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TECHNICAL AND COMMERCIAL PROPOSAL

FOR

AEROBIC SLUDGE DIGESTOR TREATMENT PLANT FOR SEPTAGE RECEIVING STATION

PRESENTED TO GIZ

PREPARED BY

DAVIS & SHIRTLIFF/BIOLIFF LTD

DATE

14th February 2017

1. BACKGROUND

Davis & Shirtliff in collaboration with Bioliff Ltd prides itself as a Total Water Cycle Management solution provider. We specialize in the design, supply and installation of water and wastewater (sewage) treatment and filtrations systems for irrigation, flushing, washing, process or potable use. Our turnkey solutions provide a consolidated approach to water security issues. Whatever the water project, Davis & Shirtliff can manage the entire process for you. From feasibility and planning, right through to approvals, installation, commissioning and the life cycle management of the facility.

Davis & Shirtliff was contacted to design a sewage treatment plant (STP) for the proposed development.

It is understood that the eventual wastewater volume of this site is 80,000lts/day of Septage waste exhausted by trucks from septic tanks.

The Problem

Septage waste transported by exhauster trucks does not just contain wastewater it is also characterized by high concentrations of septic sludge, organics, FOG (Fat, Oil & Grease) as well as inorganic materials such as sand/silt, trash, plastics, scrap metal to list but a few.

The Challenge

It is relatively simple to treat the wastewater portion of the exhauster truck haul. The challenge is not the liquid volume, but the sludge and solids. The solids must be treated and disposed of in an appropriate manner.

Caution

Unlike a typical wastewater treatment plant one cannot offload the sludge and solids to a holding tank, anaerobic digester or even a septic tank. This is not a solution, because simply transporting an existing problem to another site will in turn lead to build-up. Septage sludge levels in the new location will eventually need exhausters to remove the build-up as well.

The Solution

The Septage sludge must be converted into manageable components:

- Remove the inorganic solids upfront so that they do not accumulate in the treatment process. This allows inorganics to be easily managed and disposed of.
- Treat & stabilize the septic sludge through aerobic processes leaving a stabilized aerobic sludge by-product that is easy to handle, non-toxic, and non-odorous. This allows for easy disposal and/or for reuse applications.

- Treat the wastewater so that it is fit to discharge to the environment and/or for reuse applications.

The proposed solution will combine the following:

1. **Inlet screen** – to remove unwanted inorganic solids for separate disposal.
2. **Aerobic Sludge Digester** – to stabilize the sludge.
3. **Bioreactors (Fixed Film Media)** – to treat the wastewater to high standards fit to discharge to the environment.
4. **Sludge Drying Bed** – to receive the excess stabilized sludge from the Aerobic Sludge Digester and dewater the sludge for separate disposal or reuse.

The technology was chosen for this project because it constitutes a simple and sustainable solution at the most economic price point:

- Very cost effective setup allowing minimal civil works.
- Simplified Project management and execution under short delivery times.
- Does not employ anaerobic or septic processes (high odour risk).
- Produces a consistent final effluent of very high quality that can be discharged back into the environment or reused for applications such as irrigation, carwash, dust separation, etc.
- Stable, non-odourous sludge that is easily de-watered and fit for handling (also relevant for reuse applications).
- Simple process control and operation.
- Minimal mechanical equipment and moving components

How does the technology work?

1.) Inlet Screen

In the preliminary treatment the sewage is screened (usually 3mm) removing inorganic solids that would otherwise buildup over time and need removal AND cause issues with downstream processes. The collected screenings can be removed to garbage disposal or incineration.
The screened influent then enters the Aerobic Sludge Digester tank(s).

2.) Aerobic Sludge Digester

The Aerobic Sludge Digester, employs an aerated activated sludge process employing long Sludge Retention Times (SRT). The long SRT's under extended aeration conditions allow for a highly stable process. The result being a stabilized and thickened waste activated sludge product that is not offensive and easy to handle. The sludge levels will be measured daily and the excess wasted to the sludge drying bed as necessary.

