DGI Consulting

NAIDU CONSULTING

ETHEKWINI MUNICIPALITY

PROJECT PARTICULAR SPECIFICATION: ELECTRICAL, CONTROL & INSTRUMENTATION

PS ECI

TRENANCE 3 RESERVOIR, ELEVATED TANK AND PUMP STATION

Contract No. 32269-5W

Rev 1

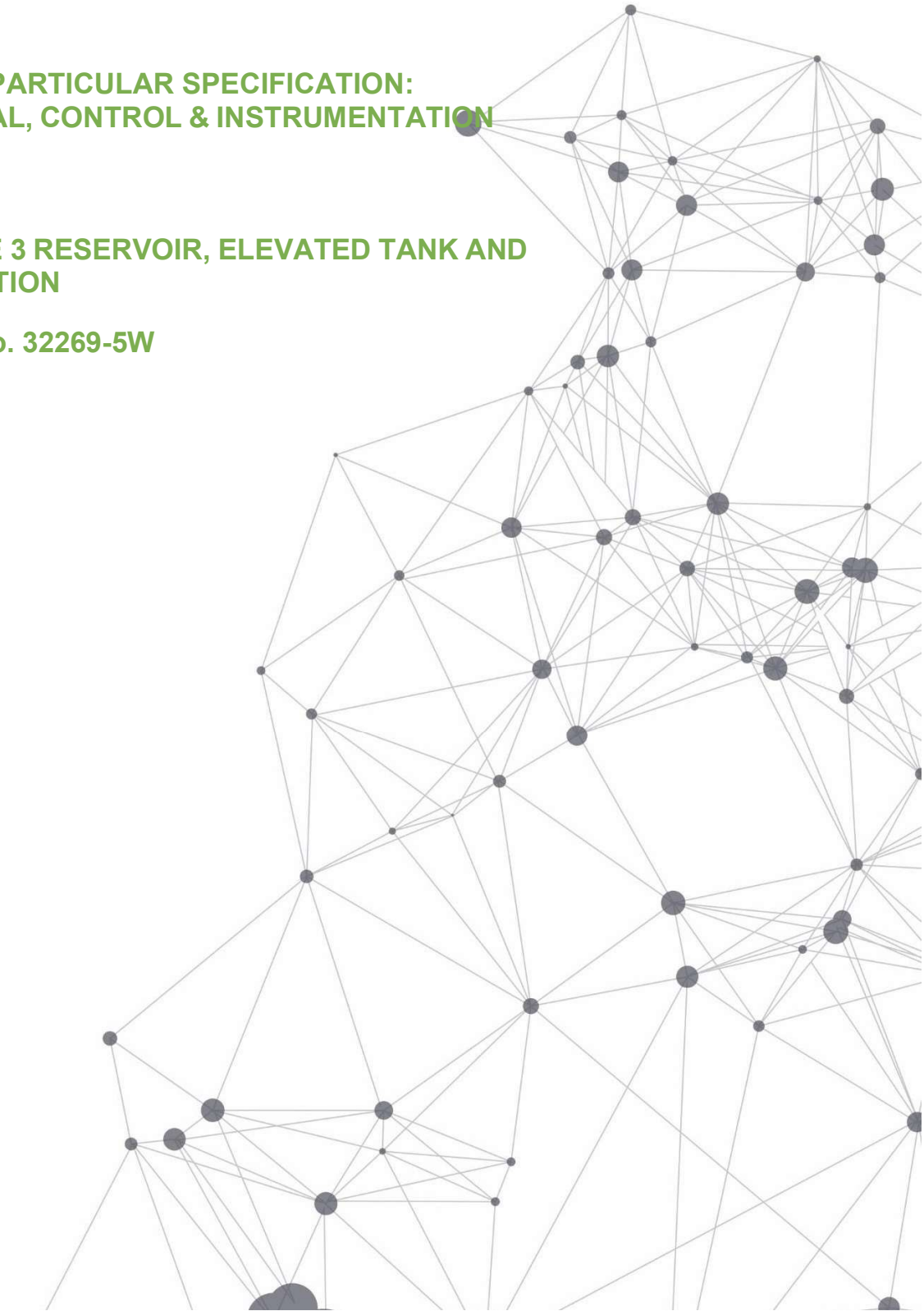

TABLE OF CONTENTS

Page

PREAMBLE

This Project Specification forms an integral part of the contract and supplements the Standard eThekwini Electrical and Instrumentation Specifications where relevant.

In the event of any discrepancy between a part or parts of the Standard or Particular Specifications and the Project Specification, the Project Specification shall take precedence. In the event of a discrepancy between the Specifications, (including the Project Specifications) and the drawings and / or the Bill of Quantities, the discrepancy shall be resolved by the Engineer before the execution of the work under the relevant item.

PS ECI 1 GENERAL

One motor control panel, telemetry and electrical installations are required for the pump station, reservoirs and elevated tank at Trenance 3. The pumps draw water from the on site reservoir/s and pump to the elevated steel tank feeding the high level zone.

Standalone telemetry systems are required for the site for the control of the pumping systems and for level monitoring of reservoirs and elevated tank levels.

PS ECI 2 PROJECT DESCRIPTION AND SCOPE OF CONTRACT

PS ECI 2.1 BACKGROUND AND SITE

Water to the Trenance 3 Pump Station will be fed from the new and existing reservoir outlets via gravity interlinked pipelines. Electronic mag flow meters will be installed on the gravity supply inlets to the existing and new reservoirs as per the specifications. Flow meters will also be installed on the outlets to the reservoirs and elevated tank

A new elevated steel tank will be constructed at the Trenance 3 reservoir site. Two pumps will be installed in the pump station, one duty and the other stand-by. They will draw water from the on-site reservoirs and pump to the on-site elevated tank for the high level draw off system.

The pumps will be automatically operated via level call signals from the elevated tank.

PS ECI 2.2 ELECTRICAL, INSTRUMENTATION & MECHANICAL REGULATIONS, STANDARDS AND SPECIFICATIONS

The design and installation of the electrical, control and instrumentation work shall conform to the following regulations, standards, and specifications:

PS ECI 2.2.1 Standards & Regulations:

a) SANS 10142 - 1 & 2: “Codes of practice for the wiring of premises” as amended.
b) SANS 10400: “The application of the National Building Regulations” as amended.
c) SANS 60439 - Parts 1 & 2 LV Switchgear and Control Assembly.
d) SANS 1765 and SANS 60947 - Low Voltage Switchgear and Control Gear Assemblies, Contactors and Motor Starters.
e) SANS 1973-1,3 - Low Voltage Distribution Boards and Control Gear Assemblies.
f) IEEE519 - Standard for Harmonic Control in Electrical Power Systems.
g) SANS 10199 - The Design and Installation of an Earth Electrode as amended.
h) SANS 10313 - The Protection of Structures against Lightning.
i) IEC62305 - Lightning Protection.
j) The Occupational Health and Safety Act (85 of 1993) as amended and contingent regulations and including the following :
    - Electrical Machinery Regulations ; latest amendment
    - Driven Machinery Regulations ; 2015 latest amendment
k) The regulations and standards of eThekwini Municipality.
l) Applicable NRS and SANS codes for electrical equipment.
m) BS or IEC codes where South African codes are non-existent.
n) Local or eThekwini Municipal Electrical Department standards and regulations.
o) Government and local authority’s ordinances or other supply authority governing its use.
p) Any other applicable by-laws or local authority by-law and amendments.
q) Eskom standards and regulations where applicable.
r) The regulations and standards as described under the relevant sections in the Standard Specifications.

The following eThekwini Municipality Standard Specifications shall apply and take precedence over all other specifications:

a) eThekwini Municipality - MSS : Mechanical Standard Specification _Ver 2 (Aug 2023)

b) eThekwini Municipality PLC_Specification_Rev06.
c) eThekwini Municipality Telemetry and Instrument Install Specification_Rev01.
d) eThekwini Municipality Quality Control Specification_Rev03.
e) EWS Standard Electrical Specifications, 19.05.2020: GS1 - Standard Specifications for DB's and Motor Control Centres.
f) Commissioning _ Fat Forms 19112020 Test Reports FAT Combined.
g) EWS List of Preferred Instrumentation Equipment 7.

