II. PERFORMANCE SPECIFICATION FOR THE SEPTAGE TREATMENT PLANT (SpTP)

1. SCOPE OF WORK

1.1. GENERAL

The SpTP shall treat septage collected from the Calamba service area and other contingent areas designated by Calamba WD within the catchment area.

All processes and facilities of the SpTP shall be designed to meet operational performance requirements. In particular, the plant must be operated in semi-automatic mode consisting of a programmable logic controller (PLC), a motor center, and a control panel. The PLC should be able to manage majority of the activities of the process equipment. To meet other performance requirements such as flexibility, maintenance, and reliability, the connections between equipment, processes, support systems, and other structures must be an integrated approach.

The SpTP works shall be within a total project duration of fourteen (14) months which shall include but not be limited to the following:

- The design and construction of the SpTP for a period of twelve (12) months, three (3) months of which should be dedicated for the detailed engineering design phase
- Installation and performance testing of equipment and the facility including operations and maintenance during the commissioning period of one (1) month and the process proving period of one (1) month
- All other works needed to obtain a complete and correctly functioning plant including the provision of process manuals and training of operators

It is the intent of this scope of works that the SpTP shall be suitable in every way for the service required. It follows that the Contractor shall supply all materials, labor, equipment, and works - which may be reasonably implied as required - at no additional cost to the Calamba WD

1.2. SITE AND AREA AVAILABLE FOR THE SpTP

The site for the SpTP is located in **Barangay Palo-Alto, Calamba, Laguna with a lot area of 1,800sqm**. The Client shall provide the geotechnical reports while the supplemental topographic and utility surveys that may be required shall be accounted by the Contractor.

1.3. PLANT OPERATING PERIODS AND INFLUENT CHARACTERISTICS

In general, the preliminary treatment of septage consisting of solids separation and dewatering shall operate at a minimum of 240 days per year (not including weekends, holidays, and planned maintenance schedules or downtimes) and there shall be one (1) - 8 hour shift per day. However, the secondary treatment component, which is a biological process, shall be operated on a continuous basis, i.e., 24 hours per day for 365 days per year.

The design and construction of the facilities shall be based on the total septage collected from the entire Calamba WD service area and nearby towns. The septage characteristics are as summarized in Table 2. The Contractor shall design, construct, supply, and install all civil works and electro-mechanical facilities to meet the design capacity.

The average capacity shall be 60 cmd of septage. The dewatering unit shall be screw press dewatering unit or similar unit for simplicity of operation and low power consumption, capable to handle 3CMH flow rate. It shall be a system complete with its appurtenances that includes the sludge feed pumps, chemical treatment provisions, filtrate pump and auxiliaries, and the power and control panels.

Table 1: Design Flow.

Parameter	Design Capacity
Average Flow	60 m^3/day

Table 2: Septage Influent Characteristics.

Parameter	Unit	Concentration Range
BOD	mg/l	3,000 to 5,000
COD	mg/l	10,000 to 15,000
Oil and Grease	mg/l	1,000 to 1,500
Moisture Content	%	95 to 98
TSS	g/l	10 to 40
Ammonia-N	mg/l	500 to 700

***Note:** Estimated characteristics of septage from Calamba WD service area.*

1.4. REQUIRED TREATMENT PLANT PERFORMANCE

1.4.1. The SpTP shall produce an effluent complying to ALL national government standards (i.e. DENR DAO 2016-08 Effluent Quality Limits for Class C Inland Water). Some effluent quality limits are shown in Table 3a.

1.4.2. The SpTP plant shall produce dewatered sludge within an average dry solids content range of 15 to 20% and sludge cakes conforming with the USEPA standards of Class B biosolids shown in Table 3b.

Table 3a: Effluent Quality Limits (DENR DAO 2016-08 for PSIC37000).		
Parameter	**Units**	**Effluent Limits**
pH		6.5 to 9
COD	mg/L	100
5-day 20ºC BOD	mg/L	50
Total Suspended Solids	mg/L	100
Oil and Grease	mg/L	5
Phenolic Substances	mg/L	0.05
Total Coliforms	MPN/100 ml	10,000
Ammonia	mg/L	0.5
Nitrate (as NO3-N)	mg/L	14
Phosphate	mg/L	1
Chloride	mg/L	450

Note: For water reuse, the significant parameters for PSIC Code 37000 should be complied and these parameters to be monitored are as follows: BOD, fecal coliform, ammonia, nitrate, phosphate, oil and grease, and surfactants.

Table 3b: Sludge Cake Requirements (USEPA 2004)	
Classification	**Requirement**
Class B	Fecal coliform density must meet 2.0×10^6 MPN/g total solids or less than 2.0×10^6 colony forming units (CFU)/g total solids

1.4.3. The plant itself shall be free from discernible odor and noise. It must meet the DENR standards on noise levels (ambient and source-specific standards) presented in Table 4. In case of non-compliance, the Contractor shall make changes on their design to meet the requirements without additional cost to the Client.

1.4.4. It must be designed to resume its normal operations after a power interruption, even if unmanned, without causing damage to or undue shortening on the economic life of the electric motors.

Table 4: Maximum Allowable Noise Levels in General Areas.			
Category of Area	Day Time (9 am – 6 pm)	Morning (5 am – 9 am) and Midnight (10 pm – 5 am)	Evening (6 pm – 10 pm)
A	55 dB	50 dB	45 dB

Notes:

- *See IRR of Chapter 18 of P.D. 856 – Sanitation Code of the Philippines Section 8.7.4 for more clarifications*

1.4.5. The various components of the SpTP shall be designed within the limits of the parameters specified in this specification. However, if it can be shown that significant savings can be attained outside the limits of the design parameters, such conditions may be considered.

1.5. MINIMUM DESIGN PROVISIONS

1.5.1. General Requirements

1.5.1.1. The SpTP must be designed to meet a maximum of four (4) hours total shutdown time for maintenance every week.

1.5.1.2. Plant structures shall be designed to withstand pressures and seismic loading. For structural concrete, the 28-day compressive strength shall not be less than 3000psi for general and water-retaining structures.

