RUAPEHU DISTRICT COUNCIL

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Our Ref: 586936
File: S27-0007

13 August 2014

Leana Shirley
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Horizons Regional Council
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PALMERSTON NORTH 4442

Dear Leana

RESOURCE CONSENT APPLICATION RANGATAUA WASTEWATER TREATMENT PLANT

Ruapehu District Council is resubmitting the application to replace the current application for Rangataua Wastewater Treatment Plant. The application has been revamped in line with the One Plan and various points raised by Science, Compliance and Ngati Rangi have been considered and remediation has been developed into this application. The application lodgement fee $1,265.00 (incl GST).and will be deposited by bank transfer.

Given the gap in application dates Council is attempting to meet with potential affected parties again and run through the system. It is expected that supporting letters or withdrawal from objections will be achieved as part of the process.

Please direct all correspondence to

Anne-Marie Westcott
Environmental Manger
Ruapehu District Council
Private Bag 1001
TAUMARUNUI 3946

Yours sincerely

A. M. Westcott

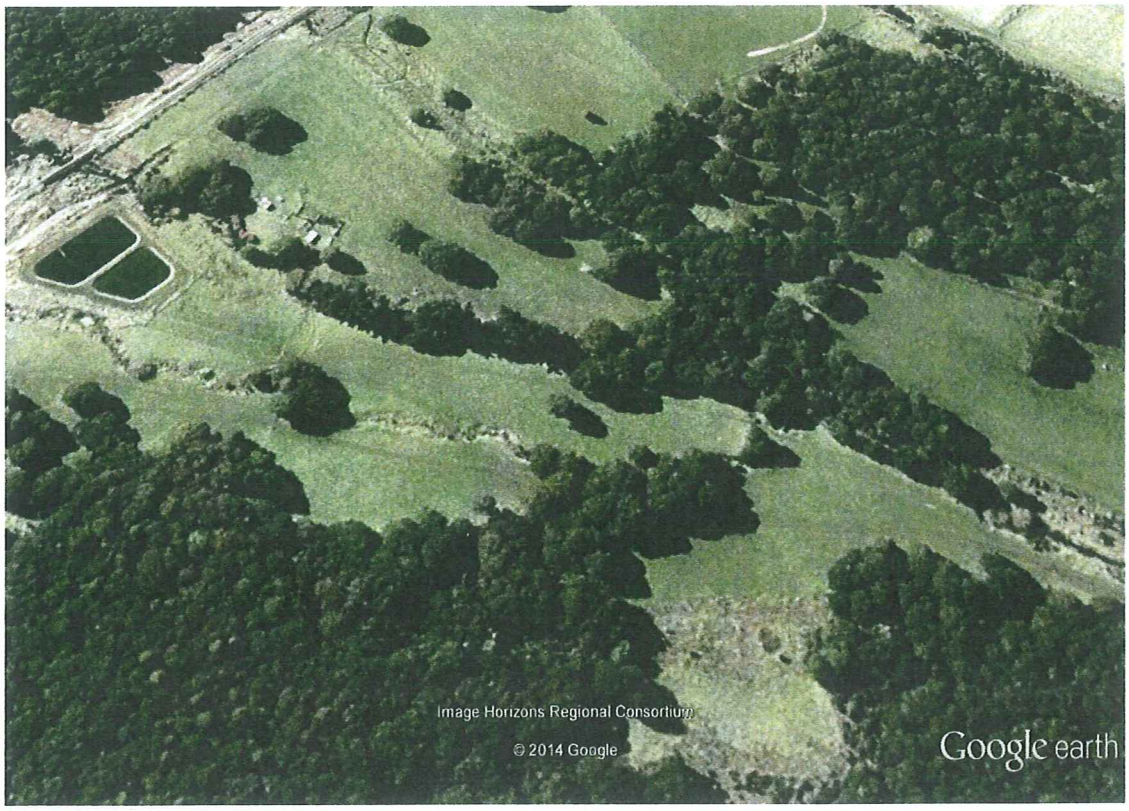
Anne-Marie Westcott
ENVIRONMENTAL MANAGER

amw:sac

Attachments

CC: Hannah Rainford, Ngati Rangi, PO Box 195, Ohakune 4660
Fiona Wilson, Department of Conservation, Ruapehu Area Office. SH 48, Whakapapa Village

Resource Consent Application for Rangataua Wastewater Treatment Plant



Ruapehu District Council
Anne-Marie Westcott Environmental Manager
30 June 2014

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1.0 INTRODUCTION

1.1 The Applicant - Ruapehu District Council

The Ruapehu District is a land-locked area encompassing 6,700km², with a population of 13,572 (Statistics NZ, Census 2006). Ruapehu is one of New Zealand's largest Districts by land area but has a relatively small and dispersed population base.

