TAHUNA TOWNSHIP – THE CHALLENGES OF TREATING AND DISCHARGING WASTEWATER TO THE LOCAL ENVIRONMENT

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ABSTRACT

The problem of how to deal with the towns wastewater has been a problem in Tahuna since the mid 1980's when the first plans were drawn up for a Community wastewater reticulation and treatment plant. Unfortunately the cost of a suitable system made the project prohibitive and the plans were shelved. Since then, the town has had to put up with failing septic tanks and raw effluent ponding and running off into surrounding properties.

Finally in 2004, the New Zealand Government introduced subsidies to assist small townships with their water and wastewater collection and treatment and this project was able to be completed. The original plans were revisited and updated to include the most up to date technologies for treating wastewater. The plant has to be capable of treating the 51 houses in Tahuna plus a variety of shops, businesses, and the local school.

A Membrane Bioreactor System (MBR) from Hynds Environmental was chosen as the most appropriate treatment technology owing to its small footprint and ability to produce an extremely high level of treatment for the wastewater. The treated water from this plant will be discharged directly into a local stream via a rock filter.

This paper discusses the challenges of gaining approval from all stakeholders for, and designing, a wastewater treatment plant with the ability to discharge directly into the local waterways. The performance of the system to date will also be presented.

KEYWORDS

Wastewater Treatment, Nutrient Removal, Membrane Bioreactor

1 INTRODUCTION

Tahuna has been looking for a solution to its wastewater treatment for over 25 years. There had been several designs proposed over this period with the penultimate proposal involving an oxidation pond, slag beds and UV filtration requiring approximately 1 Hectare of land.

In 2004 the Matamata Piako District Council applied to the Ministry of Health to utilise their wastewater subsidy scheme to help fund the reticulation and treatment of sewage from the Tahuna township. The initial proposal was for gravity reticulation of the town which was the cheapest option available at the time. This option was only available however if the council could utilise a small parcel of land in a flood plain, beside a small stream. There was no available land for disposing the treated wastewater and hence the oxidation pond and slag bed design was not suitable. The council were then required to find an innovative solution that allowed them to install a wastewater treatment plant in this area that could treat the wastewater to such a level that it could discharge directly into the stream.

2 CHALLENGES

2.1 SITE CONSTRAINTS

As this project was being subsidised by the Government the Matamata Piako District Council had a limited budget and limited land available for this project. The land available for the plant is located in a potential flood

plain so an above ground system was needed for this site. The plant also had to be very compact to fit onto the land available.

Photograph 1: The land available for the plant was minimal and located in a flood plain

2.2 CONSENTING

The consenting process was difficult for the Council. The location identified as most suitable required significant public consultation, consideration of local Iwi's concerns and a treatment process that allowed discharge into a local stream. After a lengthy consultation process, the consent was granted with strict treatment requirements.

2.3 TREATMENT PERFORMANCE

The design required the treated effluent to be discharged directly into a local stream. Consequently, the consent reflected the strict treatment performance needed to ensure no adverse effects on the receiving water course. The treatment performance required is detailed in the table below.

Parameter	Med Discharge Quality	Max Discharge Quality
$cBOD_5$ (g/m^3)	2	5
SS (g/m^3)	5	10
NH_4 (g/m^3)	2.5	5
TN (g/m^3)	8	12
TP (g/m^3)	1.7	5
Faecal Coliform (MPN/100mL)	100	400

Table 1: Resource Consent Requirements

3 DESIGN PROCESS

After investigating the options available for treating the wastewater, Hynds Environmental was chosen to design and build a Membrane Bioreactor (MBR) wastewater treatment with a five stage treatment process to meet the challenges of this project.

Membrane units house flat sheet membrane panels in stainless steel frames, aerated by a coarse bubble system below each unit. These membrane units are submerged within an activated sludge treatment tank.

The membrane panels are manufactured with a pore size in the range of 0.1 to 0.4 microns. In operation these panels become covered by a dynamic layer of protein and cellular material, providing an effective pore size of less than 0.01 microns. This is within the ultra filtration range.