1.5.1.3. The electrical/instrumentations control system shall include main and branch circuit breakers, starters, contactors, variable speed drives and reset buttons selector switches, push buttons and pilot lights, circuit control items for electrical control, liquid level control of the respective components, and all necessary wiring and conduits.

1.5.1.4. All electrical/instrumentations controls shall be wired such that the equipment can be operated either manually or automatically using PLC to achieve the intended sequence of operation and for remote monitoring purposes. All electrical controls for all processes shall be located at the Control Room.

1.5.1.5. Electrical components of mechanical equipment and systems shall be provided as needed for complete and operable systems. Interconnecting wiring for factory-wired components shall be provided as an integral part of the plant.

1.5.1.6. Sump tanks and chemical mixing tanks must be covered.

1.6. SPECIFIC DESIGN PROVISIONS FOR THE SEPTAGE PLANT

The following provisions cover the main components but do not preclude provision of other facilities that may be required in attaining the required SpTP performance requirements/efficiencies.

1.6.1. Equipment

Whenever possible and applicable, all equipment shall be installed indoors or have provisions for cover to prevent them from getting wet during rainy seasons and potentially shorten their usable lives.

1.6.2. Flow Measurement

Flow meters shall be installed in the following locations:

- Full bore magnetic flowmeter for packaged treatment unit port –after the macerator and before the sludge acceptance units and sludge inlet of the dewatering unit
    - The flowmeter display in the control station should show flow rate and total volume flow. The same information should be displayed at the loading bay and visible to the operating staff. Resetting of total volume flow by the plant operators should be possible.
- Water meter for effluent discharge
    - It shall display total volume reading for reporting.

1.6.3. Preliminary Treatment Unit

The SpTP shall have a rock trap system, separate macerator, and an automatic screening, compacting, and washing system to remove solid wastes, trash, and other floating debris prior further treatment. It shall also have a sand and grit removal system that will allow smooth operations of the downstream processes.

1.6.4. Secondary Treatment Unit

The secondary treatment shall be made with a combination of anaerobic and aerobic process. It shall start with anoxic treatment tank succeeded by a sequencing batch reactor system for the aerobic treatment. The SBR will be controlled by PLC or DDC to run without supervision during the night.

1.6.5. Tertiary Treatment Unit

The tertiary treatment focuses on the removal of excess nutrient. A chemical treatment process consisting of a series of reaction tanks and a built-in clarifier for the removal of the precipitated nutrients. A series of sand and carbon filter for final polishing before final disinfection prior to disposal. It shall have a chlorine dioxide generator disinfection unit capable of eliminating pathogenic microorganisms and odor in the effluent prior to discharge. The disinfection chemicals should not carry by-products such as chloramines, THM's, etc. that could contaminate the receiving body of water.

1.6.6. Water Re-Use

The treated effluent shall be used at the septage receiving area to wash the recovered solid wastes before collection in bags and also for the wash cycle of the sludge dewatering unit. The treated effluent may also be used for other applications within the SpTP.

1.6.7. Mass Balance and Process Flow Diagram

The Contractor shall present the mass balance (water flow, chemical used, biomass recycling and disposal, etc.) in the process worksheet for the entire SpTP system. They should also indicate the directions of flow (inlet and outlet), chemical dosing lines, and wastages or by-products. In a separate sheet, all specifications of major equipment (pumps, blowers, etc.) must be clearly indicated in the process diagram.

1.7. PROCESS PERFORMANCE TEST AND GUARANTEE

1.7.1. Prior acceptance of the SpTP, the Contractor shall demonstrate that the completed SpTP is capable of treating septage for thirty (30) consecutive days and in compliance with Table 3 with the initial septage loading. This is the process-proving period of one (1) month and shall start upon completion of the commissioning period.

1.7.2. During the process-proving period of one (1) month, daily influent and effluent monitoring must be done by the Contractor. The Contractor shall:

- Submit the following data:
  - Process-related (e.g. flow, influent and effluent COD, SVI, MLSS and other treatment criteria) including actual laboratory results
  - Inputs and outputs (power, chemical dosages, fuel consumptions, etc.)
  - Manpower deployment, including janitorial and security
  - Reactive and preventive maintenance records
  - Operating expenses (OPEX)
  - Daily incidents
- Undertake two (2) effluent sampling and analysis with a third party DENR accredited laboratory (split sampling to be conducted by the Contractor). The schedule and manner of sampling shall be determined by the Client.
- Operate in compliance to environmental requirements and on the operations and maintenance manuals.
- Carry out all routine, preventive, and breakdown maintenance activities. Maintain all assets to retain their functionality in "as new" condition until turnover.
- Supply all materials, spare parts, chemicals, water, generator fuel, and consumables required to operate and maintain the plant during the process-proving period.
- Supply all labor to undertake operation and maintenance with the exception of six operators who will be employed by the Client but work under the direction of the Contractor during the process proving period. The Client will pay all normal wages for these operators and the Contractor shall only pay the wages for any overtime worked under their supervision.

1.7.3 The Contractor may modify and test the SpTP until it achieves the projected levels of plant performance and operating costs within ninety (90) calendar days after the first test period. Any modification should be pre-approved by the Client and all costs associated will be on the account of the Contractor.

1.7.4 The Contractor will not be responsible if the SpTP is not meeting the specified level of efficiency due to any excess plant loading more than the specified volume or if the influent quality is higher than those given in Table 2 of this Performance Specifications.

1.8 CONSTRUCTION AND SHOP DRAWINGS

1.8.1 The drawings shall show the complete layout of the plant with all components, equipment, and parts, each with an assigned number corresponding to the plant spare parts list. The layout shall also indicate the relative location with respect to the boundaries of the lot allocated for the plant.

1.8.2 The drawings shall show construction details for each component, equipment, support structures, and access facilities.

1.8.3 The construction drawings shall be size A1 and shall show the complete construction and assembly of the plant with all its identified components.

