CIDB Category: 9 ME

WATER & SANITATION UNIT

Engineering Department

PROCUREMENT DOCUMENT

INFRASTRUCTURE

CONTRACT No.: WS 7342

HAMMARSDALE WASTEWATER TREATMENT WORKS: IMPROVEMENTS TO LIQUID AND SOLIDS TREATMENT FACILITIES

VOLUME 2 of 3

- **C3: SCOPE OF WORK**
- **C4: APPENDICES**

Date of issue: January 2022

Document Version: 01/04/2021

NAME OF TENDERER: .....

INDEX

PART **PAGE**

C4 APPENDICES

C4.1 Locality Plan
C4.2 Schedule of Local Sub Contractors Skills
C4.3 Health and Safety Specifcation
C4.4 Construction Environmental Management Plan
C4.5 Geotechnical Reports

TENDER VOLUME 3 of 3

D1 DRAWINGS

PART C3: SCOPE OF WORK

TABLE OF CONTENTS

C3 PART C3: SCOPE OF WORK

C3.1 PROJECT DESCRIPTION AND SCOPE OF CONTRACT

C3.1.1 Description of Works

eThekwini wishes to improve to liquids and solids treatment facilities at Hammarsdale WWTW. This is to improve and optimise the treatment process for the liquids and solids treatments facilities at Hammarsdale WWTW.

The Hammarsdale WWTW is located approximately 50km north- west of Durban which, in turn is located off the N3 National Road. The WWTW is situated on Stott Road. The coordinates of the entrance to the WWTW are 29°47'59.20"S and 30°39'43.02"E. Locality Plan of the site is shown in **PART C4: SITE INFORMATION C4.1LOCALITY PLAN.**

Hammarsdale Wastewater Treatment treats a mixture of domestic and industrial wastewater. The treatment plant has a reported design ADWF hydraulic capacity of 27ML/d. But due to the high organic concentrations of the raw sewage, the treatment plant has been de-rated to treat approximately 8.5Ml/d.

The existing inlet works, located at the southern end of the site receives the raw sewage via a 900mm pipeline. Wastewater is also discharged manually from various tankers which combines with the main wastewater flow into the plant. The combined wastewater passes through a very course screen (approximately 30mm) before entering Pump Station 6's sump via the flow measurement flume. Pump Station 6 consists of 4 centrifugal pumps which pump wastewater through six, static, 0.8mm parabolic screens before going to the bioreactors.

There are 6 bioreactors operating as a 5 Stage Barenpho configuration. The reactors are of an annular design. Aeration is supplied by surface aerators. Each reactor has a dedicated clarifier situated at the center of the annular reactor to settle out activated sludge. Effluent is discharged from the clarifiers to a series of maturation ponds. Disinfection is achieved by dosing chlorine before the wastewater is released to the environment.

Waste Activated Sludge (WAS) is pumped from the clarifier underflow to a collection sump. WAS is then either dewatered using an existing Pennwalt Sharples centrifuge and transferred to a storage silo for collection or is pumped to drying beds for further dewatering.

Most of the mechanical equipment described above has reached end of life and needs to be replaced. Further to this, it is the intention of eThekwini Municipality to upgrade the wastewater works in phases to achieve the original design ADWF of 27 Ml/d and improve overall process efficiency through equipment modernization.

The Contract involves the construction of new infrastructure as well as the refurbishment and upgrade of existing infrastructure and buildings at the Hammarsdale Wastewater Treatment Works. The new infrastructure includes reinforced concrete structures, pipelines, buildings, structural steel structures, roadways and parking bays.

The Works include, but are not restricted to the following:

CIVILS WORKS:

Inlet works:

- Construction of a new tanker discharge manhole over existing raw sewerage income pipeline;
- Construction of a new overflow manhole to existing raw sewerage income pipeline;
- Demolish existing inlet works structure and channels to make way for new inlet works;
- Construction of 900mm diameter HDPE pipeline from existing inlet works to the new inlet works;
- Construction of a new pump station sump overflow system;
- Removal of existing manual bar screen and screening collection channel;
- Construction of new reinforced concrete channels and Degritters for mechanical equipment;

- Installation of new stainless steel walkway gratings over new concrete channels;
- Installation of new stainless steel grids at the new pumpstation;
- Construction new concrete structure for housing the new screens;
- Construction of new screenings and grit handling area;
- Construction of new roadworks and paving around the Inlet works.

Reactor area:

- Demolish and reconstruct Aerator platforms and walkways;
- Repair damage to reactor concrete structure;
- Construct operator's platform for mixers in the aerators;

Second class water:

- A new steel structure for housing the second-class pumps and filters;
- Construction of a new second-class water pipe network around the plant;

Dewatering (Centrifuge):

- Construction of new Dewatering (Centrifuge) building;
- Construction of new roadworks and paving and stormwater around the Dewatering(Centrifuge) building;
- Installation of new civil services around dewatering building;

General site works:

- Realignment of bulk water supply pipeline;
- Repair to existing 600mm gate valve on stormwater bypass pipeline.

