions;
- Certificates Of Manufacture;
- Chemical Test Results And Certificates;
- Compaction Test Results And Certificates;
- Completion And Handover Certificates;
- Concrete Mix Designs Including All Required Test Results (E.G. Aggregate Test Results, 7 Day And 28 Day Cube Test Results) And Certificates;
- Construction Completion Reports;
- Corrosion Protection Consumables Certificates;
- Construction completion reports
- Certificates of Completion (CoCs)
- Detailed Piping And Valve Lists;
- Document List;
- Equipment Specifications and Certificates;
- Fabrication And Shop Drawings;

- Factory Acceptance Tests;
- Grout Designs Including All Required Test Results (E.G. Material Test Results, 7 Day And 28 Day Cube Test Results Etc.) And Certificates;
- Hydrostatic Test Results For Pipes And Tanks/Pressure Vessels;
- Inspection Reports;
- Instruction For Work/ Purchase Order;
- Internal Release Notes;
- Maintenance Manuals;
- Manufacturing Drawings;
- Material Certificates;
- Material Summary That Gives Full Traceability Between Components Used, Drawings And Material Certificates;
- Method Statements And Specifications Adhered To;
- Modifications / Engineering Changes;
- NDT Contractor Data and Reports/ Results;
- NDT Technician Qualifications;
- Non-Conformance Reports;
- Notifications;
- Operating and maintenance Philosophy;
- Updated Operating and maintenance Manuals.
- Parts Catalogue;
- Pre-Concrete And Post-Concrete Surveys;
- Approved Inspection Authority reports and documentation
- Pressure Test Procedures, Certificates And The Calibration Certificates Of The Gauges Used;
- Professional Engineering Certificate/s;
- Risk Assessment/s;
- Site Acceptance Tests;
- Slump Test Results And Certificates;

2.5 GENERAL REQUIREMENTS

2.5.1 Safety Requirements

a. No individual C&I fault shall endanger the safety of the people or plant or jeopardise the integrity of major plant.

b. The earthing concept applied by the Contractor shall be based on recognised best engineering practices and shall ensure the safe and reliable operation of the C&I systems and the protection of the electronic equipment against damaging transients.

2.5.2 Earthing, Lightning and Electrical Protection

a. All C&I system equipment shall be earthed to the station earth point.

b. All metal instrument casings shall be properly earthed (grounded) to the earth mat to avoid any electromagnetic interference which may arise from portable RF transmitters, cell phones and other equipment used on the plant.

c. All earthing required to eliminate any interference shall be provided.

d. All field cables and network cables shall be earthed (grounded). The cables shall be earthed at one end or both ends depending on the interference signal and shall comply with an overall recognized earthing arrangement.

e. Lightning and Surge protection shall be included in all the circuits where there is exposure to potential lightning.

f. All earthing and surge protection shall as a minimum be in accordance with 240-56356396 Earthing and Lightning Standard.

2.5.3 Requirements Related to Maintainability

a. The components installed shall be protected from the harsh or hazardous power plant environment.

b. The Contractor shall ensure that the installation of the transmitters:

c. Allow for safe and easy access for maintenance and calibration.

d. Allow for the environmental conditions.

e. Allow for the removal of equipment for maintenance in the vicinity of the transducer.

f. Emergency plans shall be provided for system failures and faults such that appropriate measures can be taken immediately without having to first analyse the cause of the failure.

2.5.4 GENERAL

a. Actuators to be able to work in a dusty and damp environment. Rating should be IP68.
b. No changes to the design parameters.
c. All pipework to be SANS 062.
d. Corrosion protection to be implemented, corrosion protection specification to be approved by the Employer.
e. All Plant shall be designed to fail-safe. Sudden power losses shall not have an adverse effect on Plant and shall not unduly delay return to operation after power is restored.
f. Unless otherwise specified all electrical Plant necessary for the safe and efficient working of this Plant shall be provided in terms of the electrical Employer's Requirements in section 3.6 table 2.
g. Unless otherwise specified all process and control Plant necessary for the safe and efficient working of this Plant shall be provided in terms of the electrical Employer's Requirements.

2.5.5 TESTING REQUIREMENTS AND PROCEDURES

Unless otherwise stated in these Employer's Requirements, the Works shall be tested in accordance with the requirements and procedures approved by the Engineer. To this end the Contractor shall submit his proposed requirements and procedures for all tests (including for the Tests on Completion and the Tests after Completion) to the Engineer, for approval, within 90 days of the Contract Date. These requirements and procedures shall be developed to suitably and properly demonstrate that the Works meet the Employer's Requirements and shall:

a. be in accordance with the details (if any) stated in the Contract; and

b. be further developed or amended and re-submitted at the expense of the Contractor until they are approved by the Engineer.

c. Valves and actuators to be tested to verify their functionality.

d. Test of all the C&I and Electrical works for full operation.

e. Full testing of the oil separators

Each actuator shall be factory tested. Tests shall be performed in accordance with the IEC standards as and where applicable. A final inspection record shall be supplied with each actuator. This shall include the following information:

f. General actuator data.

g. Nominal current (continuous).

h. Nominal current (short time overload).

i. No load currents.

j. Starting current.

k. Power factor at rated torque.

l. Output speed.

m. Torque switch setting.

n. Limit switch setting (turns/stroke).

o. High voltage test.

p. Visual Test & Functional Test (Including all option).

3. MAINTENANCE

The Contractor shall conduct maintenance of the completed works until the works is handed over to Eskom Generation. The Contractor to make provision of maintenance for a period of 3 months.

4. SPARES

The Contractor shall submit a schedule of, and include in the offer, all spares that are considered necessary for the long-term operation and maintenance of the Plant, considering the life expectancy

and lead time of the components. The Contractor shall identify, and include in the offer, all special tools required for ongoing operation and maintenance.

5. TRAINING

The Contractor shall be responsible for training of the Employer's Operating Personnel on the operating of the entire plant.

6. REVISIONS

Date	Rev.	Compiler	Remarks
June 2021	0		First Draft
August 2021	1		Updated the Primary Clarifier Piping Diameter from 50 NB to 65 NB.
August 2021	2		Additional of the Degrit Sump scope, include the works on TH7.
February 2022	3		Removal of the brand names for the replacement equipment.

September 2022	4		General updates to the scope.
June 2025	5		Additional scope; Installation of slurry piping for each sludge pump, emergency pumps for Degirt sumps and TH 8 upgrades.

7. ACKNOWLEDGEMENTS

8. APPENDIX A: NOT APPLICABLE