1.9 BID DRAWINGS

1.9.1 The drawings to be submitted with the bid shall be in size A3 (folded to size A4) and shall show the complete assembly of the plant with all components, equipment, and parts, each with an assigned number corresponding to the plant parts list. The layout shall also indicate the land area required and its relative location with respect to the boundaries of the lot allocated for the SpTP.

1.10 SECONDARY TREATMENT PLANT DESIGN PARAMETERS

1.10.1 The SpTP equipped with a compact aerated biological treatment system or equivalent shall be designed based on the limits and parameters shown in Table 5. Nonetheless, the Contractor shall assume full responsibility for the appropriateness of all design parameters applied in the project.

1.10.2 Aeration tanks shall be designed within the limits of the standard design parameters shown in Table 7.

1.10.3 Settling tanks shall be proportioned within the limiting dimension ratios shown in Table 8.

1.10.4 The Upflow Anaerobic Sludge Blanket (UASB) reactor shall be designed using an upflow velocity ranging from 0.6 to 0.9 m/h.

Table 5: Design Parameters for Aerated Biological Processes.

Process Modification	Mean Cell Residence Time, (d)	F/M Ratio	Volumetric loading, (kg BOD_5/ m^3.d)	MLSS, (mg/L)	Q_r/Q
Conventional	3-15	0.2-0.4	0.3-0.7	1,000-3,000	0.25 - 0.75
Complete-mix	3-15	0.2-0.6	0.30-1.6	1,500-4,000	0.25 - 1.0
High-Rate Modified aeration	0.2-0.5	1.2-2.0	1.20-2.40	200-1,000	1.0 1.5
	5-10	0.2-0.6	1.0-1.3	(1,000-3,000)[a]	0.5 - 1.50

Contact stabilization				(6,000-10,000)[b]	
Extended aeration	20-40	0.04-0.1	0.1-0.3	2,000-5,000	0.5 - 1.50
Oxidation ditch	15-30	0.04-0.1	0.1-0.3	3,000-5,000	0.75 - 1.50
Sequencing batch reactor	10 -30	0.04-0.1	0.1-0.3	2,000-5,000[c]	N/A
MBR (membrane bioreactor)	5 -20	0.1 -0.4 (based on COD)	1.2 to 3.2* COD	5,000-20,000	N/A

Legend:

[a] *=Contact unit*

[b] *=Solids stabilization unit*

[c] *=MLSS varies depending on the portion of the operating cycle*

F/M *= Food to micro-organism ratio*

Q =secondary influent flow

Q_r *=return sludge flow*

N/A = not applicable

Note: The F/M ratio can be expressed in kg BOD_5 applied/ kg MLVSS.d or in lb BOD_5 applied/ lb MLVSS.d

Table 6: Design Parameters for Secondary Clarifiers.

Treatment Processes	Overflow Rate, ($m^3/m^2.d$)		Solid loading, ($kg/m^2.h$)		Depth, (meter)
	Average	Peak	Average	Peak	
Settling following air activated-sludge (excluding extended aeration)	16.3-32.6	40.7-48.8	4-6	10	3.5-6.0
Settling following oxygen activated-sludge	16.3-32.6	40.7-48.8	5-7	10	3.5-6.0
Settling following extended aeration	8.1-16.3	24.4-32.6	1-5	7	3.5-6.0

Table 7: Design Parameters for Aeration Tanks.

Design Parameters	Aeration by Diffused Air	Mechanical Aeration
Maximum Sidewater Depth, m	7.5	7.5
Freeboard, m	0.30-0.60	1.0 –1.5

Length to width ratio*	4:1 - 5:1	per to the power rating
Width to depth ratio	1:1 – 2.2:1	1:1 – 2.2:1

Table 8: Limiting Dimension Ratios for Settling Tanks.	
Tank Shape	Limiting Dimension Ratio
Circular	tank radius not greater than 5 times the Sidewater depth
Rectangular	length not greater than 15 times the Sidewater depth
Plate/Lamella	Indicate Number of plates and the effective height

1.11.OPERATION AND MAINTENANCE MANUALS

1.11.1. GENERAL

1.11.1.1. The winning bidder shall prepare and submit a draft Operation and Maintenance Manuals with lists of Spare Parts for all the equipment of the plant, one (1) week prior to the scheduled date of commissioning.

1.11.1.2. Supply completed Operation and Maintenance Manuals within two weeks of receiving review comments in the form of two digital copies on CD and four hard copies. Produce digital copies using the latest versions of Word and AutoCAD with supplementary drawing and image files in .pdf format.

1.11.1.3. Assemble manuals in metric, A4 three ring binders with durable hard covers and of sufficient size for the information contained.

1.11.1.4. Drawings shall be assembled between metric A3 size covers and held together using three removable brass male/female screws. Produce all drawings in A3 size.

1.11.1.5. The Operation and Maintenance Manuals shall:

- Cover all aspects of the works.
- Provide 'General Principles of Operation' for the plant prepared by the designers and include the necessary information for operators to effectively operate and maintain the works.
- Incorporate safety, environmental and quality issues.
- Be specifically prepared for the Client.
- Have detailed indexes and cross referencing.