BUILDING WORKS:

- Alterations and refurbishment to Administration building, including new office partition and associated renovation activities including new staircase;
- New Guard House buildings.

CIVIL TEMPORARY WORKS

The Contractor will be required to design and install adequate shoring for excavations. Shoring will be required for all excavations deeper than 1.2 m.

The Contractor will be required to design, install, operate, maintain and remove any temporary diversions, pumps and pipework required to divert sewage flow when tying into existing manholes, structures or pipelines.

MECHANICAL SCOPE

The mechanical scope of this contract includes the design, supply, installation, testing, commissioning and upholding during the Trial Operation Period (TOP) and the Defects Notification Period (DNP) for the following: -

Inlet Works:

- Two mechanically raked, 25mm inclined bar screens
- Two mechanically raked, 6mm inclined bar screens
- A 25mm manually raked screen to be installed in the 3rd channel as a back-up
- Two (duty/standby) washer/compactor units
- Two self priming centrifugal pumps for grit removal
- Two (duty/standby) grit classifier units
- Duty/standby motorized dolly skip system for coarse and fine screen collection
- Duty/standby motorized dolly skip system for grit collection
- Hydraulic launder channels to convey screenings to the washer/compactors

- Two automatically cleaned band screens with 1mm perforated plates
- Two high pressure washwater pumps
- Two microstrainer/compactor units
- Two shaftless screw conveyors for ultrafine screenings
- Four centrifugal pumps installed at the new pump station.
- One dry well sump pump at the new pump station
- Second class water supply system including automatically cleaned cartridge filers, three centrifugal pumps and accumulation vessel.
- HVAC equipment for the new pump station building.
- All piping, fittings, supports, valves and fasteners required as indicated on the relevant Piping and Instrumentation Diagrams (P&ID's)

Dewatering Facility:

- Two (duty/standby) self-priming centrifugal pumps to transfer Waste Activated Sludge (WAS) from the existing WAS sump to the new dewatering facility.
- Two (duty/standby) macerator units
- Two submersible mixers to keep solids in suspension in the new Centrifuge Feed Tank.
- Two, progressive cavity, centrifuge feed pumps
- Two high efficiency, horizontal decanter centrifuge units complete with VSD and local control panel and PLC (package unit).
- Two (duty/standby) solid polyelectrolyte make-up systems complete with stainless steel hoppers, agitators, dual mixing chambers all controlled from a local PLC and HMI supplied as a package unit.
- Two progressive cavity polymer dosing pumps and two progressive cavity polymer lubrication pumps
- Two, centreless spiral screw conveyors to convey dewatered sludge from each centrifuge unit
- Stainless steel cake receiving hopper with motorized bridge breakers feeding two(duty/standby), screw fed progressive cavity cake pumps to transfer dewatered sludge to the storage silos
- Like-for-like replacement of the domestic sewage sump pump adjacent to the WAS sump
- General HVAC ventilation fans and ducting for the dewatering building and an air handling unit to provide temperature and humidity control to for the polymer make-up area.
- All piping, fittings, supports, valves and fasteners required as indicated on the relevant Piping and Instrumentation Diagrams (P&ID's)

Reactors:

- Removal of 2 (two) existing 37 kW fixed surface aerators in the main aeration zones of reactors 1 and 3 to 6, complete with all cabling and switchgear (10 aerators in total).
- Removal of 2 (two) existing 30 kW fixed surface aerators in the main aeration zones of reactors 1 and 3 to 6, complete with all cabling and switchgear (10 aerators in total).
- Removal of 1 (one) existing 11 kW fixed surface aerators in the re-aeration zones of reactors 1 to 6, complete with all cabling and switchgear (6 aerators in total).
- 4 (four) new fixed 37 kW surface aerators in the main aeration zone of reactors 1 and 3 to 6, operating on VSD's, complete with motor, gearbox, supports and anchors into the concrete platform (20 aerators in total).
- 1 (one) new fixed 11 kW surface aerators in the re-aeration zone of reactors 1 to 6, operating on VSD's, complete with motor, gearbox, supports and anchors into the concrete platform (6 aerators in total).
- GRP draft tubes for all 37 kW surface aerators (20 in total)
- GRP draft tubes for all 11 kW surface aerators (6 in total)
- 2 (two) dissolved oxygen probes per reactor complete with controller, enclosure and stainless steel mounting arm and supports (12 probes and mounting arms in total)
- Prior to finalising the design of the surface aerators, conduct detailed dimensional survey of the existing civil infrastructure of each reactor, so much as it affects the design of each aerators and draft tubes.
- Access stairway, platform and handrailing for each of the new submersible mixers situated in the primary and secondary anoxic zones (12 in total)
- Removal of the existing submersible mixers, guiderails and supports in all reactors (12 in total) and disposal to a site approved by the Employer.

