

**EXHIBIT I**

**SCOPE OF WORK**

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### **1. Introduction:**

Marine Terminal located 25 Km west of coastal city Port Sudan. Its sewage treatment plant, which was in operation since 2010 to serve about 45 persons with a plant capacity of 15 m<sup>3</sup>/d is now operating at a very low efficiency. At present, the plant is overloaded as the population served has increased to 120 persons. Remarks regarding the current status of the plant as follows:

- 1.1. Wastewater is only partially treated as all the treatment units all receiving flows more than that designed for.
- 1.2. Some equipment in the plant such as pumps, blower, air pump, PLC system in control panel etc. are in use, but they are not efficient for the requirements to treat the high amount of raw sewage coming to the treatment plant.
- 1.3. The tertiary treatment of the plant (rapid sand filter) was bypassed. The filtration unit was installed, but was not utilized. Further tertiary treatment, disinfection, by sodium hypochlorite has no potential effects as chlorination since the filtration process is already bypassed.

### **2. Scope of Work :**

- The contractor shall provide and erection a package of wastewater treatment plant of capacity 40 m<sup>3</sup>/d adopting activated sludge process; Organic load for treatment plant unit is 16 Kg (B.O.D)/d based on maximum quality of raw sewage of B.O.D = 400 mg/l in flowing to the plant. Tertiary treatment for the activated sludge process is recommended to be rapid sand filters & disinfection by chlorine or U.V lamps with an effluent quality of the treated waste of B.O.D < 20mg/l & S.S <15 mg/l.
- The contractor shall provide and install all piping required for the treatment plant with all fittings and accessories (gate valves, non-return valve, gate valves ... etc.)
- The contractor shall construct holding tank (equalization tank) of capacity 50m<sup>3</sup> prior to the two treatment units as illustrated in attached Drawing. The Holding Tank and all other reinforced concrete structures shall be constructed by using Sulphate Resistant Cement (SRC) with minimum concrete strength 35KN/mm<sup>2</sup>.
- The contractor shall provide and install all electrical connections for the treatment plant. Include panels control, lighting etc.
- The process units of the plant shall be above ground to allow maintenance work and routine inspection.
- The contractor shall install panel control with PLC system in a room (12 m<sup>2</sup>) near the plant.
- The contractor shall provide and install two submersible pumps in Holding Tank each pump of head 12 m, Q = 1.5 m<sup>3</sup>/hr, 2H.P, from recognized manufacturer, Speroni (Italy) or equivalent all of part are

stainless steel (AISI 316) with all fittings and accessories (gate valves, non-return valve ...etc.),panel control & electrical water level sensors.

- The contractor provide and install two submersible pumps in Holding Tank each pump of head 10 m, Q = 0.6 m<sup>3</sup>/hr., 0.8 H.P, from recognized manufacturer, Speroni (Italy) or equivalent all of part are stainless steel (AISI 316) with all fittings and accessories (gate valves, non-return valve ...etc.),panel control & electrical water level sensors for existing waste water treatment plant.
- The contractor shall connect the waste water plant to the existing irrigation storage tank & irrigation pumps include all piping required for the irrigation tank with all fittings and accessories (gate valves, non-return valve, gate valves ... etc.) & panel controls & electrical sensor.
- The contractor shall use material resistant to corrosion (GRP, HDPE, insulated steel, sulphate resistant cement (SRC) for concrete) for civil works.
- The contractor shall provide laboratory for basic tests such as pH, B.O.D, C.O.D, D.O, S.S with the plant.
- The contractor shall prepare complete package of specifications for all components of the treatment plant together with as – built drawings and submit it to the client after commissioning of the plant.
- The contractor shall Provide and apply water proofing material nontoxic epoxy internally (3 layers) on R.C. walls and foundation.
- The contractor shall prepare List of needed spare parts & consumables.
- The contractor shall provide the client with complete design report with detailed drawings & specifications for all components of the plant.

