	<b>Technical Specification</b>	<b>Generation</b>
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NOTE: This technical specification is compiled on an NEC template, Section C3 for the Scope of Work. The technical sections applicable to Engineering are included in this document. The commercial and procurement sections are highlighted in yellow and do not fall under the responsibility of Engineering and have not been completed.

These sections will be completed by the relevant departments when preparing the commercial document for enquiry.



## C3.1: EMPLOYER’S WORKS INFORMATION

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# 1 Description of the works

## 1.1 Executive overview

The *works* is inclusive of all activities necessary for the complete purchase of a fully functional rapid deployment mobile desalination plant as well as the installation, operation, and maintenance for a period of 18 months. The plant is required at Camden Power Station to treat water from the station's De Jager's Pan with the option to evaluate treatment of ash water from the AWR dams. The plant is required to treat 4ML/day of water from the De Jager's Pan to raw Usuthu water quality or better.

The *Contractor* designs, manufactures, procures and installs all Mechanical, Civil, Electrical, Control & Instrumentation Plant, Equipment and Material required for the *works* as defined in this *Works Information*. This includes interfacing with and utilisation of existing plant and equipment where applicable.

The *Contractor* shall ensure that the design of the *works* shall be performed by, or under the direction, control and supervision of an ECSA registered professional engineer for each discipline as required by the scope of the design.

## 1.2 Employer's objectives and purpose of the works

Camden Power Station is a wet-cooled and wet-ashing power station and, it is not designed to operate under a Zero Liquid Effluent Discharge (ZLED) philosophy, but strives to obtain it at all times, where all effluents are captured, cascaded and recycled in a suitable manner on site.

Camden Power Station receives raw water from the Usuthu Water Scheme into the two terminal reservoirs on site for all power station requirements. Raw water is gravitated from the station reservoirs to the station and is primarily used to supply the following systems:

- Water Treatment Plant (WTP) – for potable and demineralised water production;
- Cooling Water System – Cooling tower make-up

During the operation of Camden Power Station, the Ash Water Return Dam (De Jager's Pan) was integrated into the station's water management system and was utilised for storage and transfer of ash water from the ash dams back to the Power Station ashing system for reuse.

This pan is no longer being used for this purpose and Camden Power Station is required to restore the water quality to its natural state.

Recent events have also led to the increase in De Jager's Pan water level and necessitated the treatment of the water to reduce the dam level.

Camden Power Station requires a desalination plant to abstract the water from the dam, treat it to a quality suitable for recovery within the power station processes or for release into the environment.

A sensitivity analysis is required on the plant being able to treat water from the current ash water dam for future use.

### 1.3 Interpretation and terminology

The following abbreviations are used in this Works Information:

<b>Abbreviation</b>	<b>Meaning given to the abbreviation</b>
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
C&I	Control and Instrumentation
COC	Certificate of Compliance
CSM	Chemical Services Manager
DCS	Distributor Control System
DEMIN	Demineralised
ECSA	Engineering Council of South Africa
FAT	Factory Acceptance Test
GHS	Globally Harmonised System
HAZOP	Hazard and Operability
HMI	Human Machine Interface
I/O	Input Output
ISO	International organization for Standardization
ITP	Inspection and Test Plan
KKS	Kraftwerk Kennzeichensystem
KPI	Key Performance Indicator
NDT	Non Destructive Techniques
O&M	Operating and Maintenance
OEM	Original Equipment Manufacturer
OHS	Occupational Health and Safety
P&ID	Piping and Instrumentation Diagram
PFD	Process Flow Diagram
PLC	Programmable Logic Controller
PSR	Plant Safety Regulations
PTW	Permit To Work
QC	Quality Control
QCP	Quality Control Plan
QMS	Quality Management System
Regen	Regeneration
SABS	South African Bureau of Standards
SANS	South African National Standards
SAQCC	South African Qualification and Certification Committee
SAT	Site Acceptance Test
SIT	Site Integration Test
SRD	Stakeholder Requirements definition
TOC	Total Organic Carbon



VDSS	Vendor Document Submittal Schedule
WPS	Welding Procedure Specification
WQR	Welder Qualification Record
WTP	Water Treatment Plant

Units	Description
C	Celsius
h	Hour
Hz	Hertz
K	Specific conductivity of a solution, with units of $\mu\text{S}\cdot\text{cm}^{-1}$ (micro-Siemens per centimetre - or occasionally milli-Siemens per metre, $\text{mS}\cdot\text{m}^{-1}$ ), measured/reported at the reference temperature of 25°C.
k	Kilo ( $10^3$ )
Pa	Pascal
L	Litre
m	Meter
M	Mega ( $10^6$ )
MA	Milliamps
NTU	Nephelometric Turbidity Units
$\mu$	Micro
V	Volt

## 2 Management and start up.

### 2.1 Management meetings

The *conditions of contract* (e.g. Clause 16.2) require and other sections of the Works Information (e.g. safety risk management) may require (mandate) that a meeting shall be held. However the intention of all NEC contracts is that the Parties and their agents use the techniques of partnering to manage the contract by holding meetings designed to pro actively and jointly manage the administration of the contract with the objective of minimising the adverse effects of risks and surprises for both Parties.

Depending on the size and complexity of the *works*, it is probably beneficial for the *Project Manager* to hold a weekly risk register meeting (Clause 16.2). This could be used to discuss safety, compensation events, subcontracting, overall co-ordination and other matters of a general nature. Separate meetings for specialist activities such as programming, engineering and design management, may also be warranted.

Describe here the general meetings and their purpose. Provide particulars of approximate times, days, location, and attendance requirements, stipulating that attendees shall have the necessary delegated authority to make decisions in respect of matters raised at such meetings.

The right to hold specialist meetings should be stated generically and in such a way that ambiguity with other parts of the Works Information is avoided.

The following text could be used as a model for this section:

Regular meetings of a general nature may be convened and chaired by the *Project Manager* as follows:

Title and purpose	Approximate time interval &	Location	Attendance by:
Risk register and compensation events	Weekly on _____ at _____		
Overall contract progress and feedback	Monthly on _____ at _____		<i>Employer, Contractor, Supervisor, and _____</i>

Meetings of a specialist nature may be convened as specified elsewhere in this Works Information or if not so specified by persons and at times and locations to suit the Parties, the nature and the progress of the *works*. Records of these meetings shall be submitted to the *Project Manager* by the person convening the meeting within five days of the meeting.

All meetings shall be recorded using minutes or a register prepared and circulated by the person who convened the meeting. Such minutes or register shall not be used for the purpose of confirming actions or instructions under the contract as these shall be done separately by the person identified in the *conditions of contract* to carry out such actions or instructions.

## 2.2 Documentation control

Specify how documentation will be identified with an alpha numeric which indicates source, recipient, communication number etc. Provide details of any particular format or other constraints; for example that all contractual communications will be in the form of properly compiled letters or forms attached to e mails and not as a message in the e mail itself. State any particular routing requirements but note from ECC who issues what to whom.

## 2.3 Health and safety risk management

In addition to the requirements of the laws governing health and safety, Eskom may have some additional requirements particular to the *works* and the Working Areas for this contract. The text below provides for these being attached as an Annexure to this Works Information. PLEASE ALSO READ CORE CLAUSE 27.4 TOGETHER WITH Z7 IN THE ADDITIONAL CONDITIONS OF CONTRACT TO MAKE SURE THAT WHATSOEVER IS INCLUDED IN THE ANNEXURE FOLLOWS ON FROM THOSE CLAUSES.

The Divisional/Regional Safety Risk Manager or his representative having jurisdiction over the *works* must provide the relevant safety, health and environmental (SHE) criteria for incorporation into this Works Information. The SHE specification / scope must be signed off by the Divisional/Regional Safety Risk Manager or his representative confirming that the applicable safety criteria have been taken into account.

The Commodity Manager / Buyer must refer the tender to the Divisional/Regional Safety Risk Manager or his representative in order to evaluate against enquiry-specific safety criteria.

The Divisional Safety Risk Managers who will be responsible for the allocation of resources to assist P&SCM with the above processes are as follows:

- Generation: Roley McIntyre
- Transmission: Tony Patterson
- Distribution: Alex Stramrood
- Enterprises: Jace Naidoo
- Corporate: Kerseri Pather

The *Contractor* shall comply with the health and safety requirements contained in Annexure \_\_\_\_\_ to this Works Information.

## 2.4 Environmental constraints and management

The *Contractor* adheres to the Camden environmental policy. A copy of the policy is available from the *Project Manager*.

### 2.4.1 Disposal of Waste

Refer to Eskom's Procedure EPC 32-245.

The *Contractor* shall comply to the National Environmental Management Waste Act 59 of 2008.

The *Contractor* shall compile a waste management plan before commencing with work and prepare a register for hazardous waste in which all waste disposals will be recorded. In addition, the *Contractor* shall submit a method statement for the prevention of pollution and submit to the *Project Manager* for acceptance.

The *Contractor* shall ensure that all hazardous or contaminated materials waste is managed in accordance to the National Environmental Management Waste Act (NEMWA).

The *Contractor* shall ensure that sufficient waste bins/containers are made available for waste control, as per the Camden PS waste management procedure.

General wastes generated by the *Contractor* and its sub-contractors shall be delivered to a centralised collection facility, as designated by the *Project Manager* for disposal by the project.

All waste shall be segregated into the various waste stream fractions. Waste segregation will cover both these main waste-producing activities. Waste shall be segregated into the following waste streams as a minimum:

- Compactable;
- Un-compactable;
- Building rubble;
- Process waste;
- Scrap metal; and
- Hazardous waste (Lamps etc.).

### 2.4.2 Hazardous Waste

Hazardous / toxic waste includes all waste which contains elements or compounds listed as hazardous substances in terms of the Hazardous Substances Act No. 15 of 1973.

Any *Contractor* who produces hazardous waste on site will be responsible for the safe removal of such waste to a registered Class I site by a waste removal and disposal body.

The *Contractor* must ensure that persons handling hazardous waste have undergone suitable training and are acquainted with cleaning methods in case of a spillage.

The *Contractor* is also responsible for the safe removal of their hazardous waste

In order to ensure effective hazardous waste management, a copy of the *Contractor's* hazardous waste inventory must be supplied to the *Project Manager* at least 2 days prior to the occupation date. The *Contractor* shall keep a register of hazardous chemical substances (HCS) and material safety data sheets should be kept on file on site, at the HCS store and where the HCS is in use

## 2.5 Quality assurance requirements

Specify minimum requirements for the *Contractor's* Quality Plan and Work Procedures or provide the *Employer's* Quality Plan if that is to be used. Make sure witness and hold points are identified generally and describe any particular requirements for QA outside the *working areas*. Indicate how the *Contractor's* QA documentation is to be submitted for acceptance and any conditions that need to be imposed relating to acceptance. State whether ISO compliance is a condition and if so which ISO standard shall apply.

The *Contractor* shall prepare and submit a project Inspection and Test Plan (ITP) for all equipment included in the scope. The project ITP shall detail all elements of the plant and shall itemize the required quality levels for each of these components.

The *Contractor* shall indicate in the project ITP which items are of a proprietary nature where the level of certification is limited to standard documentation and certificates of conformity. The *Contractor* shall use only ISO 9001 accredited suppliers for these products. Evidence of ISO 9001 certification shall be supplied with the delivery documentation. Failure to include this certification at the time of delivery shall result in rejection of the equipment by the *Employer*.

All equipment not shown as proprietary equipment in the project ITP shall be designed / manufactured / constructed by an ISO 9001 certified organization. The relevant portions of the project ITP shall be issued to the supplier to ensure that all of the quality requirements are complied with. The *Contractor* shall develop and apply approved quality plans for the design / manufacture / construction / testing / commissioning of the equipment. Each of these quality plans shall be submitted to the *Employer* for review and inclusion of intervention points.

The *Contractor* must provide QCP's to the *Project Manager* to be reviewed and accepted by *Employer's* representative before work can start.

The *Employer* carries out quality inspections at his discretion.

All inspections and testing to be performed in accordance with the Quality Control Procedure (QCP) developed by the *Contractor* and accepted by the *Employer's* representatives.

The *Employer* will be provided access to the *Contractor's* premises for the purpose of:

- (1) Establishing compliance with the contractual requirements by means of inspections, surveillance and audits.
- (2) Witnessing the performance of any tests.

The *Employer's* representatives will inspect switchboards or panels forming part of the Plant before they are released from the *Contractor's* premises at his discretion. This inspection entails a thorough check to ensure complete compliance with this specification including schedules, design drawings and other applicable standards.

The *Contractor* obtains clearance from the *Project Manager* before despatching of the equipment. This factory release inspection does not release the *Contractor* of any of his obligations under the contract.

No Plant will be released for dispatch without the AS MANUFACTURED documentation and drawings accompanying them.

## **2.6 Programming constraints**

The *Contractor* shall make available, from the Contract Date to the completion of the whole of the works, skilled staff to perform all time, cost and resource planning activities required to enable the *Contractor* to timeously provide the works and supply information to the *Project Manager* as described in this section. The cost of programming and planning (labour and all other requirements) should be included in the Prices.

The *Contractor* shall use a computerised planning system recognised by the *Employer* and for which written acceptance must be obtained from the *Project Manager*.

### **2.6.1 Planning**

It is the *Contractor's* responsibility to assess the available data and knowledge explicitly. Any technical detail, policies, imposed organisational conditions, contract conditions, specification, overall programme constraints, resource availability, long delivery items or any other factor of significance to successful contract Completion must be identified by the *Contractor* and submitted to the *Employer* two weeks after Contract Award.

## 2.6.2 Project breakdown

A work breakdown structure of which the first level is systems oriented and the remaining levels functionally oriented. The *Contractor* shall decide the level of breakdown for his internal planning purposes.

### 2.6.2.1 First level

This level is in accordance with the project phases.

### 2.6.2.2 Second level

This level is in accordance with the project stages.

## 2.6.3 Work packages

The *Contractor* shall develop the work breakdown structure to the third level or further to effectively plan the execution of the works.

Work package development for the various disciplines shall follow from the third (or lower) level of the work breakdown structure.

## 2.7 Contractor's management, supervision and key people

- a) All personnel shall comply with specified PPE requirements for all plant areas and operations and shall report any unsafe condition to the supervisor or in his absence, shall report to the Eskom safety officer and/or the CSM or his/her delegate.
- b) The number, duties, training, qualifications and compulsory medical examination of personnel employed at the Mobile desalination Plant shall be in accordance with the requirement of the Plant registration certificate and the requirements stated in this document.
- c) The *Employer* may have stated reasons to instruct the *Contractor* to remove any person from the Contract /Site.
  - The *Contractor* arranges and ensures that after one day of receiving the instruction to remove any person, the person has no further responsibilities with the work included in this contract. The *Employer* shall not pay the *Contractor* for the services of the affected personnel from the day of the *Contractor* receiving the instruction.
  - Failure to comply with the instruction to remove any key person from site shall be a breach in contract and shall result in termination of the contract.
- d) The *Contractor* ensures that all staff being brought to Camden Power Station has a valid medical screening and fitness certificate based on the WTP man job specification. The *Employer* shall provide the *Contractor* with the man job specification.
- e) The *Contractor* must ensure that his personnel are in possession of a valid National driver's licence and Eskom driver's permit.
- f) The *Contractor* provide his own transport and accommodation for personnel
- g) The *Contractor* pays the telephone accounts for the telephones provided by the *Employer* for the Mobile Desalination Plant (personal calls). The *Employer* shall provide a telephone for work purposes for the duration of the contract.
- h) All staff brought onto site in connection with this work scope of work should be able to fluently speak and write in English and have computer skills.
- i) Proof of qualification to be supplied for all personnel when requested by the *Employer*.
- j) The *Contractor* shall adhere to all provisions within the National Water Act No 36 of 1998 and the National Environmental Waste Act No 59 of 2008.
- k) All the *Works* will be subject to anytime inspection from by the *Employer* at any point in time.

- l) Damage to the Mobile Desalination Plant facilities/properties, which can be clearly attributed to negligence on the Contractor, shall be for the *Contractor's* account.
- m) The *Contractor* shall record all as found conditions (state of plant, including defective equipment), outstanding corrective actions and the condition of the measuring and testing equipment.
- n) The *Contractor* shall ensure that each shift has a full staff complement at all times.
- o) The *Contractor* shall inform the *Employer* in advance of all approved leave (annual leave, sick leave, etc.) of his personnel and the arrangements for cover for the duration of the approved leave of said personnel.
- p) The *Contractor* ensures that each shift has authorised personnel for PSR (AP) and forklift driver within 6 months of contract start date.

## 2.8 Invoicing and payment

The Z clauses make reference to invoicing procedures stated here in this Service Information. Also include a list of information which is to be shown on an invoice.

Within one week of receiving a payment certificate from the *Project Manager* in terms of core clause 51.1, the *Contractor* provides the *Employer* with a tax invoice showing the amount due for payment equal to that stated in the *Project Manager's* payment certificate.

The *Contractor* shall address the tax invoice to Eskom Holdings SOC Ltd and include on each invoice the following information:

- Name and address of the *Contractor* and the *Project Manager*;
- The contract number and title;
- *Contractor's* VAT registration number;
- The *Employer's* VAT registration number 4740101508;
- Description of service provided for each item invoiced based on the Price List;
- Total amount invoiced excluding VAT, the VAT and the invoiced amount including VAT;
- (add other as required)

Add procedures for invoice submission and payment (e. g. electronic payment instructions)

## 2.9 Insurance provided by the Employer

First read ECC3 Core Clause 87.1 and then add anything necessary for the management of insurance related issues such as a cross reference to where procedures for making claims can be found. Also provide contact details for persons capable of being able to answer any insurance related queries the *Contractor* may have, as well as to whom the information required by Marine Insurance may be addressed.

## 2.10 Contract change management

This section is intended to deal with any additional requirements to the compensation event clauses in section 6 of the core clauses; such as the use of standard forms. Not the same thing as documentation control.

## 2.11 Provision of bonds and guarantees

The form in which a bond or guarantee required by the *conditions of contract* (if any) is to be provided by the *Contractor* is given in Part 1 Agreements and Contract Data, document C1.3, Sureties.

The *Employer* may withhold payment of amounts due to the *Contractor* until the bond or guarantee required in terms of this contract has been received and accepted by the person notified to the *Contractor* by the *Project Manager* to receive and accept such bond or guarantee. Such withholding of payment due to the *Contractor* does not affect the *Employer's* right to termination stated in this contract.

## **2.12 Records of Defined Cost, payments & assessments of compensation events to be kept by the Contractor**

If Option C, D, E or F applies first read clause 52.2 and then state whether the *Contractor* is required to keep any other records. Include any other constraint which may be required in regard to format and filing of the records, and whether access for the *Project Manager* shall be provided in hard copy or electronically.

Could delete if Options A & B apply unless the *Employer* requires some form of control over the *Contractor's* record keeping.

## **2.13 Training workshops and technology transfer**

Describe **type and frequency of on job training workshops**, as well as any obligation for technology transfer being included as part of the contract on Completion of the *works*.

The *Contractor* is to provide training to the operating staff, maintenance and engineering departments of the *Employer*. This includes chemical, mechanical, electrical and C&I disciplines.

All Operating & Maintenance requirements must be included in the training manuals.

### 3 Engineering and the *Contractor's* design

The *Contractor* designs, procures, supplies, manufactures, delivers to site, installs, and commissions and tests the entire *Works* to ensure a fully functional system. The *Works* is to be located at Camden Power Station, in the Mpumalanga Province. The *Contractor* is to design the *Works* to operate effectively and shall allow for continuous operation.

The *Contractor's* design is reviewed in accordance with the *Employer's* Design Review Procedure and Change Management Procedure in addition to the *Contractor's* own engineering governance processes. The *Contractor* is to submit the full design to the *Employer* before construction begins.

#### 3.1 *Employer's* design

##### 3.1.1 Description of the *works*

The *Works* is to design, procure, manufacture, deliver to site, install, test and commission a containerised process equivalent to 4ML/day treatment capacity, capable of treating water from De Jagers Pan to Usuthu water quality. The plant must be within enclosures, or alternatively have the capability to be enclosed for security and protection from the elements during storage.

The water that is required to be treated is regarded as being saline, scaling and fouling. The Contractor must evaluate the necessary pre-treatment required in order to ensure the required availability and reliability of the system is met.