The District's landscape is varied, ranging from pastoral hill country and indigenous forest to the volcanic plateau of the Desert Road and New Zealand Army (Army) land at Waiouru. In the east the District features the Tongariro National Park, which includes the mountains Tongariro, Ngauruhoe and Ruapehu and in the west, the Whanganui National Park, which accompanies much of the Whanganui River.

The District borders with Rangitikei and Wanganui Districts in the south, extends to Waitomo District in the north, stretches east to Taupo District and west to Stratford and New Plymouth Districts. Townships are scattered throughout the District. Taumarunui is a service centre for the surrounding sheep, cattle and deer farms and forestry plantations. Ohakune caters for the ski and tourist industry as well as the surrounding horticultural activity. Raetihi is a rural township servicing farming, market gardening and forestry and forms a gateway to the historical Whanganui River settlement of Pipiriki. At the southern end of the District Waiouru features the Army Base.

Ruapehu District Council has a rugged natural beauty and expansive awe-inspiring landscapes making it a natural playground for both tourists and other New Zealanders to escape to. The landscape is dominated by dramatic volcanic mountains of Ruapehu, Tongariro and Ngauruhoe. It is bordered by National Parks. The Tongariro National Park is a world heritage park boasting Whakapapa and Turoa ski fields and the Tongariro Alpine Crossing. The Whanganui River flows through the Ruapehu District with spectacular views in navigatable deep grooves, surrounded by rich flora and fauna bush area.

Map1 Geographical Location of Rangataua Township
Source: Google Earth

1.2 The Application

An application was made on 10 August 2005 for the discharge of secondary treated wastewater effluent, to a natural wetland area formed in an old drainage channel prior to discharging into the Mangaehuehu Stream in Rangataua (to replace Discharge Permit No 4925). That application's primary purpose was to:

- Secure existing use rights until new consents were determined. Until then that application will not be withdrawn.
- Ensure submissions made on that consent will be taken into account for this new application.

This application is for the renewal of the resource consent to allow the continued discharge of tertiary treated wastewater effluent from the Rangataua Wastewater Treatment Plant into the Mangaehuehu Stream.

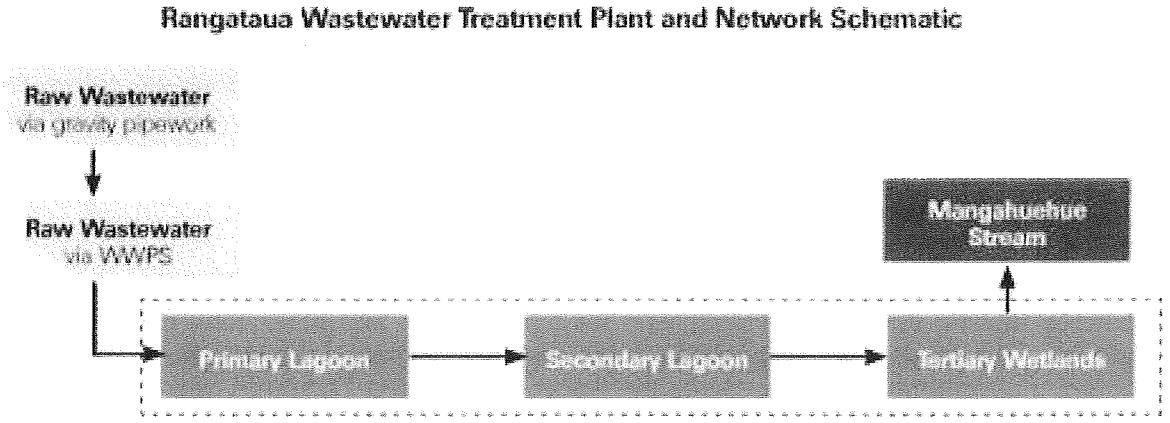


Diagram 1 Schematic of Treatment System
Source: Draft Ruapehu District Council Asset Management Plan 2014

The applicant is Ruapehu District Council. There has been significant monitoring since the application was made. Amendments to the first application have been made and a single comprehensive consent is sought. The new application is different from the previous one mainly because it:

- Includes additional flow volume and monitoring
- Includes wetland planting and species
- Includes monitoring results for the receiving environment
- Includes biota monitoring results.
- Includes assessment against the One Plan
- Includes deepening and enhancing the storwater drain
- Provides for fugitive emissions to groundwater and air
- Provides for cultural requirements

1.3 The Consent Sought

Ruapehu District Council seeks:

1. To deepen and enhance the drain on Nei Street upstream of the Rangataua Wastewater Treatment Plant
2. A permit to discharge into ground from the base of the Rangataua Treatement Lagoons
3. A discharge to air permit for odour and contaminants
4. To renew its existing resource consent (discharge permit 4926) for the Rangataua Wastewater to discharge to land and/or into the Mangaehuehu Stream via a wetland system
5. To ensure that the volume should account for population changes and set out in step changes to reflect growth calculated using Average Dry Weather Flow (ADWF) * 2 as a guide to expected discharge values under normal flow.
6. A term of 25 years with reviews at 10 year intervals reflective of the common catchment expiry date. The review will include discussions with Department of Conservation, Ngati Rangi and Horizons and cover:
    - Current technology available to treat wastewater
    - The quality of treatment achieved by the Rangataua system
    - The environmental analysis of effects on the receiving water
    - Sustainability of the community
    - A Matrix of values
        - The cost and benefits of implementing new technology at Rangataua
        - Weight will be placed on environmental achievements
        - Alignment with Cultural desires

1.4 Site and Locality

Rangataua Township was originally established as a small sawmilling village on the North Island Main Trunk Railway Line on high altitude swamp land situated off State Highway 49. Rangataua is 7 minutes south of the Ohakune Township and 20 minutes from the Waiouru Township. The township has declined over the years but has seen a recent resurgence as a quiet retreat with spectacular Mountain views of Mount Ruapehu and the Rangataua Forest. The township is a sleepy gem in close proximity to Ohakune and the Turoa Ski area which has resulted in a high proportion of non-resident home owners. Rangataua has the highest amount of people that own property who usually live outside the District at 60.9%.

The town centre lies at a latitude of -39.41824 and longitude of 175.45021 and it has an elevation of 696 meters above sea level.

Map 2 Rangataua Township Street view of Mt Ruapehu
Source: Google Earth

1.5 Population

The Population of Rangataua is not separated by Statistic New Zealand data and so has been married together from a variety of sources.

The 2013 Census mesh block data 1672900 and 1673000 combine approximates of the Rangataua area which shows the usual resident population count at 132 persons. The majority of these persons are aged between 15 and 64 years old. This is an increase on the 2001 census where the same population were measured at 111 persons. This data is an over estimation as mesh block size is greater than the actual wastewater collection zone.

To improve the data a phone survey was undertaken in 2011 and it found 60 people in summer which is significantly different to a winter a peak population of 570 persons in the 210 properties in Rangataua. The township has the highest amount of people that own property who usually live outside the District at 60.9%. A visual assessment of the houses found the majority of the houses were of rental batch size and a survey of this group found that the average bed capacity was 5 with a peak capacity set at 7 people. It is estimated that the summer population will lag significantly behind winter. Current summer population peaks are estimated at 100 people present and estimated growth would be only 100 persons every five years into the township over summer.

The estimated growth of the population is set in Table 1.

Year	Peak population
2012	570
2017	670
2022	770
2027	870
2032	970
2037	**1070**
2042	1700

Table 1 Estimated growth of population

Source: Ruapehu District Council Demand Growth Draft 2014

1.6 Treatment System

1.6.1 The Location

Wastewater is collected from the Rangataua township by a reticulated network consisting of approximately 4.1km of 150mm diameter PVC pipes and flows under gravity to a pump station located on the north-eastern corner at the intersection of Marino and Kaha Streets from where it is pumped approximately 800 metres through a rising main to the treatment plant which is situated on the eastern side of the township. Map 3 depicts the wastewater collection network in the Rangataua Township.

Map 3 Wastewater Collection Network in Rangataua Township.
Source Ruapehu District Council Asset Management Plan 2012-2022

The Rangataua Wastewater Treatment Plant is situated approximately 5 kilometres south from the centre of Rangataua within rural land situated off the extension of Nei Street. The land was gazetted as 1.7690 hectares, situated in Block V, Karioi Survey District, being part Section 33; on 12 April 1990 registration number B075103.1 Legally described as Part Section 33 Block V Karioi Survey District – Wastewater Treatment and Disposal – Gaz. 90/966.

The treatment plant was constructed on reasonably flat land on the western bank (true right) of the Mangaehuehu Stream with the top of the embankment around the oxidation lagoons raised some three metres or more above the normal stream level. The plant had a v-notch weir installed to provide an instantaneous reading of volume. This was upgraded to a "magflow" unit in August 2009 to provide continuous flow monitoring data when the lagoon is discharging. Communication improvements have also been added to capture the magflow data in 2011.

The wetland was constructed in 2001 on the western side of the oxidation Lagoons in a drain. This has been cut off from the storm water catchment area to the north of the North Island Main Trunk Line (NIMTL) by enhancing and deepening the channel above the lagoon. Effectively, the flow in the wetland is now only form the secondary treatment system.

The site concept was developed after considerable discussion between all affected parties: Department of Conservation, Ngati Rangi and Horizons Regional Council. The Department of Conservation (DOC) are Council's immediate neighbours; they own the land adjacent to the plant and the land area through which the streambed is located. This drain meanders approximately 570 metres in a southerly direction through Department of Conservation pastoral land until it discharges into the Mangaehuehu Stream.