## 2.1. Operation and Maintenance

2.1.1. The Scope of Work covers the comprehensive operation and maintenance of the entire Systems for four (4) months. The Contractor shall supply labour, materials, spare parts, tools, transport, equipment and all other necessary incidentals to carry out:

2.1.2. Comprehensive Maintenance to ensure that the System is in good quality condition includes but not limited the following:

2.1.2.1 Daily inspection and observation.

2.1.2.2 Inspection and cleaning of all mechanical and electrical items.

2.1.2.3 Dislodging of sludge when necessary, to maximum twice a year.

2.1.2.4 Routinely check chlorine and other chemical necessary.

2.1.3. Servicing of the Mechanical and Electrical equipment and adjust, repair, overhaul and replace components of the equipment that forms the entire Systems caused by the normal wear and tear during the operation of the equipment.

2.1.4. Comprehensive training to two (2) PETCO's staffs in routine operation and maintenance for four (4) months period on Site.

## 2.2. Material

- The contractor shall supply and install materials and components in accordance with the local regulations and standards acceptable to the client.
- The contractor shall supply and install materials and components standardized and adequate for the purpose required.
- The contractor shall provide all materials and equipment required for this project, including the following main components:-
  - Wastewater treatment plant
  - Sewage pumps to be installed in lifting station and buffer tanks
  - HDPE (High density polyethylene rising main)
  - Wastewater concrete tank (buffer and holding tanks).
  - Piping network with accessories such as gate valves, non-return valves, etc.
  - Manholes and valves chamber

Brief specifications for the above item are as outlined below:

### 2.2.1. Wastewater treatment plant

2.2.1.1. The contractor shall provide an activated sludge wastewater treatment plant with detailed design procedure. All design criteria should conform to the local and international standards.

2.2.1.2. The contractor shall design and construct the treatment plant to meet effluent quantity of  $B.O.D_5^{20} < 20$  mg/l, S.S < 15 mg/l.

2.2.1.3. The contractor shall provide sewage treatment plant includes the following items:-

2.2.1.3.1. Buffer tank with pump.

2.2.1.3.2. Inlet bar screens (manual & automatic)

2.2.1.3.3. Biological treatment system to include aeration tank, Membrane Bioreactor (MBR) or filtration system.

2.2.1.3.4. Air Blowers

2.2.1.3.5. Holding tank with chlorine dosing system.

2.2.1.3.6. Sludge holding tanks with small aeration system.

2.2.1.3.7. Sludge disposal unit.

2.2.1.3.8. Civil and steel works and piping system.

2.2.1.3.9. Electrical system network and control panels.

2.2.1.3.10. Accessories, valves, fittings, etc.

2.2.1.4. The contractor shall provide all above items from recognized manufactures and heavy duty with available spare parts in the local or neighboring markets.

## 2.2.2. Sewage Pumps

2.2.2.1. The contractor shall supply heavy-duty sewage pumps from recognized manufacturer with stainless steel impeller and suitable for corrosive waste pumps.

2.2.2.2. The contractor shall supply sewage pumps to be subjected to factory and site tests before commissioning the plant.

## 2.2.3. Pipes Material & Concrete Structures

2.2.3.1. The Contractor shall supply and install materials and components in accordance with the local regulations and standards acceptable to the client.

2.2.3.2. The contractor shall supply and install materials and components standardized and adequate for the purpose required.

2.2.3.3. The contract shall install drainage pipes with the following minimum quality requirements :

2.2.3.3.1. Above ground, drainage pipes shall be U.P.V.C complying to BS 4514 or equivalent with solvent welded joints / push fit rubber ring joints.

2.2.3.3.2. Waste branch pipes shall be UPVC / ABS / MUPVC complying with BS 3505 / 3506/ 5255 or push fit rubber ring joints.

2.2.3.3.3. Underground drainage pipes shall be UPVC complying with BS 4660 or equivalent with solvent welded joints / push fit rubber ring joints.

2.2.3.3.4. Underground drainage pipes between Manholes shall be UPVC Class- 16 with solvent welded joints / push fit rubber ring joints.

2.2.3.3.5. Above ground, rain water pipes shall be UPVC complying to BS 4576 or equivalent with solvent welded joints/ push fit rubber ring joints. The exposed rain water pipes shall be painted, matching the surrounding finish, subject to the Engineer's approval. However underground rain water pipes shall be same as underground drainage pipes specified above.

2.2.3.3.6. Pre- cast concrete pipes, if applicable, shall comply with British Standards, Code of Practice (BS CP) 556.

## 2.3. Execution

2.3.1. The contractor shall take special care to avoid any damage during transport, loading and off- loading, storage, etc.