The pre-treatment must cater for particulate removal which has the potential of fouling downstream processes. The selected pre-treatment system must consider redundancy to ensure pre-treatment is available and in service as per total plant availability requirements

The Contractor shall evaluate if the scaling potential of the feedwater poses a risk to downstream processes regarding the availability of the system and chemical cleans required. Should the analysis provided in the specification be inadequate, the Contractor is required to perform the necessary analysis to confirm the reliability and availability of the treatment system offered. The Contractor is responsible to ensure that the plant performance offered in this tender is met by the feedwater to be treated.

The system shall be configured to obtain a minimum of 90% recovery while ensuring the permeate quality is better than the water quality objectives as listed in Table 2: **Final treated Water Quality Required**. The plant equipment sizing and process design must be optimised such that the system is accommodated within the constraints of the cargo containers in which they will be housed.

The entire system must be accommodated within the footprint of the current fenced off area ( $\pm$  40m x 28m)

All the reject streams (including chemical clean waste piping) must be combined into a single pipe which will be routed to the ash water system (tie in point about 500m from the plant). The contractor shall ensure that any leaks from piping or equipment within the facilities are all contained, collected and transferred to the waste system. No streams are permitted to drip onto the ground.

The chemical cleaning system must also be containerised complete with dosing pumps and equipment. All chemical waste from the plant must be contained, as well as containment of any spillages from the containers or pipes.

The *Contractor's* design is reviewed in accordance with the *Employer's* Design Review Procedure and Change Management Procedure in addition to the *Contractor's* own engineering governance processes.

The *Contractor* is to submit the final accepted design (following all reviews and amendments were required) to the *Employer* before construction begins



The scope is inclusive of training and provision of services for operations, maintenance and supply of spares for a period of 18 months (with option for early termination or extension).

The scope includes:

- a) The process design of the pretreatment system required of the water prior to feeding the desalination system. The process design shall include the cleaning cycle of the pretreatment as well, (for example backwashing), the hydraulics and required protections for the system.
- b) The process design of the desalination system including the simulations showing the process of treating the feed water through the proposed system design indicating the details of the consumable type (e.g. resin, membranes, etc.), expected run length, expected chemical parameters of all streams, cleaning frequency and duration, chemicals and effluent volumes and quality
- c) The contractor shall take note of the impact of the reducing dam level and its influence to the feedwater to the desalination plant over the O&M period. The feedwater quality will be monitored and discussed over a weekly meeting and the impact assessed.
- d) The water quality of all samples analysed during the operation of the plant by the contractor will be verified by the Camden Power Station laboratory at any time. Sample points must be installed on the feed, permeate, reject and chemical waste lines.
- e) A mass balance (salt and water balance) for the plant in its entirety with projected water qualities for each of the processes (product and waste streams) based on the design feed water quality and flow.
- f) The mechanical design of the containerized treatment system showing the configuration of all equipment within the containers as well as all pipe routing and flows.
- g) The mechanical design of the containerized chemical dosing station including pipe dimensions and routing to the process vessels
- h) The mechanical connections and transfer equipment necessary for the interfacing with the existing plant, for the feed water, final water produced and effluent.
- i) The tie-ins to the existing plant must be designed with double isolations to prevent contamination as well as ensure compliance to Eskom Permit to Work System.
- j) The electrical design of the plant including load schedules, switchgear design, motors, cabling and associated protections for the board and cabling.
- k) The C&I design inclusive of the control system and HMI interface
- l) All the containers / housing for the equipment for the complete system designed
- m) The site layout of the various system containers showing the interconnecting pipework, cables, etc. between the containerized equipment
- n) Provision of instrument / service air requirements for the process if applicable. Preference is for electrical actuation.
- o) On-line sample analysers for process monitoring
- p) Civil loading of each container
- q) A civil design inclusive of pipes support details, chemical containment and drainage for process and effluent water from the mobile plant to designated discharge points on site.
- r) Drawings including P&IDs, process flow diagrams (showing interconnections between containers), I/O diagrams, loop drawings, instrument and drive & actuator schedules, instrument electrical and mechanical hook up diagrams, general arrangements and electrical wiring diagrams
- s) Documentation including detailed design calculations, operating manuals, maintenance manuals, water and salt balance, test certificates, signed quality control plans, equipment specifications, cold and hot commissioning procedures.

The *Contractor* completes the detailed design for all areas of the *Works* as specified above.

All drawings provided with this *Employer's Works Information* are for information only and any validation required will be responsibility of the *Contractor*. Wherever changes are made to the existing infrastructure, it remains the responsibility of the *Contractor* to update all the existing drawings of those areas to an as built status.

### **3.1.2 Battery Limits**

The battery limits for the *Works* are as follows:

#### **3.1.2.1 Civil Battery Limits**

The *Contractor* makes use of existing pipe racks and pipe trenches for laying of supply and delivery lines. The pipe supports are included in the *Contractor's* scope. The *Contractor* confirms that the loading on pipe racks will be within acceptable levels with the additional pipes when full.

#### **3.1.2.2 C&I Battery Limits**

The *Contractor* is responsible for the provision of the control system for the mobile plant.

The *Contractor* will install all instrumentation and cabling from field (instrumentation) to the mobile plant control system.

#### **3.1.2.3 Electrical Battery Limits**

The *Contractor* will be responsible for provision of the electrical interface i.e. motors, control panels and cabling. The *Contractor* will also be responsible for cable route identification and termination. The certificate of compliance for the electrical distribution as per SANS 10142-1: The Wiring of Premises Part 1: Low-voltage installations; will be the *Contractor's* responsibility. The power station will provide the power source for the *Contractor*. All fieldwork will be the responsibility of the *Contractor*, up to and including cabling to the switchgear room at a location/source provided by the *Employer*.

#### **3.1.2.4 Mechanical Battery Limits**

The *Contractor* will be responsible for the installation of the mechanical equipment for the mobile plant. The *Contractor* shall also be responsible for interfacing with existing plant to do the tie-ins that are required as part of the *Works*. The mechanical battery limits begin at the De Jager's Pan through a barge system which will serve as the feed to the treatment plant.

The mechanical battery limits terminate at:

- The permeate that will be sent to the cooling water system.
- The effluent produced from the mobile desalination plant will be sent to the ashing system

### **3.1.3 Employer's Engineering Design**

#### **3.1.3.1 Control and Instrumentation Design**

There is no concept design from the *Employer*. The *Contractor* to comply with the requirements stipulated under the *Contractor's* design portion.

#### **3.1.3.2 Electrical Design**

The electrical requirements are as follows:

- The *Contractor* informs the *Project Manager* of the required bulk electrical supply capacity. Should this requirement exceed the *Employer's* current capacity (of 380V, 500kW, 3 phase supply), the *Contractor* shall be required to make provision for spares necessary for retrofitting the functional unit to achieve the additional capacity required.
- The *Contractor* populates and submits the Load Schedule Template (240-56227927: Electrical Load List) for the mobile plant.
- The *Employer* provides the point of supply to the *Contractor* to modify and make connection and termination of bulk power supply for the *Works*.

#### **3.1.3.3 Civil and Structural Design**

In designing the *works*, the *Contractor* shall take due cognisance of existing plant and equipment as well as safety and housekeeping constraints. It is the responsibility of the *Contractor* to ensure that the plant design occupies the current approved footprint of the plant ( $\pm 40\text{m} \times 28\text{m}$ ) and overcome any issues that may arise due to space constraints with prior consent from project management and no extra payment or claim of any kind will be allowed on account of space constraints.

The *Contractor* confirms that the loading on pipe racks will be within acceptable levels with the additional pipes when full.

The *Contractor* will be responsible to confirm the stability of the laydown area for the mobile desalination plant. If the ground work is not suitable to the *Contractors* requirement, the *Contractor* is required to make the corrections.

The *Contractor* shall be responsible for keeping all areas of the Site for which he is responsible, including temporary facilities, buildings, and services in a clean, sanitary and orderly condition.

#### **3.1.4 Works Function and Performance Requirements**

- a) The mobile plant will be operated from the stand-alone control system to be provided as part of the *Works*.
- b) The following modes of operation must be available; automatic, remote manual, local manual and local maintenance.
- c) The normal mode of operation of the plant will be the automatic mode.
- d) The operator shall be notified by means of alarms that the cleaning cycle is required (backwashes and chemical cleans). The commencement of the backwash and cleaning cycles must be manually initiated from where it shall be automatically run. This is to ensure that the interface with the operating plant is controlled to prevent overflow of the effluent management system

#### **3.1.5 Works life-expectancy**

The design life of the *Works* shall be a minimum of 15 years from commissioning of the *Works*. The *Contractor* shall note that the plant will not be in service continuously over this duration. It is expected to be put into layup for periods when not required.

## 3.2 Parts of the works which the *Contractor* is to design

The *Contractor* shall be responsible for the design, manufacture, procurement, factory acceptance testing, delivery to site, off-loading, erection, installation, site testing and commissioning of all Plant and Material required for ensuring a fully functional system.

### Mobile Treatment Plant Design

The *Contractor* is required to carry out all design required for the *Works*. The *Contractor's* design calculations, drawings and other documents must be reviewed and signed off by a registered professional engineer.

The *Contractor* assumes final responsibility to ensure that the *Works* comply with all requirements of the *Works* Information, and any other governing laws or codes. Compliance with the *Works* Information does not relieve the *Contractor* of this responsibility.

The entire plant must be supplied as containerised units, which are required to be offloaded at the site for the duration of its operation. No civil preparation in the form of plinths will be permitted

### 3.2.1 Scope of the work

The scope of work describes the major activities, plant and material that falls within the scope of the *Contractor*. It is the responsibility of the *Contractor* to ensure that all the activities are carried out and all equipment, plant and material is supplied to complete the *Works* in every respect.

The *Works* comprises the following:

- a) Detail Design
- b) Manufacture and procurement
- c) Factory acceptance test
- d) Delivery to and offloading at site
- e) Installation
- f) KKS labelling (mobile plant and tie in points)
- g) Compliance to the GHS of classification and labelling of chemicals
- h) Corrosion protection
- i) Interfacing with existing plant
- j) Commissioning, testing and optimisation
- k) Training of *Employer's* personnel in the operation and maintenance of the system (Engineering, Maintenance and Operating personnel).
- l) Documentation as specified
- m) Quality management for all activities
- n) Safety and plant signage
- o) Storage on site
- p) HAZOP study

All plant, material and equipment is required to be designed for operation in a power plant environment with a minimum requirement for maintenance and operator intervention.

It is not the intention of this scope of work to describe in detail all the activities the *Contractor* is required to carry out, nor to describe in detail everything to be supplied by the *Contractor*.

The *Contractor* provides the whole of the *Works* as defined in section **Error! Reference source not found.** of the *Works* Information except where explicitly stated as otherwise.

The *Contractor* designs according to the requirements of the *Employer's* design stated on section **Error! Reference source not found.** of the *Works* Information.

The *Contractor's* design is required to be reviewed and accepted by the *Employer* before any manufacturing work begins.

The *Contractor's* design is required:

- To comply with the requirements of the *Works* Information,
- To be carried out by qualified, experienced and registered professional engineers.
- Prior to submission of the final design should be approved by a qualified competent person, professionally registered with an internationally recognised engineering body, in the relevant engineering discipline.

### **3.2.2 Contractor's scope for the operating, control and maintenance philosophy**

The *Contractor* is responsible for the provision of a detailed operating and control philosophy as per the *Contractor's* detailed design of the *Works* and submits this to the *Project Manager* for review prior to commencing with the construction activities. The *Contractor* is also responsible to submit operating procedures for the various operating activities.

The *Contractor* shall provide a detailed maintenance philosophy for the plant which includes a preventative maintenance plan for the plant as a whole and for each component within the plant. The *Contractor* shall provide a complete parts list as well as a critical spares list for the *Works*. The *Contractor* shall also provide the necessary periodic maintenance inspections required for the plant together with the maintenance strategy. The strategy will include all equipment inclusive of mechanical, electrical and C&I components.

The *Contractor* provides operations and maintenance service, together with spares and resources for a period of 18 months.

### **3.2.3 General Design and Manufacturing Process Constraints**

In providing the *Works*, the *Contractor* is fully responsible for the delivery to, offloading and storage of all plant, equipment and materials required for the *Works* on site. The *Employer* reserves the right to carry out any checks of his/her own on any plant, equipment and materials that have been delivered to site for the *Works*.

The *Contractor* is fully responsible for the installation of all mechanical, civil, electrical, process control and instrumentation components, equipment and material as well as the interfacing and tie-ins with existing plant and equipment as required for the *Works*.

The *Contractor* is responsible for the complete optimisation of the *Works* in order to meet or exceed the guaranteed performance levels.

The *Contractor* is required to indicate the full extent of the guarantees they are prepared to offer with respect to water quality, volumetric flow, efficiency and availability of the *Works*.

### **3.2.4 Engineering Design Phase**

The design of the Plant and Materials that forms part of the design for the *Works* shall conform to the following requirements:

#### **3.2.4.1 Process Design**

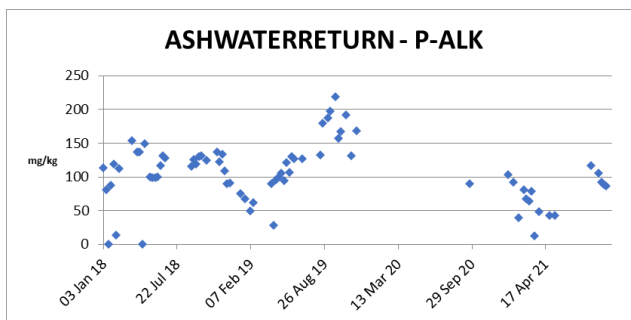
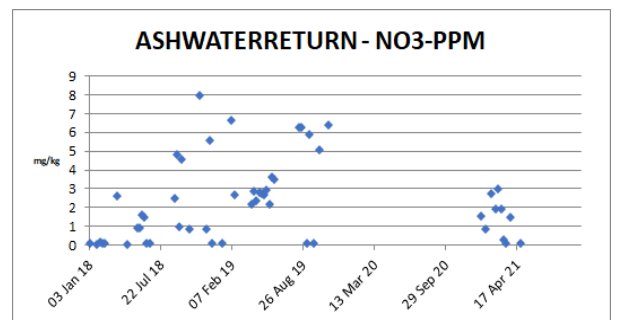
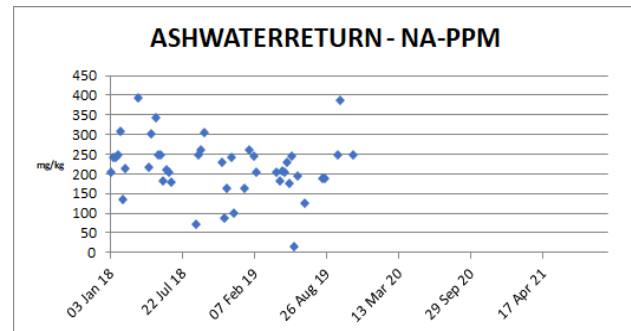
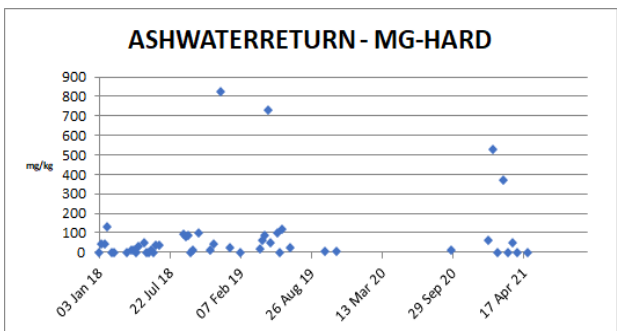
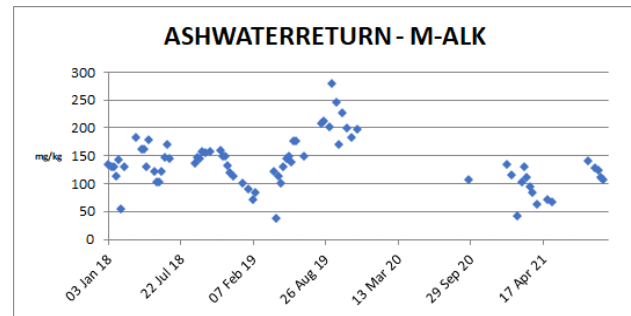
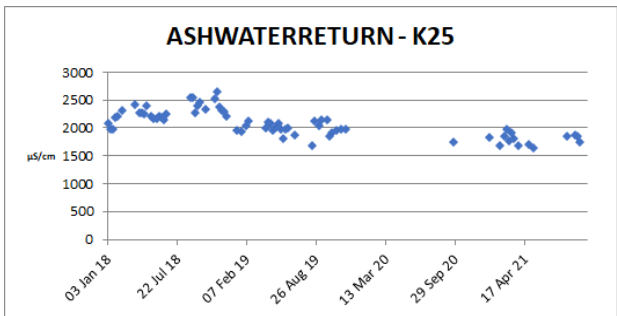
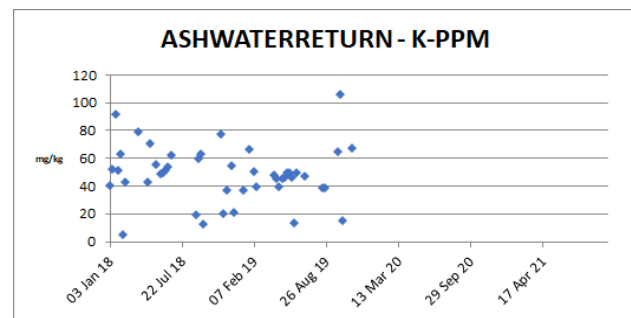
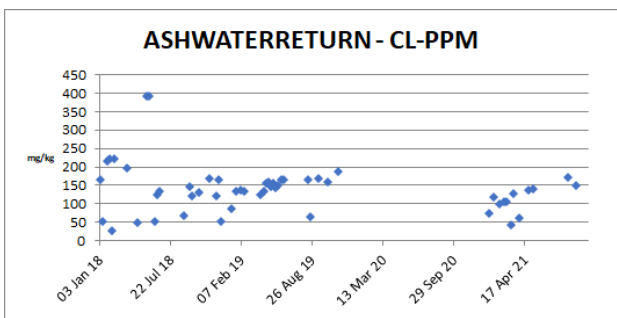
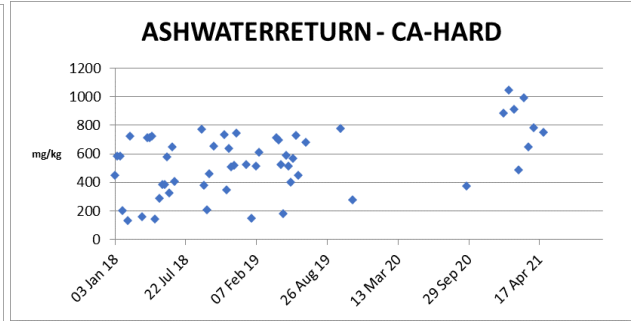
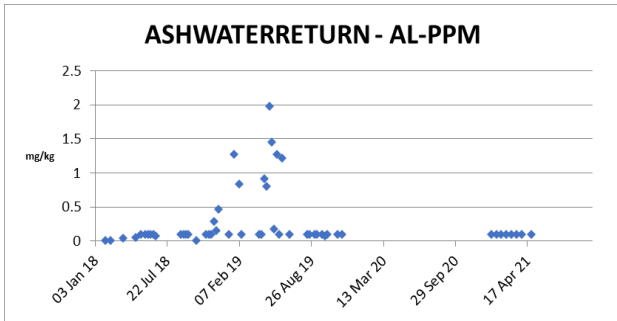
##### **3.2.4.1.1 General Requirements**