PS ECI 2.3 SCOPE OF CONTRACT

This electrical contract comprises the design, supply, manufacture, delivery, testing and commissioning and guarantee of the following:

PS ECI 2.3.1 TRENANCE 3 Pump Station and MCC 01 (MCC & VSD To Comply With IEEE 519)

a) New motor control panel for two horizontal single stage axially split volute casing pumps to supply the elevated tank for the high level supply zone.
The MCC and VSD installation shall comply with IEEE 519.
b) Separate wall mounted VSDs for the two pumps
c) Include a harmonic study of the installation since VSDs will be used for all starters. VSD filters must be installed if the installation does not comply with IEEE 519.Perform power quality tests and confirm that there are no electrical interferences outside the limits of IEEE and NRS codes are present.
d) New batteries for the UPS section incorporated into the MCC
e) Design and submission of the MCC drawings prior to any panel construction work commencing
f) PLC and HMI as per EWS specifications. ReferPLC_Specification_Rev06
g) Cabling from the MCC to the new externally mounted VSDs
h) Separate motor junction boxes for motor power cabling and sensors/instruments cabling installed locally at the motor for ease of disconnection
i) Cabling and cable support systems from the MCC/VSD to the motor junction boxes for power to motors and instrumentation
j) New motor cable termination junction boxes at the pump motors
k) Cabling and cable support systems for instrumentation equipment including low level float switches, no flow switches, pressure sensors and level instruments in the reservoirs and elevated tank.
l) Instrumentation including no flow switches on the delivery pipework of each pump and PT100 thermistors for the pumps and motors
m) Reservoir (3 in series) low level floats with stainless steel chain and weights. Floats and weights must not contain mercury or lead or other un-safe products used in potable water.
n) Ultrasonic level sensor and transmitters in the on-site reservoirs (3 No) and elevated tank
o) Power supply to the new MCC at the pump station.
p) Earthing of the complete electrical installation of the MCC and associated electrical installation and pumps. Separate earth wires are to be installed from the MCC to the VSDs and to the motors.
q) Lightning protection and earthing to the pump station, reservoirs and elevated tank
r) Application for an upgrade of the power supply to the pump station
s) Liaison with Ethekwini Electricity for the electricity supply isolation and facilitate connection of the new MCC to the supply network
t) Metering from Durban Electricity
u) Cabling from the electricity meter to the new MCC
v) Refurbishment of the existing stand-by diesel generator
w) New cabling from the stand-by generator change over panel to the new MCC
x) New lighting and small power points in the pump station including light fittings
y) Submit a preliminary schedule showing all tasks leading up to final commissioning within the stipulated timelines
z) Supply 5 hard copies and 5 soft copies of the O & M manuals consisting of datasheets of all equipment, drawings and PLC program (electronic and printed

copies). The PLC programs shall be the property of EWS.

aa) The electrical installation with testing and commissioning to comply to SANS10142.
bb) Issuing of the Electrical Certificate of Compliance (COC)
cc) Cabling and connecting up the ultrasonic flow meter on the delivery main of the two pumping systems (flow meters supplied and installed by the civil contractor)
dd) Telemetry system as indicated and integration to the SCADA system at EWS Control Room
ee) Integrating the MCC to new Telemetry system including the new mag flow meter which are to be installed under the civil works

PS ECI 2.3.2 EXISTING PUMP STATION & EQUIPMENT

a) Disconnect and remove the existing MCC from the existing concrete tower and deliver to EWS stores in Springfield
b) Disconnect and remove the existing telemetry equipment and deliver to EWS stores in Springfield
c) Disconnect and remove the existing instruments (level sensors, flow meters etc) and deliver to EWS stores in Springfield
d) Disconnect and remove the existing generator change over panel from the existing concrete tower and store for re-use. To be installed in existing generator control panel.
e) Disconnect and remove the existing cabling systems, lighting and power outlets from the existing concreter tower and deliver to EWS stores in Springfield

PS ECI 2.3.3 TECHNICAL DATA

Background

For the pump station, the pumps specified for each system consists of two horizontal single stage axially split volute casing pump sets, tested and factory approved at the contractor's or supplier's stores. The pumps will be installed in the new pump stations and deliver potable water through a rising main to the steel elevated tank.

Of the pump system to be installed, under the normal conditions only one pump will be operating as the duty pump, the second pump acting as a standby.

The pumps require an electrical panel to control the new pump operating philosophy. The pumps and pipework will be supplied and installed by others.

The pump sets shall be capable of pumping potable water without solid particles or fibres.

PS ECI 2.3.3.1 Trenance 3 Pump

The horizontal single stage axially split volute casing pumps specified are rated at a flow of 374,00m³/hr at a head of 19,7m and is model KSB Omega 150-290B or similar and equall approved and is to be supplied complete with 37kW WEG motors or similar and equal approved. Refer to mechanical pump specifications for final pumps selected and specified.

The pump casing is manufactured of cast iron with 316 stainless impellor and shaft sleeve. The motor shall be IP55 cast iron min IE3 TEFC W22 premium efficiency with 37kW 3 phase 400 V 50 Hz 1470 RPM motor and shall be designed and wired for VSD starting. The motor power cables must be terminated in separate suitably sized cable junction box with links for termination of power cables.

Motors and Pump Sensors

All the motors are to be fitted with PT100 Temp Sensors including DE and NDE bearing temperature sensors. The PT100 sensors are to be connected individually to a temperature transmitter or the analogue expansion card of the PLC.

Anti-condensate heaters are to be fitted to the motors.

The pumps are to be fitted with DE & NDE bearing PT100 temperature sensors and pump casing temperature sensors. The EWS C & I team is to confirm whether the transmitters are local and whether the output is RTD or 4-20mA.

The above must be catered for by the contractor in the control circuitry.

PS ECI 2.4 TRENANCE 3 PUMP STATION

PS ECI 2.4.1 400 Volt MCC01 For Trenance 3 Pumps (To Comply With IEEE 519)

General

The MCC design shall be undertaken by personnel who are able to demonstrate experience in the field of water treatment and pumping plant including PLC control and telemetry systems. The motor control panel components and installation methods and associated electrics shall comply strictly to the Ethekwini Water standards and requirements all as specified in the detailed specification or elsewhere in the general specification. All equipment shall comply with the requirements of the EWS Standard Specifications included with this tender enquiry. Power shall be taken from the Ethekwini Electricity metering panel.

The MCC shall be floor mounted with 300mm-500mm high steel pedestals and fitted within the pump room and generally in accordance with the Standard Specification. The panel shall be manufactured from 3CR12 material. The panel shall be designed for 2 off feeders for externally wall mounted VSD starters and control equipment.
The installation of the MCC, VSD and requirements for harmonic filters and chokes shall comply with IEEE 519.

The contractor is to include a harmonic study of the installation since VSDs will be used for all
starters. Filters must be installed if the installation does not comply with IEEE 519.

The contractor is to also perform power quality tests and confirm that there are no electrical
interferences outside the limits of IEEE and NRS codes are present.

The harmonic study, power quality tests and installation of filters and chokes must be included in the
tender prices.

The panel shall comprise the following):

PS ECI 2.4.1.1 Panel No. 1 – Incomer

<u>This panel shall contain</u>:

One set of suitable sized three phase and neutral copper bus bars complete with support insulators in accordance with the Standard Ethekwini Specification. One substantial copper earthing bar complete with sufficient number of studs or bolts, nuts, and washers for the incoming and outgoing earth conductors.

One 250 Amp 400 Volts or suitably rated triple pole switch with LSIG ETU protection and shall be compliant with type 2 co-ordination. All live parts of the switch shall be shrouded to prevent inadvertent contact by maintenance personnel.
3 No. HRC Voltmeter fuses
3 No. Current transformers
1 No. Power meter Allen Bradley PM5000 with facilities for phase / phase / neutral voltages and
current on all 3 phases. To include frequency, THDi & THDv.

1 No. Set fuses with mains and phase failure relays incorporating phase loss, phase reversal, under
voltage, over voltage and phase imbalance
4 No. Surge arresters as specified in the Standard Specification

PS ECI 2.4.1.2 Panel No. 2

Distribution and Domestic:

This panel shall be equipped with suitably rated 60 Amp TP main switch isolator with 3 phase HRC fuses to feed the following station lighting, plugs and distribution to comply with SANS10142:

Domestic:
3 No. 10Amp SP MCB for station lighting
1 No. 63Amp/30mA DP earth leakage circuit breaker for plug circuits
2 No. 20Amp SP MCB for socket outlets
1 No. 5Amp SP CB for photocell for external light circuit
1 No. 5Amp By-pass switch to control external light
1 No. 5Amp SP MCB for power supply to telemetry equipment
1 No. 10Amp SP MCB for power supply to flow meter
1 No. 30Amp TP MCB (welding socket outlet)
2 No. 5Amp TP CB with DOL contactors and stop/start push buttons with run/stop/trip indication
lights for extract fan circuits
2 No. Surge arrestors application dependant (type 2 or similar) for power supply to telemetry cubicle and flow meter as specified

Control Transformer :
Suitably Rated Control Voltage Transformer (3 kVA or similar)
6 No. Suitably rated SP MCBs for power supply to flow meters, pressure transducer, level sensors,other sensors and spares etc
Suitable surge arrestors for power supply to telemetry cubicle, flow meters and other instruments etc as specified

Make allowance and space for future spare ways. A typed legend card must be installed in the DB compartment.
Domestic DB