2.3.2. The contractor shall store pipes alongside trenches only for the shortest time possible before placing into the trench.

2.3.3. The contractor shall check all pipes for defects and damages prior to placing.

2.3.4. The contractor shall provide manual and mechanical tools and hoist for lifting and lowering of pipes allow for smooth and continuous moving.

- 2.3.5. The contractor shall keep the contact surfaces carrying sealing compounds clean during connection of pipe sections, and close all open ends for later connections to avoid entering of soil or other contamination into the bores.
- 2.3.6. The contractor shall check each pipe section as to alignment, level and slope after placing.
- 2.3.7. The contractor shall construct pipe support to guarantee the uniform transmission of loads. Neither line nor point bearing of loads will be allowed.
- 2.3.8. The contractor shall provide bearing section for supported circular profiles that cover at least an arc of 60°, unless otherwise specified.
- 2.3.9. The contractor shall ensure the trench bottom not be loosened by any means. If, however, loosening occurs, the loosened soil shall be excavated and replaced by non- cohesive soil, which shall then be compacted, all at the expense of the Contractor.
- 2.3.10. The contractor shall execute supports in sand or coarse sand by forming the bed according to the shape of the pipe to be laid to allow each pipe section support along its full length.
- 2.3.11. The contractor shall excavate soil not usable for direct pipe laying on the trench bottom to place a supporting layer of sand, coarse sand or concrete, thoroughly compacted. The minimum thickness of such layer shall be 10 cm plus 1/ 10th of the pipe outer diameter.
- 2.3.12. The contractor shall apply a cement-mortar layer for concrete supports before placing the pipes, to guarantee a uniform transmission of forces.
- 2.3.13. The contractor shall provide flexible connections of through-pipes to inspection chambers or other structures.
- 2.3.14. For all earthworks in connection with drainage work item "Earth and Rockwork" applies.
- 2.3.15. The contractor shall execute any concrete work required for the execution of the drainage work & plant foundations in accordance with "Concrete and Reinforced Concrete".

#### 2.4. Test and Properties

- 2.4.1. The contractor shall carry out the following tests at site in the presence of the Engineer by an approved laboratory:
  - Water tightness test for each diameter of non-reinforced concrete pipe.
  - Cracking and crushing test for each diameter of non-reinforced pipe absorption and hydraulic test as per ASTM C 497-75
  - All drainage lines, joints and fittings must be tested before covering up with sand or approved soil by water and/or by smoke.
- 2.4.2. All tests shall be recorded and countersigned by the Engineer if successful.

## 2.5. Braced & Sheeted Trenches (if applicable)

- 2.5.1. The contractor shall brace and sheet Open – cut trenches as necessary to protect persons, property, traffic or the work or to prevent caving and harmful sinking.
- 2.5.2. The Contractor shall be responsible for any damage done to roads, mains, cables, pipes, sewers, etc., by the execution of the work. When close sheeting is required, it shall be so driven as to prevent adjacent and bracing are used, the trench width shall be increased accordingly.
- 2.5.3. Client reserves the right to order the sheeting to be driven to the full depth of the trench or to such additional depths as may be required for the protection of the works. Where the soil in the lower limits of a trench has the necessary Stability, the Engineer, at his discretion, may permit the contractor to stop the driving of sheeting at some designated elevation above the trench bottom. The granting of permission by the Engineer, however, shall not relieve the Contractor in any degree from his full responsibility under the Contract.
- 2.5.4. The contractor shall remove trench basing when the backfilling has reached the respective levels of such bracing.
- 2.5.5. The contractor shall remove sheeting after the backfilling has been completed or has been brought up to such an elevation as to permit its removal.
- 2.5.6. The contractor shall include the cost of furnishing, placing and removing, the sheeting and bracing in the price list for the work.

## 2.6. Drainage Work Requirements

- The contractor shall carry out all the drainage work required, that comprises various kinds of drainage culverts, pipes and the like, including all accessories such as inspection shafts, etc., if not otherwise specified.
- The contractor shall supply, transport, unload and store at site and place materials according to drawings and specifications of all materials and components connected therewith.
- The contractor shall carry out all earthworks in connection with the work specified hereunder as described under "Survey Works, Dewatering, Earthwork and Foundation Work".
- The contractor shall carry out concrete work, in connection with the work specified hereunder as described under "Concrete and Reinforced Concrete".