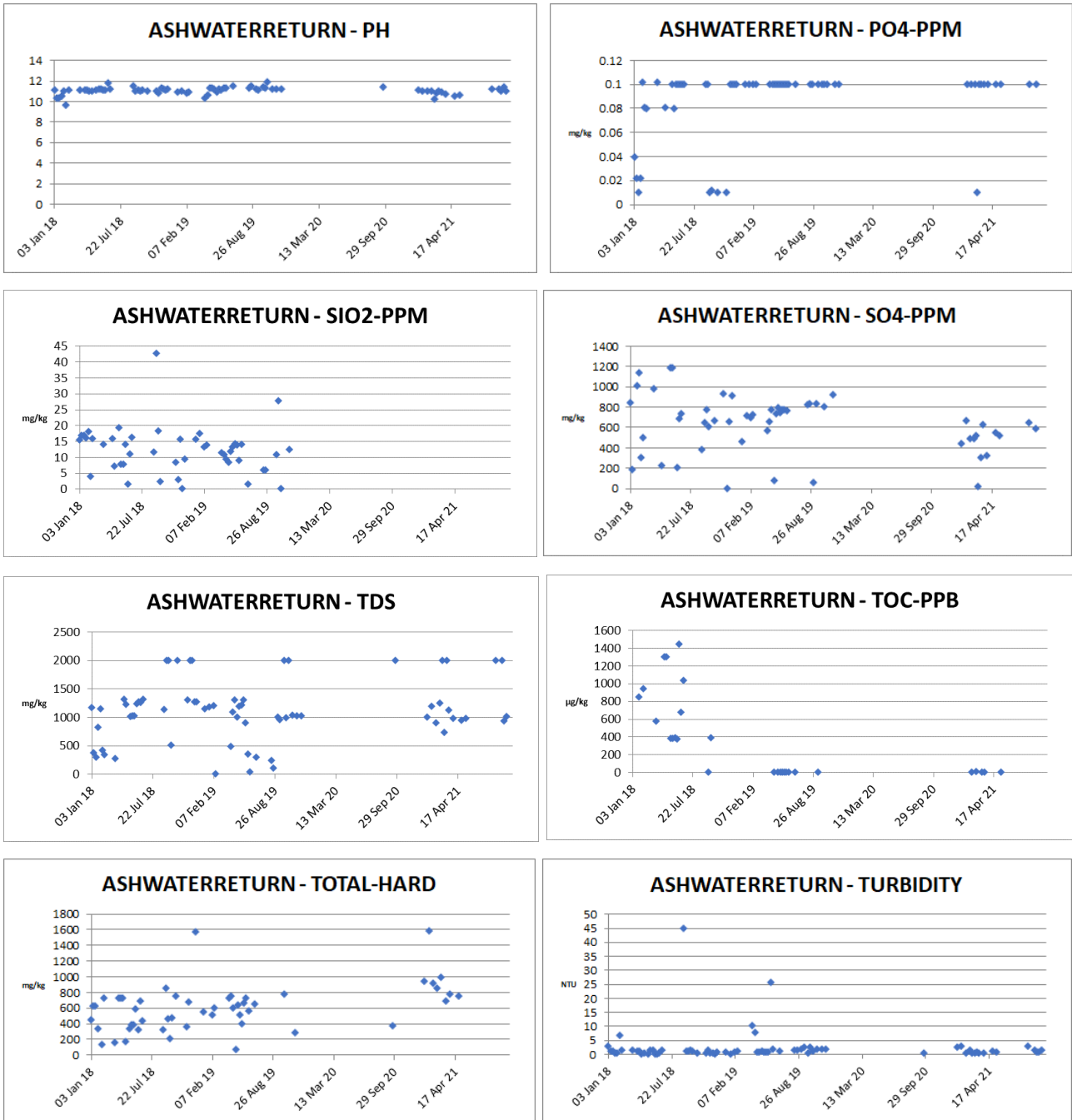
The water from De Jagers Pan was analysed for some chemical parameters between 2016 and 2022. The minimum, maximum and average values for this period is captured in the table. A comprehensive feed water analysis of a sample taken from De Jagers Pan on the 30/09/2022 is also provided.

Parameter	Units	Sample Date: 2022-09-30	Average	Min	Max
Alkalinity Total	mg/l CaCO <sub>3</sub>	36.6			
M Alkalinity	mg/l CaCO <sub>3</sub>		139.19	63.7	280.7
P Alkalinity	mg/l CaCO <sub>3</sub>		107.37	12.1	219.1
Aluminium as Al	mg/l	0.9	0.27	0.01	1.98
Ammonia as N	mg/l	0.05	8.55	0.1	17
Barium as Ba	mg/l	0.14			
Beryllium as Be	mg/l	<0.005			
Boron as B	mg/l	1.1			
Calcium as Ca	mg/l	100.0			
Calcium Hardness	mg/l CaCO <sub>3</sub>		546.59	133	1050
Cadmium as Cd	mg/l	<0.005			
Conductivity	µS/cm	1690.9	2075.31	1642	2644
Chloride as Cl	mg/l	140.0	141.19	25.4	391
Cyanide	mg/l	<0.025			
Chemical Oxygen Demand	mg/l	<10			
Cobalt as Co	mg/l	<0.005			
Chromium as Cr	mg/l	0.12			
Copper as Cu	mg/l	<0.005			
Iron as Fe	mg/l	<0.005			
Fats, Oil and Grease	mg/l	0.1			
Fluoride	mg/l	0.9			
Potassium as K	mg/l	44	50.97	5.26	161
Phosphorous as P	mg/l	0.05	0.09	0.01	0.10
Magnesium as Mg	mg/l	<1.0			
Magnesium Hardness	mg/l CaCO <sub>3</sub>		78.27	0	822
Manganese as Mn	mg/l	<0.005			
Sodium as Na	mg/l	210.0			
Nickel as Ni	mg/l	<0.005			
Nitrite as NO <sub>2</sub>	mg/l	<0.4			
Nitrate as N	mg/l	0.97	2.22	0.036	7.95
Lead as Pb	mg/l	<0.01			
pH @ 25 °C	mg/l	8.03	11.07	9.69	11.94
Reactive Silica as SiO <sub>2</sub>	mg/l	3.99	12.35	0.1	42.8
Sulphate as SO <sub>4</sub>	mg/l	660.0	639.22	22.9	1192
TDS	mg/l	1137.4	1140.6	105	2000
TOC	µg/l	2.6	349.21	1.3	1450
TSS	mg/l	<10.00			
Strontium as Sr	mg/l	4.0			
Turbidity	NTU	0.921	2.37	0.163	44.9
Zinc as Zn	mg/l	0.01			

**Table 1: De Jagers Pan Water Quality Data**

The frequencies of exceeding the average values for the parameters listed in the table are depicted in the graphs below. The Contractor shall take note of the historical water quality variation in the design / plant.





**Figure 3-1: Trends of Chemical Parameters from De Jager’s Pan**

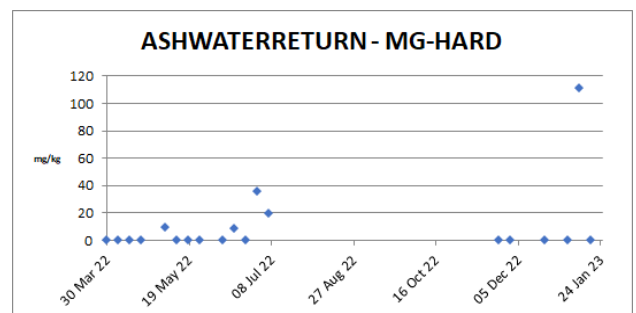
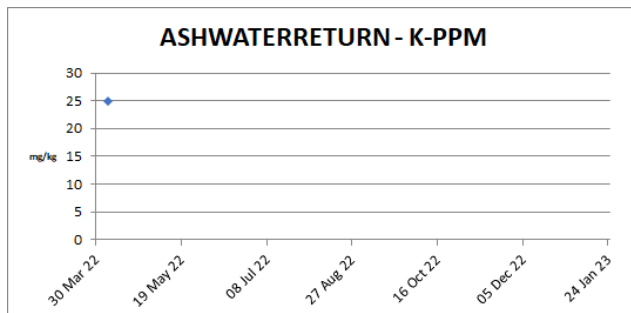
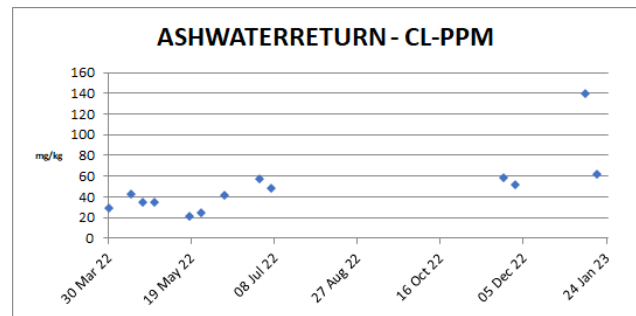
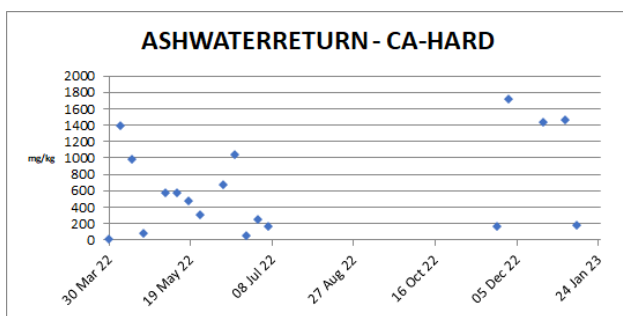
A sensitivity analysis must be conducted with ash water as the feed to the plant. The Contractor must evaluate the capability of the proposed design to treat the ash water without additional hardware as well as an indication if additional equipment will be required, with the associated cost.

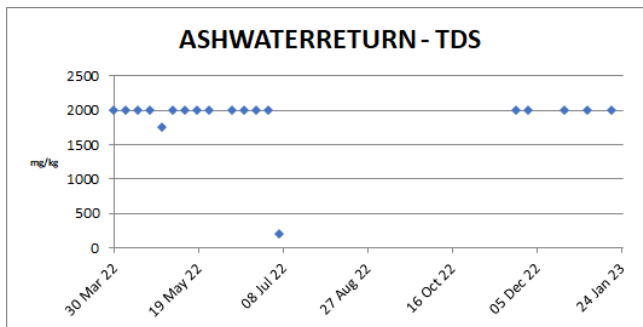
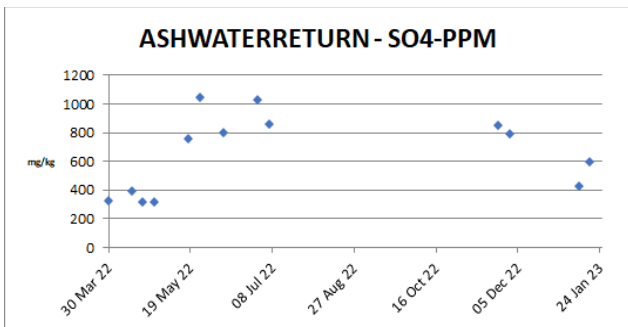
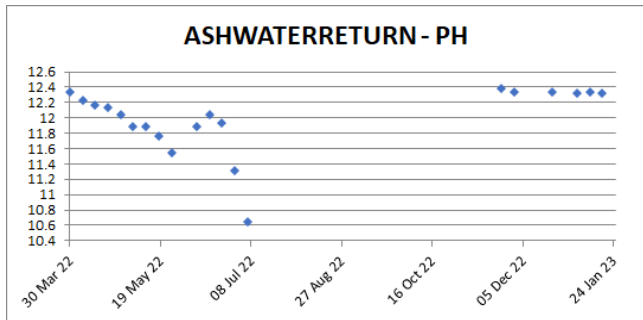
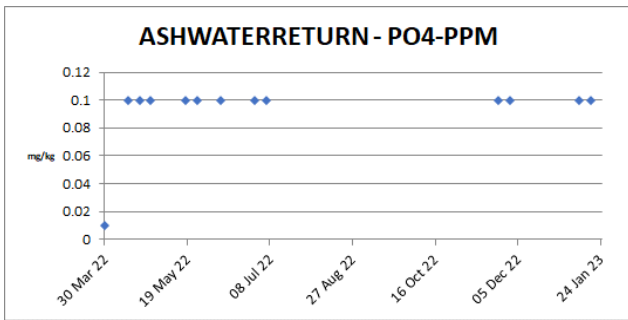
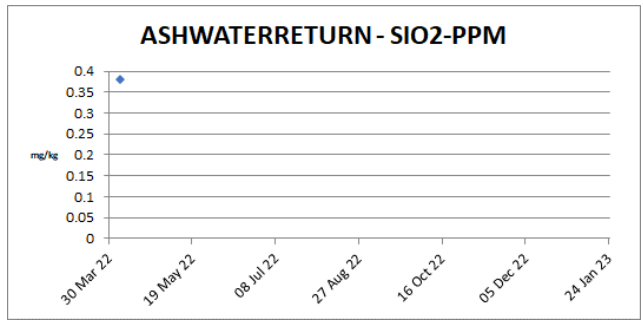
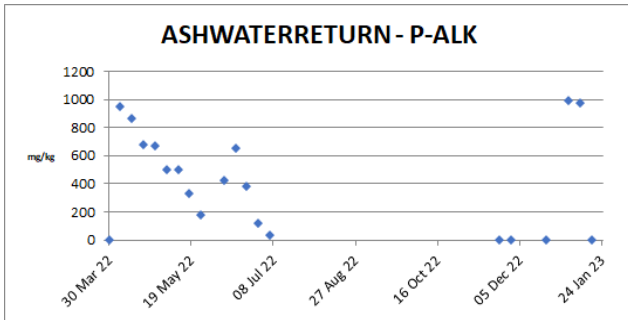
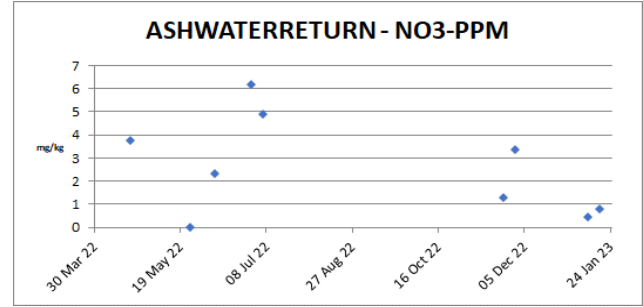
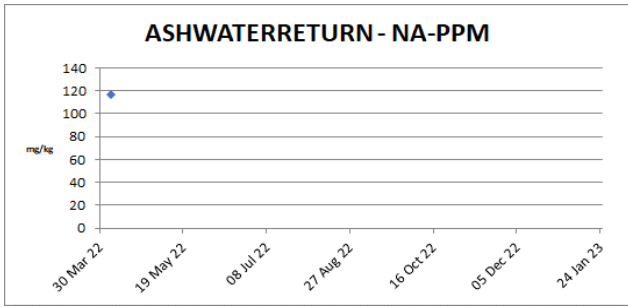
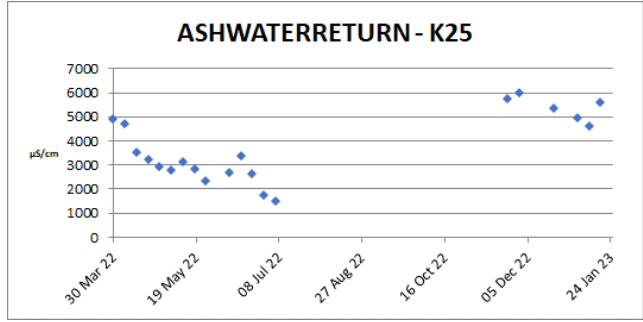
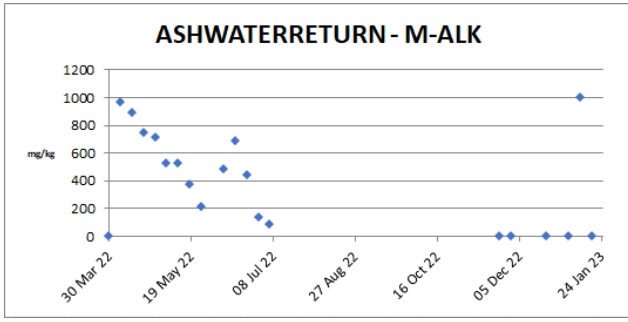


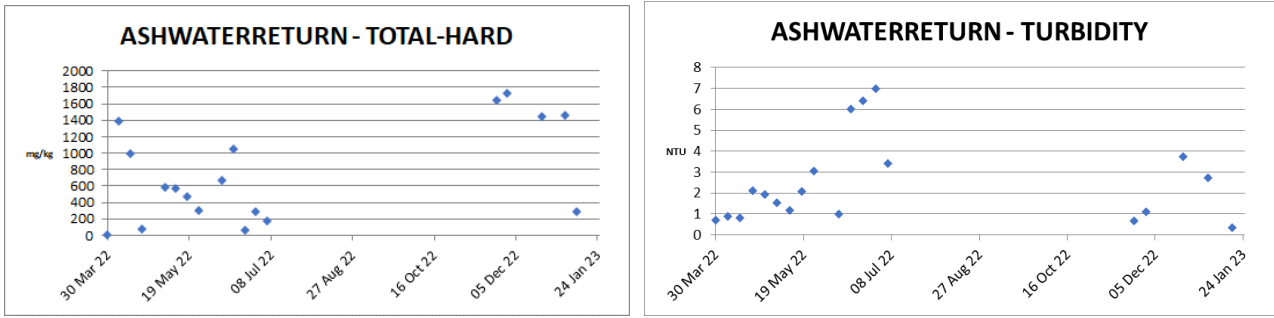
**Table 2: Water quality for Mobile Desalination plant feed from Ash Water Return Dam**

Parameter	Units	Average	Min	Max
M Alkalinity	mg/l CaCO <sub>3</sub>	373.3	0	1005
P Alkalinity	mg/l CaCO <sub>3</sub>	393.6	0	993
Aluminium as Al	mg/l	0.4	0.4	0.4
Calcium Hardness	mg/l CaCO <sub>3</sub>	688.4	12	1723
Conductivity	µS/cm	3877	1518	6688
Chloride as Cl	mg/l	49	21.1	140
Potassium as K	mg/l	23	21.1	24.9
Phosphorous as P	mg/l	0.1	0	0.1
Magnesium Hardness	mg/l CaCO <sub>3</sub>	9.3	0	111
Sodium as Na	mg/l	97.4	77.8	117
Nitrate as N	mg/l	2.6	0	6.2
pH @ 25 °C		12	10.7	12.4
Reactive Silica as SiO <sub>2</sub>	mg/l	1.2	0.4	1.2
Sulphate as SO <sub>4</sub>	mg/l	657.1	319	1043
TDS	mg/l	1897.4	200	2000
Turbidity	NTU	2.4	0.4	7

The frequencies of exceeding the average values for the parameters listed in the table are depicted in the graphs below. The Contractor shall take note of the historical water quality variation in the design / plant.







**Figure 3-2: Trends of Chemical Parameters for the Ash Water Return Dam**

The final treated water quality required is as per the target values indicated in the table below, which is the acceptable range of water from the Usuthu Water Scheme. Where parameters exceed the target but below the maximum limit, the Contractor shall evaluate the frequency of exceedance and the cost of further treatment.

Parameter	Units	Target	Max limit	Not Acceptable (water to be recycled)
Total dissolved solids	mgkg <sup>-1</sup>	< 120	< 240	> 240
Conductivity	uScm <sup>-1</sup>	< 160	< 320	> 320
Total Organic Carbon	mgkg <sup>-1</sup>	< 2	< 5	> 5
Sodium	mgkg <sup>-1</sup>	< 10	< 25	> 25
Chloride	mgkg <sup>-1</sup>	< 5	< 15	> 15
Sulphate	mgkg <sup>-1</sup>	< 15	< 40	> 40
Permanent Hardness (T Hardness – M Alkalinity)	mgkg <sup>-1</sup>	Nil	< 8	> 8
M Alkalinity	mgkg <sup>-1</sup>	< 60	< 120	> 120
Total hardness	mgkg <sup>-1</sup>	< 60	< 120	> 120
Calcium	mgkg <sup>-1</sup>	< 45	< 45	> 45
Magnesium	mgkg <sup>-1</sup>	< 55	< 55	> 55
Potassium	mgkg <sup>-1</sup>	< 4.6	< 6.6	> 6.6
Manganese	mgkg <sup>-1</sup>	< 0.002	< 0.065	> 0.065
Iron	mgkg <sup>-1</sup>	< 4.3	< 7.4	> 7.4
Aluminium	mgkg <sup>-1</sup>	< 0.005	< 11	> 11
Barium	mgkg <sup>-1</sup>	< 0.03	< 0.06	> 0.06
Strontium	mgkg <sup>-1</sup>	< 0.08	< 0.12	> 0.12

**Table 2: Final treated Water Quality Required**

The configuration of the treatment technology selected may include multiple trains operating in parallel in order to meet the total produced volume. The minimum plant availability required is >95%.