Here the wastewater is biologically purified by microorganisms that make up the aerobic activated sludge. The oxygen needed for the degradation process is brought into the water by fine bubble membrane aerators. For this process an aeration blower pumps atmospheric air into the aerobic sludge digester. The air is pressed through the small pores of the

membranes and is distributed in the wastewater as fine bubbles. The necessary oxygen dissolves in the water and provides total mixing. This way activated sludge receives oxygen and nutrients by way of constant circulation and contact time.
The holding tank for this process will be a minimum of 2 days retention (180m3), and will also behave as a flow equalization tank allowing a set hourly feed rate to the next step of the process – Bioreactors.

3.) Bioreactors

The Wastewater component (mostly free of sludge) will be fed at an hourly rate to the Bioreactors for further treatment. The Bioreactors will remove remaining nutrients, organics, and nitrogen from the wastewater. Any sludge and suspended solids will then be settled from the wastewater via the final clarifier. After clarification, the wastewater will undergo sanitization in a chlorine contact tank. The final effluent will be fit for discharge to the Environment.
The Bioreactors are composed of plastic holding tank that are fitted with a specialized Fixed-Film Media. The fixed film media provides an ideal surface area for the bacteria, responsible for removing contaminants from the wastewater, to live upon. Fine bubble aeration is installed under the media, and provides the needed oxygen for the bacteria (as well as circulation of the tanks).

4.) Clarification & Discharge

After the Bioreactors, the activated sludge and other suspended solids are separated from the clear water under still conditions within a final clarifier. The settled sludge is sent back to the Sludge Digester.
The clarifier in turn feeds the treated water to a contact storage tank where chlorine is added to sanitize the treated wastewater (for public health & safety).

5.) Sludge Drying Bed

Here the excess stabilize sludge is wasted to the drying bed where the sludge is dried. Once dried the sludge is a fraction of its former mass.

2. TECHNICAL DATA

2.1. RAW AND FINAL WATER QUALITY AND FLOW

Plant Capacity:

Daily Volume	80 m³/d (max)
BOD_5	80 kg
COD	160 kg
Suspended Solids	96 kg

Inflow Water Quality (Average):

BOD_5	1000 mg/l
COD	2000 mg/l
SS	1,600 mg/l

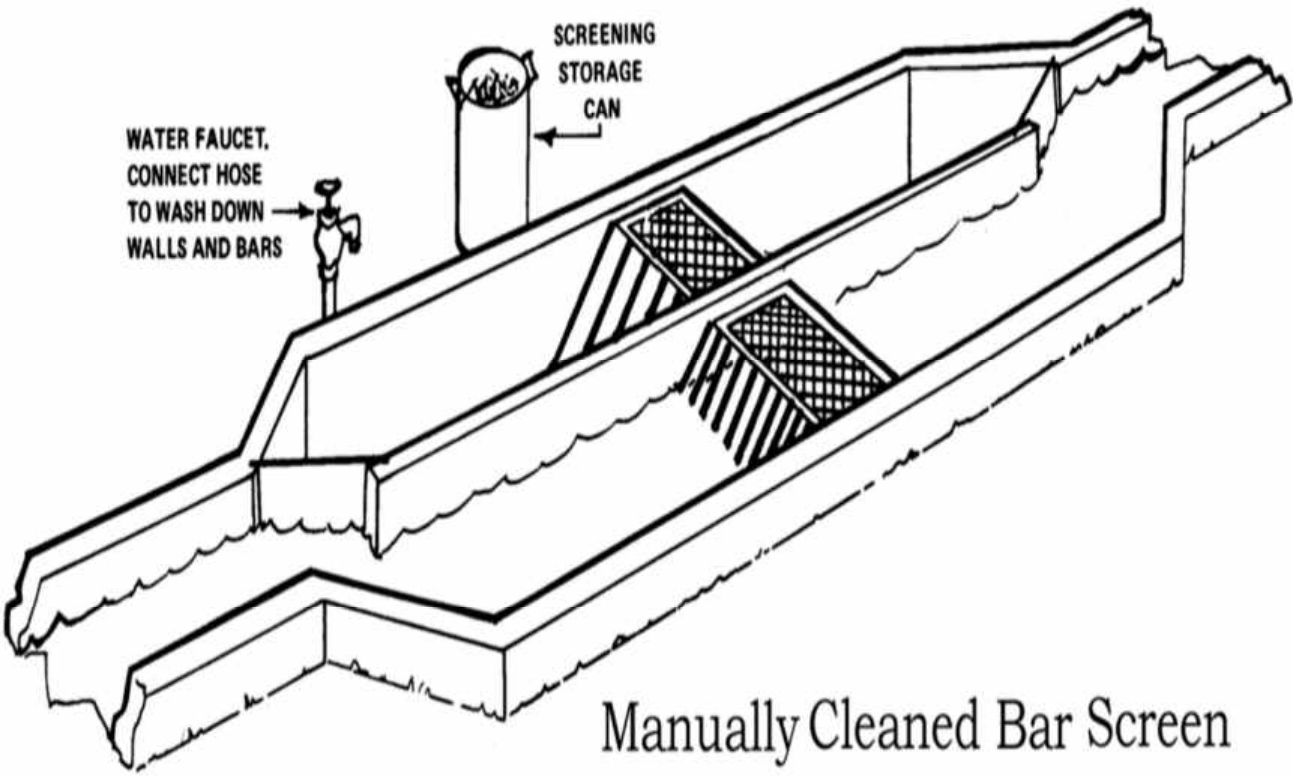
Outflow Water Quality (Average):