The discharge through the drain provides for future opportunities to enhance the wetland area receiving the discharge. However, current treatment appears adequate and appropriate for the resident population as it stands today. The wetland and enhancement of the storm water drain cut off suggests only a small fraction has been reaching the Mangaehuehu Stream since 2012. The initial treatment system installation is still being paid for by the residents. Also added to their financial burden has been the upgrade of the last older pipe bellowing to the old railway house areas to remove storm water infiltration. It is believed that the current costs are sustainable for the current population.

Over time the wetland area can be further advanced with the discharge point being moved further up the drainage channel allowing more wetland to be developed.

There is land available for future improvements as the township grows. However, the technology for treatment also continue to improve making it non prudent to lock the future treatment system down in this current consent.

Map 4 shows the general township layout from Google earth. Additional maps of the location covering the topography of the area, reticulation system and aerials are provided in Appendix A.

Map 4 Rangataua Township and Surrounding Environment
Source: Google Earth

1.6.2 Surrounding Environment

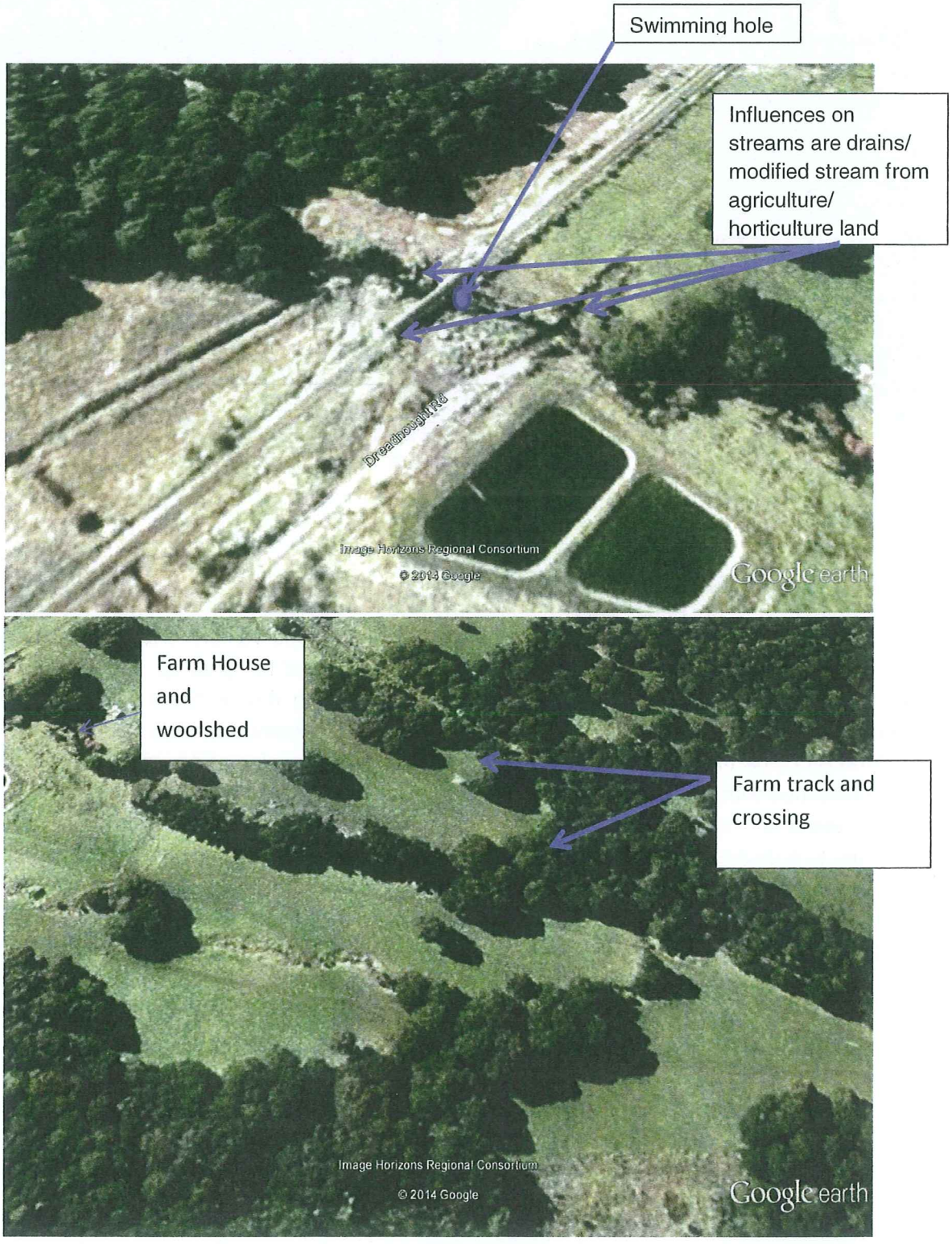
The treatment plant has the Mangaehuehu Scenic Reserve on one side, which is administrated by the Department of Conservation and leased for grazing. This is accessed from the metalled section of Nei Street which runs along the northern boundary to the Mangaehuehu Stream. The surrounding land has been modified as it is considered to be pastoral by Department of Conservation. The wetland drain joins at approximately 570m to the confluence with the Mangaehuehu Stream Southwest of the Lagoons. This channel has watercress and other "wet loving plants" in the base which act as further treatment. There is potential to enhance these species overtime to increase nutrient removal.