The Contractor shall clearly indicate the maximum and minimum feedwater conditions that will not be treatable by the plant provided. If any additional parameters for testing on the feed quality are required for the Contractor's design, the Contractor will sample and test at his own expense. The Employer will not take responsibility for parameters not tested that ultimately affects the Contractor's Works.

### 3.2.4.1.2 Sample Requirements

Provision shall be made for a sample to be collected on the outlet. As a minimum, online continuous monitoring of specific conductivity (@ 25°C) is required for all process steps. Continuous monitoring shall also be provided for the pre-treatment unit for turbidity. A grab sample facility for laboratory analyses shall also be provided for all sample points.

The *Contractor* provides bench top instruments, a workbench and cupboard, sink and associated consumables (reagents, buffers, QC standards) for use at the mobile desalination plant for analysis of the grab samples. The following shall be provided as a minimum:

- Turbidity
- pH
- Conductivity
- Autotitrator
- TOC analyser

This laboratory bench is part of the mobile plant and instruments and laboratory equipment supplied remain the property of the *Employer*. The *Contractor* is required to comply with the requirements as per the Chemistry Standard 240-162589999 Chemistry Standard for Wastewater Sampling and Analysis

### 3.2.4.1.3 Waste Management

All waste streams must be collected for transfer to the ashing system.

All chemical tanks must be equipped with a bund to contain any leaks and 110% of the contents of the tank. The waste chemicals from the bunds shall be directed to the effluent sump if required via the common effluent pipeline.

The *Contractor* shall indicate in the design how this requirement can be met. The *Contractor* must implement the containment of possible leaks across interconnecting pipework as well as in the operating vessels.

Should media/consumable replacements be required during the time of providing the O&M services on the mobile unit, the supplier shall be responsible to remove the spent consumable offsite for disposal

### 3.2.4.1.4 On-line Monitoring Requirements (Chemical Online Analysers)

The *Employer's* requirement is for standardisation in order to minimise the stock holding requirements for the Power Station.

The *Contractor* shall supply online analysers for turbidity and conductivity. The *Contractor* ensures that the brand of analysers proposed have been evaluated and approved by the *Employer's* RT&D section.

The *Contractor* makes provision for the supply of spares and consumables for the analysers for the duration of the operations and maintenance contract.

The *Contractor* submits all calibration certificates, commissioning procedures, technical data sheets, operating and maintenance manuals for the analysers. Further, the spares list and parts list must also be provided.

### 3.2.4.1.5 Chemical storage and safety requirements

The volume of chemicals stored at the mobile plant shall not exceed 80 m<sup>3</sup>, at any point in time. The *Contractor* shall indicate the total chemical storage provided for as well as the expected frequency of semi bulk chemical storage supply replacement.

A lockable container (or similar alternative) for the chemicals shall be provided as part of the design. The design ensures that any spillages can be contained, and that there is provision for extraction of chemical fumes from the container to the outside environment to prevent corrosion on all equipment and safety of personnel.

Diphoterine eyewash stations and safety showers shall be provided in the vicinity of the chemical areas in the mobile plant where chemical leaks, spills, etc. or other accidental contact with corrosive chemicals might occur.

As a minimum, the safety showers (where required) shall comply with the following requirements:  
Full drench showers (multiple jets) in accordance with ANSI Z358.1

They shall be of treadle-type activation and shall include an arm-activated eyewash bath.

The showers shall be located within easy access of probable points of contact, but sufficiently removed such that the individual is removed from immediate danger.

A potable water supply shall provide water for the drench showers.

#### **3.2.4.1.6 Preservation and Storage Requirements for the mobile plant**

The *Contractor* provides all preservation and storage requirements for the mobile plant for the periods that it is not in use. The *Contractor* takes note of the following in this regard:

- Type of media utilised; preservation and storage requirements to safeguard and prolong its life
- Preservation/layup of all equipment and plant components (tanks, vessels, pipe work, pumps, motors, instruments, chemical analysers, etc.)
- The conditions for storage (temperature, humidity, etc.)
- The handling and removal of the plant to a storage site.

All details and instructions pertaining to the above shall be captured in the appropriate operating and maintenance manuals for the plant.

#### **3.2.4.1.7 Provision of Operations and Maintenance for the Mobile Plant**

The *Contractor's* scope is inclusive of the provision of operating and maintenance services for a period of 18 months. This period commences on handover of the mobile plant to the *Employer*.

The O&M cost must be all-inclusive and must indicate the cost per m<sup>3</sup> of water produced, which includes:

- Manpower cost for Operating (24 hour coverage)
- Manpower cost for Maintenance
- Manpower cost for administration work
- Plant maintenance material cost
- Chemical and Consumables Supply (list chemicals and quantities with Material Safety Data Sheets & Product Data Sheets)
- Sample bottles and glassware for sampling and analysis of the grab samples.

The *Contractor* is required to adhere to the *Employer's* hours of work. The *Employer* operates on a 5 shift cycle (12 hour shifts).

The *Contractor* shall submit his plan for executing the service with his tender. The *Contractor* shall include in this plan:

- a) Training (in line and in fulfilment of the requirements of this scope of work)
- b) Safety
- c) Quality
- d) Recruitment plan in the cases where not all required personnel as per this scope of work is available.

#### **3.2.4.2 Mechanical design**

##### **3.2.4.2.1 Mechanical Interfaces**

- a) The mechanical interfaces into the existing systems are in the following locations:
  - a) The following tie-ins to the existing plant will be provided: feedwater connection to the plant however the inlet pipeline requires repairs and permeate connection to the recovery line.

Pipeline lengths:

- Feed pipe length is approximately 500 m (OD is 250mm, 200.9mm, Schedule 10)
- Permeate line length is approximately 600 m (OD is 160mm, ID is 129mm, Schedule 10)
- Existing waste pipeline length is approximately 220 m (reject directed back into the De Jager's Pan). A modification to this pipeline is required for the waste to be directed to the ashing system.
- All piping have an internal diameter < 320 mm
- The existing pipes are HDPE piping, class 10
- The peak flow through the feed line should not exceed 120 L/s (432 m<sup>3</sup>/hr) at any time.

The feed to the Mobile Desalination plant:

- The feed to the mobile desalination plant requires repairs were damaged. The existing floating jetty and suction pumps should be assessed by the Contractor and repaired/replaced where necessary. Suction pump specification:
  - 3 x ETA 65-200
  - Flow: 95m<sup>3</sup>/hr
  - Head: 500m
  - Power 22kW
- The power supply to the feed pumps will be provided by the *Employer*.
- The feedwater pipeline requires replacement. The routing of the pipeline must remain as it is currently. The dimensions of the pipeline must remain the same:
  - OD: 250mm
  - Material: HDPE
  - Class 10
  - Flange details:
    - Material: Carbon steel
    - PCD: 295mm
    - OD: 340mm
    - Thickness: 18
    - Number of holes: 8

Tie-in for the permeate water available will be a flange with the following specification:

- Material: Carbon steel
- PCD: 295mm
- OD: 340mm
- Thickness: 18
- Number of holes: 8

Tie-in for the reject water will be into duplicate charged ash water return lines (one in service and the other on standby) with the following specification when in operation:

- Material: Carbon steel
- OD: 609.6
- Thickness: 6mm
- Pressure: 168kPa to 217kPa
- Flow: 916m<sup>3</sup>/hr
- Couplings:

	DESIGN REQUIREMENT	COUPLING SPECIFICATION
Working Pressure	6bar	16bar
Pipe expansion/contraction	7.56mm	9mm
Setting gap between pipes	25 mm	25mm
Deflection	0,005'	5' (maximum allowable)
Tolerance on Pipe OD	+/- 1.6mm (SANS 719)	+/- 4.58mm

NB. The Contractor will be responsible for installing the connection points to both lines with the necessary isolations and protections to prevent backflow.

- b) The *Contractor* will provide pump and piping for the feed, permeate and reject streams to and from the mobile plant.
- c) A 2-way connector with the flanges and isolation valves must be installed on the permeate connection to allow for future routing of the permeate to alternative users post Power Station shutdown.
- d) Drains from the mobile plant kitchen shall be directed to the station drains.
- e) The *Contractor* is responsible for the supply, installation, testing and commissioning of all the pipe work listed above. All dimensions to be verified by the *Contractor* prior to construction.
- f) All of the above interfaces must be done such that there is no disruption to the operating plant. It must also be done in a manner that does not cause contamination of the system
- g) Facilitate compliance with the latest regulatory requirements and Eskom standards, and incorporate any additional design improvements that can be justified by a cost-benefit analysis.
- h) Determine what (if any) plant process modifications are necessary with regards to the tie-ins
- i) Perform engineering design for mechanical plant modifications to support upgraded or additional measurements, as required.
- j) Design of all pressurised components shall comply with Pressure Equipment Regulation and classified as per SANS 347.

### 3.2.4.2.2 Pipework

The *Contractor* designs, supplies, installs, tests and commissions piping and valves for the off take and delivery lines from the mobile plant to designated discharge points (refer: Mechanical Interfaces)

The *Contractor* ensures that all pipework is adequately supported and fastened to prevent excessive stresses.

The *Contractor* may select his preferred pattern for interconnecting pipework between the ion exchange trains/units (this may or may not allow for flexibility with respect to cross feeding of units).

The design shall make provision for isolation of vessels, resin traps, etc. for maintenance purposes.

Piping material selection is part of the *Contractor's* design. The *Contractor's* design verifies and ensures the integrity of all pipe work. The *Contractor* takes into consideration the requirements below:

- a) Piping is in accordance with document 240-123801640 (Standard for Low Pressure Pipelines).
- b) Piping is sized to minimise pressure drop.

- c) Piping is welded and flanges are provided where openings are necessary for maintenance and repair purposes.
- d) The *Contractor* submits the pipe data sheets and complete design to the Project Manager for acceptance.
- e) The *Contractor* marks all pipe work associated with the *Works* with the description of the medium and direction of flow clearly displayed and visible from a normal operating perspective and in accordance with the specification SANS 1091: National colour standards of paint and SANS 10140: Identification colour markings.
- f) Crossing of existing pipelines and sumps: the *Contractor* is required to be aware of all existing pipelines and sumps along the routing. Should the new pipeline be required to cross an existing pipeline or sump, the *Contractor* will do so without damaging and interfering with the existing pipeline. The *Contractor* may either cross over or underneath the existing pipeline. In a case where the pipe is crossing over, the pipe must not rest on the existing pipeline and it must cross such that it does not restrict any maintenance on the existing pipeline. Prior to construction, the *Contractor* will submit a method of construction for when crossing existing pipelines and sumps. If the pipeline crosses a clean water sump, then allowance must be made for leak containment in the event that the pipe leaks, so that it does not contaminate the sump. This method will need to be accepted by the *Project Manager* prior to commencing the installation.
- g) The Contractor must apply the applicable standards or legislation not specifically mentioned that may be relevant.
- h) The Employer shall conduct a final inspection of the installed system prior to its commissioning in order to render it safe for use and issue a certificate to the Contractor to commence commissioning.
- i) The Contractor shall ensure a safe working environment and that all work practices comply with Eskom's SHEQ requirements.
- j) The Contractor shall take on site measurements for installation of the equipment of the system and produce complete workshop drawings for fabrication and installation.
- k) The Contractor submits a detailed method statement for the installation prior to the installation for approval by the Employer. Explanation of the sequence/order of work areas. The information to be detailed by narrative and to be indicated on drawings.
- l) The Contractor shall provide specifications/material certificates for all high pressure components. The Contractor shall further guarantee that all materials used are of appropriate quality for the varying concentrations of fluids being used.
- m) The Contractor shall provide a pressure surge analysis to indicate that the pipes have been designed to withstand any pressure transients, which may result as a cause of abnormal system pressure surges.
- n) Design of all pressurised components shall comply with Pressure Equipment Regulation and classified as per SANS 347.
- o) The *Contractor* shall design and install all pipelines and associated equipment supports, and support spacing required to complete the *works* as per pipe manufactures requirements.
- p) The design and layout of the pipelines for mobile desalination plant feed water, permeate and effluent shall be provided for acceptance.
- q) The *Contractor* shall supply latest As-Built P&ID's for mechanical tie – ins for acceptance by the *Project Manager with* all mechanical equipment used.
- r) All drawings for installation to battery limits shall be signed off by the ECSA Registered professional engineer for each discipline as required by the design.
- s) The Contractor shall ensure that all manual isolation valves are lockable as per Eskom General Plant Safety Regulations Procedure (36-681).



### 3.2.4.2.3 Pipe Supports

- a) All pipe work, valves and pipe hangers, brackets and supports are arranged in such a manner that they do not obscure the view of any instrumentation or obstruct safe and normal access.
- b) All supports must be designed according to pipe manufactures requirements.
- c) The design and calculations of the pipe supports are to be based on Eskom Standard 240-56364545 "Structural design & Engineering Standard".
- d) Above ground HDPE piping is placed on a continuous support structure which is supported by structural members at various spans to prevent pipe bending as a result of sun exposure.
- e) The *Contractor* will conduct calculations to determine forces acting from the pipe onto its supports due to the moving water as well as when the water is stationary. Forces acting on the supports in all directions need to be determined and designed for.
- f) If the pipeline will be supported as far as possible on existing structures, adequate calculations and design checks need to be shown to ensure the existing structure can carry additional forces.

Should existing supports be used, it is the *Contractors* responsibility to ensure these supports can carry the new load and design. If required the *Contractor* will be required to refurbish all old pipe supports that will be used to support the new pipeline.

### 3.2.4.2.4 Pumps

The *Contractor* selects pumps to satisfy the operating pressures, temperatures and flow rates of the mobile plant as designed.

- a) The *Contractor* supplies, installs, tests and commissions all the pumps for the mobile plant. The sizing of the pumps is dependent on the system head losses as determined in the *Contractor's* design. The *Contractor* submits the hydraulic design for the plant as part of the design package.
- b) The *Contractor's* design makes provision for redundancy in order to allow full production capability during maintenance of equipment.
- c) All chemical dosing pumps must have automatic stroke adjustment or similar capability to allow for automatic injection of the required chemical.
- d) All chemical dosing pumps must be equipped with pressure relief mechanisms, strainers and isolation valves that are chemically resistant.
- e) The *Contractor* is to design, supply and install pulsation dampers on each of the dosing pumps discharge lines. The pulsation damper should ensure that the flow of the fluid is continuous and constant.

### 3.2.4.2.5 Valves requirements

- a) Preference is for stainless steel valves and check valves compliant with 316L ASTM A182 specification.
- b) All valves are to be lockable and meet requirements of the PSR.
- c) All valves are flanged so that they can be removed for maintenance purposes.
- d) Valves are selected by the *Contractor* to ensure that the pressure and temperature ratings can withstand the various operating pressures and temperatures as per the design.
- e) The *Contractor* installs, tests and commissions all valves for the mobile plant
- f) The *Contractor* ensures that the valves are compatible with the chemicals they are in contact with as well as with process conditions as determined in his design
- g) Each vessel/unit must be equipped with requisite control valves; suitably lined diaphragm valves are preferred for this purpose.

- h) All actuated valves must be provided with positioners and limit switches. Provision should be made for manual operation of these valves.
- i) All chemical flow control valves must be designed to fail in the closed position in the event of loss of electrical supply.
- j) All valves must fail in their fail-safe mode/position according the HAZOP study.
- k) The *Contractor* submits a valve schedule with the design. This includes details of actuators, and actuator sizing for all electrically actuated valves.
- l) The following minimum requirements apply:
  - All valves are arranged and positioned at accessible locations to ensure safe, efficient and easy operation and maintenance. The *Contractor* provides clear access to the valve hand wheels and avoids valve hand wheels being tucked behind other valves or components.
  - All hand isolation valves shall be operable from outside the bunds as per SANS 310 requirements.
  - All valves are of approved design and manufacture and those of similar size, make, and duty are interchangeable with one another.
  - All valves for the *Works* are numbered for identification purposes. The *Contractor* uses the codification provided to them by the *Employer*.
  - The *Contractor* supplies the following minimum valve information to the *Project Manager*:
    - Recommended spares list,
    - Valve assembly and dis-assembly procedure,
    - Maintenance procedure.
    - All mechanical parts list

#### 3.2.4.2.6 Day tanks

Day tanks for the chemicals must be equipped with vents (reaction of the chemicals with humidity must be taken into consideration), top manhole, filling connections, level indication with provision for alarming capability, and a drain at the bottom to allow for draining and cleaning of the tank when required.

All day tanks must be constructed with suitable, chemically resistant material and material selection must take into account the density of the chemical for which the day tank will be utilised.

#### 3.2.4.2.7 General Requirements

The *Contractor* shall provide specifications/material certificates for all components of the design, for example valves, gaskets, welding material, pipeline, paintwork, tanks, etc. The *Contractor* shall further guarantee that all materials used are of appropriate quality for the varying concentrations of fluids being used.

The *Contractor* shall provide a pressure surge analysis to indicate that the pipes have been designed to withstand any pressure transients, which may result as a cause of abnormal system pressure surges

#### 3.2.4.2.8 Welding Requirements

All welding fabrication related activities must be performed in accordance with the latest revision of the Standard for Welding Requirements on Eskom Plant (240-106628253). The *Contractor* must be supplied with the latest revision of this Standard. All codes and standards related to Eskom welding fabrication are listed and summarised in the document listed above. The welding must be in accordance with the BS EN welding specifications.

##### 3.2.4.2.8.1 Basic requirements

Welding procedure qualification for welds shall be in accordance with the appropriate welding standard incorporated into the relevant design and construction code. Combination or mixing of different codes shall not be permitted.

A WPS (welding procedure specification) shall be supported by a valid WPQR/PQR (welding procedure qualification record). The PQR/WPQR shall be approved by a registered IWE or IWT with minimum qualifications as defined in section 7 of the Standard for Welding Requirements on Eskom Plant (240-106628253).

The WPS shall be submitted to Eskom for review. Welders and welding operators shall be qualified in accordance with the requirements of the latest applicable construction code or engineering specification relevant to the plant.

The WPQR/PQR must be accompanied by the following documentation:

- Test coupon parent material certification.
- Consumable material certification.
- Destructive and non-destructive test results as required by code.
- Heat treatment chart (if applicable).

#### **3.2.4.2.8.2 Additional requirements**

An Eskom IWE or IWT must approve welding documentation used for fabrication.

Eskom reviews the Welder Qualification Records (WQR) for acceptance. Welders and welding operators shall be qualified in accordance with the requirements of the latest applicable construction code or engineering specification relevant to the plant. Welding and testing (destructive and non-destructive) of the test pieces shall be witnessed by an AIA or Notified Body. Mechanical tests conducted during welding procedure qualification shall be performed at an accredited mechanical test laboratory conforming to the requirements of ISO/IEC 17025.

The *Contractor* must provide QCP's to the *Project Manager* to be reviewed and accepted by *Employer's* representative before work can start.

Acceptance levels for flaws for metallic welds must be evaluated according to Levels B, C or D as described in BS EN ISO 5817. These levels will be determined before work starts. For projects relating to ASME BPVC designs, evaluation methods and acceptance criteria stipulated in Sections V and VIII of the code will apply. When ASME BPVC designs are used, ASME IX should be used for welding procedure as well as welder qualifications. Refer to 240-106628253.

NDT shall be performed by an entity suitably independent from the welding operation to ensure unbiased inspection. Company to perform welding shall have accreditation to ISO 3834 Part 3 as a minimum (for Eskom Level 1 plant).

100% NDT is required on all welding done.

NDT on welds shall be performed according to the requirements of the relevant design and construction codes, applicable (additional) engineering or product specifications and Eskom standard 240-83539994. All technicians performing NDT shall be Eskom approved and shall be employed by an Eskom approved company.

The *Contractor* shall adhere to the requirements of the Standard for Low Pressure Pipelines (240-123801640)

#### **3.2.4.2.9 Corrosion protection requirements**

The documents most applicable to the scope of work set out in this document are:

- 240-101712128 - Eskom Standard for the Internal Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with Linings
- 240-106365693 Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings
- ISO 9001: Quality Management Systems – Requirements.
- SANS 1198: The manufacture of rubber sheeting for rubber lining.