PS ECI 2.4.1.3 Panel No. 3 - Trenance 3 Pump 1

400 Volt VSD Feeder Panel for 37 kW VSD for Pump No. 1 (Horizontal single stage axially split volute casing pump)

The panel shall be generally as described in the Standard Specification and shall have padlock or fuse pad lockable and contain:
1 No. Suitably rated triple pole fuse switch isolator mechanically interlocked with the panel door. All Live parts shall be fully shrouded.
1 No. HRC control fuse
1 No. Control link
1 No. 400V VSD Feeder Motor Protection Breaker for 37 kW VSD or similar approved to eThekwini standards
(Note : The 37 kW 400 Volt VSD is to be externally wall mounted separately with a IP54 or better IP rating for dust and moisture prevention. The VSD is to be priced separately)
1 No Suitably rated control voltage transformer with supply to motor heaters
1 No Manual/Auto/Off selector switch
2 No Manual stop/start buttons
1 Set Power on / run / trip & inhibit indicator lights (4 off)
1 No. Suitably rated ammeter with 96mm dial and current transformer
1 Set Motor 230V heater power and control circuit
1 Set Control equipment, telemetry/PLC relays, contacts, etc. to automatically start, stop, trip and protect the pump from dry run no flow, low suction pressure and reservoir low level protection as described in the control section.
Sets of controls wired to PLC for pump and motor temperature protection (built in

temperature sensor fitted with the pump and motor). The motor shall be fitted with PT100 winding temperature sensors and the pump casing shall be fitted with PT100 temperature sensors and DE & NDE PT100 bearing temperature sensors for the pump and motors. The pumps shall also be fitted with casing vibration sensors
Set of controls wired to PLC to trip the pumps in the event of low pressure on the suction side of the pumps.
1 Set Circuitry for emergency stop
1 Set 3 phase links for the VSD supply

This panel shall be labelled “Pump No. 1”

PS ECI 2.4.1.4 Panel No. 4 - Trenance 3 Pump 2

Feeder Motor Protection Breaker for 37kW 400 Volt VSD Starter for Pump No.2 (Horizontal single stage axially split volute casing pump)

This panel shall be identical to the panel No. 3 for Pump No. 1

(Note : The 37 kW 400 Volt VSD is to be externally wall mounted separately with a high IP rating
for dust and moisture prevention. The VSD is to be priced separately)

This panel shall be labelled “Pump No. 2"

PS ECI 2.4.1.5 Panel No 5

PLC Auto Control & HMI

The panel shall be equipped as follows:
1 No. Control circuit HRC fuse
1 No. Neutral link

PS ECI 2.4.1.6 Panel No. 6

UPS and backup batteries

The UPS, battery charger and batteries as specified under the standard specification shall be installed in this cubicle. The battery shall be installed in a separate cubicle within the MCC all to eThekwini standard specifications. The battery shall be 45 Amp Hour 12V DC Deltec deep cycle battery as per the standard specification.

The contractor shall provide the cabling between the MCC and the battery cabinet. A limit switch shall be provided in the battery box and UPS compartment for intruder alarm and wired to the PLC for remote monitoring via the telemetry system. The limit switch shall form part of the supply of the UPS and batteries

PS ECI 2.5 DB PUMP STATION & RESERVOIR SITES

The DBs for the pump stations and reservoir sites shall be surface mounted manufactured of 3CR12 sheeting with lockable doors and painted orange and be in accordance with SANS10142.

The DB shall feed the telemetry panel and the MCC building lighting and socket outlets. The telemetry panel shall also supply the new level sensors to be installed in the existing reservoirs.

The DB shall be equipped as follows :

1 No 30 Amp DP main switch
3 No. 10Amp SP MCB for station lighting (with spare)
1 No. 60Amp/30mA DP earth leakage circuit breaker for plug circuits
2 No. 20A SP MCB for socket outlet circuits
1 No. 5A SP MCB for photocell for external light circuits
1 No. 10Amp By-pass switch to control external light

1 No. 5Amp SP MCB for power supply to telemetry equipment
1 No. 10Amp SP MCB for power supply to flow meter (2 No)
2 No. Surge arrestors for power supply to telemetry cubicle and flow meter as specified

Make allowance and space for future spare ways. A typed legend card must be installed in the DB compartment.

PS ECI 2.6 OPERATING AND CONTROL PHILOSOPHY OF THE PUMPS

a) Trenance 3 Pumps

This specification covers the operating and control philosophy for the horizontal single stage axially split volute casing pumps for the Trenance 3 pumps.

Any deviations or changes from the operating and control features described here must be agreed upon between EWS and the Contractor in writing. The finally agreed upon operating and control philosophy must be included in the O&M manuals which will be submitted by the Electrical Contractor to EWS at the end of the contract.

The MCC will have two feeders, one each feeder for 2 x VSD pump starters for the Trenance 3 pumps which will be controlled by the PLC. Two wall mounted VSD starters per pump will control the duty pumps that will pump water to the Trenance 3 Elevated Tank.

The Pumps shall operate in three distinct modes of control, namely Automatic, Manual and
Tele-override.

The duty and stand-by pump call shall be cycled after every start. Interlocking shall be provided that only one pump shall start at any time in both manual and tele-control modes.

PS ECI 2.6.1 Automatic Mode

The pump/s shall operate automatically via level start and stop signals from the on-site elevated tank. Ultrasonic level transmitters will be installed in the elevated tank for this wired to the PLC in the MCC. The pumps must operate on a duty- standby philosophy. In both manual and tele-control mode, only one pump must run at a time and there must be an interlock programmed into the PLC to prevent the second pump from starting while the one is running. The interlock must only inhibit the pump when a start attempt is made. The duty pump must be automatically rotated by the PLC after every start.

PS ECI 2.6.2 Manual Mode

In Manual Mode, the pumps shall operate when they are locally selected to do so, using the Auto/Manual/Off selector switch and the push buttons on the panel door.

All VSD protection must be active including “Overload Trip”, “Under-Current Protection “, and “ Earth Leakage Trip” etc where applicable. All pump trip signals must be taken to the PLC to de-energize a “Pump Inhibit” relay which will trip the pump.

A no-flow switch shall be installed on the delivery side of each pump to trip the pump should a no flow condition arise. This is to protect the pump from dry running. Low level floats shall be installed in the 3 x clear water suction reservoirs (wired in series) to cut out the pump should any of the reservoir levels be low. These levels shall be determined on site later. A pressure transmitter shall be installed on the common delivery lines of the pumping system. A pressure transmitter shall be installed on the suction side of each pump and shut down the pump should the pressure drop below certain set-points (settings to be determined later). The pressure shall also be displayed on the local PLC/HMI. There should be no hard-wired trip signals (besides the inhibit, low level cut-out etc) wired into the pump control circuit (unless agreed with EWS during review of the electrical drawings).

When the pump inhibit relay is activated, the inhibit indication lamp on the pump panel

must also be activated and the stand-by pump started if required and is being called, and if available. In auto mode only, the pumps must automatically start up after a trip has been reset/cleared. Also should any pump fail to start, after a period of 10 seconds, the next available pump should be requested to do so.

In auto mode only, the duty pump/s must automatically start up after power is restored in the event of a power failure. All pumps must be limited to a maximum of ten starts per hour (to be set on the HMI). All other protection and other features, as mentioned in the contract document and standard specifications must be incorporated as required.

PS ECI 2.6.3 Telemetry

A “Telemetry Control” feature must be incorporated into the design which will provide remote control (starting and stopping of pumps) from the Water Control Room. This feature will only be applicable when the pumps are in Automatic mode on the MCC selector switch. The Control Room shall be capable of remotely switching telemetry control on/off, and capable of starting/stopping each pump individually when telemetry control is on. If only one pump can run at anytime, tele-override should have a duty start command. The pump interlocks must still be active in the tele-control mode.

Telemetry communications from the PLC to the Telemetry unit will be via Ethernet IP. Refer to the PLC specification for the requirements and typical draft I/O list. The final list shall be prepared and submitted by the contractor.

Provision should be made in the PLC program to ensure that when the “phase fail” signal is active it does not result in every other signal erroneously being sent through to Telemetry as well.

The pumps shall be automatically controlled by levels in the on-site elevated tank for the high level zone feed and automatically via the telemetry system from the EWS control room.

PS ECI 2.6.3.1 Marshalling:

Signals shall include but are not limited to what is required below. Refer to the typical I/O lists under the EWS PLC specifications for the full requirements.

The following minimum signals shall be provided as specified in the project and Standard
Specification for local control and display/alarms on the PLC/HMI and to the remote SCADA system for control and remote alarms:

PS ECI 2.6.3.2 Pump Signals:

Auto / manual/ off selected
Mains fail, phase fail, over and under voltage
Pumps run/stop
Pumps trips
E-Stop activated
Inhibit
Pumps run hours
No flow or low level trip
Temperature trip (PT100 or thermisters)
Pressure trip (optional if installed)
Motor and pump temperature trips (all)
Motor and pump vibration trips (optional if installed)

PS ECI 2.6.3.3 Instrumentation Signals

Flow meter signals (instantaneous and total) - All
Pressure
Local Reservoir or Tank low level trip
Local Reservoir (3 No) or Elevated Tank levels

Local Reservoir high level and alarms
Local Reservoir low level and alarms
Local Elevated Tank high level and alarms
Local Elevated Tank low level and alarms
MCC/Pump Room intruder alarm and battery box intruder alarm (wire into panel/plc)
Fire Alarm (wire into panel/plc)
24V DC fuse fail
Other signals as determined with EWS and the contractor

Note: Detectors and PIR shall be supplied by the electrical contractor.