There is little vegetation screening, although the treatment plant site cannot be viewed from the township to the west. It is visible from the railway line passing parallel to the northern boundary. The planting of a screen will require extremely tall trees to reduce the visibility from the commuter train which would only sight the system for a number of minutes during their journey.

The closest residences are over 250m away to the east of the site in the Rangataua Township. The Ruapehu District Council does not provide reticulated water for the township. There are no known bores in the area of the lagoons. Water is collected from the roofs of houses into individual tanks.

There are a significant number of influences immediately above the Rangataua Wastewater Treatment Plant which could degrade or enhance the immediate upstream environment. Observations of the site show the modified water course, draining native swamps and

farmland immediately opposite the primary lagoon, can have visible volumes of sediment. The railway has influence modifications to the drainage systems immediately upstream from the treatment system on both banks of the river as shown in Map 5 a and b below.



Map 5 Possible Additional Environmental Influences
Source: Google Earth and Rupaehu District Comments

1.6.3 Adjacent Land Owner

An onsite meeting was held between Department of Conservation where it was established that their main interest was in the native bush remnant and the main Mangaehuehu Stream. The surrounding land has been modified as is considered to be pastoral by Department of Conservation. An understanding was developed which covered the following points. It is our understanding that Department of Conservation:

- Supported the improvement in the township infrastructure and treatment process being done in a sustainable manner.
- Agreed and supported the general concept that saw the discharge being diverted away from the higher valued Mangaehuehu Stream into the drain which is already modified.
- Supported the concept that the drain discharge into the Mangaehuehu Stream is in compliance with the One Plan rules.
- Supported a "natural wetland" system.
- Supports the development of the wetland in an ongoing manner and Council undertaking future works in line with best practices and community sustainability.
- Support the extention of the wetland system into their lands in the future.
- Supported in principle of the iwi and their cultural aspirations being considered in a sustainable manner.

1.6.4 Nearest Neighbour Department of Conservation Land.

The land occupier is subject to the terms and conditions as agreed with the Department of Conservation. Concerns of Lessee should be discussed with Department of Conservation in the first instance. The Department of Conservation Land is not fenced from the Mangaehuehu Stream.

1.6.5 Mangaehuehu Stream

The Mangaehuehu Stream originates in the Tongariro National Park on the south western slopes of Mount Ruapehu. It then flows down through pastoral farming with sheep and beef predominating land use with some horticulture crop rotation. The stream is part of the Whangaehu catchment and falls into the zone Whau_1c in the proposed One Plan. The Mangaehuehu Stream is managed against region wide water quality targets that apply to all rivers in the One Plan. The standards and results provided by Horizons for the major parameters are provided in Section 2.2 One Plan Targets.

Upstream of the Rangataua wastewater plant discharge fails to meet the regional water quality standards for pH, particulate organic matter, soluble inorganic nitrogen, soluble carbonaceous biological oxygen demand on occasions. This is explored under section 2.2 One Plan Targets as an assessment of the receiving environment. The Mangaehuehu Stream drainage system dictates the water chemistry characteristics and ecological environment therefore it is important to keep these in mind when assessing human developed targets of water quality.

The report '*Statistical Analysis of River Flows with the Horizons Region*' (NIWA, 2007) does not provide any flow data for the Mangaehuehu Stream. The Mangaehuehu Stream is

joined by the Waiharuru Stream then the Tokiahuru Stream which joins the Whangaehu River.

The only flow data available in the report is for the Tokiahuru Stream at the Whangaehu River junction post diversion. Values are taken from the report '*Statistical Analysis of River Flows with the Horizons Region*' (NIWA, 2007):

	1 July – 30 June (m3/s)	**Nov – 30 April (m3/s)**
Mean Flow	7.641	
Mean Annual Low Flow (MALF)	4.821	
Half Median Flow	3.37	3.096
Three Times Median Flow	20.22	18.573

Table 2 River Flow Data

Source: *Statistical analysis of river flow data in the Horizons Region. NIWA, 2007 pg 170.*

1.6.6 Whangaehu River

The Whangaehu River headwaters are Te Wai-a-Moe, the crater lake of Mount Ruapehu on the central plateau, and it flows for 135 kilometres southward into the Tasman Sea eight kilometres southeast of Whanganui. The waters received from the Crater Lake periodically give the river a relatively high acidity, conditions not favourable to fish and wildlife.