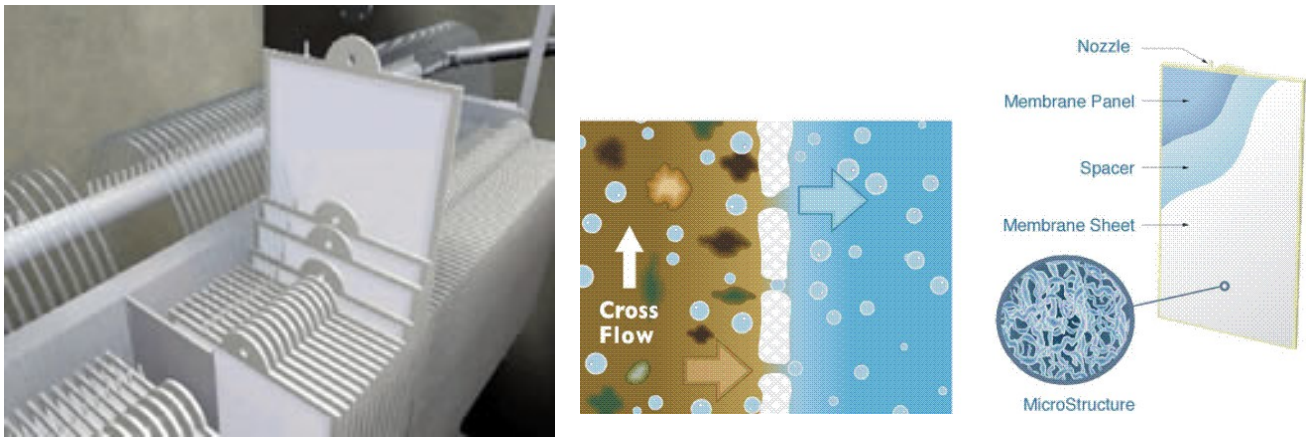

Figure 1: Schematic of Flat Sheet Membrane Units

MBRs operate at a high mixed liquor suspended solids (MLSS) concentration which allows the plant design to be very compact with a small footprint. This was ideal for this application. The plant was designed in a series of above ground tanks to overcome the potential flooding issues at this site.

The proposed five stage treatment process involved initial primary treatment, two-stage anoxic treatment, aeration and MBR treatment. The raw effluent is gravity fed from the township to the wastewater treatment plant. The primary treatment utilises a primary tank with outlet effluent filters. The primary tank is designed to ensure grit is removed and the effluent is screened. This screened effluent enters the four stage treatment process described below (refer to P&ID below).

Photograph 2: The finished MBR plant. Discharge is to the stream behind the vehicles.

3.1 STAGE 1: 1ST STAGE ANOXIC

The primary effluent enters the first stage anoxic tank which also receives recycled activated sludge (RAS) from the MBR tank and aerated sludge from the aeration tank. This aerated sludge is rich in nitrites/nitrates (NO_2/NO_3) which denitrify in the anoxic tank to release the nitrogen as a gas. Carbon is added to this stage to ensure there is sufficient food source for the denitrification process to occur. Soda ash is also added at this stage to ensure there is sufficient alkalinity to allow nitrification in the following aeration tank. The third chemical used in this process is Alum to remove phosphorous. This is also added at the first stage anoxic tank. A mixer in this tank ensures the tank's contents are homogeneous.

3.2 STAGE 2: AERATION

Fine bubble diffusers produce the aeration required to nitrify the ammoniacal nitrogen in the effluent entering from the first stage anoxic tank. An internal recycle pump discharges nitrified waste back to the 1st stage anoxic tank.

3.3 STAGE 3: 2ND STAGE ANOXIC

The second stage anoxic tank receives effluent from the aeration tank only. This tank allows any remaining nitrites/nitrates in the effluent to be denitrified. There is an allowance for carbon dosing to this tank if there is a requirement to achieve lower total nitrogen (TN) values.

3.4 STAGE 4: MBR

The MBR tank holds the dual Kubota membrane units that provide the final stage of treatment. Course bubble aeration from the membrane units ensures the waste in the tank remains aerobic and provides scouring for the membrane panels. The tank design allows for gravity to provide the pressure differential between the membranes that forces the permeate through the membranes to be discharged.