- One submersible mixer in each of the reactor's primary anoxic zone complete with guiderail, lifting davit arm and anchors (6 in total).
- One submersible mixer in each of the reactor's secondary anoxic zone complete with guiderail, lifting davit arm and anchors (6 in total)

ELECTRICAL AND CONTROL & INSTRUMENTATION (C&I) SCOPE

The scope of the Hammarsdale Improvements Project includes the electrical and C&I elements required to operate, control and monitor the new head of works and de-watering plants. In addition, existing critical electrical equipment which has reached the end of useful life has been identified for replacement or upgrade. A new PLC and SCADA based control system will be provided to operate the new plants and certain existing processes.

The electrical scope of work includes:

- Replacement of the Main Substation medium voltage (MV) switchgear.
- Supply of a new emergency power diesel generating plant to provide back-up power to the head of works, pump stations No. 1 and No. 2 and the de-watering plant.
- Complete new electrical infrastructure for the new head of works plant.
- Complete new electrical infrastructure for the new de-watering plant.
- New motor control centres (MCC) and electrical reticulation for the reactors and pump stations No. 1 to No. 4.
- Replacement of the existing mini-substation units.
- Administration building upgrade small power and lighting requirements.
- Administration building, head of works building and the de-watering building lightning protection and earthing.
- Head of works area lighting

The electrical work will include the manufacture, supply, installation and commissioning of complete systems, which includes the necessary; switching equipment, isolation equipment, cabling, earthing, cable support, cable sleeving/trenching, small power and lighting requirements.

The C&I scope of work includes:

- New SCADA system, including hardware and licenses to be installed in the control room.
- New fibre optic Ethernet based network, connecting monitored plant areas to the main control room.
- Complete new C&I infrastructure for the new head of works plant.
- Complete new C&I infrastructure for the new de-watering plant.
- New C&I systems for the reactors and pump stations No. 1 to No. 4.
- New MSU monitoring
- New emergency power system monitoring
- New MV switchgear monitoring

The C&I work includes the manufacture, supply, installation and commissioning of complete systems, which includes the necessary; PLC hardware, PLC software, SCADA hardware, SCADA software, instrumentation, network equipment, junction boxes, cabling, earthing, cable support and cable sleeving/ trenching.

C3.1.2 Description of Site and Access

Hammarsdale Wastewater Treatment Works (WWTW) is an extended aeration plant which has a design capacity of 27Ml/d. The works will undertake the upgrading of the inlet works, dewatering facility and other miscellaneous items.

The Site is in the existing Hammarsdale WWTW and is located approximately 50km north-west of Durban. The WWTW access is accessed by taking Anderson Road eastwards from Kelly Road and then turning right into Stott Road. The map reference is 29°47'58.96"S; 30°39'42.65"E. A site locality plan is included in Part 4: Site Information C4.1

C3.1.3 Nature of Ground and Subsoil Conditions

According to the 1:250 000 Geological Map Series, 2930 Durban, and the observations recorded during the field investigation, the site in its entirety is underlain by sandstone of the Natal Group.

The fill, residual sandstone and weathered sandstone horizons sampled from the trial pits within the development area generally grades as a clayey silty sand, with low plasticity index values and a “low” potential expansiveness according to the empirical methods of Van der Merwe (1964) and Weston (1980), for the prediction of expansivity. According to COLTO (1998), the residual sandstone horizons classifies as G7 whereas the weathered sandstone horizons generally classify as G6 to G8.

See attached to Site Information section of this document, a copy of the site specific geotechnical investigation report. Tenderers are to expect at least the ground conditions outlined in this report. No claims for variance in expected ground conditions will be entertained if the forementioned report has not been taken into account in the tenderer’s pricing assumptions.

C3.2 ENGINEERING

C3.2.1 Design Services And Activity Matrix

Component	Responsible	Input information provided by
Concept, feasibility	Employer	
Overall Process	Employer	
Basic Engineering and preliminary design of Civil Infrastructure	Employer	
Detailed design and drawing of mechanical and electrical equipment	Contractor	Employer
Detailed design of control and instrumentation equipment and SCADA	Contractor	Contractor
Detailed design of civil infrastructure	Employer (based on M&E detailed design)	Contractor
Detailed design of building	Employer	Contractor
Building plan approval	Employer	
Detailed design of mechanical, electrical, fire and plumbing for building	Contractor	
Temporary works	Contractor	
As-built drawings (Mechanical & Electrical)	Contractor	
Operation and Maintenance manuals	Contractor	
Monthly operations reports (during operations period)	Contractor	

C3.2.2 Employer's Design

The Employer, through the Engineer, has undertaken a preliminary and detailed design of the permanent civil, building and structural works to be executed under this Contract.