The above signals shall also be transferred via telemetry and integrated to the EWS SCADA system at the EWS Control Room.

PS ECI 2.7 OPERATING PHILOSOPHY OF THE PUMP STATIONS

1. TRENANCE 3 PUMP STATION

The control philosophy for the Trenance 3 Pumping Station is fully described under the PLC and MCC auto control section.

a) The pump station consists of two sets of pumps, both sets pumping to the on-site elevated tank operating on a duty and stand-by basis.
b) The pump system consists of new horizontal single stage axially split volute casing pumps with motors rated at 37kW drawing from the clear reservoirs on the site.
c) The pumps and MCC shall be installed in the new pump station.
d) The automatic starting and stopping of the pumps shall be controlled by level control from the on-site elevated tank
e) A new MCC room and telemetry room within the pump station building is to be constructed to house the MCCs and telemetry equipment.
f) The new pumps (duty and standby) will be fully automated, operating on the level sensor calling system and monitored by the telemetry & SCADA system. The PLC will be programmed to carry out this function.

PS ECI 2.8 PLC & HMI SPECIFICATION AND REQUIREMENTS

Refer to PLC_Specification_Rev06 for the PLC and HMI to EWS requirements and details.The PLC and HMI shall be installed and connected in the PLC cubicle of the MCC in accordance with the standard specifications.

PS ECI 2.8.1 Program / Schedule/ Management

The electrical contractor must provide the programs or project schedules clearly indicating the start dates from award of contract and the estimated completion dates. The program must address the following as a minimum:

- Logical flow of activities, milestones and deliverables
- The schedule must be realistic in relation to provided key resources and sub contractors. (WBS)
- Include verifiable milestones, e.g. PLC development complete, equipment ordering complete, Factory Acceptance testing etc.
- Clearly indicate the critical path on the program (if applicable).
- The schedule must be resource loaded to show which resources (OEM, Tenderer, sub-contractor, EWS and others) will be completing each activity. (RACI Matrix)
- Make provisions for lead times (hardware ordering times, Client approval times, etc.) Include schedule assumptions to help the evaluation team understand how certain durations were estimated or arrived at and others.

The contractor must provide a Project Communications Plan, Implement a Change Management Request Process as well as a Lessons learnt Register on Handover.

PS ECI 2.8.2 Intellectual Property

All Intellectual Property developed in the course of a contractual relationship with the Municipality during this project shall remain in full control of the Municipality in terms of ownership and control rights. Intellectual Property rights assigned to the Municipality shall include but not be limited to the following:

PS ECI 2.8.2.1 Works Related Design and Documentation

The Contractor grants the Municipality the right in accordance with the provisions of Section 22 of the Copyright Act 1978:

- The PLC Code shall not be protected or locked in any way
- To copy any plan, diagram, drawing, document, specification, bill of quantities, design, calculations, works specific software developments and configurations, e.g. standard templates, mimics, reports, etc. or any other similar document made by the Contractor in connection with the works;
- To make free and unrestricted use thereof for its own purposes, modify same or have it modified by a third party for any reasons, without obtaining permission from the Contractor;
- To provide copies thereof to others (third party Contractors or Consultants of the Municipality) to be used by them for purposes of tendering, consultancy or service delivery.

PS ECI 2.8.2.2 Testing/ Commissioning

Refer to QualityControl_Rev03 Specification for the testing and commissioning procedures, specifications and details.

It is a requirement that the designer and manufacturer of the MCC be present for the FAT and for the site testing and commissioning of the MCC and associated electrical installations.

The contractor is to also perform power quality tests on the installation and confirm that there are no electrical interferences outside the limits of IEEE and NRS codes are present.

PS ECI 2.9 OTHER

The PLC will be programmed by a specialist system integrator employed by the supplier of the motor control panel in consultation with EWS Mechanical and Electrical Branch and the Control and Instrumentation Branch.

The project will not be signed off for payment before all snags identified in the preliminary inspection are complete and a compliance certificate and test report is issued.

PS ECI 2.10 OPERATING PHILOSOPHY OF THE PUMP STATION

The control philosophy for the potable water pumping systems are fully described under the PLC auto control section for each MCC and under the telemetry sections.

PS ECI 2.11 GENERATOR SUPPLY

The existing site is installed with an outdoor canopy type generator supplied by Sinabo. The gen-set comprises a Perkins four cylinder in-line motor and Leroy-Somer generator rated at 100kVA, 1500rpm 400Volt, 50Hz. The generator is operational.
The capacity of the existing generator after de-rating is adequate to power one duty pump with a motor rated at approx. 37 kW on the proviso that VSDs are used to start and ramp up the pump to full speed. A new generator rated at 150kVA will be required in the event the existing unit is too costly to repair or refurbish.
The controller on the gen-set control panel is in good condition. The auto change-over panel situated in the existing tower on the ground floor is also in a good condition. This

change over panel will have to be moved to the existing generator control panel. New cables between the gen-set control panel and the new MCC in the new pump station is required.

An on-site meeting was arranged for the 29 May 2025 with the OEM (Sinabo) to conduct an assessment of the existing generator. A senior technical manager from Sinabo was present together with representatives from the Client, Naidu Consulting and DGI Consulting.

The generator could not be started and run as it had run out of fuel, however a visual assessment was done without the set running. Attempts to get some diesel to run the generator were unsuccessful.

A second on-site meeting was arranged for the 4th June 2025. A technician from Sinabo was present together with representatives from the Client, Naidu Consulting and DGI Consulting. Sinabo brought some fuel in a container and temporarily connected it to the fuel system just to run the set so that the assessments could be done.

After bleeding the fuel system of air due to the low fuel level, the gen-set was run for a short while and the visual inspections and operational assessments revealed the following:

- There was a mixture of water and diesel fuel in the bund of the set, presumably from rainwater and diesel leaks whenever the diesel tank was being manually filled. This is to be investigated further
- The cooling water radiator shows signs of corrosion
- Leak on the one injector line
- The battery did not have a battery box or any locking arrangement to prevent theft
- There is surface rust on the diesel motor and alternator which needs to be de-rusted.
- The locks on the canopy doors are not vandal proof and access could be easily gained into the canopy
- The gen-set requires a shelter to protect it from the elements
- A concrete bund is required around the set to contain spillages

The diesel motor and generator ran smoothly and there were no issues that were identified. There was no evidence of diesel smoke (due to engine wear) or noises coming from the motor or alternator. The OEM indicated that the motor and alternator are in fairly good working order, however it should be monitored and inspected regularly.

Future wear and tear of the unit including breakdowns and repairs required are not projected nor any allowances made at this stage.

PS ECI 2.12 DOMESTIC ELECTRICAL, LIGHTING & POWER INSTALLATION

The electrical contractor shall be responsible for the supply, installation, testing and commissioning of the light points, switches, socket outlets, isolators, light fittings, conductors and wiring in the MCC and Telemetry buildings, pump stations and telemetry rooms all as directed by the Engineer to the Contractor on site or as specified and quantified in the Schedule of Quantities.

PS ECI 2.12.1 Wiring:

Lighting - 1,5 mm² + earth
Sockets - 2,5 mm² + earth.

The entire electrical supply and installation work shall be in accordance with SANS 10142-1 latest amendment and the regulations of the OSH Act (Act 85 of 1993) and any contingent regulations. All work to be neat, parallel, level, uniform etc. Wiring shall be in galvanised bosal conduit.

PS ECI 2.12.2 Internal Lighting and Power Outlets:

Light fittings are to be installed in the pump station/MCC rooms and telemetry room and are to be wall mounted or as shown on the drawings or as directed on site. The lighting shall be wired back to the local DB in bosal or PVC conduit. One lever one way light switches are to be installed inside the pump station near the door at a height of 1.4 meters above FFL.

One double socket outlet is to be installed within one meter of the MCC and telemetry room at a height of 1.2 meters above FFL. All lights and plugs are to be wired using GP wire in 20mm bosal or PVC conduit in accordance SANS 10142-1.

New lighting and socket outlets or power points are to be installed in the new pump

stations/ MCC Rooms or Telemetry Rooms all as indicated on the electrical drawings. Switched socket outlets, isolators and other dedicated or specialised power points are to be provided as require all as shown on the electrical drawings.

A local distribution board (DB) shall be installed in each pump station or telemetry room.

Internal lighting is to be 1,5m 2 tube corrosion resistant lights with LED lamps.

All circuits must be clearly marked on the face of the DB panel.

PS ECI 2.13 OUTSIDE LIGHTING

External lighting shall consist of external bulkhead light fittings with LED lamps as specified in the SOQ. The luminaires shall be operated by means of a photocell and a by-pass switch in the MCC building and in MCC or DB, all in accordance with the standard specification.