BOD_5	< 30 mg/l
COD	< 50 mg/l
Suspended Solids	< 30 mg/l

3. EQUIPMENT DETAILS

3.1. EQUIPMENT DETAILS

a. INLET SCREEN



Manually Cleaned Bar Screen

b. BIOREACTORS, CLARIFIER & CONTACT TANK

c. SLUDGE DEWATERING

A sludge drying bed provides a low-tech and economic solution for sludge dewatering. The excess sludge is periodically drained form the aerobic sludge digester and spread over the drying bed. The water passes though the sand bed leaving behind the sludge. The sludge left behind is then left to dry and then raked from the sand surface. The water that passes through the sand is directed back to the aerobic sludge digester inlet.
The dried sludge is odourless and can be disposed of by landfill, incineration, and even for reuse application such as soil conditioner.

4. PRICE SCHEDULE

For the supply and installation of the above equipment;

Plant Size	TOTAL PRICE OF WWTP EQUIPMENT	CIVIL WORKS ESTIMATES
22.5m3/day	**6,200,000**	850,000
52.5m3/day	**9,920,000**	1,590,000
75m3/day	**10,800,000**	1,890,000

Prices quoted are exclusive of 16% VAT

5. SCOPE OF WORKS

Client Scope

- Carry out all requisite civil works to specifications from Davis & Shirtliff. This includes but is not limited to construction of the receiving bay and concrete slab, construction of the sludge drying bed and equipment plant room.
- Avail a dedicated operator(s) for the equipment to be trained onsite and offsite. The operator will be required to carry out regular plant monitoring, collection of plant data, record keeping and basic maintenance duties.
- Provision of 3phase, 415V, 50Hz electric power supply (stabilizer over/under voltage & phase failure protection), main circuit breaker, wiring, conduit to the main control panel.

Davis & Shirtliff scope:

- Supply, Delivery (to site) and Installation of the equipment proposed above.
- Training of the plant operator(s)
- Testing and commissioning of the equipment described above to meet the required output as discussed.
- Provision of user operation and maintenance manuals
- Provision of log sheets for daily operations' record keeping
- Provision of Water Analysis reports after testing and successful commissioning of the equipment.

6. DELIVERY

Supply and delivery of equipment to site will take about **6-8weeks** from date of receipt of your order and deposit payment. Installation will take approximately **2week,** contingent on site readiness.

7. PAYMENT TERMS

70% on order, 20% on delivery of equipment to site and 10% on commissioning. These terms are negotiable.

We hope that this is in order and look forward to your further instructions.

Yours faithfully,
For DAVIS & SHIRTLIFF LTD,

Elvis Khamala