In respect of the mechanical and electrical work, the Employer has determined the general performance requirements, specifications, general arrangement and design criteria for the equipment required, however the detailed design shall be undertaken by the Contractor.

The Employer's design is documented on the drawings and in the Works Specifications which form part of this Procurement Document.

The Employer shall provide the detailed design for the civil and building infrastructure. However, this design will be based on the detailed design of the mechanical and electrical equipment that shall be undertaken by the Contractor. As such, the detailed design for the civil and building infrastructure will be reliant on the detailed design provided by the Contractor. The Employer will provide detailed design drawings for the civil infrastructure that is affected by the Mechanial and Electrical design one month after all the required design information is provided by the Contractor to the Employer. The Contractor shall allow for this in their programme.

The Employer is not responsible for any errors in the Mechanical and Electrical design provided by the Contractor. If there are errors or failures in the civil and building infrastructure due to errors or incorrect information provided by the Contractor, the Contactor shall cover all costs to correct the errors and remove and reconstruct the civil and building infrastructure to the Employers satisfaction. The Contractor shall also cover the redesign costs, if any, that are incurred by the Employer due to an error in the Contractors design.

The civil and building infrastructure that is expected to be influenced by the Mechanical and Electrical design, includes, but is not limited to:

- Inlet

- New Inlet works Pump station;
- Dewatering facility;
- Second class water pump station;
- Biological reactors;
- Administration building

Note however that other civil and building may be influenced by the Mechancial and Electrical design and the Employer may request additional design information from the Contactor in order to complete the detailed civil design.

C3.2.3 Design Brief

The Contractor shall be responsible for the detailed design of mechanical and electrical plant and its installation to give effect to the Employer's performance requirements and specifications.

The detailed design specifications, performance standards, general and specific technical requirement, commissioning, testing and verification acceptance criteria for the Mechanical, Electrical and Electronic equipment is provided in Volume 2.

Where adaptations of the Employer's design are necessary to meet the Contractor's specific requirements, approval shall be obtained from the Engineer.

Where any alternative to the Works Specifications is agreed to, the onus shall be upon the Contractor to design such alternative, to the satisfaction of the Engineer, to meet all performance and operational specifications given in the Works Specifications.

Upon Commencement of the Works, the Contractor shall scrutinize the Works Information and within 4 weeks of the Commencement Date, give notice to the Project Manager of any error, fault or other defect found in the Works Information.

C3.2.4 Drawings

DRAWINGS PREPARED BY THE EMPLOYER

The Works shall be carried out in accordance with the following drawings, as well as any further Drawings which may be issued by the Engineer.

See section **ANNEX 3: DRAWING INDEX for a full drawing register.**

The Drawings forming part of the tender documents are marked '**for tender purposes only'** and shall not be used for construction.

Three full-size copies of each drawing required for construction will be issued to the Contractor free of charge. The Contractor shall make any additional copies he may require at his own cost. Electronic versions of the drawing in pdf form shall be provided free of charge. Selected Autocad drawings will be provided.

Only figured dimensions shall be used and drawings shall not be scaled unless so instructed by the Engineer. The Engineer will supply any figured dimensions that may have been omitted from the drawings. All levels given on the drawings on existing services and road surfaces where connections are required shall be confirmed on site well in advance of the commencement of any new work. Any discrepancies shall immediately be brought to the Engineers attention.

All levels on drawings of new services at tie in points are to be checked by the Contactor before installation of the service and any discrepancies shall immediately be brought to the Engineers attention.

DRAWINGS PREPARED BY THE CONTRACTOR

Mechanical and Electrical Works

The Contractor shall be responsible for the production of the following drawings:

- General arrangements and details documenting the Contractor's design;
- Construction Process Flow Diagram (based on the Engineer's design diagram issued).
- Construction P&ID diagram (based on the Engineer's design diagram issued).
- Control philosophy for each item of equipment (based on the Engineer's philosophy issued)
- Details showing civil, structural and building infrastructure requirements;
- Wiring diagrams and detailed electrical drawings;
- Detailed control and instrumentation drawings;
- Detailed network drawings;
- Fabrications drawings for all items of equipment;
- As-built drawings documenting the mechanical (e.g. mechanical layouts, equipment GA's, piping isometrics) and electrical works.

The Contractor shall also submit technical data sheets and performance curves for all equipment and instrumentation offered.

Drawings shall comply with the requirements given in the General Specifications for Mechanical and Electrical Work.

Shop Details for Structural Steelwork

The Contractor shall be responsible for the production of all shop details for structural steelwork, in accordance with clause 5.1 of SANS 1200 H and/or SANS 1200 HA.

Upon the Engineer's request, the Contractor shall also provide the fabrication details of all structural steel for approval.