1.11.2. OPERATION MANUAL

A single operation manual shall be provided for the operation of the plant. The contents of the manual shall include but not be limited to:

- Title Page: Project Name, Employer and Contractor information (names, addresses, contact details)
- Index: Include a comprehensive index
- General Description
    - Location

    - Site layout, Process and instrumentation diagrams, Hydraulic profile
    - Description of Process and Effluent Criteria
    - Design Criteria
- Safety Management
- Environmental Management
- Detailed operations instructions (for each process unit)
    - Describe each process unit including size and number of mechanical/electrical units
    - How it operates (Start, Shutdown, Manual and Auto Control)
    - Performance criteria for each process unit
    - Sampling points
    - Troubleshooting
- Record Keeping Requirements
- Duty Statements (for operators)
- Operating Procedures (covering safety and environmental procedures)
- Environmental and Emergency Response
- Sampling and Monitoring Requirements
    - Includes performance criteria for each process unit
    - Monitoring of the receiving environment (waterways, noise and odors)
- Cross Reference to Maintenance Manuals

1.11.3. MAINTENANCE MANUALS

Prepare maintenance manuals for each and all equipment. The content of the manuals shall include but not be limited to:

- Title Page: Project Name, Employer and Contractor information (names, addresses, contact details)
- Index: Include a comprehensive index
- Description: a full description of the equipment with a tabulation of dimensions and performance ratings
- Principles of Operation - basic working description, including novel features and any automatic control.
- Operating Instructions - a step-by-step procedure organised in sections entitled:
    - Check before starting
    - Starting
    - Continuous operation
    - Stopping
    - Emergency stopping
    - Abnormal operation (if applicable)

- Installation and Commissioning Instructions - details of standards and procedures for transporting and installing the equipment. Including a step by step procedure for mounting or erecting, wiring and lubricating the equipment. Alignment tolerances and check requirements shall be stated.
- The commissioning instructions shall include step by step procedures for checks before the first start, checks after starting and operational tests.
- Routine Maintenance - step by step procedure for preventive maintenance work carried out at intervals of two weeks or less.
- Periodic Maintenance - step by step procedure for fault correction and preventive maintenance carried out at intervals in excess of two weeks, involving replacement of consumables. A list of any necessary special tools shall be included.
- Repair, Overhauling, and Dismantling - step by step procedures to extract, fully dismantle, re-assemble and re-install the equipment.
- Test Data and Troubleshooting - instructions to qualified tradesmen for assessing the operational performance of the equipment.
- Spare Parts List - illustrations and schedules for identification and specifications of all parts of the equipment. Exploded diagrams are required. The recommended spare parts stock must be indicated.

2. PLANT DESCRIPTION AND REQUIRED FACILITIES

2.1. GENERAL

All processes and facilities shall be designed to meet the performance requirements of the overall plant. In particular, the inter-connection between various plant support services and structures must be an integrated approach, which meets operational performance, flexibility, maintenance and reliability criteria.

As envisioned, the SpTP shall contain the following Main Process Systems, Support Systems and Facilities:

Main Process Systems

- Septage Tanker Unloading Bay
- Rock Trap
- Macerator
- Packaged Treatment Unit with trash and grit removal system
- Septage Holding Tanks with Hyperbolic Mixer
- Dewatering Feed Pumps
- Chemical Treatment Unit
- Sludge Dewatering Unit

Support Systems

- Potable Water Storage System with booster pump system
- Treated Water Storage System with booster pump system
- Electrical and Control System
- Generator Set

Facilities

- Control and Instrumentation Room

- Scum Trap System
- Anoxic treatment tank with hyperbolic mixer
- Equalization Tank
- Sequencing Batch Reactor System
- Effluent Disinfection and Nutrient Removal System
- Filtration and Clarification Systems
- Flow Meters
- Structural provisions for Receiving and Dewatering Units
- Sludge Cake Storage (Drying bed)
- Blower and Genset room
- Chemical and Supplies Storage Room
- Laboratory Room
- Administration Building

2.2. MAIN PROCESS SYSTEMS

2.2.1. Septage Tanker Unloading Facilities

Each septage unloading bay shall be provided with quick-connection ports for connection to vacuum tanker discharge hoses. The whole unloading bay shall be open but provided with a roof to protect personnel from rain while connecting/disconnecting the hoses to the ports.

- There shall be at least two (2) unloading points for connection of vacuum tanker discharge hoses and this unloading point shall be connected to one (1) sludge acceptance unit.
- Have a spill pit with grating and properly designed grit and trash trap constructed underneath to ensure efficient collection of spillage during unloading. Collected spillage shall be conveyed to a holding tank with sufficient capacity and pumped to the desired process stage.
- Have sufficient roofing to protect personnel from rain when connecting/disconnecting the hoses to the ports.
- The unloading points shall feature Cam-lock quick-connection fittings with non-return valves, flow metering and control, for the connection of vacuum tanker discharge hoses.
- Have couplings installed at a suitable height for accessibility during operations

2.2.2. Rock trap

A rock trap system should be connected to the couplings at the unloading point. This allow the settling of heavy objects like stones, rebar, gravel that might damage equipment down the line. The unloading operation shall use the discharge pump from the tankers or by gravity for larger trucks.

2.2.3. Macerator

A macerator will grind the trash not sorted by the rock trap system. It shall have a separate control panel with PLC to control rotation or reverse in case hard material gets caught in the equipment.

A full-bore magnetic flow meter shall be installed after each Macerator to allow simultaneous vacuum trucks unloading. The display shall be included at the control station for two functions:

- Instantaneous flow rate in l/s
- Total volume unloaded

Total unloading volume read by the flowmeter shall be noted for recording and billing purposes.

2.2.4. Packaged Treatment Unit

2.2.4.1. General

Provide a Packaged Treatment Unit (PTU) to perform the preliminary treatment of the raw septage. It should:

- Be a completely sealed unit and placed in an area with sufficient ventilation.
- Have an instantaneous capacity of about 30 LPS to cater a quick sludge discharge from one tanker truck.
- Have its main parts including the conveyor systems (when applicable) made of stainless steel with a minimum grade of Type 304.
- Have a compaction screw made of special alloy steel.
- Have components like gear motor drives with proven reliability and lifetime under set operational conditions.
- Discharge compacted and washed screenings via enclosed discharge chutes into an enclosed and inclined conveyor into separate industrial bags or sacks.
- Discharge screened and de-gritted septage by gravity pipework into a Holding Tank
- Shall have provisions for upgrade with electronic card readers or recording of truck offloading information to be connected with its electrical controls and flow metering capability, to re recorded to a central computer in the control room.
- Consist of mechanically-cleaned screen, screw type screenings compactor with washing, grit trap, grit classifier, flowmeter, trash and grit chute, air blower, integrated supports, pipe lines and conduits, electrical switchboard, and control panel.