Documentation and information (specific to this project) to be provided by the *Contractor* shall include:

- 1) A Quality Management System that meets or exceeds the requirements of ISO 9001. Relevant and applicable certification and the quality management policy to be submitted. A quality control plan (QCP) should be provided by the Contractor that should align with the Supplier Contract Quality

- Requirements Specification (QM-58). This QCP will be reviewed by Eskom for final acceptance before any work can start
- 2) The SANS 1198 line call-out for the rubber compound to be used.
  - 3) Name of applicator, facility, web address, e-mail address, contact telephone number and physical address.
  - 4) Provide the latest product and material safety data sheets as well as manufacturing batch certificates for each of the products being proposed.
  - 5) The supplier must provide service temperatures, chemical compatibility for all products used as well as materials of construction, in order to confirm that the correct material has been used for the environment and will provide the longevity as stated in this *works*.
  - 6) The supplier must provide case studies for materials to confirm material compatibility as well.
  - 7) The Product Data Sheet/s shall be signed by the manufacturer, Contractor and applicator. The signed Product Data Sheet/s shall be deemed to be part of this standard and any further/other subsequent revisions of the Product Data Sheet/s shall be submitted to Eskom for reacceptance clearly stating the variations/deviations. No further use/application of the related product is permitted until acceptance by Eskom.
  - 8) The Contractor must provide method statements detailing all steps, procedures and activities of the corrosion protection application process.
  - 9) The Contractor must provide detailed Quality Control Plans (QCP's) and shall detail all inspections and tests with acceptance criteria during application of corrosion protection systems. Inspections during application shall at least cover surface preparation, environmental, parameters, dry film thickness, hardness, adhesion, continuity and visual tests.
  - 10) The Contractor must provide a detailed programme showing how the works will be carried out and completed within the time constraints of the project.
  - 11) Provide verifiable/auditable evidence that the proposed rubber lining applicator has experience in the application of each of the same proposed corrosion protection systems, for similarly sized projects in comparable environments. Unless explicitly specified in the enquiry document then the minimum requirement is that two separate projects older than 10 years and three projects within the last five years shall be listed. The listing shall include contact details for the listed reference projects. The listing shall include contact details for the listed reference projects.
  - 12) The Contractor must provide joint guarantees by the *Coating Manufacture and Applicator and Contractor*. This guarantee with proposed terms and conditions shall perform in the given environment for a minimum period of 10 years
  - 13) Provide an organogram, specific to this particular supply, detailing all the positions and individuals responsible for technical expertise and logistic support.
  - 14) Curriculum vitae of these key personnel shall be included with the submission. Suitably qualified applicators, supervisors and inspectors are considered key in the application process. In this regard details of personnel number, qualification type, level and experience to be provided as part of the organogram.
  - 15) Competent site supervisors qualified to SAQCC (Corrosion Protection) Module PS1 'General Painting Supervisors'.
  - 16) Coating applicators/painters qualified to SAQCC (Corrosion Protection) Module PA1 'General Heavy Duty Coatings Applicator'.
  - 17) Coating inspectors qualified to SAQCC (Corrosion Protection) 'Coating Inspectors' Level 1 (shop inspections) or Level 2 (site inspections) or NACE Coating Inspection Programme (CIP).

If no exclusions or qualifications are submitted at the time of tender, the requirements as prescribed in this specification shall apply.

During the design phase, a plant/project specific corrosion protection specification shall be developed for this project and shall be implemented by the Contractor. This specification shall include all relevant components: tank, bunds, sumps, valves, pumps, piping, etc.

### 3.2.5 Electrical Design

The *Contractor* performs designs, supply, installation and commissioning for;

- a) Containerised substation room
- b) LV Switchgear and Control gear assembly and control panels/ distribution boards
- c) Power and control cabling
- d) Earthing and Lightning protection
- e) Small power and lighting
- f) Electrical Motors

#### 3.2.5.1 Containerised Substation

The *Contractor* supplies a trailer mounted containerised substation room to house LV Switchgear and control gear Assembly as well as other electrical equipment.

Clearances between equipment shall be in accordance with OHS Act to allow for maintenance and operating work on the equipment.

The substation room shall be equipped with normal florescent lighting, as well as essential lighting with battery pack backup in case normal lighting fails. The minimum lux level must be as per OHS Act.

The *Contractor* shall provide earthing and lightning protection for building and structures forming part of the *Works* in accordance to Eskom Drawings on Earthing Standards 0.54/393.

All materials used in the construction of containerised substation shall withstand fire rating of 2 hours.

#### 3.2.5.2 LV Switchgear and Control gear Assembly and Control panels/ Distribution Board

The *Contractor* designs, constructs, installs and commissions LV Switchgear and Control gear Assembly and control panels/ distribution board in accordance with SANS 61439-1: Low Voltage Switchgear and Control gear Assemblies. For LV Switchgear and Control gear Assembly that is rated 10kA and above shall be designed in accordance with 240-56227516: LV Switchgear and Control Gear Assemblies and Associated Equipment for Voltages Up To and Including 1000V AC and 1500V DC. The Contractor shall populate LV Switchgear Schedule A and B Template (240-115583001) during the enquiry phase.

#### 3.2.5.3 Cabling and Racking

- a) The *Contractor* supplies and installs the cabling in suitable racking in accordance with 240-56227443: Requirements for Control and Power Cables for Power Stations Standard. Since the water treatment plant will be of the mobile nature, the *Contractor* may utilise flexible (trailing) power cables. This must be in line with relevant SANS standards. The cabling scope will include but not limited to, MV cabling, LV cabling, trenching, cable racking, and all auxiliaries and accessories.
- b) MV cables to be of steel armoured type.
- c) Compliance to Requirements for Control and Power Cables for Power stations Standard (240-56227443).

#### 3.2.5.4 Earthing and Lightning Protection

- a) The *Contractor* designs earthing and lightning in accordance with 240-56356396: Earthing and Lightning Protection Standard. The mobile platform comes with a point of earth bonding via portable earth. *Employer* provides earth bar for the mobile plant to be earthed. *Contractor* to perform earth mat studies, simulate and prove earth mat is safe for step and touch potentials. Earth mat in accordance to proven study.
- b) All equipment to be earthed.
- c) *Contractor* to perform lightning study/assessment. Lighting protection in accordance to study/assessment outcome.
- d) Compliance to Earthing and Lightning Protection Standard (240-56356396).

#### 3.2.5.5 Small power and lighting

- a) General lighting of the plant, 4 floodlights on the four corners of the plant. Specifications below:
  - a. CCT – 2700k to 4100k
  - b. CRI – >80-90
  - c. Surge protection fitted,
  - d. Driver circuit fitted,
  - e. Must have earth connection point
  - f. SABS/ SANS accredited
  - g. Light must have a warranty
  - h. Driver and surge arrestor must be replaceable
- b) Lighting for each plant to be designed in such a way, as to have a mix of supply from each board. In the event of loss of power from any 1 supply, both plants will still have lighting.
- c) Full certificate of compliance (COC) for all circuits.
- d) Compliance to Coal Fired Power Stations Lighting and Small Power Installation Standard (240-55714363).

#### 3.2.5.6 Electrical Motors

Electrical motors shall be in accordance with 240-57617975: New Low Voltage Motors Procurement Standard and Technical Schedule AB Template (240-77100923) shall be populated by the *Contractor* during an enquiry phase.

#### 3.2.6 Control and Instrumentation Design

The *Contractor's* design makes provision for fully automatic operation and control of the various control sequences, process steps and regeneration, through use of a stand-alone Programmable Logic Controller (PLC).

The preference is for a Siemens PLC. The *Contractor's* main offer should be based on a Siemens PLC and as an alternative option; the *Contractor* may propose an alternative PLC supplier of his choice. The PLC (regardless of make), must be provided with a fully licenced and unrestricted programming computer, to allow the *Employer* to perform complete and detailed diagnostics and engineering.

The control equipment, including the local HMI, shall be located in a separate location as to that of the electrical equipment.

The *Contractor* must provide an on-board local operating panel to allow full plant operational functionality, diagnostics and alarm viewing. The *Contractor* must provide an engineering station with all the required software and licencing installed.

All computer equipment (including monitors) provided by the *Contractor* shall comply with the following as a minimum:

- Fully licenced software with no expiry dates
- Rated as industrial type equipment
- Suitable for use in the intended environment
- Rated for continuous use
- Computer equipment provided shall comply with the following cyber security features (not limited to):
  - a) Employment of a user management system
  - b) Installed with Security Technologies (Anti-malware software), allowing for manual virus definition updates and patch management,
  - c) Locking of all USB ports
  - d) Employment of a fully configured Back-up and Restore software

The control program must allow operator intervention to extend any of the cleaning steps. The local and remote HMI and operating interface must be able to display in real time, at both an overview and detailed level, each process control sequence and its respective sub-steps, including the status of each step's permissive. The C&I design will include the local and remote HMI design, which will incorporate a graphic display indicating process and regen steps, as well as indication of the status of each unit (in service, standby or regeneration mode).

The *Contractor* must indicate in his design how the signals from the mobile plant will be stored in the plant's historian.

The *Contractor's* design must include capability for indication of the plant's performance indicators on a SCADA.

The *Contractor* makes provision for a hard-wired interface from the desalination plant outlet(s) flow meters to the mobile plant, through a junction box connection.

All signals for controls and protections shall be hardwired, within the control system architecture.

The *Contractor* indicates which form of communication will be used to send these signals to the HMI, the link must be such that it is not fixed and can be moved with the units to different locations with ease (plug and play).

As a minimum, the following signals are required:

- Inlet flow to the mobile plant
- Final outlet flow from the mobile plant (permeate plus waste streams)
- Pretreatment unit outlet turbidity
- Final conductivity from the mobile plant (permeate and waste streams)
- Status of the process units in the mobile plant – in service / standby /backwash/ in clean
- Integrated flow values
- Alarms related to the process control
- Trip and/or protection alarms should be clearly visible.
- The stand-alone control and monitoring system should have the ability to store history for a minimum period of 6 month before overwriting the data. This is to ensure history is kept for the desalination production should a chemical excursion occur. All networking equipment shall be installed in enclosures with filtered air ventilation compliant with standard document 240-56355731 Environmental Conditions for Process Control Equipment Used at Power Stations Standard.

### 3.2.6.1 Instrumentation

All instruments supplied shall be rated for the environment. Instrumentation shall be interfaced to the control system. Analogue signals shall be 4-20mA 24V DC and loop powered. Binary signals shall be interfaced to the control system via potential free contacts or 24V DC relays. All instruments shall have a local display.

The instruments are installed as close as practicably possible to the tapping point to minimise impulse-piping lengths. Instruments are mounted on stands where applicable. Stainless steel tubing shall be utilised and all instrument internals shall be constructed of material that is compatible with the fluid being measured. Instruments shall be installed in accordance to

- 240-56355754: Field Instrument Installation Standard.
- 240-56355888: Temperature Measurement Installation Standard.
- 240-56355843: Pressure Measurement installation Standard.
- 240-56355815: Field Instrument Installation Standard: Junction Boxes and Cable Termination.

#### 3.2.6.1.1 Instrument Installation requirements

- All field equipment shall be installed in accordance with the manufacturer's instructions, the requirements of this specification, and good practices.
- All field equipment shall be installed with due regard for the following:
  - Passageways and the movement of people and equipment during maintenance activities,
  - Ergonomics and maintenance access to the equipment,
  - Field equipment supports shall not be welded to vessels or handrails, but shall utilise self-supported racks with integrated cable and tubing trunking.
  - Instrumentation and transducers shall be grouped together in areas away from other maintenance activities and where the environmental conditions are more favourable for the equipment,
  - All instruments and transducers on a rack and all racks throughout the plant shall be installed on the same level and with even spacing between instruments and transducers.
  - All instrument and transducer installations shall be free from vibration.
  - Junction boxes in close proximity of each other shall be installed on the same level and with even spacing between boxes.

Indicating instruments shall be orientated to permit viewing from walkways or platforms. Instruments shall normally be accessible for adjustment or maintenance without the need for any temporary access equipment such as ladders or platforms.

#### 3.2.6.1.2 Accessibility

All field equipment including instrumentation, transducers, transmitters and junction boxes shall be accessible for servicing or maintenance.

#### 3.2.6.1.3 Isolation

All instrumentation and transducer shall have individual instrument isolation valves within reach of the instrument to allow for on-line removal of the instrument or transducer.

#### 3.2.6.1.4 Dosing Pumps Electrical Drive Interface

The drives shall be interfaced directly to the control system. Smart drives shall be used with integrated switchgear located on the drive. As such, drive control is managed at the drive itself and not at the electrical switchgear. The cables shall be interfaced from control system remote I/O panel to drive motor with integrated switchgear. This approach minimises cable lengths.

#### 3.2.6.1.5 Local Control Stations

The functionality of the local control stations if utilised must include remote, manual, maintenance mode selection as per the Eskom standard.



### **3.2.6.1.6 Instrument Stands**

The instrument stands shall be installed in accordance with 240-56355754 Field Instrument Installation Standard.

### **3.2.6.1.7 Labelling**

Instrument and cable numbers shall be installed as per 240-40643427 Coding and Labelling Standard.

### **3.2.6.1.8 C&I Cabling**

The *Contractor* allows for the following cable types:

- 2 pairs - UVG2ACV
- 4 pairs - UVG4ACV
- 8 pairs - UVG8ACV
- 12 pairs - UVG12ACV
- 16 pairs - UVG16ACV
- 20 pairs - UVG20ACV
- 40 pairs - UVG40ACV

Cable sheath specification shall be Blue stripe Low halogen, Flame retardant Polyvinyl Chloride (LH PVC). All cabling installed outside of building shall be UV resistant (UV stabilised). All process cables follow the cable core identification marking and termination sequence shall be as the existing colour-coding standard. The *Contractor* sizes power cables in terms of the respective load these cables will be carrying. The *Contractor* allows for any special application cables required by his design. C&I cables shall be in accordance with the standard specifications 240-56227443 and SANS 10142. All digital and analogue low-level signal cables shall be of the thermoplastic-insulated, overall screened twisted pair, UVG type. Control cables that run outside the buildings must be UV Resistant and/or protected from elements by sufficient covering along the route. C&I cables may run on the same cable tray as telecommunication cables. Field cables shall be rated for the various environmental temperatures found in the respective plant areas.

UVG cables shall be rated for 300/500V with a conductor area of 0,5mm<sup>2</sup>.

Unarmoured cables can be buried if the cable is installed in a conduit before placing underground.

Cables shall be installed in accordance with 240-56227443 Requirements for Control and Power Cables for Power Stations.

### **3.2.6.1.9 Cable Glands**

Stainless steel cable glands must be installed for all cables entering/exiting junction boxes.

### **3.2.6.1.10 Cable Racks**

C&I cable racks must be done in accordance with 240-56227443 Requirements for Control and Power Cables for Power Stations.

Appropriate cleats, saddles and clamps are used to secure cables to the cable racks to avoid damage to the cable sheath and the cables are installed to prevent strain on terminals or connections.

### **3.2.6.1.11 Cable Conduit/Trunking**

Cable conduit or trunking is used where cables are exposed and can potentially be damaged during normal plant operation. Galvanised material is used. The conduit or trunking shall be in accordance with 240-56227443 Requirements for Control and Power Cables for Power Stations.

### **3.2.6.1.12 Junction Boxes and Terminations**

All cables use compression glands on the gland plates without affecting the IP65 rating.

Terminal lugs are used for all cable terminations and are in accordance with 240-56227443 Requirements for Control and Power Cables for Power Stations

### **3.2.6.1.13 Standardisation of equipment**

Standardisation of C&I equipment and installation methods are maintained as far as possible.

#### **3.2.6.1.14 Documentation**

The *Contractor* shall provide documentation as per Vendor Document Submittal Schedule (VDSS).

#### **3.2.6.1.15 Testing**

The control and instrumentation system solution shall undergo a factory acceptance test (FAT), site acceptance (SAT) and site integration testing (SIT) in accordance with IEC62381.

### **3.2.7 Civil and Structural Design**

#### **3.2.7.1 Foundation**

In designing the *works*, the *Contractor* shall take due cognisance of existing plant and equipment as well as safety and housekeeping constraints. It is the responsibility of the *Contractor* to ensure that the plant design occupies the current approved footprint of the plant ( $\pm 40\text{m} \times 25\text{m}$ ) and overcome any issues that may arise due to space constraints with prior consent from project management and no extra payment or claim of any kind will be allowed on account of space constraints.

The *Contractor* confirms that the loading on pipe racks will be within acceptable levels with the additional pipes when full.

The *Contractor* will be responsible to confirm the stability of the laydown area for the mobile desalination plant. If the ground work is not suitable to the *Contractors* requirement the *Contractor* is required to make the corrections.

The *Contractor* shall be responsible for keeping all areas of the Site for which he is responsible, including temporary facilities, buildings, and services in a clean, sanitary and orderly condition.

#### **3.2.7.2 Structural**

All structural steel used to be grade S355JR in accordance with SANS 50025.

All *Works* to be in accordance with the latest edition of SANS 2001 CS1.

The *Contractor* is responsible for the stability of the entire structure and all structural elements during all the erection stages.

All steel work is required to be hot dipped galvanized including grating.

All galvanizing is required to be done in accordance with SANS 121. Preparation of steel prior to galvanizing and coating thickness is also required to be in accordance with SANS 121.

#### **3.2.7.3 Pipe route**

The *Contractor* utilizes the existing pipe racks and pipe trenches to do site runs.

The *Contractor* ensures in his design that all pipework is suitably supported/anchored.

The *Contractor* ensures that the additional load can be accommodated by the existing infrastructure and makes provision for the necessary modifications where required.

### **3.3 Design Review**

- a) The design documentation shall be submitted to the *Project Manager* two weeks after the Contract Date. The *Employer* approves or rejects within two weeks after the design is submitted.
- b) All design work is signed and approved by the applicable Professional Engineer (mechanical, electronic, electrical, chemical, civil etc.) responsible for their preparation before being submitted to the *Project Manager*.
- c) The *Contractor* submits detailed Technical Data Sheets of all equipment used for the *Works* to the *Project Manager* as part of the design.
- d) Acceptance of the design by the *Project Manager* does not relieve the *Contractor* of his liability for his design and drawings.

### 3.3.1 HAZOP Study

The *Contractor* shall conduct a HAZOP study with the participation of Eskom prior to the finalisation of the design, prior to construction and prior to commissioning of the system. Upon completion of the study, the HAZOP report shall be issued to Eskom for review.

### 3.3.2 Reliability

The plant shall be designed such that known failure mechanisms will not prevent the system from achieving its design life or meeting the availability.

The system design shall incorporate design features to support high reliability of safety significant equipment and high system availability.

### 3.3.3 Availability

The system shall be designed for an availability of >95% during the course of the operation.

## 3.4 Procedure for submission and acceptance of *Contractor's* design

The *Contractor* establishes a document tracking system to record the dates for the supply and receipt of all design drawings, calculations, requests for information and design documentation.

The *Contractor* is to supply the following documentation as the minimum requirements of this specification in the design package before any manufacturing, construction or commissioning commences:

- Document submittal schedule indicating when all documents will be submitted
- Drawing Register indicating when drawings will be submitted
- Complete detailed design file
- Functional Specifications
- Line Sizing Calculations and Material Selection
- Final isometric and general arrangements illustrating pipe dimensions, pipeline layouts and showing pipe supports
- General Arrangement Drawing of System and boundaries
- Piping and Instrument Diagrams
- Component material datasheets
- Constructability Assessment
- Quality Manual
- Quality Control Procedures
- Quality Control Plan and Inspection and Test Plan
- Method Statements
- Commissioning procedures
- Assembly procedures
- Technical, Operation and Maintenance Manuals of all plant equipment
- Operating and Control Philosophies
- Chemical Safety Data Sheets and Safe Handling Procedures
- Maintenance Philosophy/strategy
- Process design
- Water and salt balance across the plant
- Tanks and Vessels sizing calculations
- System curves and pump curves (for applicable pumps)
- Hydraulic calculations
- Loop Diagrams
- Field termination drawings
- Pipe Schedule
- Valve schedule
- Instrument schedule
- Drive and Actuator Schedules

- Mechanical Hook-up diagrams
- Power distribution drawings
- I/O block diagrams
- Software drawings
- LOSS diagrams
- Alarm list
- Functional Distribution (Allocation of field devices to I/O)
- Detailed I/O List and Channel Assignments
- Electrical load schedules
- Electrical cable schedules
- C&I cable schedules
- Electrical termination schedules
- C&I termination schedules
- Cable installation and loop check sheets
- Instrument datasheets
- Instrument calibration certificates
- Drive configuration reports
- Valve datasheet
- Schematics for the electrical design
- Parts list for all components
- Critical Spares List
- Welding Procedure Specifications
- Welding Procedure Qualification Record
- Operating, Maintenance and Engineering Training Manuals

### **3.5 Other requirements of the *Contractor's* design**

#### **3.5.1 Physical Characteristics Requirements**

The *Contractor* shall ensure that the design of the system is consistent throughout; such as valves, pumps and tanks.