PS ECI 2.14 LIGHT FITTING

The light luminaries as specified in the schedule of quantities shall be supplied and installed complete with lamps, etc. All luminaires shall be guaranteed for a period of 12 months from the date of the completion certificate. Alternatives shall be considered if similarly approved. Lamps and control gear shall bear the SABS mark of approval. All lamps shall be energy efficient LED type

PS ECI 2.15 CABLES, CABLE TRAY, TRENCHING AND CABLE MARKERS

PS ECI 2.15.1 GENERAL

All power cabling shall be PVC/SWA/ECC/PVC, with copper conductors to SANS 1507. Cables shall be buried at a depth of min 500mm. Power cable glands and shrouds shall comply with SANS 1213 type Pratley or similar approved. Cables shall be full length point to point, no joints will be permitted.

All instrumentation cabling shall be multi strand copper braided cable or multi strand twisted
pair cable. Installed in a sleeve or fixed to cable tray.

Instrumentation cable glands and shrouds shall be type Pratley or similar approved brass
compression or as approved by the Client or Engineer. Each cable end shall be labelled with a Bowthorpe Hellerman or similar type PK tag showing the cable details as indicated
in Appendix A in the standard specification.

Cable tray shall be of the Cabstrut or as approved pre-galvanised epoxy painted, medium
duty tray supported on the wall by galvanised P2000 at intervals not exceeding one meter
on the vertical or 750 mm on the horizontal, or P2000 cantilever arm if secured to the floor.
All trenches for low voltage and control cables are to be 600mm deep and 400mm wide.

Cable marking tape 150mm wide is to be installed at a depth of 300mm below ground line. All trenches must be inspected before they are backfilled. The trench must be back filled and compacted with a plate compactor in layers not exceeding150mm. Ducts must be installed complete with 1.6mm galvanised draw wire. Two ducts may be laid in the same trench at a minimum distance of 150mm apart. All bends must be the long radius type. No more than 500 metres of excavation may be left open at a time. Excavations may not be left open especially over the December / January builders shut down period.

Cable markers shall be LG Green or similar and are to be installed at distances not exceeding 10 meters and at every change of direction. Markers are to consist of a concrete block 100mm c 100mm x 300mm and installed in the vertical position. An aluminium plate 75 x 75mm is to be embedded in the concrete or secured to the top of the block by means of two ram set screws 25mm long. The plate is to be punched with numbers and arrows on smaller than 10mm.

Installed cabling shall be made vandal proof which includes encasing the cables in concrete by the civil contractor.

PS ECI 2.15.2 Cables to MCC, Motors and Other Equipment

The electrical contractor shall supply, deliver to site, lay in cable ducts or sleeves and in ground or on surfaces the power and associated control cables for the various motors, between panels of the distribution board, the isolators, motor junction boxes, associated stop push buttons, motors, motor heaters, level electrodes, flow switches, etc.
Cables to motors and instruments shall terminate in separate suitably sized junction boxes installed adjacent the pumps and motors and then terminated onto the equipment.

He shall connect up the cables at all ends and then test and commission the various plant electrical installations.

Refer to Telemetry and Instrument Specification Revision 00, Section 17.

PS ECI 2.15.3 Cable Schedule

The contractor shall be responsible to provide the correct size and rated cabling for each application to be measured on site. Cables shall be full length and jointed cables will not be permitted. All lengths are re-measurable and payment will be made for actual lengths installed.

Note each operating / safety device is to be supplied with a separate cable to a IP65 CCG box or weatherproof isolator at the device. Multi-core cables run to two or more devices will not be acceptable.

The following minimum cables are required and as itemised in the schedule of quantities:

A. TRENANCE 3 PUMP STATION , ELEVATED TANK AND RESERVOIRS

NO	DESCRIPTION	FROM	TO	FUNCTION	LENGTH (m)
1	95 mm² x 4C PVC ECC SWA PVC	Ethekwini transformer / mini-sub LV Panel	New Meter	Power	50
2	70 mm² x 4C PVC ECC SWA PVC	New Meter	Generator Change Over Panel	Power	40
3	70 mm² x 4C PVC ECC SWA PVC	Generator Change Over Panel	New MCC	Power	20
4	25mm² x 3C PVC ECC SWA PVC	MCC	Pump 1 - 37kW VSD	Power	10
5	25mm² x 3C PVC ECC SWA PVC	Pump 1 VSD	Pump 1 motor 37kW	Power	10
6 a-b	16mm² PVC insulated earth wire	MCC	VSD 1 and to pump motor 1	Earth	10
7	25 mm² x 3C PVC ECC SWA PVC	MCC	Pump 2 - 37kW VSD	Power	10
8	25mm² x 3C PVC ECC SWA PVC	Pump 2 VSD	Pump 2 motor 37kW	Power	10

9 a-b	16mm² PVC insulated earth wire	MCC	VSD 2 and to pump motor 2	Earth	10
10 a-b	1,5mm² x 2C PVC ECC SWA PVC	MCC	Pump 1 & 2 no-flow switch	Control	10
11 a-b	1.5mm² x 2C PVC ECC SWA PVC	MCC	Pump 1 & 2 motor heater	Power	10
12 a-b	1.5mm² x 2C PVC ECC SWA PVC	MCC	Pump 1 & 2 motor winding temp sensors	Control	10
13 a-b	1.5mm² x 2C PVC ECC SWA PVC	MCC	Pump 1 & 2 casing temp sensors	Control	10
14 a-d	1.5mm² x 2C PVC ECC SWA PVC	MCC	Pump 1 & 2 motor bearing temp sensors	Control	10
Power	1.5mm² x 2C PVC ECC SWA PVC	MCC	Pump 1 & 2 bearing temp sensors	Control	10
16 a-c	1,5mm² x 4C PVC ECC SWA PVC	MCC	Reservoir 1 -3 low level floats	Control	Varies
17 a-d	1,5mm² x 2C PVC ECC SWA PVC	MCC	Inlet/outlet mag flow meters 1 - 4	Power	Varies
18 a-b	1,5mm² x 2C PVC ECC SWA PVC	MCC	Pump 1 & 2 stop lock	Control	10
19 a-b	1,5mm² x 4C PVC ECC SWA PVC	MCC	Pressure transmitter on pump discharge	Control	10
20 a-b	1,5mm² x 4C PVC ECC SWA PVC	MCC	Extract fan 1 & 2	Power	20
21	16mm² x 4C PVC ECC SWA PVC	MCC	Lighting DB	Power	15
22	1,5mm² x 2C PVC ECC SWA PVC	MCC	Telemetry panel	Power	10
23	10mm² x 4C PVC ECC SWA PVC	Lighting DB	Welding socket	Power	15
24	1,0mm² 4 or 6 pair individually screened overall screened instrument cable	MCC	All sensors , flow meters, level transmitters , pressure transmitters etc	Control & signal	Varies
25	1mm² 2 pair PVC overall screened Dekoron cable	MCC	Telemetry panel	Signal	10
26	Modbus cabling	MCC	Telemetry panel	Signal	10

Note :

a) The cables required for the telemetry system are shown under the telemetry scope of work and the BOQ.
b) The cable numbering above is indicative and for tender purpose only. The contractor shall determine and provide the final cable schedule and numbering to suit. Although all the cables required may not be in the above schedule, there is sufficient cables measured in the bill of quantities to cover all the cable requirements.
c) All cables are re-measurable and only cables actually installed shall be claimed for payment. Cable lengths shall be physically measured on site prior to ordering.

PS ECI 2.16 TELEMETRY

1.0 Project overview

This project involves the supply and installation of new telemetry systems at the following sites forming part of the Trenance 3 Scheme with the affected sites being :

- Site 1 - Trenance 3 Pump Station, Elevated Tank and Reservoirs
- Site 2 - EWS SCADA at Pinetown Control Room

The new infrastructure will be constructed and or installed in each of these sites. With the new infrastructure being installed, there is a need for the installation of the new telemetry or the improvement of the existing telemetry systems and instrumentation to ensure for adequate monitoring and control.
The project also involves, inter alia, the supply, installation, configuration, testing and commissioning of the new telemetry and instrumentation equipment. It also involves the integration to the MCC and SCADA configuration at the EWS Control Room. The scope of work for each site is detailed below

a) Site 1 - Trenance 3 Reservoir, Elevated Tank and Pump Station :

Scope of work

- Integration of the three reservoirs (3 No) new mag flow meter (4 No) at the new pump station and reservoir site to the new telemetry system. The new mag flow meter will be installed on separate inlets to the existing reservoirs and on the outlets to the reticulation mains
- Integration and monitoring of the new pumps (2 total) for automatic starting and stopping from the on-site elevated tank
- Supply, install and commission a new telemetry panel as per specification. Power supply to the telemetry panel will be provided by the electrical contractor
- The panel must include the RTU and digital radio amongst other equipment with 100 amp hour batteries complete,
- Supply and incorporate two Dual point transmitters (type Siemens 7ML50331AB102A) in the elevated tank and reservoirs (4 No)
- Supply and install the XPX10 four ultrasonic-level transducers (7ML11153CA30) with stainless steel brackets and housings as per agreed positions (4 No)
- Supply and installation of new omni directional Webb radio antenna, cables and antennae cables, mounting brackets and accessories.
- Supply and wire optical isolation between serial devices (Moxa TCC120I) (4
- sets)
- Supply and wire serial surge protection and DC surge protection devices for all telemetry equipment
- Supply and install new level instrument cables and any additional installation accessories
- Enabling monitoring of the intruder alarm, fire alarm and battery box alarm for the new Pump Station, MCC and Telemetry Rooms.
- SCADA configuration and integration
- Provide project management

Deliverables

- A fully functional and integrated telemetry system, enabling monitoring of all alarms and events of the reservoirs, elevated tank and pump controls (start/stop) etc on the existing SCADA.
- Enabling monitoring of the 4 new mag flow meters on the inlets and outlets of the gravity or pumped mains :
    - DN200 - Inlet to Existing Reservoirs 1 & 2, and the new reservoir
    - DN200 - Outlet from Existing Reservoirs 1
    - DN250 - Outlet from Existing Reservoirs 1 & 2, and the new reservoir
    - DN200 - Outlet from New Elevated Tower
- The meters will be installed in chambers or bunkers within the pump station or reservoir sites.