### 2.6.1. Access Covers

- The contractor shall provide ductile iron access covers and frames according to BS497, except that the bituminous based protective coating shall not flow of chip when exposed to temperature in the range (0 to 76) °C.

### 2.6.2. Heavy Duty Manhole Covers, Grade-A

- The contractor shall provide access cover that are suitable for heavy duty, fast moving wheeled traffic.

- The contractor shall provide heavy duty triangular / square (600 x 600) mm or circular 600 mm dia. covers for main road.

#### 2.6.3. Medium Duty (Grade-B) Manhole Covers

- The contractor shall provide access medium duty cover where heavy commercial vehicle would be exceptional.
- The contractor shall provide circular medium duty cover of 600mm dia. Or rectangular 600 x600 mm for road and parking areas within the building compound.
- The contractor shall provide medium duty covers of double sealed type or sealed with GRP sealing plate, if used within 5.0 meters from the building.

#### 2.6.4. Light-Duty (Grade-C) Manhole Covers

- The contractor shall provide access light duty rectangular [600 x 600 mm] cover for pedestrian only.
- The contractor shall provide light duty covers of double sealed type or sealed with GRP sealing plate and shall be used for paved areas inside the building compound.

#### 2.6.5. Light Duty Small Covers

- The contractor shall provide rectangular [300 x 300] mm access covers for Gully Traps, Valve chambers, inspection chambers, ventilating chambers, etc..

#### 2.6.6. Floor Drain Covers

- The contractor shall provide floor drain covers of (150 x 150) mm, thick stainless steel or mad from brass, chromium plated with strainer and cover.

#### 2.6.7. Maintenance Access

- The contractor shall provide vertical drainage pipes at each floor with cleaning eyes to each pipe and removable access covers/ panels to pipe shaft.
- The finish of access covers/ panels shall be according to the Representative's approval.

#### 2.7. Earthing of Metal Parts

- The Contractor shall ensure electrical continuity of all metal parts installed by him.

#### 2.8. Description of Sanitary Sewer

- The Contractor shall carry out connections of sewer network to the existing manholes connected to main city sewer to the satisfaction of the Engineer.

#### 2.9. Disposal of Storm Water

- The contractor shall equip in basement all sumps with electrical pumps and float switch with pipe connection outside the wall.
- The contractor shall ensure drainage of rain water pipes by gravel filled away soak pits.

#### 2.10. Inspection of Sewer Lines

- 2.10.1. The contractor shall not execute backfilling without inspection and approval of the Client for all pipelines.

- 2.10.2. The contractor shall test the pipelines, which is the straight part connecting between manholes, after making the joints for bearing the pressure of a water head of 1.5 m in respect of pipes, as follows:
- 2.2.3.4. The lower end of the pipe to be tested shall be closed with a solid plug, sealed by mortar or shall be closed by a rubber plug and the upper part of the pipe shall be fitted with a plug having an opening fitted with a funnelled-top vertical pipe and then pipeline shall be filled with water.
  - 2.2.3.5. The Engineer shall have the right to make visual inspection of all lines and joints to ensure that there is no leakage. If, in the opinion of the Engineer, after test, pipes show any unreasonable sign of moisture, then the Engineer shall have the authority to reject or to instruct any measures deemed necessary to rectify such work at the Contractor's expense.
  - 2.2.3.6. Any pipes, which show cracks, holes, or any other effects, which the Engineer deems to be in excess of a slight nature, the Engineer shall have the authority to reject and instruct the Contractor to remove and replace in a satisfactory manner. The Contractor shall to exercise extreme care in fitting the necessary rubber rings and / or making the cement mortar joint, including connections to manholes and gullies and other appurtenances, in a manner to ensure that no leakage whatsoever occurs from the joints. Should such leakage occur, then the Contractor shall remove and refit in a manner to the satisfaction of Client Representative. The complete expenses of all tests, replacements and /or reparative work, etc., shall be borne by the Contractor.
  - 2.2.3.7. The Contractor shall remove the defective pipe in the event that after installation the pipe fails to meet the line test or other requirements, , except below:
  - 2.2.3.8. At the request of the Contractor and subject to approval of the Engineer, the Contractor may encase the defective portion of the pipe with a minimum of 15 cm of Class C 20 Concrete. However, no additional payment shall be made for this work.