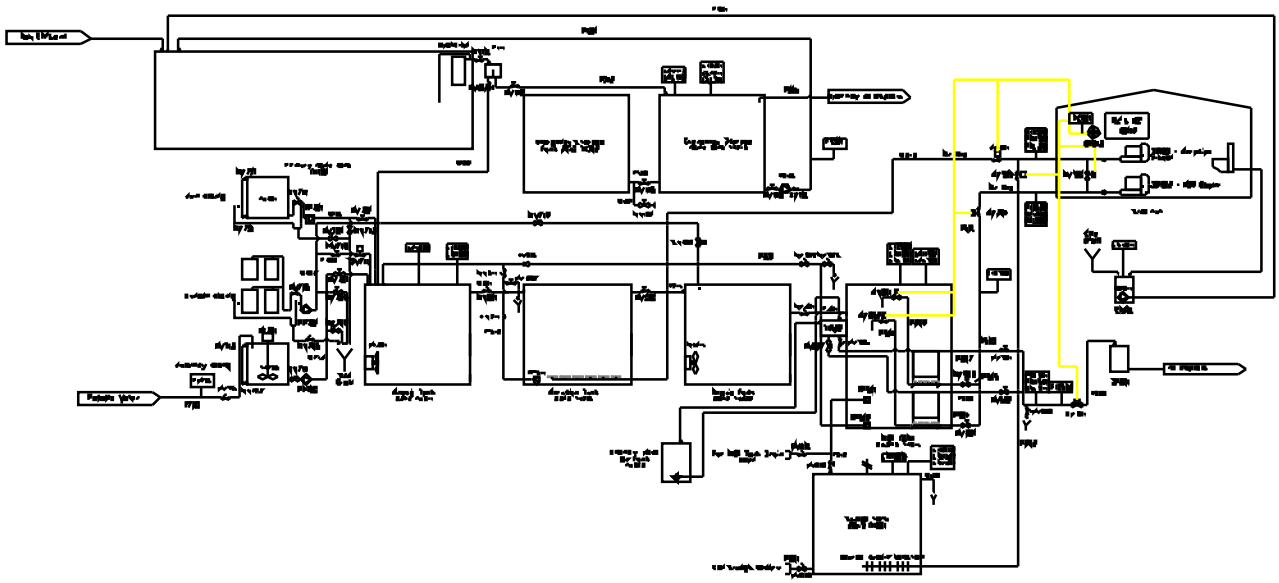

Figure 2: P&ID of Tahuna's WwTP

Emergency storage tanks allow storage if there is a catastrophic plant failure resulting in the plant not being able to discharge. A sludge tank stores the waste activated sludge for periodic removal and there are chemical storage and make-up tanks on site for storing and/or making up the chemicals required for the process.

4 RESULTS

The table below gives the initial testing results from Tahuna's wastewater treatment plant.

Date	Post Primary TN[1]	Post Primary TP	Post Primary COD	Discharged TN	Discharged TP	BOD	SS
16-Dec-09	67	8.2	464	2.7	0.00	< 1	< 3
17-Dec-09	71	8.5	467	2.3	0.00	< 1	< 3
18-Dec-09	106	9.6	498	2.6	0.00	< 1	< 3
21-Dec-09	72	8.8	516	2.6	0.00	< 1	< 3
22-Dec-09	75	9.4	517	2.7	0.00	< 1	< 3
23-Dec-09	76	10	333	2.2	0.00	< 1	< 3
24-Dec-09	72	9.6	493	2.1	0.00	< 1	4
29-Dec-09	70	10.8	548	2.4	0.00	< 1	< 3
30-Dec-09	82	9.8	545	2.5	0.00	< 1	< 3
31-Dec-09	75	10.4	526	1.9	0.00	< 1	< 3
5-Jan-10				1.3	0.06		
7-Jan-10				1.7	0.04		
11-Jan-10	55	9.6		2	0.15		
13-Jan-10				2	0.04		
15-Jan-10				1.6	0.04		
18-Jan-10	70	11.2	443	2.8	0.07		
21-Jan-10				3.7	0.14		
25-Jan-10	75	11.6		3.3	0.09		
Average	**74**	**10**	**486**	**2**	**0**	**< 1**	**< 3**
90%ile	**81**	**11**	**545**	**3**	**0**	**< 1**	**< 3**

Table 2: Results from Tahuna's Wastewater Treatment Plant

5 CONCLUSIONS

Finding an appropriate solution to treat the wastewater from the Tahuna township was a long and challenging process. The Matamata Piako District Council evaluated all the alternatives and decided that a Membrane Bioreactor wastewater system would meet all the challenges of the site. The main challenges were high level of treatment required and the site constraints. Hynds Environmental designed a system to suit all the requirements of the site and the system is exceeding all performance criteria to date.