

## Case Studies

### Case Study 1 – Ministries of Marine Resources, Infrastructure and Planning, Office of the Prime Minister and Rarotonga Lawn Bowls Club Settled Sewerage System, Avarua - Rarotonga.

In anticipation of the Pacific Games to be held on Rarotonga, the Games Organising Committee allocated funding to renovate the Rarotonga Lawn Bowls Club. As part of this renovation was an upgrade of the existing sewage system. A site inspection by government officials, local plumbers, overseas experts and consultants identified that the existing sewage system was merely a hole in the ground. The committee set about addressing this concern by installing a septic tank. After due deliberation by those at the site it was also noted that the available land would not be sufficient to irrigate the liquid waste. The immediate option was to purchase and install an advanced system that would provide better treatment and allow for a smaller irrigation field. The costs of such a system were deemed to be not cost effective so the team had to identify another solution. Inspection of neighbouring government properties identified that their sewage systems were not in compliance with the code either. At this stage the project evolved and it was decided that it would be more cost effective to include these properties in the renovation. The team decided that a settled sewerage system with a denitrifying banana trench would be sufficient to meet the code. Although not often employed in the Pacific due to high initial costs, technical know-how and dependence on a regular source of water, the system does provide good service, requires little maintenance from the individual except for desludging of septic tanks, costs can be shared across users and allows for development to proceed on land that is not sufficient to treat liquid waste.

Parameter	Mean Result (gm <sup>-3</sup> )	Maximum Result (gm-3)	Code Standard
Biological Oxygen Demand <sub>5</sub>	3.6	7.0	90% of results shall not exceed 10mg/litre no sample shall exceed 20mg/litre
Total Suspended Solids	10	34	90% of results shall not exceed 10mg/litre no sample shall exceed 20mg/litre
Total Nitrates	12.5	13.9	90% of results shall not exceed 15mg/litre no sample shall exceed 20mg/litre
Total Phosphates	5.1	6.1	90% of results shall not exceed 5mg/litre no sample shall exceed 10mg/litre

**Table 2. Environment Bay of Plenty - Regional Council summarised testing results of the Waipapa Maxi-Treat systems. Available at <http://www.envbop.govt.nz/Land/Rotorua-Lakes-Catchment.asp>**

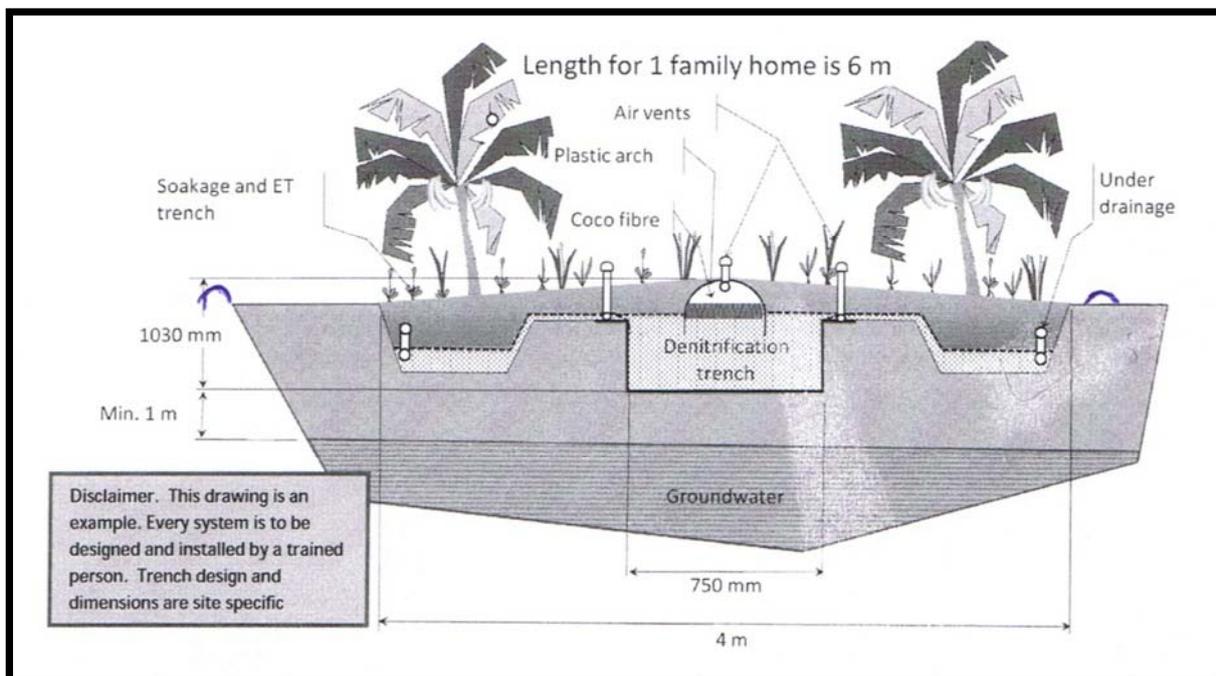
The case study set up involved the installation of a proper 8000L single chamber septic tank at the Rarotonga Lawn Bowls Club and 3600L single chamber septic tanks at three government departments, all installed with biofilters to exclude solid waste from the liquid