All equipment shall be protected from external ingress, corrosion and be explosion proof where applicable.

#### **3.5.2 Fire Protection**

The *Contractor* must provide a fire risk analysis as part of the design approval process to the *Employer* for approval. The *Contractor* is to implement the protection measures required to mitigate the risks identified in the fire risk analysis.

#### **3.5.3 Testing and Commissioning**

Testing and commissioning shall include as a minimum:

- (1) The services of skilled Engineers to supervise the testing, commissioning, and making ready for the full duty operation of the complete *Works*.
- (2) All management, supervision, labour, tools, instruments, chemicals, test apparatus, calibration equipment and any other equipment and facilities as may be necessary.

The *Contractor's* preliminary trials and commissioning of the *Works* shall be carried out by the *Contractor's* representatives, who shall remain in attendance until the *Works* are working to the *Employer's* satisfaction. A requirement of these trials is a 72- continuous hour test to determine that all activities as laid down in the operating manuals are correct and are carried out in the correct sequence and to determine that all the plants have been provided as required in the scope of work.

The operating and maintenance manuals shall be submitted at least 2 weeks prior to the start of commissioning for acceptance by the relevant *Employer's* representative. The *Contractor* is responsible for commissioning of the mobile plant control system logic included in the *Works* and provides a functional logic commissioning

procedure for testing the applied logic and plant functionality in accordance to the plant operating and control philosophy requirements. The functional logic commissioning procedure is developed with reference to the mobile plant operating and control philosophy and is subject to the approval of *Project Manager* before functional testing commences.

The Contractor's staff with the Employer's operations /commissioning staff shall do commissioning of the system.

The *Contractor* submits a commissioning schedule and program for acceptance by the *Project Manager* by the contract date.

Before plant and equipment is placed in service, the *Contractor* certifies that it is in a suitable and safe condition. In addition, the *Contractor* provides a complete list of numbered schematic, wiring and cable diagrams which are a true record of the plant and equipment as installed and certifies that the system has been wired in accordance with these diagrams.

Prior to the time when commissioning is to commence, the *Project Manager* will appoint a representative who will co-ordinate the commissioning of all plant and equipment forming an integral part of the system being commissioned. The *Contractor* is responsible for the commissioning of all the plant and equipment he/she is to supply to the requirements of this specification in conjunction with the *Project Manager* and the *Employer's* representatives. Where various components are already in place, or are supplied by the *Employer* to form an integrated system, the *Contractor* at the time of commissioning, carries the responsibility for the correct functioning of the whole system.

In the event of incorrect functioning, the *Contractor* determines the cause and he/she corrects the defect if the defect is within plant and equipment of his/her own supply. The *Contractor*, at the time of commissioning, has the agreement, or alternatively, the attendance of the *Project Manager* involved in a particular phase, before proceeding with commissioning. Consequently, the *Contractor* must assure himself/herself as to the safety of his/her own plant and equipment in respect of any particular commissioning test and in the event of damage accept responsibility for such plant and equipment.

### **3.6 Use of Contractor's design**

The design when completed will become the property of the *Employer*.

### **3.7 Design of Equipment**

On some complex projects requiring sophisticated temporary works, it could be in the Parties best interests that some details of the *Contractor's* design or proposed design of Equipment are shared with the *Project Manager*, not necessarily for his acceptance but as an assurance that the Equipment will be able to allow the *Contractor* to Provides the Works efficiently and without delay. For example a tunnel boring machine, or specialised shuttering for a bridge or caisson. Draft in such a way that there is no doubt that the liability for such design and use of the Equipment remains with the *Contractor*. Clause 23.1 is always available to the *Project Manager* if this section is not used.

### **3.8 Equipment required to be included in the works**

All materials and equipment shall be of a recognised standard and quality specified. The *Contractors* design is required to be in accordance with the appropriate design standards and codes of practice defined by the Employer.

The *Contractor* ensures that the *Works* complies fully with all South African Government Ordinances, all relevant local rules and regulations and with current national standards.

The International Standards Organisation (ISO) system of units must be used throughout this contract. This includes, but is not limited to documentation, correspondence, drawings, measurement and equipment sizing. Pressure parts and pipework design must comply with the appropriate British or American codes.

The following non-exhaustive list of specific codes and standards has been identified that should be followed. The standards, specifications and all procedures listed below form part of this contract. The Employer reserves the right to add to this list should the proposal differ significantly from the proposed design as highlighted in this specification. All other standards and specifications used by the *Contractor* must be listed and accepted for use by the Project Manager. The design and manufacture of equipment and the complete installation shall be carried out and tested in accordance with the latest issue or amendments of the following Regulations, as applicable:

**Table 3: Regulations for design, manufacturing and installation of equipment.**

Code No.	Title
QM 58	Supplier Contract Quality Requirements
SANS 10142	The Code of Practice for the Wiring of Premises
EPC 32-245	Environmental Procedure Waste Management Procedure
SANS 10108 (2005)	Classification of Hazardous Location (Electrical Plant)
240 – 56355815	Junction Boxes and Cable Termination Standard (Rev 1)
36-681	Generation Plant Safety Regulations
240-49230111	Hazard and Operability Analysis (HAZOP) Guideline (Rev 1)
240-30008949	Safety, Health and Environmental Specifications for Contractors
SABS 0142-Part 1 and IEC 639-1	Earthing, Lightning and Electrical Protections
SANS 10064	The Preparation of Steel Surfaces for Coatings
32-421	Life saving rules
OHSA	Occupational Health and Safety Act 85 of 1993
SANS 10102-1&2	The selection of pipes for buried pipelines Part 1 & 2
SANS 10268	Welding of Thermoplastics – Welding Processes
SANS 10269	Welding of Thermoplastics – Testing and Approval of Welders
SANS 10270	Welding of Thermoplastics – Approval of Welding Procedure
SANS 6629	Welding of thermoplastics – Test methods for welded joints
SANS 1200 Series	Civil Work Standards
SANS 4427 (1996)	Polyethylene (PE) pipes for water supply Specifications
SANS 719 (2011)	Welded Low-Carbon Steel Pipes (Large Bore)
Regulation nr. 36958	Regulations relating to compulsory national standards for process controllers and water services works regulation number 813 dated 23 October 2013 Schedule 2
IEC 60034-1 to 30	Rotating Electrical Machines
IEC 60085	Electrical Insulation – Thermal Classification
SANS 1973-3:2017	Low voltage and control gear ASSEMBLIES Part 3: Safety of ASSEMBLIES with rated prospective short-circuit currents of up to and including 10kA
SANS 61439	Low Voltage and Control gear ASSEMBLIES
SANS 10142-1	The Wiring of Premises Part 1: Low-voltage installations
SANS 1804	Low Voltage Induction Motors
240-55410927	Cyber Security Standard
240-72926760	Operational Technology (OT) Operating Model
32-373	INFORMATION SECURITY – IT or OT and Third party remote Access Standard
IEC 62381	Automation systems in the process industry (FAT)
240-56227443	Requirements for Control and Power Cables for Power Stations Standard

240-56355754	Field Instrument Installation Standard: Field Installation Requirements
240-56356396	Earthing and Lightning Protection Standard
240-56355888	Temperature Measurement Systems Installation Standard
240-56355789	Flow Measurement Systems Installation Standard
240-56355815	Control & Instrumentation Field Enclosures and Cable Termination Standard
240-56355843	Pressure Measurement Systems Installation Standard
240-61379755	Control and Instrumentation Schedule Template
240-61379755	Control and Instrumentation Drive & Actuator Schedule Template
240-56355731	Environmental Conditions for Process Control Equipment Used at Power Stations Standard
240-109607736	Eskom KKS Key Part Standard
240-109607332	Eskom Plant Labelling Abbreviation Standard
240-56355466	Alarm Management System Guideline
240- 56361435	Eskom Transportation of Power Station Electric Motors Standard
240- 57617975	Eskom Procurement of Power Station Low Voltage Motors Specification
240-56357518	Power Station Electric Motor Standard
240-115583001	LV Switchgear and Control gear Assembly Technical Schedule A and B
240-56356421	Low voltage switchgear schedule template
240-56227516	LV Switchgear and Control Gear Assemblies and Associated Equipment for Voltages up to and including 1000V AC and 1500V DC

### 3.9 As-built drawings, operating manuals and maintenance schedules

All as-built drawings, operating manuals and maintenance schedules to be available to the *Employer* as soon as the plant is ready for commissioning. All drawings and reports compiled for the *Works* are to become the property of the *Employer* on completion of the *Works*.

The *Contractor* ensures the following:

- (1) Makes use of a system compatible with the *Employer's* Microstation CAD and all drawings supplied to the *Employer* are to be provided in electronic medium in addition to prints.
- (2) Implements and maintains an updated drawing register, the format of which is to be accepted by the *Employer*. Updates are submitted on a regular basis or when significant changes are made.
- (3) The *Contractor* submits detailed drawings of all the separate items of the *Works* included in the specification for acceptance once the general arrangement drawings have been accepted. If *Works* or materials are supplied before such acceptance has been given, the *Contractor* modifies or replaces such *Works* or material at his own expense if called upon by the *Project Manager* to do so.
- (4) Submit four prints of all "as built" drawings with approval signatures at Completion by the ECSA registered professional engineer for each discipline as required by the design, backed up on the electronic medium, without delay on request by the *Project Manager*.

The *Contractor* provides good quality operating and maintenance manuals prepared by suitably experienced personnel. The maintenance manuals must state explicitly the maintenance requirements for each piece of equipment. Copies of the first draft manuals as well as all "as built" drawings are submitted to the *Employer* for review and acceptance. Manuals are in English and each manual is complete with the Power Station's name, contract number and index. The *Contractor* must also provide an electronic copy of these documents. The manuals should indicate the level of responsibility of the operating personnel for each action in the procedures.

Included in these manuals are the following, where applicable:

- (1) Design data including descriptions of control philosophy with alarms, set points, interlocks and logics clearly explained.
- (2) Process and instrumentation diagrams.
- (3) Range, calibration factors, calibrations certificates, data sheets, etc., for all control and instrumentation equipment.
- (4) Electrical diagrams.
- (5) General arrangement and installation drawings and instructions.
- (6) Operating procedures and instructions for normal and emergency conditions, including flow diagrams.
- (7) Maintenance procedures and instructions for specific plant and equipment.
- (8) All drawings required for component location, dismantling and re-assembly for maintenance.
- (9) Equipment details such as make, model, type, specifications, etc.
- (10) Detailed parts lists and ordering instructions pertaining to storage of spare parts or to their shelf life.
- (11) Exploded view type drawings clearly detailing the part and uniquely identifying it, technical descriptions of the equipment and component parts.
- (12) Catalogues, schedules and other product support documents.
- (13) Troubleshooting and fault finding guide.
- (14) Safety procedures and instructions.
- (15) All special tools and equipment required for maintaining and operating the *Works*.

The maintenance manuals shall be separated into mechanical, electrical and C&I volumes.

The technical manuals shall include fully detailed descriptions, as-built drawings, diagrams, illustrations, schedules and data for use by Eskom technical staff to evaluate performance, trace faults, adjust, maintain and fully understand the plant and plant equipment and to allow satisfactory training of junior staff in conjunction with the operating manuals.

The operating manuals shall be set out in simple terms in ordinal, tabular or pictorial form to provide factual and concise descriptions of:

- (1) How to carry out start-up, shutdown, and service operation of the plants by automatic, semi-automatic and by manual control.
- (2) What happens when the plants are operated, e.g. where does the water, chemical, air, etc. flow when a sequence is initiated or a valve is operated.
- (3) What an alarm condition implies and how it is corrected.
- (4) What problems can occur and how they are overcome.
- (5) A routine visual plants inspection procedure.
- (6) Preservation and or storage requirements for when the mobile plant is not in use.

The operating manuals are intended for daily use and therefore shall be separated from the technical and maintenance manuals. Bold print, diagrams, illustrations, etc. shall be used.

The maintenance instruction manuals shall include schedules to cover plant inspection procedures, fully detailed maintenance programmes for plant and plant equipment services at daily, monthly, three monthly, six monthly, yearly and any other necessary intervals, and contain manufacturer's and supplier's detailed maintenance and lubrication instructions, diagrams, sectional drawings giving part numbers, descriptions, etc. Where spare parts have been provided these should be coloured in, scheduled, and their filling procedure described. The manual shall also include minimum surveillance requirements for the plant.

Detailed maintenance procedures, covering removal, dismantling, replacement of parts, re-erection, checking, and reassembly and re-commissioning shall be included for all equipment. The re-commissioning shall be included for all equipment. The maintenance manual shall be fully comprehensive and cover all plants and plant equipment installed. As the manuals will be frequently used for training and maintenance, they shall be prepared similarly to those described for the operating instruction manuals for use by operating personnel.



## 4 Procurement

There is a cross reference from the definition of Disallowed Cost in Options C D and E to the Works Information regarding procurement procedures. This part of the Works Information MUST include any such procedures to be able to administer this procedure. Options A & B may also require constraints on procurement procedures.

### 4.1 People

#### 4.1.1 Minimum requirements of people employed on the Site

Specify any constraints relating to people employed to Provide the Works; for example permits for foreigners, training (other than H & S), use of labour from designated areas and industrial relations.

#### 4.1.2 BBBEE and preferencing scheme

Specify constraints which *Contractor* must comply with after contract award in regard to any Broad Based Black Economic Empowerment (B-BBEE) or preferencing scheme measures.

#### 4.1.3 Accelerated Shared Growth Initiative – South Africa (ASGI-SA)

If the ASGI-SA requirements are to be included in this contract specify constraints which *Contractor* must comply with after contract award in regard to any ASGI-SA requirements. The ASGI-SA Compliance Schedule completed in the returnable tender schedules is reproduced here. If ASGI-SA does not apply, delete this paragraph.

The *Contractor* complies with and fulfils the *Contractor's* obligations in respect of the Accelerated and Shared Growth Initiative - South Africa in accordance with and as provided for in the *Contractor's* ASGI-SA Compliance Schedule stated below

[Insert the agreed ASGI-SA Compliance Schedule here]

The *Contractor* shall keep accurate records and provide the *Project Manager* with reports on the *Contractor's* actual delivery against the above stated ASGI-SA criteria. [Elaborate on access to and format of records and frequency of submission etc.]

The *Contractor's* failure to comply with his ASGI-SA obligations constitutes substantial failure on the part of the *Contractor* to comply with his obligations under this contract.

### 4.2 Subcontracting

#### 4.2.1 Preferred subcontractors

ECC does not make use of nominated subcontracting, but the *Employer* may list which subcontractors or suppliers the *Contractor* is required to enter into subcontracts with. This is usually only required where Plant and Materials need to be obtained from a particular supplier or group of suppliers in order to comply with operational standards.

#### 4.2.2 Subcontract documentation, and assessment of subcontract tenders

Specify any constraints on how the *Contractor* is to prepare subcontract documentation, whether use of the NEC system is compulsory or not (compulsory is recommended) and how subcontract tenders are to be issued, received, assessed (using a joint report?) and awarded.

#### **4.2.3 Limitations on subcontracting**

The *Employer* may require that the *Contractor* must subcontract certain specialised work, or that the *Contractor* shall not subcontract more than a specified proportion of the whole of the contract.

#### **4.2.4 Attendance on subcontractors**

State requirements for attendance on Subcontractors, if any

### **4.3 Plant and Materials**

#### **4.3.1 Quality**

The *Employer* places emphasis on the provision of a comprehensive Quality Management System (QMS) for all phases of the project. The QMS shall comply with the requirements of document 240-105658000 (Supplier Quality Management Specification). The *Contractor* and all of the *Contractors'* suppliers shall hold a valid certificate of compliance for their QMS to the requirements of ISO 9001:2015. The *Employer* may at his sole discretion carry out an audit any supplier or sub-supplier QMS for compliance.

Documents are submitted for review and acceptance by the *Employer* after the Contract Date and prior to the commencement of work.

The *Contractor* submits a fully detailed Quality Manual and Quality Control Plan for acceptance within two weeks of the Contract Date.

No work is allowed to start until the *Employer* accepts the Quality Control Plan.

The *Contractor* utilises the *Employer's* quality documentation forms for requesting access, erection checks etc. These request forms are to be submitted to the *Project Manager* at least one week prior to the requested activity, or as agreed to by the *Project Manager*.

Apart from any statutory data packages required, the *Contractor* also compiles a data package of the relevant drawings, test certificates etc. for each section of work which is to be reviewed and signed off by the *Employer's* representative at erection check stage prior to the commencement of the commissioning phase.

#### **4.3.2 Plant & Materials provided "free issue" by the *Employer***

No free issue will be available. All Plant and Materials are to be provided by the *Contractor*.

#### **4.3.3 *Contractor's* procurement of Plant and Materials**

The *Contractor* procures all Plant and Materials required for constructing, installing and commissioning the *Works*.

The *Contractor*:

- (1) Advises the Project Manager in advance of all major shipments of Plant and Material and co-ordinates with the Employer the arrival, off-loading and release of such. The *Contractor* promptly unloads its shipments and promptly releases carrier equipment.
- (2) Notifies the Project Manager of being unable to promptly unload any shipment not less than 5 (five) days prior to arrival. The Project Manager, at his option, off-loads or makes arrangements for others to off-load such shipments for the account and risk of the *Contractor*. Costs incurred in respect of off-loading will be for the *Contractor's* account.

- (3) Ensures that all the Plant and Materials are inspected. The *Contractor* notifies the *Project Manager* to arrange for the *Employer's* representatives to inspect the Plant and Materials at the factory, or the *Contractor's* premises, before it is transported to the Site.
- (4) Ensures that all relevant factory tests are witnessed and accepted by the designated *Employer's* representatives. Any deviations from accepted drawings, standards or specifications are noted and reported to the *Contractor* (for correction) by the above-mentioned representatives.
- (5) Submits calibration certificates of all test equipment used for testing of any of the equipment to the *Project Manager*.

#### 4.3.4 Spares and consumables

The *Contractor* supplies, on acceptance by the *Employer*, a set of spares considered essential and as part of the *Works*. This shall include any spares and provision of consumables for the duration of the operations and maintenance contract.

#### 4.4 Tests and inspections before delivery

The *Employer* carries out quality inspections at his discretion.

All inspections and testing to be performed in accordance with the Quality Control Procedure (QCP) developed by the *Contractor* and accepted by the *Employer's* representatives.

The *Employer* will be provided access to the *Contractor's* premises for the purpose of:

- (3) Establishing compliance with the contractual requirements by means of inspections, surveillance and audits.
- (4) Witnessing the performance of any tests.

The *Employer's* representatives will inspect switchboards or panels forming part of the Plant before they are released from the *Contractor's* premises at his discretion. This inspection entails a thorough check to ensure complete compliance with this specification including schedules, design drawings and other applicable standards.

The *Contractor* obtains clearance from the *Project Manager* before despatching of the equipment. This factory release inspection does not release the *Contractor* of any of his obligations under the contract.

No Plant will be released for dispatch without the AS MANUFACTURED documentation and drawings accompanying them.

#### 4.5 Marking Plant and Materials outside the Working Areas

Core clauses 70.1 and 71.1 require the Works Information to state how the *Contractor* is to "mark" Plant and Materials which is outside the Working Areas if they are to be paid for before delivery to the Working Areas. Specify here how the *Contractor* is to mark the Plant and Materials.

#### **4.6 Contractor's Equipment (including temporary works).**

The *Contractor* is liable for all plant & equipment in the designated area under his control. The *Employer* will not take any responsibility for any loss or damage to the equipment.

- (1) The *Contractor* provides all Equipment that is required to complete the *Works*.
- (2) The *Contractor's* Equipment does not impair the operation or access to the plant.
- (3) The *Contractor* provides all or any temporary or expendable materials required for the storage of material.