- Enabling monitoring of the intruder alarm, fire alarm and battery box alarm for the new Pump Station, MCC and Telemetry Rooms.
- Re-established communication between sites and front end
- Detailed Project Documentation and Safety File (Hard Disk)
- Documentation pack with all drawings, wiring diagrams, loop diagrams , I/O lists , as-builts , O & M manuals etc complete
- Integrated MCC/PLC, enabling the monitoring of all alarms and events, on the existing GeoSCADA at the EWS Control Room.
- Testing of all signals to the existing GeoSCADA at the EWS Control Room.
- Booked training on SCADA, Instrumentation and Telemetry Systems provided by specialist equipment supplier

b) Overview of the control and instrumentation system

1. Trenance 3 Pump Station :

The control philosophy for the Trenance 3 Pumping Station is fully described under the PLC and MCC auto control section.

a) The pump station consists of two sets of pumps, both sets pumping to the on-site steel elevated tank for the high level supply zone
b) The pump system consists of two horizontal single stage axially split volute casing pumps rated at 37kW (duty and standby) drawing from the 3 x interlinked clear water reservoirs on the site.
c) The pumps and MCC shall be installed in the new pump station.
d) The automatic starting and stopping of the pumps shall be controlled by level control from the Elevated Tank within the Pump Station site
e) A new MCC room and telemetry room within the pump station building is to be constructed at the pump station to house the MCCs and telemetry equipment.
f) The new pumps (duty and standby) will be fully automated, operating on the level sensor calling system and monitored by the telemetry and SCADA system. The PLC will be programmed to carry out this function.

The pumps shall be controlled by radio telemetry for starting and stopping signals system from the EWS Control Room.

New mag flow meters will be installed as follows :

- DN200 - Inlet to Existing Reservoirs 1 & 2, and the new reservoir
- DN200 - Outlet from Existing Reservoirs 1
- DN250 - Outlet from Existing Reservoirs 1 & 2, and the new reservoir
- DN200 - Outlet from New Elevated Tower

These flow rates and totaliser signals shall be transmitted via telemetry to the EWS Water Control Room.

All the signals for the pump/s status, reservoir levels, flow, pressure etc shall be relayed via telemetry to the EWS Water Control Room. The “Pump Call “ signals will be received from the level sensor/s installed in the on-site Elevated Tank.

In order to monitor and control the new and existing infrastructure, there is a need to install a new Telemetry and Instrumentation systems for these sites. The telemetry and SCADA system at the EWS Water Control Room needs to be upgraded to include for the new sites, new pumps, new reservoir and elevated tank levels, new flow meters, intruder and fire alarms etc.

2.0 Dependencies

Access - Ethekwini Water or their appointed civil contractor to provide site access when required
Transducer Coring - Civil contractor to ensure that the transducer cores and associated galvanized enclosures are provided in advance of installation.
Civil Structures - Civil contractor to ensure that the civil structures such as Telemetry Room and Pump Rooms are ready for installation of equipment.

Civil Contractor to ensure that trenching for transducer cabling is carried out and that cables are concreted in as per requirements.
Routing - Agreement on the positions for equipment mounting and the routing of cabling.
Power - Power should be installed and made available in the Telemetry room before Telemetry work can proceed.
Commissioning - An authorized person from the telemetry contractor must be available to sign off all testing, delivery, site installation and handover/commissioning and documentation for the project.
Communication Process
Communication process for the project to follow EWS guidelines as per the table below:-

Communication	Medium	Delivery Date	Frequency	Description/Notes	Audience	Owner
Project Team Communication	Meeting	Ongoing	Weekly	Weekly status meeting to discuss schedule, communications, actions, risks & issues	Project Team	PM
EWS Communication	Email	Ongoing	Weekly	Weekly status report for overview of the project progress	EWS	PM
	Meeting	Ongoing	Monthly	Monthly executive overview of the project progress	EWS	PM
	Email/Phone	Ongoing	As required	Queries	EWS	PM
	Meeting	Ongoing	As required	Safety File	EWS	Safety Officer
Main Contractor Communication	Email	Ongoing	Bi-monthly	Bi-monthly status report for overview of the project progress	Main Contractor	PM
	Email/Phone	Ongoing	As required	Queries	Main Contractor	PM
	Meeting	Ongoing	Monthly	Monthly overview of the project progress	Main Contractor	PM

A 1mm² 2 pair PVC overall screened cable such as a DEKORON cable is to be installed within a telemetry encasement and cable tray from the main panel or MCC to the telemetry panel.

Refer to Ethekwini Telemetry and Instrument Install Specification Revision 01 & 02 included with the tender

PS ECI 2.17 EARTHING

The entire installation must be properly and effectively earthed as prescribed in the Standard Regulations of the Wiring Premises SANS 10142-1 and to the requirements of the relevant supply authority.
Earthing of the buildings and electrical installations shall meet the requirements of SANS 10313 as amended and SABS/IEC 61024 as amended. The main earth from the Supply Authority must not be relied upon as an effective ground earth.
The testing of the earthing system must be witnessed by the EWS representatives and the Engineer.

PS ECI 2.18 METERING & POWER SUPPLY

When applying for a new or upgraded electrical supply, the contractor may be given or obtain a property key number from the survey department. This number must be used when applying for the electrical supply. The incoming supply is to be sized to suit the full load of the operational duty pump/s and associated ancillaries. Cabling from the meter box to the MCC and telemetry DB shall form part of the internal electrical installation. The contractor will be required to liaise closely with the Supply Authority to ensure a timely mains connection to the meter cubicle/s.

The application for the power supply or connection to each site including the completion and submission of the application forms etc is to be made by the contractor (main civil and electrical contractor) on behalf of the Employer.

Completion certificates, COC's and meter cards shall be submitted to the Supply Authority to enable the Supply Authority to energise the mains where required.

PS ECI 2.19 MCC DISTRIBUTION BOARD

The electrical installation at the pump station/MCC building and telemetry room/s shall comply with the latest requirements of SANS 10142-1 and a compliance certificate with test report shall be issued at the completion of the project. The local distribution board may form part of the main MCC in new installations.

DB circuit breakers shall be clearly marked with the item they are feeding eg. lights, plugs, external lights. A typed legend card shall be installed in the domestic cubicle indicating all equipment, circuit breakers etc.
If there is more than one lighting circuit, each circuit shall be marked lights 1, light 2, etc. the light fittings that are fed by light circuit 1 shall be clearly marked LC1… to identify where they are feed from. Plug and all other circuits must be marked in the same manner.

PS ECI 2.20 INSTRUMENTATION

Refer to EWS Telemetry Specification Rev 02 and Instrument Specification Rev 01 included as a separate document issued with the tender

PS ECI 2.20.1 Pressure Transducer

The pressure transducer is to be mounted on the delivery main pipeline within the pump stations and shall be the type WIKA S-10, 0-40 bar 4-20mA loop powered (2cwire) unit supplied complete with a PTFE pressure washer. A pressure transducer shall also be installed on the suction side of each pump and trip the pumps should the pressures deviate above or below the set points. The max pressure rating is to be confirmed and the operating pressure setting will be given later. The contractor is to obtain prior approval if he intends using a transducer from another supplier.
Where specified, the pressure switch shall be used to automatically control the pumps via the PLC depending on the set point pressure settings in the pumping system.
The delivery pressure transmitter shall be wired to the PLC which shall relay the signal to the SCADA system.

PS ECI 2.20.2 Temperature Transducer (Supplied with Pump and motor)

Approved motor PT100 thermistors and controllers shall be supplied with the pumps. The installation of the controllers and wiring in the MCC shall be undertaken by the electrical contractor.

PS ECI 2.20.3 Pump Casing Transducer, No Flow Switch, Float Switches and Pump Casing or Bearing Temperature Sensors

An IFM electronic or similar approved no flow switch or similar and equal approved shall be installed on the delivery line on the discharge of the pumps where specified. An ½ inch BSP socket shall be welded on the pipework for this. The controller shall be installed and wired in the MCC.
PT100 or other approved temperature sensors shall be installed for all the motor windings and for the pump casings as specified similar or equal to the IFM sensors.