effluent. Calculated sewage flows for the project was 5080L/day (refer to Appendix 7), the code prescribes that daily flows over 2000L/day requires advanced treatment of sewage waste, this posed the next issue for the project. The team were dealing with three government entities and a private sports facility, it was decided that government would not support maintenance cost of a sewage system for the bowling club, therefore two All Waste Treatment Systems were purchased with government funds and funds allocated to bowling club under the Pacific Games contract. These systems were tested by Environment Bay of Plenty – Regional Council and summarised results are detailed in Tables 2 and 3.

Parameter	Mean Result (cfu/100mL)	Median Result (cfu/100mL)	Maximum Result (cfu/100mL)	Code Standard
Fecal Coliforms	8.2x 10 <sup>4</sup>	7.2x 10 <sup>4</sup>	1.9 x 10 <sup>5</sup>	no sample shall have a median value exceeding 10 cfu/100mL 80% of samples containing less than 20cfu/100mL

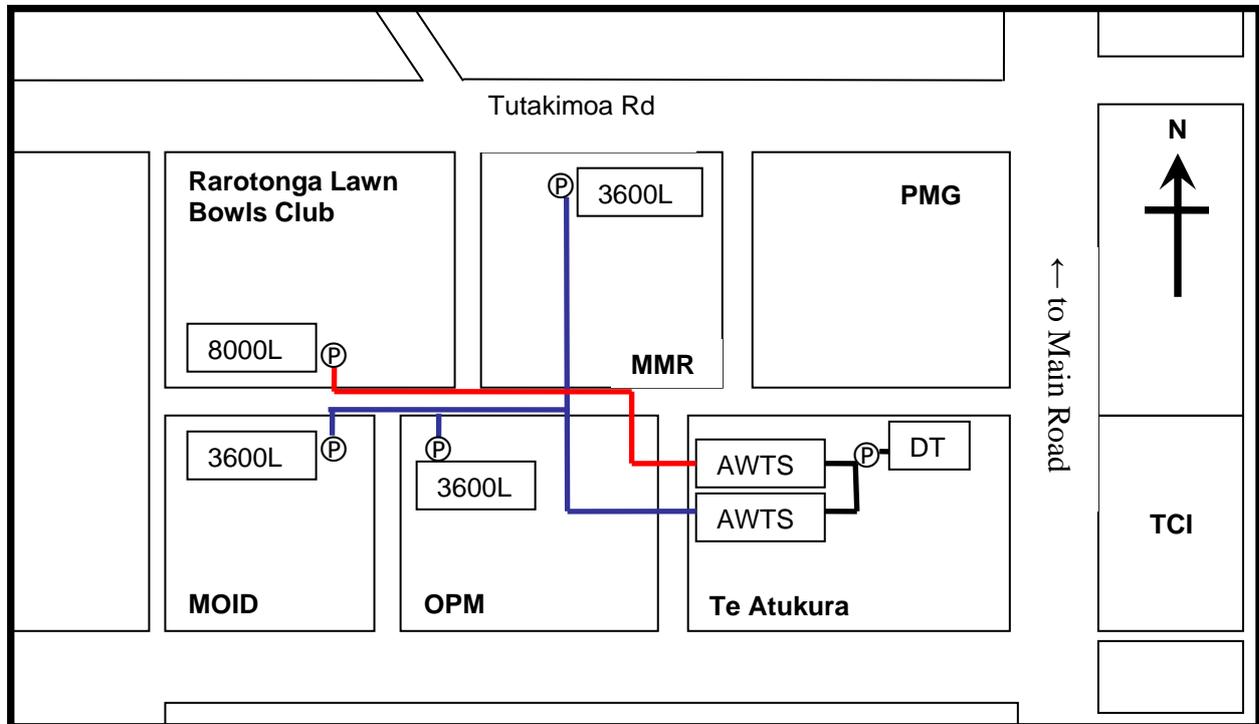
**Table 3 Environment Bay of Plenty - Regional Council summarised testing results of the Waipapa Maxi-Treat systems.** These values appear to be above the level prescribed in the Public Health Sewage Code. Available at <http://www.envbop.govt.nz/Land/Rotorua-Lakes-Catchment.asp>