Temporary Works

Upon the Engineer's request, the Contractor shall provide drawings and sketches for approval, showing the temporary works.

'As-Built' Drawings

The Contractor shall record all amendments and deviations from the drawings issued at the start of the Contract. This shall be done on a set of drawings specially issued for this purpose. These shall be handed to the Engineer on completion of the Works. The Certificate of Completion will not be issued without this information having been submitted to the Engineer.

C3.2.5 Operation and Maintenance Manuals

The Contractor shall prepare operation and maintenance (O&M) manuals in respect of all mechanical and electrical plant supplied under this contract.

The manuals shall comply with the requirements given in Volume 2. It shall also cover all items required by the Department of Water Affairs Blue Drop system.

Two copies of the Operation and Maintenance Manual as specified in the Standard Specification for Mechanical Works shall be issued prior to commencement of the Tests on Completion and the start of the Trial Operation Period. The Engineer will not approve of the commencement of the Trial Operation Period until Operation and Maintenance Manuals that comply with the Specification in Volume 2 have been submitted

C3.2.6 Engineer's approval

All drawings, schedules and technical data sheets pertaining to plant and equipment forming part of the permanent works shall be submitted to the Engineer for approval, prior to placing firm orders or commencing manufacture.

Drawings issued to the Engineer for approval shall be full size paper copies and electronic copies.

The Contractor shall supply the Engineer with supporting calculations or data if so requested.

The Contractor shall allow for a period of two working weeks in his programme for the review of each submission by the Engineer.

The Engineer's approval or acceptance of any drawings, method statement, design or document will not relieve the Contractor of his responsibilities in terms of the Contract and the Specification, neither will it relieve the Contractor of any liability in terms of Health and Safety, Environmental or any other specification

C3.2.7 Design Procedures

Required Submissions within 42 days

The Contractor shall submit the following for acceptance within 42 days from the Commencement Date:

a) Dimensioned layout drawings (preferably A0 size but no smaller than A1) of the installation showing the proposed layout and design of all plant and equipment (including lifting equipment) as well as any required building modifications. Sufficient sections and elevations must be shown so that the relative arrangement of all equipment is clear.

b) Process flow diagram, indicating items of equipment.

c) Control system specifications.

d) Dimensioned arrangement drawings of all equipment requirements in respect of the building and civil structures.

e) Loadings which the lifting gear will place on other structures.

f) Drawings of pipe support details.

g) Technical data sheets for all coatings proposed.

h) Layout and construction drawings of all electrical distribution, starter, control, instrument and indicator panels with full details of proposed switchgear, relays, timers, instruments, indicators, trips, control switches, labelling (including wording), printing, and so forth.

i) Data sheets giving performance, sizing, physical and general technical data for all components of the installation.

j) Contents list for the Manual.

k) Contractor's document register.

The date by which possession of the Site can be handed over to the Contractor and consequently the completion date of the Works, is dependent on the date of submission and acceptance of the documents referred to above. Cost resulting from delays in submission of the Contractor's Documents or in correcting errors or making changes on documents not approved by the Engineer shall be for the Contractor's account.

The contractors a progamme shall also clearly indicate the submission date for all designs.

The item allowed for in the Schedules of Quantities to cover expenses incurred by the Contractor in the event of delays in handing over the Site shall not apply where such delay is attributable to the late submission and acceptance of the drawings referred to above.

General Requirements

The requirements relating to the information and drawings to be submitted by the Contractor for approval by the Project Manager prior to the purchase and manufacture of any plant and equipment must be read together with Volume 2.

The Contractor's Documents shall comply with the following general requirements:

(a) A register of all the Contractor's documents shall be provided with each submission.
(b) Drawings shall be prepared in accordance with the latest issue of SANS 10111. An equivalent international code of engineering drawing practice will also be acceptable.
(c) General Arrangement drawings shall be to A1 or A0 size.
(d) Drawings shall be to scale, with both the scale and the drawing being large enough to clearly show all relevant components of the plant and equipment.
(e) In addition to the usual plan and two side elevations, sufficient additional sections shall be included to clearly show the arrangement of all plant and equipment.
(f) Item lists shall be provided on the drawing or on a separate parts list.
(g) Item descriptions shall include the material of construction, quantity and full identification information, including, as applicable, brand name, manufacturer's reference number, model number, size, rating, source, duty, quantity, etc.
(h) All annotations shall be clear and legible when the drawing is printed with up to 50% reduction.