Pump and motor bearing temperature sensors shall be installed in the pumps and motors as supplied with the pump sets.
Pump casing vibration sensors shall be provided to all pumps.

Float switches shall be as supplied by AC/DC or similar and equal approved and installed on stainless steel chain with weights to keep the floats in position. The floats are not to contain mercury and is to be safe for use in portable water. The weights are not to contain any lead or any unsafe product for use in potable water.

PS ECI 2.20.4 Magnetic Ultrasonic and Mechanical Flow Meter

Ultrasonic or Mag Flow Meter

All electronic mag flow meters for this project will be supplied and installed by the main contractor under the civil works. The electrical contractor will only be responsible to provide power to the units and install the power and signal cabling and connect up at their respective devices. Earthing of the flow meter will form part of the electrical scope.

The following in-line flanged mag flow meters are required :

- DN200 - Inlet to Existing Reservoirs 1 & 2, and the new reservoir

- DN200 - Outlet from Existing Reservoirs 1
- DN250 - Outlet from Existing Reservoirs 1 & 2, and the new reservoir
- DN200 - Outlet from New Elevated Tower

The flow sensors will be installed on their respective pipelines. The flow transmitters will be installed adjacent the telemetry cabinet.

The flow meters shall be supplied with factory supplied cable of 20m length between the sensor and transmitter/converter.
The flow meter shall consist of primary head sensor IP68 rated with grounding rings and terminal box complete with flow converter 24V DC power supply with RS485 modbus communication capability with 20m factory supplied instrument cable complete with all other accessories etc.

A 16C screened signal cabling will be required from the flow meter to the telemetry panel.
The rate of flow and total flow signals shall be transmitted via telemetry to the existing EWS Control Room SCADA system.

The flow meter shall be installed and fitted to pipework and flanges to be provided by the civil contractor.

The rate of flow and total flow from these shall be converted and be transmitted via telemetry to the existing EWS Control Room SCADA system.

Mechanical Flow Meter

Mechanical meters are not required.

PS ECI 2.21 SIGNAGE

Signage inside and on the outside of the door to the pump station shall be provided in compliance with OHS Act (85 of 1995) and SANS 10142-1. In addition, a sign with the designation of the relevant pump station shall be fixed above the pump station door and a sign on the outside of the door shall read “UNAUTHORISED ENTRY NOT PERMITTED” It shall be on black PVC board with yellow lettering.

A label no smaller than 80mm high shall be mounted adjacent to each pump to identify it as a “PUMP 1 or “PUMP 2”.

Other standard signage and labels to SANS requirements will be installed as follows :

- “ Warning machine starts automatically ” signage
- “ Danger - No Unauthorised Entry “ signage
- “ Electricity Danger “ signage
- Name of Pump Station
- Fire extinguisher signage

PS ECI 2.22 SECURITY

PS ECI 2.22.1 Fire Detection:

A detector type photoelectrical smoke detector of type Regal Altro Type (photoelectric smoke detector model No. JIC-636AR) must be installed on the ceiling or roof slab near the MCC panel, telemetry room and pump rooms only in accordance with the suppliers specification and in a position where the smoke will accumulate if there is a fire in the pump station and other rooms. The detector must be wired back to the main panel in 4 core 0.25mm² telephone cable and must be wired directly to the isolation relay and PLC. The unit may not be installed near ventilation fans, florescent lights or in the A frame roof space.

PS ECI 2.22.2 Intruder Alarm:

An intruder alarm system shall be provided inside the pump station MCC Room and the Telemetry Room (where applicable) consisting of a single passive infra red and microwave detector (IR AND MW) in each room, directly wired to the isolation relay and PLC for remote monitoring through the telemetry system. Cabling shall be a 0.25mm² 4 core telephone type cable. The detector shall be wall mounted at a height of 2.6 meter from floor level opposite the door and shall be a Regal Altro Type (Rokonet digital Zodiac PIR/QUAD RK-410QD0000A).

PS ECI 2.23 OPERATING PHILOSOPHY OF THE PUMP STATIONS

Refer to Clause PS ECI 2.7 for details on the operational philosophy for both pump stations and as described elsewhere in these specifications

PS ECI 2.24 OTHER REQUIRMENTS`

a) The PLC will be programmed by a specialist employed by the supplier of the motor control panel in consultation with EWS Mechanical and Electrical Branch and the Control and Instrumentation Branch.
b) The PLC system integrator must be a Recognized Certified Siemens System Integrator. Proof of this must be submitted with the tender.
c) The project will not be signed off for payment before all snags identified in the preliminary inspection are complete and a compliance certificate and test report is issued.
d) All cables are to be numbered according to the standard specification. Wiring colour codes must be adhered to in accordance with the standard specification. All light and plug circuits are to be labelled in accordance with the standard specification.
e) Signage of the pump station must be done in accordance with the standard specification.
f) All equipment supplied and installed shall be in accordance with the project specifications and as laid out under the standard specification.
g) All documentation such as insurances, compliance with Dept of Labour and OHS Act requirements, construction programme, cash flow schedule and approved MCC shop drawings must be completed before work on site may begin.
h) The complete O & M manuals as detailed in the enclosed documents must be submitted for comments and approval prior to the commissioning. The final documents shall be submitted on approval.

PS ECI 2.25 LIGHTING PROTECTION AND EARTHING TO PUMP STATION/MCC ROOM, TELEMTRY ROOM, ELEVATED TANKS AND RESERVOIRS AT THE TRENANCE 3 SITES

The lightning protection and earthing installation shall comprise the following:

a) The Pump Stations/MCC Rooms and Telemetry Rooms will be constructed of brickwork with a concrete roof over. They may be independent separate buildings or in some cases may be constructed on top of the reservoirs.
The elevated steel tanks will be constructed on concrete plinths / bases and pads. The reservoirs will be constructed of concrete walls and concrete roof where applicable.
b) A lightning protection and earthing system is required for the electrical room, MCC/ telemetry room, reservoir and elevated tanks and shall be installed in accordance with IEC62305, SANS1013 and SANS 10199 standards.
c) The earth resistivity survey shall determine the final number and spacing of the earth electrodes.
d) An earth mat consisting of 70mm² bare copper earth conductor shall be installed around the reservoirs/elevated tank and Pump Station/MCC Rooms and Telemetry Rooms with earth electrodes installed in positions shown on the drawings or as directed by the Engineer on site. A 10dia solid aluminium roof terminal conductor shall be installed around the roof of the reservoir or Pump Station and MCC/Telemetry Rooms and connected to the reinforcing steel. This conductor

shall be connected to the earth mat using 70 mm² PVC insulated earth conductors in PVC conduit. Test points shall be installed on all down conductors to the earth mat.

e) The pump station, MCC Room, Telemetry Room and Reservoirs roofs shall be connected to the earthing ring main using 70mm² PVC insulated earth conductors. installed in positions shown on the drawings or as directed by the Engineer on site. A 10dia solid aluminium roof terminal conductor shall be installed around the roof of the buildings or structures and connected to the reinforcing steel in the reservoir. This conductor shall be connected to the earth mat.
f) The steel columns or supporting structures of the elevated steel tank shall be bonded to the earthing system. 70mm² insulated earth wires installed in PVC conduit shall connect the steel bases and connected to the earth mat
g) All underground connections to the earth electrodes or other earth conductors shall be exothermic welds and denso wrapped.
h) All exposed earth wires shall be installed in conduit.
i) The final resistance required for each site is 7 ohm or less.
j) A 300mm x 6mm earth bar shall be installed adjacent the MCC and connected via 70mm² insulated earth wire to the earth mat.
k) All steel handrailing, staircases, catladders or other metal structures shall be bonded to the earthing system.
l) The integrity of the any existing earth mat is to be checked and tested
m) The installation shall be undertaken as shown on the drawings or as directed by the Engineer on site. The installation and testing shall be witnessed by the Engineer and a full test and compliance certificate shall be submitted by the contractor.
n) An as built layout shall be provided to the Engineer and Employer.

PS ECI 2.26 DRAWINGS AND MCC REQUIREMENTS

a) The contractor will be required to provide schematic and wiring and layout drawings with parts list of the MCC for approval prior to manufacture. The I/O list and diagrams, FDS (functional design specification), cable terminations, cable block diagrams , tag numberings, , network diagrams and architecture, cable schedule and instrument loop diagrams shall be included and supplied with the wiring diagrams (also refer to the EWS standard specifications). These shall be updated to as built and included in the O & M manuals.
b) The contractor shall provide 3 sets of final as-built record drawings. Three sets of manuals with technical leaflets of only the equipment supplied shall be bound into a hard covered hinged binder together with contact details of the contractor and MCC manufacturer. The manuals shall also be provided in electronic format to the Client and Engineer.
c) It is the contractor's responsibility to design the motor control centre power and control circuitry installation in accordance with the specification and good engineering practice.
d) The design shall be undertaken by personnel who are able to demonstrate experience in the field of water pumping plant including control systems, PLC and telemetry systems.
e) The testing and commissioning of the MCC and control systems shall be undertaken by the MCC designer and manufacturer in conjunction with the electrical contractor. The designer and manufacturer shall be present for both the FAT and on site SAT testing and commissioning.