Each septic tank was fitted with a 600L pumping station each set at a dose level of 200L and these were all plumbed to the All Waste Treatment Systems (refer to Figure 1.2). The final step was to install an effluent irrigation system; Te Atukura was selected as the site for this due to ample availability of land. Although ample land was available for irrigation, there were characteristics of the property that placed constraints on how the irrigation would be constructed. Te Atukura sits in an area with a shallow water table (1.4m depth under normal conditions, less than 1m during rainfall events), further to this, surface flooding is common. Taking these characteristics into consideration the team settled on above-ground denitrifying banana tree trenches (a modification of standard Wisconsin Mounds). This particular trench system was designed Andrew Dakers, Sanitation Adviser to the Cook Islands Marine



**Figure 4. Cross-section of the Denitrifying Banana Tree Trench.** Not the actual schematic for this case study, variation includes the addition of lateral bunds and the elevation of the trench above ground.

Resources Institutional Strengthening project, to suit local socio-economic and climatic factors (refer to Figure 4.). The denitrifying banana tree trench receives 600L of effluent daily, pumped from the All Waste Treatment Systems, which is dispersed in smaller doses during the day. Application of the sewage code determined that the trench must be at least 120m<sup>2</sup> to allow for the required 50mm/m<sup>2</sup>/day. Figure 5 shows the site layout of the project.



**Figure 5. Project site layout – not to scale and give approximate locations of facilities and amenities. MMR = Ministry of Marine Resources, PMG = Pitt Media Group, MOID = Ministry of Infrastructure and Planning, OPM = Office of the Prime Minister, TCI = Telecom Cook Islands, AWTS = All Waste Treatment System, DT = Denitrifying Banana Tree Trench and Ⓟ = 600L pumping station.**

This project is an ideal case study for the following reasons;

- It complies with Public Health Sewage Code and therefore deemed to be successful;
- The thought processes involved in many aspects of the project have been documented
- The evolution of the project from an on-site treatment plan catering for one organisation to a reticulated, off-site sewerage system reflects one of the challenges facing government considering this may be the only option for sewage treatment for future property developers in the Cook Islands;
- This is the first successful large scale communal reticulated system installed across different organisations in the Cook Islands;
- The denitrifying trench is a relatively new technology to be applied in the Cook Islands;
- The project required the collaboration of many stakeholders each negotiating to achieve their own goals;
- The advanced treatment systems have been field-tested in New Zealand and documentation is readily available;
- The site is located on and near government land and is therefore easily accessible;
- The site is adjacent to the workshop venue.