2.2.4.2. Mechanically-Cleaned Screen with Screenings Compaction

Incorporate a continuous and automatic mechanical screen cleaning in the unit with perforation or spacing range of 5mm – 8mm. It should:

- Have an integrated inclined screw screenings press capable of a screenings removal rate of approximately 2 cubic meters per hour on a continuous basis with a dry solids content of 40%.
- Provide a discharge system and chutes to accurately discharge screenings to the screenings bags.

- Not allow free fall of screenings on the unit exterior or the escape of screenings.

2.2.4.3. Grit Trap Tank

Provide a grit trap tank section in the PTU with volume capacity enough to allow settling of sand and grit. It should:

- Be capable of removing at least 95% of grit equivalent to sand of 0.3 mm diameter and at maximum flow.
- Be incorporated with an air diffuser agitation system for continuous agitation to prevent septage from manually operated drain at the lowest point of the unit.

2.2.4.4. Grit Conveyor and Extractor

Incorporate an inclined screw grit classifier capable of a grit removal rate of at least 0.3 cubic meters per hour on a continuous basis with a dry solids content of 4%. It should:

- Have a discharge system and chutes to accurately discharge grit to the grit bags
- Not allow free fall of grit on the unit exterior or the escape of grit

2.2.4.5. Integrated Supports

Fabricate the PTU to fit with an integrated system of support brackets and foundation legs that will enable it to stay on a concrete surface. The supports shall:

- Be manufactured with the same material as the body of the acceptance units.
- Allow transport and movement of the acceptance units without the need for disassembly or additional bracing
- Have provisions for control of vibration and for electrical grounding.

2.2.4.6. Pipelines and Conduits

Include all pipelines and conduits needed for a correctly functioning PTU.

- Locate the pipelines associated with the tanker unloading system above ground.
- Locate all other pipelines below ground with connections to the PTU.
- Design pipelines with sufficient grade and with accessibility for maintenance.
- Include fittings to allow routine sampling of septage both before and after the acceptance units.
- Pipelines shall be color-coded and properly labelled.
- Provide electrical conduits below ground linking the main switchboard, the PTU, and the local control stations.

- Terminate the electrical conduits within the area of the integrated supports for the PTU.
- Include water supply standpipes with hoses within the building and in close proximity to the acceptance units for maintenance.
- The concrete floor under the PTU shall be a grated sump tank with a grit/sand trap and connected to the septage transfer pump or directly to the septage holding tank.

2.2.4.7. Electrical Switchboards and Control Panel

Provide a single electrical switchboard and control panel for and located near each PTU. The panel should meet the following requirements:

- Provide all power, control, and instrumentation requirements for the functionality of the PTU
- Include provision for automatic and manual operation
- Should have suitable push-buttons and displays to enable checking of functions, identification of faults, manual operation, flowmeter displays, and links to the overall plant control system.
- Should be in a protective and waterproofed enclosure that will allow routine cleaning or maintenance operations with water

2.2.5. Sludge Holding Tanks

2.2.5.1. Provide two (2) holding tanks for the screened septage ready for dewatering and other one is for receiving of the hauling for the day, each with an active volume of at least sixty (60) cubic meters. The tanks are for storage and mixing of screened and de-gritted sludge and of any waste sludge from the biological treatment.

2.2.5.2. Under normal conditions, tanks shall be operated alternately with one tank fully mixed and supplying feed to the sludge dewatering system and one tank in settlement mode receiving septage sludge and waste activated sludge.

2.2.5.3. Construct the tanks from concrete and finish the internal surfaces by smooth plastering to eliminate areas for solids to deposit.

2.2.5.4. Install at least one electrically driven shafted hyperbolic mixers mounted to each tank to completely mix the tank contents and provide homogeneous feed to the dewatering system. Size the mixers to ensure suspension of settled material following any period of interruption to mixer operation. Mount the mixers at the center of the tank. Suspended shaft should be stainless steel 304.

2.2.5.5. Equip the tanks with manhole large enough to accommodate the passage of the hyperbolic impeller if servicing is needed.

2.2.5.6. A decanter pump should be in-place to allow withdrawal of supernatant liquid in the event the septage hauled is watery or below 1% solids content.

2.2.5.7. Include suitable arrangements for level control within the tanks using any non-contact or ultrasonic instruments. Use the level controllers to assist

the operation of the sludge transfer pumps, the sludge dewatering pumps, and the waste activated sludge pumps Display the tank levels at ground level near the tanks.

2.2.5.8. Provide pipework with valves at ground level to allow a full range of functions and protection for the tanks. Include the following:

- inlets from the septage transfer pumps and the filtrate pumping station;
- interconnecting pipework to allow series operation, outlets to the sludge dewatering system;
- inlets for waste activated sludge from the biological treatment system;
- outlets for clear wastewater discharge to the biological treatment system;
- scour outlets from the lowest point of the floors and overflows.

2.2.5.9. Prevent odor nuisance from the tanks. Provide air suction pipework above top of tank or ensure sufficient ventilation.

2.2.6. Sludge Dewatering System

2.2.6.1. General

2.2.6.1.1. Provide a Screw Press Type of dewatering unit or approved equal with a minimum of 3 m3/hr capacity. It shall be a compact and complete system to perform the separation of mixed septage from the PTU and the intermittent activated sludge wastes from the SBR System. It should consist of:

- Dewatering pumps
- Chemical dosing pipework
- Flocculation Reactor
- Sludge Dewatering unit
- Filtrate recycle system
- Integrated supports
- Pipe lines and conduits
- Electrical switchboard and control panel

2.2.6.1.2. It shall have the capacity to produce sludge cake from the incoming septage and waste activated sludge. It shall produce sludge cakes with dryness or solid content not lower than fifteen percent (15%).

2.2.6.1.3. Discharge dewatered sludge to the solids stabilization system. Provide a standby bagging system with sufficient stock of bags for one month of operation at full plant capacity.

2.2.6.1.4. Fabricate casings, frames, pipelines and all components from stainless steel, generally of grade 316 but with a minimum of grade 304 for certain small components.