Preliminary Design

The Contractor shall submit the following for acceptance before continuing with the detailed design:

(a) Dimensioned layout drawings (preferably A0 size but no smaller than A1) of the installation showing the proposed layout and design of all plant and equipment (including lifting equipment) as well as any required building modifications. Sufficient sections and elevations must be shown so that the relative arrangement of all equipment is clear.
(b) Process flow diagram and P&ID, indicating items of equipment.
(c) Control system specifications and control philosophy.
(d) Dimensioned arrangement drawings of all equipment requirements in respect of the building and civil structures.
(e) Loadings which the lifting gear will place on other structures.
(f) Drawings of pipe support details.
(g) Technical data sheets for all coatings proposed.
(h) Layout and construction drawings of all electrical distribution, starter, control, instrument and indicator panels with full details of proposed switchgear, relays, timers, instruments, indicators, trips, control switches, labelling (including wording), printing, and so forth.
(i) Data sheets giving performance, sizing, physical and general technical data for all components of the installation.
(j) Contents list for the Manual.
(k) Contractor's document register.

Detailed Design

The Contractor shall submit the following for acceptance before proceeding with ordering and fabrication of plant.

(a) Dimensioned drawings of equipment.
(b) Electrical and control circuit diagrams.
(c) Instrumentation table including, as a minimum, the make, model, range and any set points of units to be installed.
(d) Cable schedule for power, data, control and instrumentation cables. This shall include the cable type and construction, conductor material, insulation, protection, voltage rating, start and finish points, route length, duty, load, voltage drop, core area, no. of cores, no. of cores used and gland size. For cable voltages above 400 Volts, the schedule shall also include the purchase details, specification and date of manufacture.
(e) Contractor's drawing and document register.

HAZOP

A Hazard and operability study shall be undertaken by the Contractor during the design phase at a time agreed with the Employer. The Contractor shall chair the HAZOP study which shall be attended by appropriately skilled and experienced designers from the Contractor. The Contractor’s team shall be qualified cover all aspects of the design including process, mechanical, electrical and instrumentation.

The Contractor shall follow the internationally recognised HAZOP procedure and he shall record all findings and design changes that are a result of the HAZOP.

A detailed HAZOP report shall be presented to the client 1 week from the conclusion of the study.

Required Submissions before Commissioning the Works

Prior to commencement of the Tests on Completion and the start of the 28 day Trial Operation Period, the Contractor shall submit two copies (and an electronic copy) of the Operation and Maintenance Manual as specified in the Standard Specification for Mechanical Works.

Before Taking-Over Certificate

The Contractor shall provide reports indicating the methodogy and results of all activities conducted during the commissioning and Trial and Operation Period (TOP) for approval by the Engineer.

Before Performance Certificate

Before the Defects Certificate is issued, the Contractor shall provide six copies of the final version of the Installation, Operation and Maintenance Manual and shall also provide, on electronic data storage, all design drawings, corrected where necessary to be "as built". The drawings shall be compatible with AutoCAD. The Manual shall comply with the Standard Specification for Mechanical Works.

The Contractor shall have provided all reports during the DNP period as described in the Detailed Mechanical Specification. All defects pick-up in the defects period shall be recorded in the reports and all root causes of the defects resolved. Evidence of the resolutions to be included in the DNP reports.

C3.3 PROJECT SPECIFICATION

PREAMBLE

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.

C3.3.1 General

PS 1 PROGRAMME, METHOD OF WORK, AND ACCOMMODATION OF TRAFFIC

This Clause is to be read in conjunction with the provisions and obligations as contained in SANS 1921-1 and SANS 1921-2.

PS.1.1 Preliminary Programme

The Contractor shall include with his tender a preliminary programme on the prescribed form (see Part T2.2: Preliminary Programme) to be completed by all Tenderers. The programme shall be in the form of a simplified bar chart with sufficient details to show clearly how the works will be performed within the time for completion as stated in the Contract Data.

Tenderers may submit tenders for an alternative Time for Completion in addition to a tender based on the specified Time for Completion. Each such alternative tender shall include a preliminary programme similar to the programme above for the execution of the works, and shall motivate his proposal clearly by stating all the financial implications of the alternative completion time.

The Contractor shall be deemed to have allowed fully in his tendered rates and prices as well as in his programme for all possible delays due to normal adverse weather conditions [refer to Clause 8.5 c)] and special non-working days (refer to Clause 8.5(c)) as specified in the in the Contract Data.

PS.1.2 Programme in Terms of Clause 8.3 of the Conditions of Contract

It is essential that the construction programme, which shall conform in all respects to Clause 8.3 of the Conditions of Contract, be furnished within the time stated in the Contract Data (refer to Clause 1.1.86 as amended by the Contract Data).

The preliminary programme to be submitted with the tender shall be used as basis for this programme.

The Tenderer's attention is drawn to the fact that a number of factors will affect the programming of and method of carrying out the works. The more important of these are:

(1) Time required for service relocations.
(2) Time allowances to be made for the ordering of special items.
(3) Notification required by service organisations.
(4) Any special sequence in which work must be carried out. Must certain areas of work be finished before work commences on others?
(5) If delays are anticipated with service relocations the contractor should be asked to allow time.
(6) Is work required out of normal hours? (eg. to accesses).
(7) Working with live sewer and water pipelines (method statement should be carried out).
(8) Ability to undertake activities at the Dewatering Facility and Inlet Works (as well as other aspects of the work) in parallel.