Tributaries of the Whangaehu River on the eastern side have water abstracted via 23 intakes known as the Waihianoa Aquaduct and diverted to the Tongariro Power Scheme, resulting in a significant reduction in the volume of water in the river. The main river has not been used in hydroelectric generation as the water acidity would require the use of special materials in generation machinery and structures.

The report '*Statistical Analysis of River Flows with the Horizons Region*' (NIWA, 2007) provides relative flow data for the Whangaehu River. This data has not been reproduced in this document as it is moving outside the scope of this report.

1.7 Report Structure

Chapter 2 of this report outlines the planning provisions relevant to the application for resource consent, including an assessment against the rules in the One Plan to determine the activity status for the application. The existing Rangataua Wastewater Treatment Plant is then detailed in Chapter 3, including upgrade works. A summary of the consultation undertaken by Council with key affected parties is contained within Chapter 4. Compliance with the existing resource consent conditions and the One Plan requirement is investigated within Chapter 5 to demonstrate the Council's compliance and what improvements are required to achieve the latest water quality targets within the One Plan. The various alternative treatment and discharge options are outlined within Chapter 6, and the application then assesses the effects of this option on the Mangaehuehu Stream and affected parties within Chapter 7. The One Plan water quality targets provide the benchmark for granting consents. Chapter 8 assesses the application against the relevant statutory framework, including Part II (purpose and principles) of the Resource Management Act 1991 and the objectives and policies of the relevant planning documents. Chapter 9 provides recommended conditions of consent.

2. Statutory Requirements

The intention of this section of the report is to outline the statutory requirements relevant to the application and to determine the activity status based on the relevant rules within the One Plan.

2.1 Resource Management Act 1991

The Resource Management Act 1991 (RMA) is the overlying legislation that manages the use of natural and physical resources within New Zealand and it specifically seeks to manage discharges to air and water within Section 15 of the Act. The sections of the RMA 1991 relevant to this application for resource consent are:

> **Section 15 RMA 1991**
>
> *No person may discharge any*
> *(a) Contaminant or water into water; or*
> *(b) Contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water; or*
> *(c) Contaminant from any industrial or trade premises into air; or*
> *(d) Contaminant from any industrial or trade premises onto or into land*
> *unless the discharge is expressly allowed by a national environmental standard or other regulations, a rule in a regional plan as well as a rule in a proposed regional plan for the same region (if there is one), or a resource consent.*

The presumption under Section 15 of the Resource Management Act 1991 is that no person may discharge contaminants into a waterway unless the discharge is permitted under rule within an operative or proposed regional plan, or the discharge has been granted resource consent. For this reason, an assessment of the relevant regional plan, the One Plan is required to establish that an application for resource consent may actually be applied for, and if this is the case, whether consent is required for a controlled, discretionary, restricted discretionary or non-complying activity.

Section 2 of the Resource Management Act 1991 defines contaminant as:

> *Any substance (including gases, [odorous compounds], liquids, solids and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat-*
> *(a) When discharged into water, changes or is likely to change the physical, chemical, or biological condition of water; or*
> *(b) When discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged.*

Section 107 of the Resource Management provides guidance as to when a discharge permit cannot be granted under the Act:

> **Section 107 RMA 1991**
> *A discharge permit cannot be granted if, after reasonable mixing, the contaminant or water discharged (either by itself or in combination with the same, similar, or other contaminants or water), is likely to give rise to all or any of the following effects in the receiving waters:*
> *(c) conspicuous oil or grease films, scums or foams, or floatable or suspended materials.*
> *(d) any conspicuous change in the colour or visual clarity.*
> *(e) any emission of objectionable odour.*
> *(f) the rendering of fresh water unsuitable for consumption by farm animals.*
> *(g) any significant adverse effects on aquatic life.*

The discharge has been assessed against these effects.

(c) conspicuous oil or grease films, scums or foams, or floatable or suspended materials.

Visual observations indicate that after reasonable mixing there is no conspicuous oil, grease films, scums or foams or floatable or suspended material that can be attributed to the Ranagataua Wastewater Treatment Plant.

(d) Any conspicuous change in the colour or visual clarity

Hue has not been assessed during the sampling programme. The change in visual clarity is a significantly more sensitive measure than a change in hue. Water Clarity (black disc) is measured in metres by assessing the horizontal visibility through water of a black disc. The black disc is moved away from the viewer until it is no longer visible, the distance between the viewer and disc is measured. A high black disc measurement indicates good water clarity. Horizontal visibility is measured by the black disc change between upstream and downstream of the discharge. This method is reliant on human eye assessment and selecting habitat with similar substrates and water velocity which may not always be possible in some water bodies.
The Water Quality targets for Whau_1c allows for a Clarity change of 20%.