Any Equipment, or appliances, used by the *Contractor* conforms to the applicable OHS Act safety standards and is maintained in a safe and proper working condition. The *Project Manager* has the right to stop the *Contractor's* use of any Equipment, which, in the opinion of *Project Manager* does not conform to the foregoing.

The Contractor arranges their own off-loading, rigging and material handling Equipment such as cranes, forklifts, and the required personnel for this purpose. The *Contractor* has to submit a list of all tools and equipment entering site. Equipment and tools not declared will become the *Employer's* property.

On completion of the project, all tools and equipment will be removed only with permission from the *Employer* on the applicable approved *Employer* documents.

#### **4.7 Cataloguing requirements by the Contractor**

State whether cataloguing is applicable, if it is, reference the requirements for cataloguing that need to be satisfied by the *Contractor* (consult Procurement Instruction Number 1 of 2018 – Incorporating Cataloguing into the Procurement Environment, Unique Identifier 240-1289988974).

## 5 Construction

### 5.1 Temporary works, Site services & construction constraints

- The *Contractor* constructs and erects the *works* in accordance with the *Contractor's* approved design and taking cognisance of applicable SANS 1200 series.
- All work is performed in accordance with the *Contractor's* accepted Quality Control Plan. All construction and erection work conducted on Site is subject to inspection by the Supervisor.
- The construction and erection of the *works* is performed under the supervision of the *Contractor*. An acceptance/test schedule is compiled by the *Contractor* and approved by the Supervisor.
- All equipment required for the erection and completion of the *works* are supplied by the *Contractor*. This Equipment is in good condition and subject to the Employer's safety requirements.
- The *Contractor* supplies all Plant and Materials where new Plant and Materials are required for the completion of the *works*.
- All Plant and Materials used complies with the requirements regarding quality, method of manufacturing, testing and performance specification as given in the relevant SABS/SANS specification, or where such a specification does not exist, the requirements of the relevant British or ISO standard. All plant materials shall be suitable for use or operation under the operating conditions applicable to the system.

#### 5.1.1 *Employer's* Site entry and security control, permits, and Site regulations

All the *Contractor's* employees are required to attend a safety induction course before they will be allowed to work on the Site. It is the responsibility of the *Contractor* to ensure that all employees have attended the safety induction. The *Contractor* has to compile his/her safety file for approval from the *Employer's* safety officer. The safety officer must first approve this file, before the *Contractor* can attend the safety induction course.

A list of employees requiring safety induction must be submitted at least 2 days in advance of arrival on site with the date and time of arrival so that safety induction can be arranged.

Site access control to Camden Power Station will be arranged with the *Project Manager* after successfully completing the safety induction course.

Alcohol testing will be conducted at any time on all employees entering the Power Station premises. No staff that tested positive for alcohol will be allowed on site.

##### 5.1.1.1 Permit to work system

- The *Contractor* to have his site supervisor trained, tested and declared competent as responsible person, by the *Employer* , within 6 months of contract start date.
- The *Contractor* to have his site plant controller and/or senior plant operator trained, tested and declared competent as an appointed person, by the *Employer* , within 6 months of contract start date.
- NO work can to be carried out without a "PERMIT TO WORK".
- The *Contractor's* Responsible Person must satisfy himself that all sources of possible danger are isolated.
- The *Contractor* must provide a facility to lock valves, switchgear and other equipment in accordance with the Permit to Work system.

##### 5.1.1.2 Safety induction course

Refer to section 4.1.1

### 5.1.1.3 Local safety procedures

The *Contractor* adheres to all local procedures. A list of local procedures is available on request from the *Employer*.

### 5.1.1.4 Incidents/accidents

- (1) Incidents and accidents must be reported and investigated as detailed in Safety, Health and Environmental Requirements for Contractors (document 32-136). All incidents must also be reported to the *Employer* within 24 hours.
- (2) First aid must be available by the *Contractor* or use can be made of the Camden medical centre at a fee. The availability of the *Contractor's* own first aid does not relieve the *Contractor* of his obligation to report and investigate the incident in accordance with Camden procedures.

### 5.1.1.5 Safety and Fire Hazards

The installation in its entirety is to comply with regard to electrical safety and supply interference suppression requirements, with SABS and/or and local authorities' by-laws.

All safety devices are to be tested by the *Contractor* under the simulated or actual fault conditions for which the safety devices are installed to prevent damage to system equipment and/or building. The *Contractor* confirms proper functioning of these safety devices in the form of signed inspection reports.

Satisfactory test results from the National Building Research Institute or test reports from an approved testing laboratory are required, to certify the fire hazard ratings for proposed materials for insulation, covering and vapour sealing.

Fire prevention and protection requirements to which *Contractors* must comply are detailed in Safety, Health and Environmental Requirements for *Contractors* (document 32-136).

#### In Case of fire:

**Contact Control Room at Extension 3471**

### 5.1.1.6 Inspection of equipment

- The *Contractor's* equipment is inspected by an authorised employee of the *Employer* on arrival at the Site.
- The following documentation is required to accompany the equipment where applicable: copies of all test certificates and maintenance records.
- Lifting equipment and electrical equipment must be marked with a unique number, code or colour code for identification. If the equipment is found to be in an unsatisfactory condition or if insufficient maintenance has been carried out on the equipment, then it will not be accepted for use on site.
- A list of all lifting equipment and electrical equipment is submitted to the *Employer* at least 2 days prior to the occupation date. This list must indicate the unique number and description of the equipment.
- Training of operators must comply with the *Works Information* and statutory requirements.
- Every piece of workshop equipment and tools, the *Contractor* brings on site must be declared and logged at Protective services, the *Employer* will not issue gate release permits to take *Contractors* workshop equipment/tools off site.

### 5.1.2 Restrictions to access on Site, roads, walkways and barricades

All vehicles must comply with the Road Traffic act.

Vehicle inspections will be conducted on a daily basis and check sheets must be kept at the *Contractor's* offices.

### 5.1.3 People restrictions on Site; hours of work, conduct and records

Restrictions and hours of work may apply on some Sites. It is very important that the *Contractor* keeps records of his people on Site, including those of his Subcontractors which the *Project Manager* or *Supervisor* have access to at any time. These records may be needed when assessing compensation events.

### 5.1.4 Health and safety facilities on Site

Section 2.3 deals with contractual H & S requirements in addition to those of the OHSA Act. This section allows the *Employer* to state what measures are to be taken on Site against disease and epidemics and in emergencies. Also describe where First Aid facilities provided by the *Employer* are located and any other emergency arrangements. Do not use if already addressed in 2.3. The cross reference from Clause 27.4 applies.

The *Contractor* and his subcontractors ensure at all times compliance with safety regulations imposed by any Act of Parliament, ordinance or any regulation or bylaw of any local or statutory authority.

The *Contractor* shall comply with:

- the Occupational Health and Safety Act, 1993, and all Regulations made there under;
- all Eskom Safety and Operating Procedures listed in this Works Information.

The *Contractor* acknowledges that it is fully aware of the requirements of all the above and undertakes to employ only people who have been duly authorised in terms thereof and who have received sufficient training to ensure that they can comply therewith.

The *Contractor* undertakes not to do, or not to allow anything to be done which will contravene any of the provisions of the Act, Regulations or Safety and Operating Procedures.

The *Contractor* shall appoint a person who will liaise with the Eskom Safety Officer responsible for the premises relevant to this contract.

The person so appointed shall, on request:

- Supply the Eskom Safety Officer with copies of minutes of all Health and Safety Committee meetings, whenever he is required to do so;
- Supply the Eskom Safety Officer with copies of all appointments in respect of employees employed on this contract, in terms of the Act and Regulations and shall advise the Eskom Safety Officer of any changes thereto.

Eskom may, at any stage during the currency of this agreement, be entitled to:

- Do safety audits at the *Contractor's* premises, its work-places and on its employees;
- Refuse any employee, sub-contractor or agent of the *Contractor* access to its premises if such person has been found to commit any unlawful act or any unsafe working practice or is found to be not authorised or qualified in terms of the Act;
- Issue the *Contractor* with a work stop order or a compliance order should Eskom become aware of any unsafe working procedure or conditions or any non-compliance with the Act, Regulations and Procedures referred to in the above by the *Contractor* or any of its employees, sub-contractors or agents.

No extension of time will be allowed as a result of any action taken by Eskom in terms of the above and the *Contractor* shall have no claim against Eskom as a result thereof. Furthermore, no amendments to the Act or Regulations or reasonable amendment to Eskom's Safety and Operating Procedures will entitle the *Contractor* to claim any additional costs incurred in complying therewith from Eskom.

### 5.1.5 Environmental controls, fauna & flora, dealing with objects of historical interest

The *Contractor* shall not clear any vegetation without prior approval by the *Camden Station*. All contractors shall be responsible to prohibit their employees from hunting all forms of fauna and setting of snares.

### 5.1.6 Title to materials from demolition and excavation

Clause 73.2 states that the *Contractor* has title to materials from excavation and demolition (e. g. copper) only as stated in the Works Information. Hence state here any special arrangements regarding such title. If nothing is stated then the default position is the *Contractor* has no such title.

### 5.1.7 Cooperating with and obtaining acceptance of Others

This sub-paragraph could be used to deal with two issues.

- 1) The cross reference from core clause 25.1 about cooperation generally as well as details about Others with whom the *Contractor* may be required to share the working areas. See clause 11.2(10) for the definition of Others.
- 2) Requirements for liaison with and acceptance from statutory authorities or land owners.

### 5.1.8 Publicity and progress photographs

State requirements for notice boards, advertising rights, media relations, photography and progress photographs if required.

### 5.1.9 Contractor's Equipment

- (1) The *Contractor* provides all Equipment that is required to complete the *Works*.
- (2) The *Contractor's* Equipment does not impair the operation or access to the plant.
- (3) The *Contractor* provides all or any temporary or expendable materials required for the storage of material.

Any Equipment, or appliances, used by the *Contractor* conforms to the applicable OHS Act safety standards and is maintained in a safe and proper working condition. The *Project Manager* has the right to stop the *Contractor's* use of any Equipment, which, in the opinion of *Project Manager* does not conform to the foregoing. The *Contractor* arranges their own off-loading, rigging and material handling Equipment such as cranes, forklifts, and the required personnel for this purpose. The *Contractor* has to submit a list of all tools and equipment entering site. Equipment and tools not declared will become the *Employer's* property.

On completion of the project, all tools and equipment will be removed only with permission from the *Employer* on the applicable approved *Employer* documents.

#### 5.1.10 Equipment provided by the Employer

Not Applicable.

#### 5.1.11 Site services and facilities

Under no circumstances will the *Contractor* or his employees be allowed to connect up to any piped services or electrical supply without the permission of the *Project Manager* or his delegate.



#### **5.1.11.1 Supply of electricity**

The *Employer* as per this *Works* information shall provide a single point of supply (refer Electrical Design) No other connection is made to any other the permanent installation at the Power Station without the prior acceptance of the *Project Manager*.

No guarantees of power supply quality are given and power supply breaks of some duration may occur without warning. Planned outages are also a possibility. The *Contractor* makes arrangements at his own expense to improve continuity and quality of power where necessary for any reason and no claim of any nature relating to power failures is considered.

All electrical work will have a valid Certificate of Compliance (COC).

#### **5.1.11.2 Potable water**

A potable water supply is available at the plant. The *Contractor* is required to connect to this supply point for potable water requirements e.g., drinking purposes and supply to safety showers or eyewash stations. The current potable water supply available is approximately 210.4kPa through a 25mm hose pipe.

The *Employer* does not guarantee continuity of supply and in such cases; the *Contractor* shall make his own provision for standby supplies to maintain continuity. The variation of pressure in the water supply or breakdown in the supply shall not be considered to be valid for an extension of time or compensation.

#### **5.1.11.3 Compressed air**

The *Employer* does not provide compressed air. The *Contractor* is required to make provision for compressed air supply, should the *Contractor* require use of compressed air for the purpose of executing the *Works*.

#### **5.1.11.4 Roads**

All traffic is limited to using existing roads. The *Employer* shall recover any costs from the *Contractor* that is incurred from damage caused to underground services, structures, etc., as a result of the *Contractor* not using the prescribed routes.

#### **5.1.11.5 First aid and fire fighting**

The *Contractor* in cases of emergencies or accidents calls upon the services of the first aid and firefighting resources at Camden Power Station. Minor First Aid requirements should however, be provided by the *Contractor*. Should these prove to be inadequate, for example in the event of a major injury, the *Employer's* Medical Centre and facilities can then be used. However, the *Employer* shall be entitled to recover the reasonable costs incurred in respect thereof from the *Contractor*.

#### **5.1.11.6 Sanitary facilities**

The *Employer's* sanitary facilities are used as directed by the *Employer*.

#### **5.1.11.7 Telecommunications**

The telephone system is for the *Contractor's* own account. The *Employer* shall not recognize international mobile phones as a medium of communication.

#### **5.1.11.8 Barricading and Screens**

The *Contractor* will provide and install barricades and warning devices to ensure that equipment and persons are not exposed to danger or to prevent access to dangerous areas.

All welding, flame cutting and grinding work shall be properly screened to protect persons from any injury. All gratings shall be covered with adequate protective screening when welding or flame cutting in the vicinity to prevent falling sparks and welding slag.

#### 5.1.11.9 Mess facilities

There are no mess facilities available for the Contractor staff. .

#### 5.1.12 Facilities provided by the *Contractor*

Describe what the *Contractor* is to provide in the way of Site accommodation, laboratories, storage, vehicles and office equipment etc for the *Project Manager* and the *Supervisor*, and any restrictions or minimum requirements concerning the *Contractor's* own facilities. State requirements for facilities to be provided by the *Contractor* such as construction camps. Also state what happens to these facilities upon completion of the contract. Set out constraints, if any, as to the location by the *Contractor* of such facilities on the Site and requirements for drawings of Site facilities, as necessary.

#### 5.1.13 Existing premises, inspection of adjoining properties and checking work of Others

Details under this sub-paragraph are very contract specific and may be quite extensive in some cases. State requirements for the inspection with the owners of adjacent buildings and properties and representatives of local authorities before commencing with the *works* that have the potential to damage surrounding buildings and property. State whether *Contractor* is required to inspect the work of Others to which he is required to connect and if so by when to avoid delays to his work.

#### 5.1.14 Survey control and setting out of the *works*

Provide information on survey controls established by the *Employer*, if any, and state requirements for survey control and the setting out of the *works*.

#### 5.1.15 Excavations and associated water control

State any particular requirements for handling deep foundations and controlling water from excavations.

#### 5.1.16 Underground services, other existing services, cable and pipe trenches and covers

Describe known services making reference to drawings containing known services and state requirements for locating, marking and recording such services.  
State requirements for the treatment of existing services i.e. their termination, diversion or continued use, either temporarily or permanently, and set out the procedures relating thereto.  
State requirements, as necessary, for the use and availability of detection equipment for the location of underground services.  
State responsibility for damage to services, known and unknown, and requirements for working in close proximity to services etc.  
State requirements and reinstatement procedures for the notification and repair of damage to services and any penalties applicable to the damage of services.

#### 5.1.17 Control of noise, dust, water and waste

##### Waste and Refuse Management

**5.1.18 Sequences of construction or installation**

Only prescribe sequences of work where absolutely necessary such as when *Contractor* has to give access to Others (without take over) and for technical reasons such as under tidal conditions and in rivers.

**5.1.19 Giving notice of work to be covered up**

State the procedure for notifying the *Supervisor*

**5.1.20 Hook ups to existing works**

Refer to 3.1.2 Battery Limits

**5.2 Completion, testing, commissioning and correction of Defects**

**5.2.1 Work to be done by the Completion Date**

On or before the Completion Date the *Contractor* shall have done everything required to Provide the Works except for the work listed below which may be done after the Completion Date but in any case before the dates stated. The *Project Manager* cannot certify Completion until all the work except that listed below has been done and is also free of Defects which would have, in his opinion, prevented the *Employer* from using the *works* and Others from doing their work.

	Item of work	To be completed by
	As built drawings of the <i>Works</i>	Within 14 days after Completion
	Performance testing of the <i>Works</i> as specified in this <i>Works Information</i> .	See performance testing requirements.

**5.2.2 Use of the *works* before Completion has been certified**

Not applicable

**5.2.3 Materials facilities and samples for tests and inspections**

State what materials facilities and samples for tests and inspections the *Contractor* and the *Employer* are to provide, per core clause 40.2.

## 5.2.4 Commissioning

The Contractor's staff with the *Employer's* dedicated operations /commissioning staff shall do commissioning of the Works.

The *Contractor* submits a commissioning schedule and program for acceptance by the *Project Manager* within 4 weeks of contract award.

Before plant and equipment is placed in service, the *Contractor* certifies that it is in a suitable and safe condition. In addition, the *Contractor* provides a complete list of numbered schematic, wiring and cable diagrams which are a true record of the plant and equipment as installed and certifies that the *Works* has been wired in accordance with these diagrams.

Prior to the time when commissioning is to commence, the *Employer* will appoint a representative who will coordinate the commissioning of all plant and equipment forming an integral part of the system being commissioned. The *Contractor* is responsible for the commissioning of all the plant and equipment he/she is to supply to the requirements of this specification in conjunction with the *Employer's* representatives. Where various components are already in place, or are supplied by the *Employer* to form an integrated system, the *Contractor* at the time of commissioning, carries the responsibility for the correct functioning of the whole system.

In the event of incorrect functioning, the *Contractor* determines the cause and he/she corrects the defect if the defect is within Plant and Equipment of his/her own supply. The *Contractor* must assure himself/herself as to the safety of his/her own Plant and Equipment in respect of any particular commissioning test and in the event of damage accept responsibility for such Plant and Equipment.

The *Contractor* commissions the *Works* and ensures conformance to the *Employer's* performance requirements for the *Works*. The *Employer* takes over sections of the system as required once the Contractor has verified the system performance requirements.

### 5.2.4.1 Tests and Tests Certificates for Electrical Motors

The following Electrical tests shall be performed at the factory on the motors before it is delivered on site at Camden Power Station:

- Winding Insulation resistance
- Polarisation Index test
- Winding resistance test
- Uncoupled test run

Eskom, or its authorised representative, reserves the right to inspect the motor components and to witness type tests and routine tests where applicable. The supplier shall ascertain whether, and at what stages, inspection and witnessing is required by Eskom and shall then give Eskom not less than seven days' notice of when the inspection maybe undertaken. Motor's dispatched to site without the required inspection maybe returned at the supplier's cost on Eskom discretion. Routine tests shall be witnessed by Eskom and or an authority, independent of the supplier or contractor.

Before the delivery date of the motors, type, and routine certificates where applicable, shall be submitted for approval.

### 5.2.4.2 Tests and Tests Certificates for the Control Panel

The following routine tests shall be performed at the factory on the control panel in accordance with SANS 61439-1, before it is delivered on site at Camden Power Station:

#### 5.2.4.2.1 Construction

- Degree of protection of enclosure
- Clearances and creepage distance
- Protection against electric shocks and integrity of the protective circuits
- Internal electric circuits and connections
- Terminals for external conductors

#### 5.2.4.2.2. Performance

- Dielectric properties
- Wiring, operational performance and functionality tests

Functionality tests, correctness of wiring shall also be verified after the control panel has been erected and bolted into the final position before energizing. The wiring and the electrical installation must be certified by issuing of a CoC to confirm that the installation complies with *SANS 10142-1: The Wiring of Premises Part 1: Low-voltage installations*.

#### 5.2.5 Start-up procedures required to put the *works* into operation

Plant is to be put in operation only after safety clearance of all plant and systems and successful completion of functional testing.

Sign off will be scheduled as per the project schedule on completion of each activity.

#### 5.2.6 Take over procedures

Take-over / hand over will be scheduled as per completion once the plant has been successfully proven (performance tests completed successfully).

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

Clause 43.4 requires that the *Project Manager* arranges for the *Employer* to allow the *Contractor* access to and use of a part of the *works* which has been taken over if needed to correct a Defect. After the *works* have been put into operation, the *Employer* may require the *Contractor* to undertake certain procedures before such access can be granted (for example barricading a motorway or in a nuclear power station). Include these here.