2.2.6.1.5. Enclose the system in a secured area and place a barrier between the units and the sludge cake handling area. Provide normally locked double hinged gates for access to plant and equipment and single gates for operator access.

2.2.6.2. Dewatering Feed Pumps

2.2.6.2.1. Provide a dewatering feed pump system suitable for handling septage and sludge with two pumps (1 Duty, 1 Standby) allocated specifically for the sludge dewatering unit. Install slow speed positive displacement progressive cavity type pumps for consistent flow rate regardless of solids content of the sludge. Locate the pumps inside a secured area.

2.2.6.2.2. Design individual pump capacity to suit each sludge dewatering unit. Equip pumps with variable frequency drivers to control the flow rates using the plant control system. Interlock operation of the pumps with the holding tanks level and the dewatering unit. Use motors with suitable electrical protection to allow direct application of water from hoses as a minimum.

2.2.6.3. Chemical Dosing Pipework

2.2.6.3.1. Provide pipework between the dewatering feed pumps and the flocculation reactor tank leading to the sludge dewatering unit. Incorporate fittings for isolation, measurement of flow, dosing of polyelectrolyte solution, injection of filtrate return flow, and sampling. Ensure sufficient length of pipework to allow proper chemical dispersion and flow measurement.

2.2.6.3.2. Measure flow using full-bore magnetic flowmeters. Include display at the control station for two functions:

- An instantaneous flow rate L/s
- Total Flow in liters for the particular dewatering unit

2.2.6.4. Flocculation tank with mixer

2.2.6.4.1. Provide a flocculation tank with mixer at the head of the dewatering unit to achieve adequate contact and mixing time between the sludge and chemicals.

2.2.6.4.2. Ensure adequate size, sufficient freeboard and overflow arrangements to prevent surge or spillage on start and stop of dewatering feed pumps. Include a scour outlet.

2.2.6.5. Sludge Dewatering Unit

2.2.6.5.1. Incorporate a Screw Press dewatering unit or approved equal capable of removing all sludge solids generated by the plant in no more than 80 hours per week. Produce sludge cake with dry solids content in the range of 15% to 20% and with polyelectrolyte consumption not exceeding 10kg/kg of dry sludge.

2.2.6.5.2. Provide a discharge system and chutes to accurately discharge sludge to the solids stabilization system. Do not allow free fall of sludge on the unit exterior or escape any liquids or solids.

2.2.6.6. Filtrate Scum Trap

Provide a system for the capture of scum and other wastes going through with the filtrate. Provide easy access and removal of accumulated scum by overflowing via gravity or using a skimmer pump that returns to the sludge holding tank. Construct a minimum of 2 compartment-baffled tank that can handle 30% more on the total dewatering capacity.

2.2.6.7. Integrated Supports

The sludge dewatering units shall fit with an integrated system of support brackets and foundations that enable anchoring to a concrete surface. The supports shall:

- Be manufactured with the same material as the body of the acceptance units.
- Allow transport and movement of the acceptance units without the need for disassembly or additional bracing Have provisions for control of vibration and for electrical grounding.

2.2.6.8. Pipelines and Conduits

Include all pipelines and conduits needed to form a complete and correctly functioning sludge dewatering system.

- Locate pipelines generally below ground with connections to the dewatering units and neatly at appropriate points.
- Design pipelines with sufficient grade and to allow access for maintenance. Include fittings to allow routine sampling of sludge and filtrate both before and after the dewatering units.
- Provide electrical conduits below ground linking the main switchboard, the dewatering units and the local control stations. Terminate the electrical conduits within the area of the integrated supports for the acceptance units.
- Include water supply standpipes with hoses within the building and in close proximity to the dewatering units for maintenance. Grade the concrete floor of the dewatering unit area to a grated sump with a trapped outlet to the sludge transfer sump.

2.2.6.9. Electrical Switchboard and Control Panel

Provide a single electrical switchboard and control panel for each sludge dewatering unit. Locate the panel near the dewatering unit.

- Arrange for the panel to provide all power, control and instrumentation requirements for the complete functioning of the sludge dewatering system.
- Include provision for automatic and manual operation, suitable push-buttons and displays on the front of the station to enable checking of functions, identification of faults and manual operation, flowmeter displays and links to the overall plant control system.

- Supply the panel in a protective enclosure that will allow water from hoses to be directed onto the cabinet during maintenance cleaning operations.

2.2.7. Equalization/Anoxic Tank

2.2.7.1. Provide a filtrate pumping station to collect filtrate from the sludge dewatering system and deliver it to the biological treatment system if cascading tank orientation is not possible.

2.2.7.2. Design the pumping station with a concrete wet well and external valve chamber suitable for the installation of submersible sewage pumps.

2.2.7.3. Provide two pumps arranged on a duty/standby/parallel basis complete with lower mounting bends and grade 316 stainless steel guide bars and lifting chains. Match the wet well and pump capacities to avoid excessive numbers of starts for the pumps.

2.2.7.4. Include a permanent lifting davit able to conveniently withdraw the pumps and raise them to ground level. Provide sufficient electric cable to allow removal to ground level without the need to disconnect. Locate a standpipe and hose near the pumping station for maintenance.

2.2.7.5. Include aerated and un-aerated mixing options available. A hyperbolic mixer shall be used for anoxic treatment mixing to effectively agitate the filtrate. Suitable air diffusers shall be installed for aerated mixing use. Arrange the control system for both options not to be operated simultaneously.

2.2.7.6. Include suitable arrangements for level control within the pumping station using non-contact ultrasonic instruments.

2.2.7.7. Provide an emergency overflow at high level in the pumping station with a pipeline discharging to the receiving waterway adjacent to the plant.

2.2.8. Biological Treatment System

2.2.8.1. Provide a complete Sequencing Batch Reactor biological treatment system to receive filtrate from septage treatment as well as sewage and process overflows from the plant site. It shall produce final treated wastewater effluent meeting the specified DENR DAO 2016-08 Class C discharge quality criteria.