Horizontal Visibility

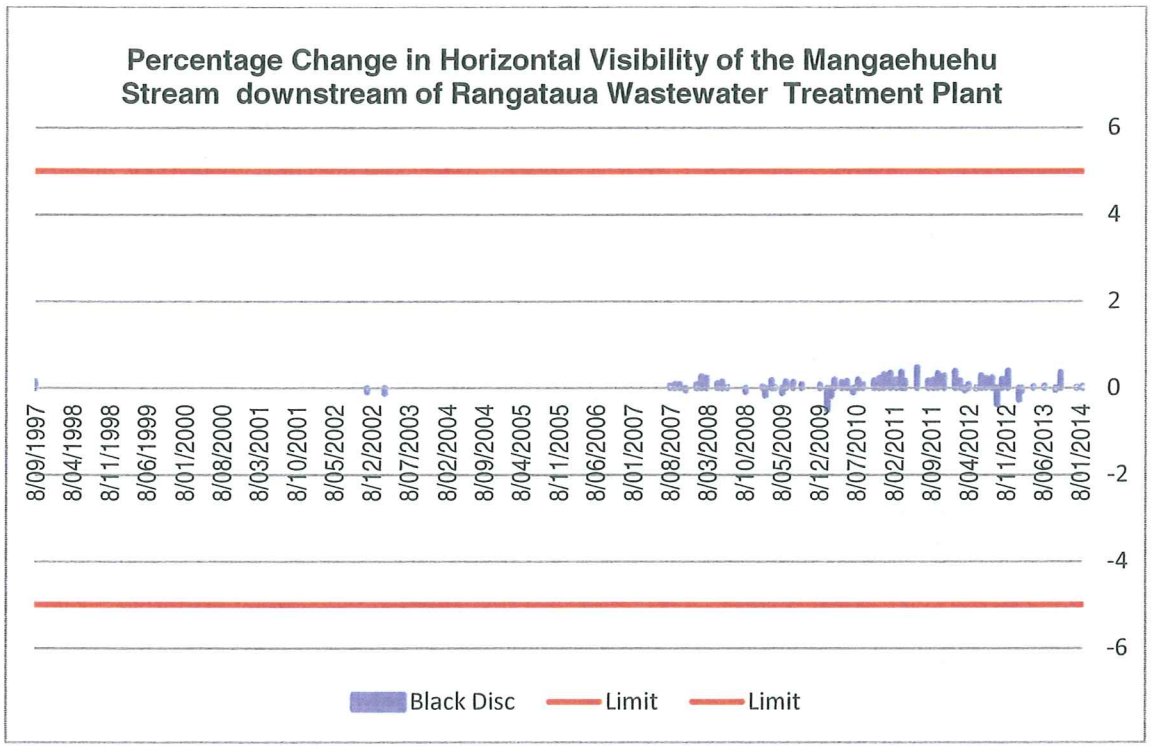


Figure 1 Horizontal visibility percentage change in the Mangaehuehu Stream upstream and downstream of Rangataua Wastewater Treatment Plant discharge.
Source: Horizons RC monitoring data.

The percentage change in horizontal visibility of a black disc within the Mangaehuehu Stream monitoring sites upstream and downstream of the Rangataua Wastewater Treatment Plant discharge has not changed by greater than 5% over the sampling period. This meets the water quality target: visual clarity of the water measured as the horizontal sighting range of a black disc must not be reduced by more than 20% has been met.

(e) any emissions of objectionable odour

There are no records of objectionable odour beyond the boundary on any field sheet for this site. The customer complaints register provides no complaints for the site.

(f) the rendering of fresh water unsuitable for consumption by farm animals

Livestock production in Australia and New Zealand relies on both surface water and groundwater supplies. Water quality in streams and dams (surface waters) is influenced by catchment geology, topography, soil type and climate. The quality of both groundwater and surface waters may be affected by catchment land use practices, including agriculture, mining and other industries, with the potential for increased concentrations of salt, nutrients and other contaminants, such as pesticide residues and heavy metals.

The Australia New Zealand ECC 2000 Livestock drinking water guidelines has values for: Nitrate at 400 g/m3. The results below are guidelines which show the value of nitrate at or below 0.4 g/m3 which is the detection limit for the laboratory.

(g) any significant adverse effects on aquatic life

Ammoniacal nitrogen (ammonia) is a common nitrogenous pollutant that is toxic to many species, particularly fish and invertebrates, at elevated concentrations and under certain temperature and pH conditions. Direct discharges to waterways of animal or domestic effluent, industrial discharges, runoff and decaying organic material can contribute to high levels of ammonia.

> Ammonia is toxic to aquatic life at the levels over 1.1 g/m^3 when the water temperature is equal to or less than 15°C and 0.8 g/m^3 when the water temperature is greater than 15°C.