Those known, existing services in the area of the works have been depicted on the contract drawings. It is evident, however, that the status of existing service records as far as can be ascertained might not reflect the actual situation in the field. As such, due allowance has been made in the Bill of Quantities for the proving of services where directed by the Engineer.

PS.2 SERVICES

This Clause is to be read in conjunction with the provisions and obligations as contained in SANS 1921-1 and SANS 1921-2.

PS.2.1 Existing Services

The Tenderer's attention is drawn to the numerous existing services in the area. Although every effort has been made to depict these services accurately, the positions shown must be regarded as approximate. An approximate existing services drawing layout is also included in the drawing register. All excavation around site should be done by hand unless instructed or verified by the Engineer.

PS.2.2 Proving Underground Services

This clause must be read in conjunction with Clause DB.5.1.2, the requirements of which shall be extended to cover all earthworks operations whether for trenching or bulk earthworks, in the vicinity of underground services.

It is stressed that all services in a particular area must be proven before commencing work in that area.

Insofar as bulk earthworks are concerned, where services are indicated on the drawings or where from site observations can reasonably be expected that such services are likely to exist where excavations are to take place, the Contractor shall without instructions from the Engineer carefully excavate by hand to expose and prove their positions.

The cost of the proving trenches is to be included in the work covered by Clause DA.8.3.

When a service is not located in its expected position the Contractor shall immediately report such circumstances to the Engineer who will decide what further searching or other necessary action is to be carried out and shall instruct the Contractor accordingly. The cost of this additional searching shall be to the Council's cost and shall be paid for under DB.8.19 - Proving Existing Services.

Should any service be damaged by the Contractor in carrying out the works and should it be found that the procedure as laid down in this clause has not been followed then all costs in connection with the repair of the service will be to the Contractor's account.

Proving of services shall be completed at least two weeks in advance of the actual programmed date for commencing work in the area. The position of these services located must be co-ordinated and levelled by the Contractor, and the information given in writing to the Engineer’s Representative.

The requirements of this clause do not relieve the Contractor of any obligations as detailed in the Conditions of Contract or under Clause 4.17 of SANS 1921-1.

PS.2.3 New Services and Relocation of Existing

This clause shall be read in conjunction with Clause PSC 8.2.7.

New services are either to be installed by the Contractor as part of the contract or by others during the contract period. In the latter case excavation and subsequent backfilling of the trench from the top of the bedding layer shall generally be carried out by the Contractor.

Relocation of services shall generally be carried out by the relevant services organisation. Generally their work shall include the excavating and bedding the service which will include backfilling to a

depth of approximately 300 mm above the service. The remainder of the backfilling shall be carried out by the Contractor.

Generally work shall only commence on the installation of new services once the bulk earthworks have been completed and roughly trimmed to level along a substantial portion of the services route. In addition no sidewalk, verge, median or island shall be surfaced or topsoiled until all work on the services has been completed.

Services affected by the contract are described as follows:

- PS.4: Watermains;
- PS.5: Sewers;
- PS.6: Stormwater;
- PS.7: Electrical Cables / Lighting;

Further to the above, tenderers are referred to the services drawing and are to note that several minor cables / pipes may be encountered during excavation works which may require to be relocated to some extent. It is anticipated that the two week period required under PS.2.2 will allow sufficient time for these relocations.

PS.2.4 Accommodation of Services

Further to Clauses PS.1 and PS.2 of this specification, tenderers are to note that allowance must be made under this item and / or the appropriate rates, for all costs incurred as a result of complying with these clauses. It shall also cover liaison with the services organisations and accommodation of their work gangs / contractors on site.

PS.6 ELECTRICAL PLANT

The new plant and equipment will require the supply and installation of electrical and C&I infrastructure within areas where existing services and infrastructure are currently installed.

The replacement of the main substation MV switchgear will require liaison with Eskom. Isolation of the Eskom supply to the works will be required for the change over and will need to be planned accordingly.

Isolation of any other supplies required for the installation of new equipment will be coordinated with the works maintenance manager.

PS.6.1 General

Various types of electrical cables including high voltage, low voltage, street lighting and domestic connection cables are affected by the contract. The laying, relocation and jointing of all cables will be carried out by eThekwini Electricity's work gangs, or agents appointed by them, whilst the excavation and backfilling forms part of this contract. Close liaison will therefore be necessary with eThekwini Electricity throughout the contract.

PS.6.3 MV / LV Cables

Certain MV / LV cables are to be replaced within the contract area. The actual cable work associated with this relocation and / or replacement of these cables will be carried out by eThekwini Electricity and it is stressed that the two week period referred to in Clause PS.2 is the minimum period required to enable eThekwini Electricity to be on site timeously.