#### 5.2.8 Performance tests after Completion

Acceptance tests shall be carried out to prove all the plant guarantee figures provided by the *Contractor* in the technical schedules once commissioning has been completed. This includes:

- Volume of pretreated water as per design
- Pretreated water turbidity as per design
- Projected operating production volumes before chemical cleans / cleaning cycles will be required
- Volume of water produced
- Volume of effluent produced as per design
- Quality of water produced as specified in this document
- Cleaning cycles and recirculation of out of spec water (streams) as per design
- Cleaning efficiency as per design
- The mobile plant availability of > 95%

The performance tests are conducted over a 72 hour continuous operation period. Where the results of the performance tests performed don't correlate with expected results (concentration values, flow rates, pressures etc.) and/or the control functions as per the operating philosophy do not meet the specifications guaranteed, the *Contractor*, at his own expense, carries out all necessary adjustments and modifications to the *Works* required to obtain the stated tolerances. Fully detailed proposals are submitted in writing to the *Project Manager* for approval before any adjustments, modifications are made, and work in this respect is carried out when convenient to the *Employer*. All adjustments and modifications are subject to inspection and approval by the *Employer*.

When adjustments and modifications are completed, the *Contractor* advises the *Project Manager* in writing to this effect and applies for a further acceptance test. From the results obtained, and if the *Project Manager* is satisfied that it will be lasting, the *Works* will be finally accepted by the *Employer*.

Where tests cannot be conducted during the first 72 hours continuous period, the acceptance test will be performed during the first time the activity takes place, for e.g. cleaning cycles and cleaning efficiency. These shall be clearly reflected in the performance assessment report.

### 5.2.9 Training and technology transfer

The *Contractor* is to provide training to the operating staff, maintenance and engineering departments of the *Employer*. This includes chemical, mechanical, electrical and C&I disciplines. All Operating & Maintenance requirements to be included in the training manuals.

### 5.2.10 Operational maintenance after Completion

#### Requirements for the provision of operations and maintenance Services after Completion

The operations and maintenance contract portion of the *Works* commences once successful hot commissioning, performance testing, correction of defects and handover of the plant has taken place. The operations and maintenance scope is inclusive of all interfaces with the *Employer's* WTP.

The *Contractor* provides operating and maintenance personnel and resources for the duration of the contract.

The *Contractor* provides transport and accommodation for their people.

The *Contractor* provides PPE for personnel, office consumables, etc.

#### 5.2.10.1 Plant Performance Penalties

a) The *Contractor* will only be paid for the volume of total water produced.

b) The *Contractor* will not be penalised if the *Employer* causes loss of production. The minimum production volume will be used for payment.

c) The mobile plant output water quality shall be maintained by the *Contractor* as specified in the *Works*. In an event where the quality of the final water produced is out-of-specification, the water shall be recycled through the mobile plant and thus no production for that period of recycling will be valid. The water produced will be deemed as the volume of water recovered

The key performance indicators requirements are consolidated in table 3.

KPI	Requirement	Source of Evidence
Volume of water produced	As per accepted design	Plant logs and DCS reports
Overtime management	≤5% of contract labour cost	
Number of out of specification per month without corrective action	zero	Analysis sheets and DCS reports
Plant breakdowns due to <i>Contractor</i> negligence	zero	Investigation report
Instrument breakdown due to <i>Contractor</i> negligence	zero	Investigation report
LIMS (WTP) Management	Results recorded on LIMS daily	LIMS monthly report

**Table 4 Key Performance Indicators for the Mobile Plant**

Failure to meet any of the key performance indicators will result in 5 % deduction of the total monthly payment of the *Contractor*.

Where plant breakdowns, equipment and instrument damage is incurred because of negligence on the *Contractor's* side and the cost of repair or replacement exceeds the 5% penalty fee, the cost of repair or replacement shall be recovered from the *Contractor* or shall be for the *Contractor's* account. Replacement will always be one on one (replace with same specification).

Further, any downtime for cleaning activities and maintenance leading to production losses as a result of the *Contractor's* personnel having not met the KPIs or failed to do their duties as prescribed in this scope, will result in the 5% penalty being applied. Investigation reports shall serve as evidence in such instances.

The *Contractor* shall be duly notified of incidents within two days of occurrence and shall receive an investigation report where applicable within 4 – 6 weeks of date of occurrence. This allows for the *Employer* to receive investigation reports from external suppliers where use of such is employed.

#### **5.2.10.2 Reporting requirements during operational period**

The CSM shall be immediately notified when any part of the mobile system becomes unavailable and is required to be removed from service.

Continuous communication between the operator of the mobile plant and the Chemical Services operator of the installed desalination trains is critical. Prior to performing any activities on the mobile plant, consultation with the WTP operator must be conducted

The Chemical Services Laboratory at an agreed frequency shall verify all samples taken by the operator of the mobile plant. Sampling and reporting of the water quality across the train shall be conducted

Detailed weekly reports should include (every Monday):

- Interpretation of plant performance (qualities of all streams, volumes of all streams, plant availability, run length, backwash efficiency, cleaning efficiency, etc.)
- Defects raised and maintenance activities performed
- Quantity of water treated and produced (full water balance across the mobile plant)
- Summary of log sheets
- Chemical consumption log sheet and chemical stock levels
- Highlight any general issue that may affect continuous operation or performance of the plant.

Monthly report should include (third working day of the new month):

- Consolidated report of weekly activities
- Final treated volume recovered as per the valid meter reading certificate (per train and overall)
- Highlight any general issue that may affect continuous operation or performance of the plant.
- Trending of the filtration and ion exchange system regarding actual performance vs design, chemical consumption, backwash efficiency, regeneration efficiency, water quality produced, etc.)

All communication pertaining to this contract shall be in the form of properly compiled letters or forms attached to emails.

Any verbal communication shall be followed up with a written communication within two working days. All communication shall be in English and shall be properly numbered. It shall indicate the source, recipient, contact details of both parties, the contract number, communication number/reference and the date.

### 5.2.10.3 General scope requirements

- a. The *Contractor* is required to conduct the plant classification according to the design and ensure that the *Works* operators and operating staff comply with the requirements as promulgated under Water Affairs Regulation 17. A copy of the plant classification must be submitted to the *Employer*.
- b. Liaison meetings shall be held with the *Employer's* Representative or his/her delegate on a weekly basis to discuss any technical details or concerns. The *Employer* can call Adhoc meeting as and when required to address any issues pertaining to this contract.
- c. Analysis shall be carried out in accordance with work instructions, methods, procedures, standards and guidelines prescribed by the *Employer* and corrective actions must be taken immediately.
- d. The *Contractor* shall ensure that results are recorded on analyses sheets and submitted to the *Employer*
- e. The *Contractor* shall ensure that the work area is left in same or better state on completion of any work, good housekeeping shall be maintained on all areas of the plant all the time, before, during and after work
- f. All instrumentation, on-line analysers and equipment must be maintained and calibrated according to quality control system (QCS) proposed in the instrument OEM manual and approved by the *Employer*.
- g. The chemical on-line analysers shall be managed in accordance with 240-139753164 (Online Chemical Monitoring Systems Analyser Responsibility Matrix Guideline)
- h. Quality Control Standards must be checked on every instrument before use. If the QC is above or below by a margin of 5 the instrument must be calibrated and QC checked to verify instrument reliability and availability
- i. Instrument files must be put in place. These files are updated every Monday (as a minimum) and kept current.

### 5.2.10.4 Plant Personnel Requirements:

The *Contractor* must submit an organogram of all the personnel involved in operation of plant during the O&M contracting period, indicating numbers and qualifications. The *Contractor* should comply to the following regulations in terms of personnel requirements for operating and maintenance of the *Works*: "Regulations relating to compulsory national standards for process controllers and water services *Works* regulation number 813 dated 23 October 2013 Schedule 2".

All personnel registrations with the Department of Human Settlement, Water and Sanitation (DHSWS) should be performed by the *Contractor* and should be specific for the *Works* and valid for the entire duration of the contracting period. These registrations should be done prior to any commissioning activities.

As a minimum, each operating shift shall consist of a process controller and a senior plant operator. The operating personnel should have at least 3 years WTP/industrial water treatment experience.

It is a requirement that the control desk is manned 24/7. The controller/assistant shift supervisor (ASS) is responsible to ensure that the desk is manned at all times.

### 5.2.10.5 *Contractor's* management of his personnel

- a. All personnel shall comply with specified PPE requirements for all plant areas and operations and shall report any unsafe condition to the supervisor or in his absence, shall report to the Eskom safety officer and/or the CSM or his/her delegate.
- b. The number, duties, training, qualifications and compulsory medical examination of personnel employed at the Mobile Desalination Plant shall be in accordance with the requirement of the Plant registration certificate (Class C) and the requirements stated in this document.
- c. The *Employer* may have stated reasons to instruct the *Contractor* to remove any person from the Contract /Site.

The *Contractor* arranges and ensures that after a one day of receiving the instruction to remove any person, the person has no further responsibilities with the work included in this contract. The *Employer* shall not pay the *Contractor* for the services of the affected personnel from the day of the *Contractor* receiving the instruction.



Failure to comply with the instruction to remove any key person from site shall be a breach in contract and shall result in termination of the contract.

- a) The *Contractor* ensures that all staff being brought to Camden Power Station has a valid medical screening and fitness certificate based on the WTP man job specification. The *Employer* shall provide the *Contractor* with the man job specification.
- b) The *Contractor* must ensure that his personnel are in possession of a valid National driver's licence and Eskom driver's permit.
- c) The *Contractor* provide his own transport and accommodation for personnel
- d) The *Contractor* pays the telephone accounts for the telephones provided by the *Employer* for the Mobile Plant (personal calls). The *Employer* shall provide a telephone for work purposes for the duration of the contract.
- e) All staff brought onto site in connection with this work scope of work should be able to fluently speak and write in English and have computer skills.
- f) Proof of qualification to be supplied for all personnel when requested by the Employer.
- g) The *Contractor* shall adhere to all provisions within the National Water Act No 36 of 1998 and the National Environmental Waste Act No 59 of 2008.
- h) All the *Works* will be subject to anytime inspection from by the *Employer* at any point in time.
- i) Damage to the Mobile Desalination Plant facilities/properties, which can be clearly attributed to negligence on the Contractor, shall be for the *Contractor's* account.
- j) The *Contractor* shall record all as found conditions (state of plant, including defective equipment), outstanding corrective actions and the condition of the measuring and testing equipment.
- k) The *Contractor* shall ensure that each shift has a full staff complement at all times.
- l) The *Contractor* shall inform the *Employer* in advance of all approved leave (annual leave, sick leave, etc.) of his personnel and the arrangements for cover for the duration of the approved leave of said personnel.
- m) The *Contractor* ensures that each shift has authorised personnel for PSR (AP) and forklift driver within 6 months of contract start date.

#### **5.2.10.6 Plant Maintenance Requirements**

The *Contractor* shall provide qualified and competent maintenance personnel to conduct all disciplines of maintenance work required on the plant (i.e. mechanical, electrical, instrumentation and control & automation). A list of competencies / qualifications of these individuals is to be provided to the *Employer* prior to the commencement of work on site.

#### **5.2.10.7 Corrective Maintenance Interventions**

- a) It is the responsibility of the *Contractor's* operations team to highlight all plant defects as and when they occur.
- b) Once a plant defect is noticed, the Project Manager is to be immediately notified by the operator
- c) The *Contractor's* operations team is to safeguard the plant to prevent any further plant damage.
- d) Should it be required for the Eskom Battery Limits/ tie-ins to be isolated (mechanical or electrical) permit applications will be applied for by the relevant Responsible Person (RP) at the respective Eskom maintenance department.
- e) Once the permit has been issued, work can commence by the *Contractor's* personnel in assessing and rectifying the defect.
- f) Any defect, which may affect overall plant production or result in plant downtime must be assessed within two (2) hours of the occurrence, irrespective of time of day. An action plan is to be formulated and defect correction duration is to be discussed and agreed with the Employer before the work commences.
- g) All tools required to carry out the corrective maintenance action, shall be provided by the *Contractor*.
- h) The onus will fall on the *Contractor* to source, provide and install the relevant spares to execute the maintenance work.
- i) All spares required to carry out piping leak repairs or replacement must be provided for by the *Contractor*, including site installation.

- j) In the event where the ion exchange resin replacement is required, the *Contractor* shall provide the services of competent personnel to carry out such services. Any deviations found in the final water qualities from expected design conditions will need to be immediately rectified and the mobile desalination train retested. This will ensure the desired water qualities are achieved post media/consumable replacement.
- k) A detailed record (maintenance action, durations, permits issued, utilities utilised, etc.) of all corrective maintenance activities shall be kept by the *Contractor* and must be produced when requested upon by the *Employer*.

#### **5.2.10.8 Preventive maintenance**

All preventive maintenance for all plant equipment and components shall be carried out in accordance with the maintenance philosophy.

All PM's shall be scheduled on SAP and signed off as and when they are completed. Records of PM's executed shall be kept on files.

#### **5.2.10.9 LIMITED ACCESS REGISTER (LAR)**

- a) The LAR is for the person in charge of the plant to maintain control over activities taking place on his plant that are not covered by the Plant Safety Regulation and Operating Regulations for High Voltage Systems.
- b) Activities that are allowed to be carried out under the LAR must not require a permit and must satisfy the following criteria:
  - They must not involve danger to the person carrying out the activity;
  - No plant isolations must be required;
  - The activity must be performed by a skilled person and there must be no risk of a production loss;
  - The duration of the activity must be less than 24 hours.
- c) The Supervisor accompanies the *Contractor* during the first instances of working under a LAR on a specific plant area.
- d) It is very important that the person who plans to do an activity on a plant under the LAR inform the person in charge of the plant of what will be done.
- e) This means verbally telling the person in charge of the plant what will be done and not just signing the LAR book. The *Contractor* is also responsible for signing the LAR book.
- t) It is also important that as soon as the activity is completed the person, who was doing the activity, notify (verbally) the person in charge of the plant that conditions are back to normal and that the LAR has been signed off. Just signing the LAR book is not sufficient.

## 6 Plant and Materials standards and workmanship

This section of the Works Information contains all the specifications for the work which is left behind; the permanent works. It is likely to be the largest section by far and may even be compiled in volumes, e. g. Section 6 Volume 1: Civil Engineering Works. In design and construct contracts, it may be compiled in accordance with systems within the *works*; e. g. Section 6 Volume 4: Crushers.

Because practice varies widely between employers it is not practical in a general template such as this to deal with all arrangements. Only the discipline based section subheadings are provided below in the order the *works* are likely to be constructed together with some notes of a general nature.

### 6.1 Investigation, survey and Site clearance

Some contracts may require the *Contractor* to carry out further investigation of existing facilities or of the Site before commencing final design. There could be constraints on Site clearance especially in pipeline or transmission grid servitudes.

### 6.2 Building works

Reference could be made to the latest Model Trade Preambles published by the Association of South African Quantity Surveyors. However these have been developed for use with the JBCC series of contracts and an approach where description of the work is made part of the bill of quantities, which is not the case in other forms of contract. Only parts of the Model Trade Preambles could be referenced by an ECC contract, with a covering note dealing with the changes in terminology. Further changes are required depending on which parts are to be selected.

This subsection would typically comprise

- a) Particular specifications provided by the *Employer*
- b) List of standardised specifications applicable to the *works* and
- c) Variations to the standardised specifications

### 6.3 Civil engineering and structural works

- a) SANS 10400 - Application of the National Building Regulations
- b) BS5531:1988 Code of Practice for Safety in Erecting Structural Frames

### 6.4 Electrical & mechanical engineering works

#### Electrical Standards

- a) 240-150642762: Generation Plant Safety Regulations
- b) SANS 10142-1: The wiring of premises Part 1: Low-voltage installations
- c) 240-56227516: LV Switchgear and Control Gear Assemblies and Associated Equipment for Voltage up to and Including 1000V AC and 1500V Standard
- d) 240-115583001: LV Switchgear Schedule A and B Template
- e) 240-56227443 - Requirements for Control and Power Cables for Power Stations Standard
- f) 240-56176097: Electrical Cable Schedule Template
- g) 0.00/1310: Eskom Standard Code for Power and control cables

- h) 240-56356396: Earthing and Lightning Protection Standard
- i) 054-393: Earthing Standards
- j) 240-55714363: Coal Fired Power Stations Lighting and Small Power Installation Standard
- k) 240-57617975 :Procurement of Power Station Low Voltage Electric Motors Specification Standard
- l) 240-56178825: New Low Voltage Motors Procurement Standard
- m) 240-77100923: New LV Motor Technical Schedule AB Template
- n) 240-56361435 :Transport of Power Station Electric Motors Standard
- o) SANS IEC 60034-1: Rotating Electrical Machines: Part 1 Rating and Performance
- p) 240-56227927: Electrical Load List Template

### **Mechanical Standards**

- a) 32-632: Requirements for Non-Destructive Testing (NDT) on Eskom Plant
- b) 240-56241933: Control of Plant Construction, Repair and Maintenance Welding Activities
- c) 240-56355225: Welding of High Pressure, Temperature Tube and pipework
- d) 240-56246601: Personnel and Entities Performing Welding Related Special Processes on the Employer's Plant
- e) SANS 1091: National colour standards of paint
- f) SANS 10140: Identification colour markings
- g) SABS BS 4994 (1987:1) - Design and construction of vessels and tanks in reinforced plastics
- h) 240-123801640 Standard for Low Pressure Pipelines
- i) 240-101712128 Standard for the Internal Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with Linings
- j) 240-106365693 Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings
- k) 240-106628253 Standard for Welding Requirements on Eskom Plant
- l) 240-150642762: Generation Plant Safety Regulations

## **6.5 Process control and IT works**

These specifications are usually project specific and developed by the *Employer* to suit his operations. Either include these specifications here, or refer to them in attached Annexure.

Check the specifications for inconsistencies in terminology and that they do not contain any provisions already dealt with in the chosen NEC *conditions of contract* or clash with them in any way.

### **Control and Instrumentation**

- a) 240-56227443: Requirements for Control and Power Cables for Power Station Standard
- b) IEC62381 Acceptance Testing
- c) 240-129014618 Generation Cyber Security Compliance Guideline
- d) 240-56355754 Field Equipment Installation Standard
- e) 240-56355731 Environmental Conditions for Process Control Equipment Used at Power Stations Standard
- f) 240-56355728 Human Machine Interface Design Requirements Standard
- g) 240-56355910 Management of Plant Software Standard

- h) 240-61379755 Control & Instrumentation Drive & Actuator Schedule Template
- i) 240-61379718 Control & Instrumentation Instrument Schedule Template
- j) 240-72345357 24 VDC Load Schedule Consumer Per Battery Charger Template
- k) 240-72350241 C&I Hardwired Signal List for External Signal Exchange Template
- l) 240-72351455 C&I Typical Loop Wiring Diagram Template
- m) 240-85521112 C&I Documentation Requirements from Vendors Template
- n) 240-61532190: C&I Cabling, Earthing and Racking
- o) 240-56355815: Junction Boxes and Cable Termination Standard
- p) 240-56355888: Temperature Measurement Systems Installation Standard

## **6.6 Chemistry Standards**

- a) Eskom Guideline 240-139753164: Online Chemical Monitoring Systems Analyser Responsibility Matrix Guideline
- b) United Nations, ST/SG/AC.10/30, Globally Harmonized System of Classification and Labelling of Chemicals (GHS)
- c) Eskom Standard 240-162589999 Chemistry Standard for Wastewater Sampling and Analysis

## **6.7 Other**

- a) Plant Labelling Specification: Drawing 24.57-46945
- b) Occupational, Health and Safety, Act Number 85 of 1993
- c) 240-49230111: Hazard and Operability Analysis (HAZOP) Guideline (Rev 1)
- d) 240-30008949: Safety, Health and Environmental Specifications for Contractors
- e) 240-105658000 Supplier Quality Management Specification (QM 58)
- f) 240-28463367: SHE Organization
- g) 240-62196227: Life Saving Rules



## **C3.2 *CONTRACTOR'S WORKS INFORMATION***

This section of the Works Information will always be contract specific depending on the nature of the *works*. It is most likely to be required for design and construct contracts where the tendering contractor will have proposed specifications and schedules for items of Plant and Materials and workmanship, which once accepted by the *Employer* prior to award of contract now become obligations of the *Contractor* per core clause 20.1.

Typical sub headings could be

- a) *Contractor's design*
- b) Plant and Materials specifications and schedules
- c) Other

This section could also be compiled as a separate file.

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