PS ECI 2.27 PUMPSTATION INSTALLATIONS

PS ECI 2.27.1 RWQUIREMENTS FROM THE ELECTRICAL & C & I CONTRACTOR

The following documentation is required from the tenderer :

a) Company profile and company registration documents
b) Tax clearance certificates
c) VAT registration documents
d) CSD documents
e) Letter of Good Standing (COID)
f) Compulsory CIDB registration of minimum CIDB grading of 5EB,

g) BEE Certificates
h) Registration with Department of Labour
i) Experience report with list of at least five completed projects and values of similar nature (ie Motor Control & Instrumentation Installations for Pumping Plant & Water Treatment Works). Three reference letters are to be provided.
j) Qualifications and CVs of key personnel. Criteria to be assessed will be qualifications of the design engineer, site agent and site supervisor. NQF qualification of minimum NQF Level 5 will be required for each personnel in key positions for the project
k) References
l) Documentation of the MCC equipment and electrics (returnable schedule)
m) Meeting with EWS Mechanical and Electrical Branch and the Employer's Representative (Consulting Engineer) to discuss the dynamics of the project
n) The complete installation must be guaranteed for 12 months from the date of the completion certificate.
o) The contractor shall insure the entire works for the duration of the contract.

PS ECI 2.27.2 PAYMENT & RETENTION

Payment will be in accordance with the items included in the Schedule of Quantities and will be on successful completion of the activity.

The tendered rate is to include for all mobilisation costs, company overheads, insurances, guarantees, overtime (where applicable), transport, profit, site supervision for the duration of the works, reporting and printing requirements, computer and associated data costs.

PS ECI 3 STANDARD ETHEKWINI SPECIFICATIONS APPLICABLE TO THIS PROJECT

The following eThekwini standard specifications enclosed with this document shall apply and be read with this specification at all times;

- eThekwini Municipality PLC_Specification_Rev06
- eThekwini Municipality Telemetry and Instrument Install Specification_Rev01
- eThekwini Municipality Quality Control Specification_Rev03
- EWS Standard Electrical Specifications, 19.05.2020 : GS1 - Standard Specifications for DB's and Motor Control Centres
- Commissioning _ Fat Forms 19112020 Test Reports FAT Combined
- EWS List of Preferred Instrumentation Equipment 7

PS ECI 4 TYPICAL FACTORY ACCEPTANCE AND SITE ACCEPTANCE TESTING (FAT AND SAT) PROCEDURE

Refer to Latest Working Revision of the EWS Quality Control Specification included with this tender.

PS ECI 4.1 PROCEDURES

PS ECI 4.1.1 Project Flow (PF)

a) Receive control philosophy from EWS (included in specifications)
b) Review above philosophy
c) Raise queries to EWS
d) Receive final control philosophy from EWS (Signed)
e) PLC Quality Control FDS, Processes and Procedures
f) Program PLC
g) Create HMI Screens
h) Send HMI screens for approval
i) Review and finalise screens with EWS
j) Factory acceptance test
k) Site acceptance test

PS ECI 4.1.2 Factory Acceptance Test (FAT)

a) Visual inspection to confirm that the drawing matches the physical panel.
b) Input & output testing (Confirm correct wiring to and from PLC) – Refer to Annexure1
c) Verify HMI signals correspond to item 1 – Refer to Annexure2
d) Verify telemetry signals
e) Operating and control philosophy – Refer to Annexure3
f) All external signals to be simulated

PS ECI 4.1.3 Site Acceptance Test (SAT)

a) Input & output testing of field wiring and marshalling
b) Test all signals as per FAT including no flow and overload tests

Note : The designer and manufacturer of the motor control panel together with the electrical contractor shall be present on site to carry out the site testing and commissioning of the complete MCC, electrical and associated systems.

PS ECI 4.1.4 PLC HARDWARE & FAT CHECK LIST

The electrical contractor and panel builder shall confirm the equipment for the PLC and HMI for the equipment and parts as outlined below and confirm with EWS before submitting the tender and ordering the equipment.

PLC Hardware

The below list of minimum hardware to be installed within the PLC cubicle of the MCC;

Item	Description	Tag Name (Ref. to DWG)	Supplier	Part Number	Quantities
1	PLC Controller	CPU	Siemens	6ES7214-1AG40-0XB0	1
2	Digital Input Module	Digital Input Card	Siemens	6ES7221-1BH32-0XB0	2
3	Digital Output Card	Digital Output Card	Siemens	6ES7222-1HH32-0XBO	2
4	Analog Input Card	Analog Input Card	Siemens	6ES7231-4HF32-0XB0	2
5	HMI	HMI TP1500	Siemens	6AV2124-0QC02-0AX0	1
6	Ethernet Switch	8 PORT EHERNET SWITCH	DELTA	DVS-008I00	1
8	Wireless Router	WIFI	D-Link	N150	1

Note : Ethernet Switch, Modbus Serial Module, Power Monitor , Wireless Router etc as required shall be determined by the contractor and approved obtained from EWS C & I Department prior to procurement.
Also refer to the EWS Standard Specifications included with the tender for the detailed specifications and other requirements.

ANNEXURE A

COMPULSORY RETURNABLE DATA SHEETS

TECHNICAL DATA SHEET: MCC PANELS (Complete one for each MCC)

NAME OF SITE: _____

RATING OF MCC PANEL: _____

No	ITEM	SPECIFIED	OFFER
1	Manufacturer	Unspecified	
1A	Applicable Standards & IEEE 519 Compliance	Contractor to Specify	
2	Floor/Wall Mounted	Yes (floor)	
3	Front & Side Access	Yes	
4	Form Type & kA rating	2b/4b (manufacturer to confirm)	
5	Material	2mm 3CR12 SS	
6	Finish	Painted Electric Orange (epoxy coated)	
7	Cable Entry	Bottom	
8	Base	Hot dipped galvanised	
9	Doors	Lockable	
10	IP Rating	IP 44	
11	Electrical Details	400V, 50Hz, Full Neutral	
12	Earthing Details	Full Length	
12A	Instrument Earth	Full Length	
13	Busbar Chamber	Top	
14	Grouping of Equipment	Individual	
15	Door Interlocks	Isolator Interlocks	
16	Panel tiers	Bolted together transportable sections - no more than 1.5m in length. Extensible and modular	
17	Dielectric Barriers	Yes	
18	Busbar Supports	Epoxy Insulators on Steel	
19	Compliance with detailed technical specification	Yes/No	
20	SANS Approved	Yes/No	
21	Busbar Material	Copper	
22	Mouldered Case Circuit Breakers	Schneider, ABB or similar	
	Manufacturer	Yes/No	
	In Accordance with Spec	Yes/No	
23	Main Circuit Breakers	Schneider, ABB or similar	
	Manufacturer	Yes/No	
	In Accordance with Spec	Yes/No	
24	Selector Switches	Unspecified	
	Manufacturer	Yes/No	
	Type	Rotary	
	In Accordance with Spec	Yes/No	

NAME COMPANY: _____SIGNATURE OF REP:_____

DATE_____

ANNEXURE A

COMPULSORY RETURNABLE DATA SHEETS

TECHNICAL DATA SHEET: MCC PANELS (Complete one for each MCC)

NAME OF SITE: _____

RATING OF MCC PANEL: _____

No	ITEM		SPECIFIED	OFFER
25	HRC /Semi Conductor Fuses			
	Manufacturer	Unspecified		
	Type	Visible Link		
	In Accordance with Spec	Yes/No		
26	Contactors			
	Manufacturer	Unspecified		
	Type	AC3		
	In Accordance with Spec	Yes/No		
27	Variable Speed Drives-Low Harmonics	Yes/No		
	Harmonic study and report to be included	Yes		
	Manufacturer of Harmonic Filters & Chokes	Unspecified		
	Type	AC3		
	In Accordance with Spec and IEEE 519	Yes/No		
	Soft Starters	Yes/No		
	Manufacturer	Unspecified		
	Type	AC3		
	In Accordance with Spec	Yes/No		
28	Ancillary Relays			
	Manufacturer	Unspecified		
	Type	Plug-In		
	Field convertible contact configuration	Yes/No		
	In Accordance with Spec	Yes/No		
29	Push Buttons			
	Manufacturer	Unspecified		
	Type	As per spec		
	In Accordance with Spec	Yes/No		
30	Indicator Lamps			
	Manufacturer	Unspecified		
	Type	As per specs		
	In Accordance with Spec	Yes/No		
31	Emergency Stop Button			
	Manufacturer	Unspecified		
	Type	As per specs		
	In Accordance with Spec	Yes/No		
32	Automatic Change over Equipment			
	Manufacturer	Unspecified		
	Type	As per specs		
	In Accordance with Spec	Yes/No		
	Power Safe as per specs	Indicator Lamps		
		Manufacturer	Unspecified	
		Type	As per specs	
		In Accordance with Spec	Yes/No	

NAME COMPANY: _____SIGNATURE OF REP :_____

DATE_____