Wastewater Treatment System

Otehei Bay

I thought of writing a long-detailed report on the upgrade to Otehei Bay but since reading a report on keeping it simple I have abbreviated the report to address the essential elements.

We will commence by reviewing the situation and provide the solutions and options:

Current Situation

Our review of the current plant verified by physical excavation of the site, showed that the as-built drawing of September 1999 was basically a fair representation of the existing system components. However, two of the existing primary tanks are outside of the fenced area and within the treeline of the northern boundary.

The balance tank lid had collapsed, and completely failed when disturbed by the excavation and so in the interests of safety was filled in during the exploratory excavation. This action has effectively stopped the entire system from operating.

The design of the old system gives evidence of a progressive expansion over years, as demand has grown, however the way it was done compromised the effectiveness of the anaerobic treatment process with small septic tanks in series which is an ineffective way of making a treatment system work and creates a maintenance overhead that is very expensive and time consuming. Inter-connection piping had been poorly laid which had sunk in many places allowing ground water infiltration, further compromising the treatment process and adding power use through the needless pumping of discharge water.

The result is that the system has not been effectively maintained which is no fault of the present team as there was no documentation to determine either what to maintain, nor ready access to the areas that needed maintenance.

The system has been able to function only by the fact that the discharge quality has not been monitored and there was no discharge field to clog, that would have signalled a failing system.

New Design Approach

The revamp of the existing system has been to return to the basics of good design, simplifying the overall system and using where possibly, elements of the existing system. It may have been the easier option to replace the system entirely but to do this would be by far the more expensive solution.

The redesign includes:

1. Management of grease from the kitchen-café area
2. Increasing the anaerobic treatment capacity of the system
3. While reusing the aerobic biofilter treatment towers allowing for future air injection to increase their efficiency if required
4. The addition of a clarification stage with clarifier pump
5. The replacement of the electronic controls to provide clarifier stage control, air injection and alarm system operation.
6. Upgrading the interconnecting pipes in the system and laying them in the correct bedding
7. Creating a distribution field of sufficient size to handle the daily design flow of $15m^3$

Activity Plan

Based on the new design approach the following activity plan is required to achieve acceptable output from the design.

Commencing from the influent (front) of the system:

Grease Trap

Influent from the kitchen is pumped into one of the 5000l septic tanks.
Modifications to this tank to act as an effective grease trap needs to include:

1. The discharge outlet requires a dropper outlet to be added to allow the grease to float to the top of the water and congeal without discharging into the anaerobic chamber
2. The pumped inlet needs to discharge into a flow reducer so the outlet of this can gravity discharge into the grease trap. The flow reducer can be a small flange base box (Hynds) with lid .
3. Outlet of the grease trap directed into the anaerobic chamber (requires new piping)
4. Addition of an access hatch the permits proper cleaning of the accumulated grease.

Anaerobic Chamber

A new 20-25,000l tank to be the anaerobic chamber needs to be installed. This chamber takes flows from the toilet block in the café and the external toilet block/s and showers
The anaerobic tank to be located between the external toilet block and the existing pump station.
All the available local supplier tanks that can be underground located have been assessed including solutions from Promax Plastics Cost $23,648 + GST, Eloy Water $17,800 + GST, Hynds $11,443 + GST and Duracrete $4,400 + GST
From the assessment made the Duracrete tank is considered of suitable size and design to fit in the space available and has access features permitting multiple points of entry to the tank which will be useful in this installation.
Good maintenance access is to be allowed for the removal of sludge by way of the access hatch placement.
The discharge from this tank will be by gravity into the two existing biofilter chambers.

Biofilter Chambers

The two biofilters will remain unchanged at this time, however their performance will need to be monitored with regular sampling of the output to the discharge field, to verify that the current passive air flow system permits sufficient dissolved oxygen to be present for the aerobic stage to perform to the level required. This will require monitoring during the peak visitor season with the correct equipment and samples taken for laboratory analysis.
This is a consent requirement and NRC routinely require a record to be kept and supplied to them.
Outlet flow from the biofilters will flow into the clarifier/irrigation tank as is currently the case.

Clarifier/Irrigation Tank

This tank currently exists however the plan is to fit a wall/partition in it with a weir that flows into the pump chamber area.
The upstream section of the tank is to be fitted with a KP350-A-1 Grunfos drainage pump unilift or equivalent, to return the fines collected in this tank to the anaerobic chamber located near-by. It is important that the clarifier stage operates efficiently as its operation is critical to keeping the discharge field operating, without plugging the disposal lines.
Adequate ground level access needs to be provided to facilitate service of the pump and chamber cleaning
Grunfos pump cost $900 + GST

The existing irrigation pump head and flow needs to be sized to suit the discharge field as the back pressures caused by the enclosed dripper field will increase substantially.

Irrigation Field

The irrigation field is a substantial new addition to the system and is located a significant distance and elevation from the treatment plant. Attention needs to be given to the design of the field when its exact position is known, to ensure there is adequate flow in each leg of the field to achieve adequate purging in each line. Distribution across the field can be achieved with the installation of indexing valves, adequate pressure relief installed, effective backflow prevention in place and correctly sized distribution lines.
Assistance can be given when the location of the field is finally determined.

Electronic Control

Allowance has been made to replace the present analogue control cabinet with one using current PLC technology. This system will provide:

- Timed output control for the sludge pump
- Timed output control for an airblower (if required in the future)
- Continuous output for the irrigation pump
- Input for blower failure
- Input for high level alarm
- Light and buzzer alarm indication
- Mounting in an IP64 plastic enclosure
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It also might be useful to consider remote indication either by wired or wireless means.
Price for feature indicated $1.799 + GST

In this document attention has been given to replacing or upgrading the key components in a cost-effective way along with simplifying the system to create a treatment plant using a well proven SAF design.
Installation of the interconnecting piping needs to be given careful attention as there is clear evidence of groundwater infiltration due mainly to poor attention to detail and use of incorrect bedding materials.
Given the need for ongoing maintenance of the system on an annual basis (at least) after the peak season and the likelihood of NRC requiring adequate records to be kept attention to ready access along with a documented maintenance procedure needs to be in-place and understood by staff and contractors.
If these actions are undertaken the system should serve the Otehei Bay users for a long-time.

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