2.2.8.2. Base the design of the biological treatment system on an activated sludge process as prescribed in Table 8. Construct the reactors in concrete.

2.2.8.3. Equip the reactors with automatically operated inlet pipe arrangements, aeration systems, and waste activated sludge removal systems.

2.2.8.4. Include facilities for scum suppression and withdrawal for disposal with the waste activated sludge. Construct metalwork from grade 316 stainless steel.

2.2.8.5. Provide at least two waste activated sludge pumps arranged on a duty/standby/parallel basis. Ensure sufficient range of capacities to allow

withdrawal of waste activated sludge during either the aeration or settlement phases of the biological process.

2.2.8.6. Provide at least one alternative blower arranged on a duty/standby basis complete with acoustic covers. Locate the blowers in a suitably ventilated building with additional noise suppression features. It can be housed together with the Power Generating unit.

2.2.8.7. Provide blowers or aerators able to deliver the full process air requirements against the maximum system air pressure under the full range of plant ambient conditions. Ensure automatic capability for continuous operation under conditions of reduced operational air demand, lower system pressures, and varying ambient conditions without throttling or significant loss of overall operating efficiency.

2.2.8.8. Provide dissolved oxygen instruments in aeration tank for automatic control of the throttling valves prior to the use of the submerged aerators. Operate the system to sustain a dissolved oxygen set point selected by the operator.

2.2.8.9. Equip the facility with walkways, platforms, handrails and cages to allow safe access to the structures for operations staff. Locate standpipes and hoses on the walkways for maintenance.

2.2.9. Tertiary Treatment

2.2.9.1. Provide an effluent disinfection and nutrient removal system to receive flow from the biological treatment system and disinfect the treated effluent to meet the required effluent discharge criteria.

2.2.9.2. Provide concrete disinfection contact tanks. Include sufficient detention volume and freeboard to prevent escape of insufficiently disinfected effluent, with a minimum detention time of one hour.

2.2.9.3. Provide separate chemical dosing tanks, mixers, and dosing pumps for nutrient removal methods such as pH adjustment, coagulation, flocculation, or similar processes.

2.2.9.4. Provide a pipeline with a suitable outlet structure to convey the final treated effluent to the receiving water adjacent to the plant. Measure the flow of final effluent and display the instantaneous flow in L/s at the contact tanks.

2.2.9.5. Equip the tanks with, walkways, platforms, handrails and cages to allow safe access to the structures for operations staff. Equip with standpipes and hoses on the walkways for maintenance.

2.2.9.6. Supply and install all equipment necessary for disinfection using a chlorine dioxide solution. Place the chemical dosing system in a separate building. Include a storage tank for bulk delivery of Chlorine Dioxide with a storage capacity equal to at least one week of chemical consumption required for full plant capacity.

2.2.9.7. Recommend the required safety features and practices in consideration of the chemicals to be handled during operations. Safety features including

but not limited to safety shower, eyewash, warnings, and safety signs should be included in the engineering designs.

2.2.9.8. Recommend sampling and test equipment and identify the consumables required for the daily testing of total and residual chlorine.

2.2.9.9. An alternative disinfection system based on the use of chlorine gas or sodium hypochlorite may be proposed.

2.2.10. Filtration and Clarification System

2.2.10.1. For purposes of water re-use for plant irrigation, toilet flushing, and vehicles wash, the quality of the re-use water shall comply with the effluent quality requirement as defined in Table 3a for the Effluent Quality Limits for PSIC37000.

2.2.10.2. The filtration system shall consist of a two-stage process consisting of sand and activated carbon filters.

2.2.10.3. Clarification systems shall form part of the treatment process prior effluent discharge for the removal of residual solids and treatment chemicals still present in the effluent.

2.3. SUPPORT SYSTEMS

2.3.1. Potable Water Supply System

2.3.1.1. Provide polyethylene tanks if possible with a roof and sufficient elevation to flood the suction of booster pumps. Connect the tank to the chlorine contact tank to ensure disinfection of supplies as needed.

2.3.1.2. Include a tanker discharge point with a permanently installed booster pump at the base of the potable water tank to receive supplementary deliveries of potable water should the need arise. Include overflow and scour pipelines directed to the plant storm water drainage system.

2.3.1.3. Include suitable arrangements for level control within the potable water tank using non-contact ultrasonic instruments or an external sight board for visual indication of level.

2.3.1.4. Equip the tank with internal and external ladders, walkways, platforms, handrails and cages to allow safe access to the structures for operations staff.

2.3.1.5. Connect the pipe reticulation network to all areas of the plant. Include provisions for below-ground fire hydrants at suitable locations with appropriate signage, pavement markings and reflectors. Provide signs at outlets from the system in close proximity to outlets from the service water system.

2.3.2. Non-Potable Water Supply System

2.3.2.1. Provide polyethylene tanks if possible with a roof and sufficient elevation to flood the suction of booster pumps. Connect the tank to the chlorine contact tank to ensure disinfection of supplies as needed.

2.3.2.2. Provide a tanker discharge point with permanently installed booster pump at the base complete service water system for process, washing and landscaping use around the plant.

2.3.2.3. Equip the system to obtain chlorinated final effluent from the treated effluent holding tank and distribute service water around the plant in a dedicated reticulation network. Use materials suitable for the chlorinated effluent.

2.3.2.4. Install one high pressure pumps in a duty/standby/parallel configuration with an automatically backwashed filter and pressure storage tank. Use 220 V three-phase motors.

2.3.3. Water recovery system

2.3.3.1. Direct backwash water to the filtrate pumping station. Interlock faults in the system to protect the sludge acceptance and dewatering units.

2.3.3.2. Provide a pressure storage tank to initiate and sustain flow in the system. Ensure capability to allow immediate system response on operation of any outlet from the system without large pressure variations or water hammer and with a minimum capacity of 30 seconds storage at full flow for the system.

2.3.3.3. Distribute service water to all areas of the plant in a reticulation pipework system. System should feature adequate pipe sizes required to sustain discharge pressures by at least the PTU and sludge dewatering units.