PS.6.4 Relocation of Existing Services

Should it be necessary to adjust the line, level and / or position of any service not catered for in the contract to enable the construction to proceed the Contractor shall on no account effect such

adjustment himself but shall notify the Engineer who will arrange for the work to be carried out at no cost to the Contractor.

PS.7.3 Environmental Management Plan

In addition to the above, all requirements according to the Environmental Management Plan as detailed in C3.5: Particular Specifications, will be adhered to. The remainder of the Project Specifications are contained in Volume 2.

PS.8 OCCUPATIONAL HEALTH AND SAFETY

PS.8.1 General Statement

When considering the safety on site the Contractor's attention is drawn to the following:

Detailed Standard Health and Safety Specification in Volume 2

It is a requirement of this contract that the Contractor shall provide a safe and healthy working environment and to direct all his activities in such a manner that his employees and any other persons, who may be directly affected by his activities, are not exposed to hazards to their health and safety. To this end the Contractor shall assume full responsibility to conform to all the provisions of the Occupational Health and Safety Act No 85 and Amendment Act No 181 of 1993, and the OHSA 1993 Construction Regulations 2014 issued on 7 February 2014 by the Department of Labour.

For the purpose of this contract the Contractor is required to confirm his status as mandatory and employer in his own right for the execution of the contract by entering into an agreement with the Employer in terms of Section 37(2) of the Occupational Health and Safety Act.

In addition to the above, all requirements according to the OHSA 1193 Safety Specification (2014) as detailed in C3.5: Particular Specifications, will be adhered to.

PS.8.2 Health and Safety Specifications and Plans to be submitted at tender stage

PS.8.2.1 Employer's Health and Safety Specification

The Employer's Health and Safety Specification is included in Part C3.4: Particular Specifications. The remainder of the Project Specifications are contained in Volume 2.

PS.8.2.2 Tenderer's Health and Safety Plan

At tender stage only a brief overview of the tenderers perception on the safety requirements for this contract will be adequate. This will be attached to Part T2.2: Contractor’s Health and Safety Plan.

Only the successful Tenderer shall submit a separate Health and Safety Plan as required in terms of Regulation 7 of the Occupational Health and Safety Act 1993 Construction Regulations 2014, and referred to in Part T2.2: Contractor’s Health and Safety Plan.

The detailed safety plan will take into consideration the site specific risks as mentioned under PS.10.1 and must cover at least the following:

(i) A proper risk assessment of the works, risk items, work methods and procedures in terms of Regulations 9 to 29;
(ii) Pro-active identification of potential hazards and unsafe working conditions;
(iii) Provision of a safe working environment and equipment;
(iv) Statements of methods to ensure the health and safety of subcontractors, employees and visitors to the site, including safety training in hazards and risk areas (*Regulation 7)*;

(v) Monitoring health and safety on the site of works on a regular basis, and keeping of records and registers as provided for in the Construction Regulations;

(vi) Details of the Construction Supervisor, the Construction Safety Officers and other competent persons he intends to appoint for the construction works in terms of Regulation 8 and other applicable regulations; and

(vii) Details of methods to ensure that his Health and Safety Plan is carried out effectively in accordance with the Construction Regulations 2014.

The Contractor's Health and Safety Plan will be subject to approval by the Employer, or amendment if necessary, before commencement of construction work. The Contractor will not be allowed to commence work, or his work will be suspended if he had already commenced work, before he has obtained the Employer's written approval of his Health and Safety Plan.

Time lost due to delayed commencement or suspension of the work as a result of the Contractor's failure to obtain approval for his safety plan, shall not be used as a reason to claim for extension of time or standing time and related costs

A generic plan will not be acceptable.

PS.8.3 Cost of compliance with the OHSA Construction Regulations

The rates and prices tendered by the Contractor shall be deemed to include all costs for conforming to the requirements of the Act, the Construction Regulations and the Employer's Health and Safety Specification as applicable to this contract. Should the Contractor fail to comply with the provisions of the Construction Regulations, he will be liable for penalties as provided in the Construction Regulations and in the Employer's Health and Safety Specification.

Items that may qualify for remuneration will be specified in the Employer’s Health and Safety Specification.

PS.9 SITE SECURITY

The Contractor shall, for the duration of the contract, provide sufficient security and watchmen to adequately ensure the safety and protection of the works, the Contractor’s staff, including local labour and subcontractors, and all site plant and construction equipment required for the works.

Site Security, in conjunction with the SAPS (where necessary), shall be responsible for removal of disruptive elements, that may interrupt the progress of the contract through acts such as, but not limited to, intimidation, threats of disruption, violent disruption, or criminal and illegal activity by the local community or independent organisations or entities that may result in slowing down or partial or total stoppage of the works.

Payment for this item shall be made under Section 1, Part A of the Bill of Quantities.