## 2.11. Testing

- 2.11.1. The contractor shall do all testing of pipes and fittings at his cost.
- 2.11.2. The contractor shall bear the cost of the sampling and of any certificate, which may be required. The number of samples as well as the testing procedure to be determined by the Engineer.
- 2.11.3. The contractor shall test pipes of different diameters according to the requirements, or if not defined, according to the applicable ASTM standard.
- 2.11.4. The Contractor shall test all drainage pipelines, joints, fittings before carrying out hunching or surrounding of pipes or backfilling trenches. The tests shall be carried out for all the drainage pipes and pipes between each two manholes or less in the presence and with the approval of the Engineer, considering the following:
- 2.11.5. Drainage pipelines and concrete works shall be clean and dry and the joints not covered with earth.

- 2.11.6. The underground water level shall be at the lowest possible level.
- 2.11.7. Air, smoke or water may be used for testing drainage pipe- lines and the Client Representative reserves the right to request that the tests be carried out by any one or all of the three methods, and the Contractor shall comply with such request, without claiming any compensation or additional cost. All plugs should be fixed prior to the testing operation.
- 2.11.8. Drainage pipelines shall be tested at 0.15 bar for 6 hours.

## 2.12. Procedure for Construction of Manholes

- 2.12.1. The contractor shall excavate to formation level for each manhole to invert level below sand bedding and to adequate diameter to include brickwork shuttering and reinforced concrete wall of the manhole.
- 2.12.2. The contractor shall place 10 cm sand bed on formation level.
- 2.12.3. The contractor shall cast plain concrete 5 cm thickness.
- 2.12.4. The contractor shall build circular brickwork shuttering ( $\frac{1}{2}$  BW) to invert levels of Inlet and Outlet sewers.
- 2.12.5. The contractor shall place inlet and outlet sewers to invert levels specified.
- 2.12.6. The contractor shall complete building brickwork shutting to G.L. plaster inside of bricks with cement mortar and then coat the plastered layer with bitumen.
- 2.12.7. The contractor shall put bottom reinforcement (12 mm @ 15 c/c) and vertical steel cage (12 mm @ 15 c/c) with proper bonding to bottom reinforcement.
- 2.12.8. The contractor shall cast the bottom of manhole with concrete (1: 1  $\frac{1}{2}$ : 3) with proper rodding.
- 2.12.9. The contractor shall put the inside shuttering (usually circular steel) immediately after one hour, for casting the walls of manhole.
- 2.12.10. The contractor shall place rubber rings around the pipes and in the middle of the reinforced concrete wall of the manhole for sealing purpose.
- 2.12.11. The contractor shall caste concrete (1: 1  $\frac{1}{2}$ : 3) for the wall of the manhole with proper materials (gravel, sand and cement) and carry out continuous rodding during casting of concrete.
- 2.12.12. The contractor shall make proper benching to manhole (slope of benching 1:10).
- 2.12.13. The contractor shall apply adequate wetting for the concrete for at least 3 days after removal of internal shuttering.
- 2.12.14. The contractor shall plaster the concrete surface and coat with three bitumen layers.
- 2.12.15. The contractor shall test manhole for no leakage.
- 2.12.16. The contractor shall cast the top slab of manhole with proper steel bonding between that of the walls of manhole and the top slab.
- 2.12.17. Inspection chamber of manhole to be covered with heavy-duty cover.

2.13. Warranty

- The Contractor has to give a warranty cover for one (1) year after final acceptance for the satisfactory functioning of the plant including free replacement of defective components if any.

**3. Contractor Obligation:**

- 3.1. Contractor shall prepare the site for work and all requirements.
- 3.2. Contractor shall provide all material and equipment according to scope of work and PETCO specification.
- 3.3. Contractor shall arrange for a factory acceptance test of new treatment plant by two engineers from PETCO.
- 3.4. Contractor shall submit Factory Acceptance Test procedure, subject to PETCO's approval.
- 3.5. Contractor shall be responsible for accommodation and transportation during the project.

**4. PETCO Obligation:**

- 4.1. Hand the site to the Contractor.
- 4.2. Issue gate passes and work permits for contractor.
- 4.3. Settle the Site problems to smooth the project execution.

**- END OF EXHIBIT I -**