2.3.3.4. Ensure signage complying with international codes to identify recycled water and select hydrants and all other types of fittings to prevent cross-connection of potable water fittings. Color-code all items with the recognized color for recycled water. Provide hoses, sprays and any other items needed to allow maintenance of the plant, equipment, and landscaped areas.

2.3.4. Electrical and Control System

2.3.4.1. Provide a complete electrical and control system description and design.

2.3.5. Other Engineering Designs

2.3.5.1. Provide a complete plant layout of the SpTP with the equipment in place and with provisions for the following facilities:

- Genset and blower room
- Chemical Storage Room
- Control and Instrumentation room
- Administrative Building
- Motorpool/parking area
- Laboratory Room

2.3.6. Laboratory Requirements

2.3.6.1. The laboratory room should be able to have sufficient space and provision for installation (if applicable) of the following minimum equipment:

- pH meter
- Turbidity meter
- Dissolved oxygen meter
- Conductivity or TDS meter
- Halogen moisture analyzer

2.3.6.2. The contractor shall also provide recommended specifications for the abovementioned equipment.

3 OPERATION AND MAINTENANCE

3.1 GENERAL

3.1.1 Operate and maintain the SpTP and associated works for a continuous period of one (1) month following completion of all commissioning works. Operate the plant in accordance with environmental requirements and relevant approved Operations and Maintenance Manuals. Carry out all scheduled routine, preventive and breakdown maintenance. Maintain all assets to retain their functionality in "as new" condition.

3.1.2 Supply all labor to undertake operation and maintenance except for six operators who will be made available by the Employer. The Client may place additional staff and will shoulder the costs associated beyond the staff recommended by the Contractor.

3.1.3 The Contractor shall procure all materials, chemicals, water, generator fuel and consumables required to operate and maintain the plant for the duration of the process-proving period. The Client shall procure all materials, spare parts, chemicals, water, fuels, and consumables required to operate and maintain the plant for the duration of the life of the program.

3.1.4 The Employer shall cover all utilities consumed i.e. electricity and water. Power and chemical consumption will be measured during the process-proving period.

3.1.5 Dispose of all waste materials from the site in an environmentally acceptable manner.

3.1.6 Maintain and deliver all records specified in the Operation and Maintenance Manuals.

3.1.7 The Client shall undertake the following duties as minimum requirements:

- The efficient operation and maintenance of the Septage Treatment works to ensure the plant meets all requirements.
- Maintain and clean plant amenities, buildings, grounds and surrounds to required standards.
- Effective control and direction of labor at the works.
- Maintain an accurate record of information with regard to plant operations such as process monitoring, maintenance, and repairs.

- Monitor and report the status or condition of each unit through inspection
- Review of operations performance to ensure that units are maintained in the best possible condition with respect to safety and performance.
- Ensure that all precautions are taken for the security of all staff and property in the facility
- Ensure compliance with environmental regulatory requirements.
- Train all personnel on operational requirements and safety aspects of the plant.
- Undertake sample collection and on-site chemical testing relevant to plant operations.
- Initiate work orders for the repair and maintenance of plant, equipment and systems by service personnel.
- Organize and manage sub-contractors and suppliers to undertake minor works, repairs or services at plant.
- Ensure that all personnel are supervised and work in accordance with existing water district policies and practices.
- Ensure that all work is carried out in a safe manner in accordance with an approved safety plan for the site.

3.2 SPECIFIC FUNCTIONS

The Client shall:

3.2.1 Operate all septage treatment unit main process systems, support systems and facilities to perform the works under the contract.

3.2.2 Sample, analyze and report on process streams to demonstrate performance.

3.2.3 Conduct daily and scheduled cleaning and maintenance of equipment, structures, amenities and grounds. Maintain all electrical, mechanical, telemetry and control equipment at the SpTP.

3.2.4 The work under the program includes but is not limited to the following:

- Treatment of septage to comply with effluent discharge criteria
- Odor control and management
- Optimization of efficiency and effectiveness of the operation of the SpTP
- Management and maintenance of the treatment plant assets
- Effluent sampling and analysis
- Management and control of chemicals and services
- Management and control of energy
- Transport and disposal of screenings, grit, bio solids, oil and grease and all other waste products and garbage to approved locations off-site
- Maintenance of operations and analysis records
- Provision of feedback on field observations
- Submission of monthly reports and attendance at monthly meetings required
- Preparation and submission of a Management and Safety Plan
- Implementation and operation of a quality management system.

3.3 TREATMENT OF SEPTAGE

3.3.1 Treat raw septage at the facility to meet the minimum quality limits required by the effluent discharge standards and at the flow rates specified.

3.3.2 Operate the treatment facilities with trained and qualified operators. Undertake daily operation of the treatment facilities including, but not limited to:

- Operating treatment units and equipment
- Monitoring of operation of equipment
- Monitoring of treatment processes and performance
- Monitoring of final effluent quality
- Monitoring and taking actions in response to alarms
- Maintaining and cleaning of equipment, treatment units, buildings and amenities
- Transport and disposal of screenings, grit, biosolids, oil and grease and all other waste materials and garbage
- Dewatering and treatment of biosolids to produce Grade A material
- Undertaking actions to rectify any problems associated with the operation of the septage treatment facilities
- Maintaining the store of bulk chemicals
- Coordinating planned maintenance activities.

3.4 BIOSOLIDS MANAGEMENT

3.4.1 Manage the dewatering, processing and loading of biosolids into trucks, transportation off-site and reuse/disposal of biosolids.

3.5 DATA RECORDS

3.5.1 Provide and maintain a monthly record on CD and in hardcopy of the following in the form of an electronic data base using the latest version of MS Excel:

- All data showing quantities and costs of chemicals and similar inputs used to perform work under the contract.
- All data showing quantities and costs of energy used to perform work under the contract.
- All septage deliveries, biosolids analysis, stabilization grades and quantities. Store the records in a database and submit with the monthly report.