The graph below highlights that there are a number of occasions where downstream results are higher than those upstream. Only one result is just above the lower threshold for summer or high water temperatures in the receiving water. This high value was recorded in July when the winter temperatures of the stream are colder and a higher tolerance of ammonia levels that is up to 1.1 mg/m^3 of ammonia may enter the receiving environment before it has toxic effects on the macro invertebrate life. The Rangataua Treatment Plant Discharge is not discharging ammonia at levels that may have toxic effects on the aquatic life in the Mangaehuehu Stream.

There are a number of occasions where the upstream ammonia values are higher than downstream suggesting that, there are other sources releasing ammonia into the environment.

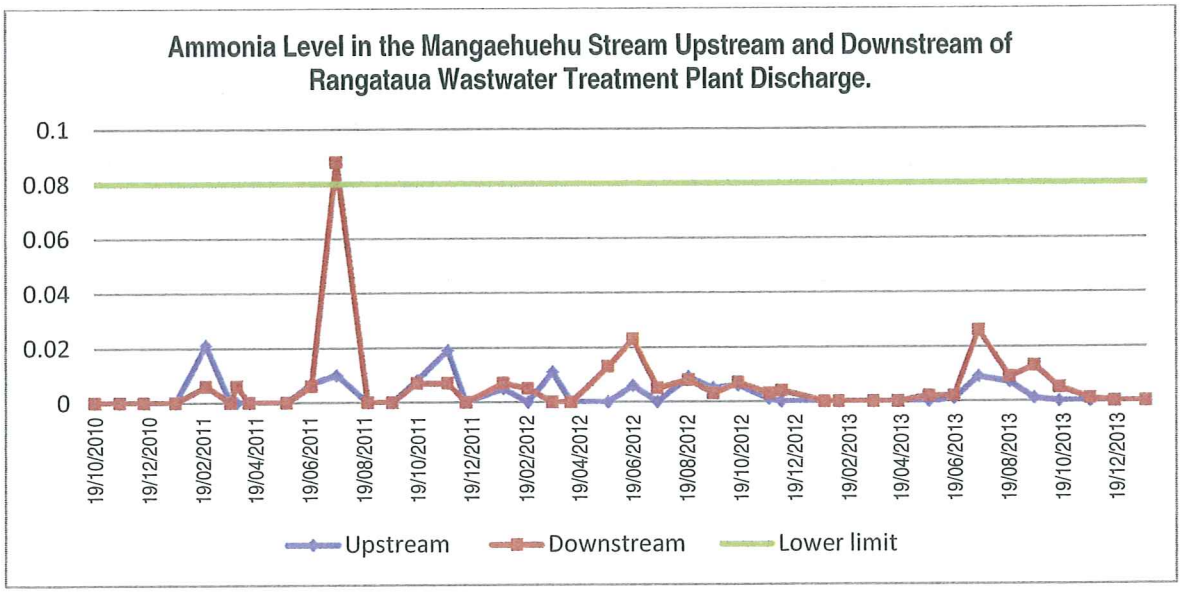


Figure 2 Ammonia concentrations in the Mangaehuehu Stream upstream and downstream of Rangataua Wastewater Treatment Plant discharge.
Source: Horizons RC monitoring data.

2.2 One Plan Targets

The One Plan sets targets for Water Quality Standards under Schedule D. The management zone and consequence targets have been abstracted in Table 3 to enable the Rangataua receiving environment to be assessed against the Targets where information has been collected.

Region-wide Water Quality Targets				
Ecoli/100ml		Periphyton Filamentous Cover	Diatom or Cyanobacterial Cover	QMCI %Δ
<50th %ile	<20 %ile			
260	550	30%	60%	20

Δ symbol for change

Management Zone Targets for Whau_1c									
pH		Temp (°C)		DO (% SAT)	$_{sc}BOD_5$	POM	Periphyton	DRP (g/m^3)	SIN (g/m^3)
Range	Δ	<	Δ	>	g/m^3	g/m^3	Chla (m- g/m^2)	<	<
7-8.2	0.5	19	2	80	1.5	5	50	0.006	0.070

Management Zone Targets for Whau_1c						
Deposited Sediment Cover (%)	MCI	Ammonia Nitrogen g/m3		Tox.	Visual Clarity (m)	
≤	>	<	max	%	<50th %ile	%Δ
15	120	0.320	1.7	99	3	20

Table 3 One Plan Targets Parameters
Source: Horizons One Plan

i. Enterococci

E. coli (Escherichia coli) is a type of faecal coliform indicator bacteria commonly found in the intestines of humans, warm-blooded mammals and birds. It is excreted in large numbers and normally dies off from ultra-violet exposure or is eaten by other microbes within a few days or weeks of being released into the environment. E. coli in water is not usually harmful in itself but high concentrations are an indicator of the risk of other more harmful pathogens and the presence of human or animal faecal contamination.

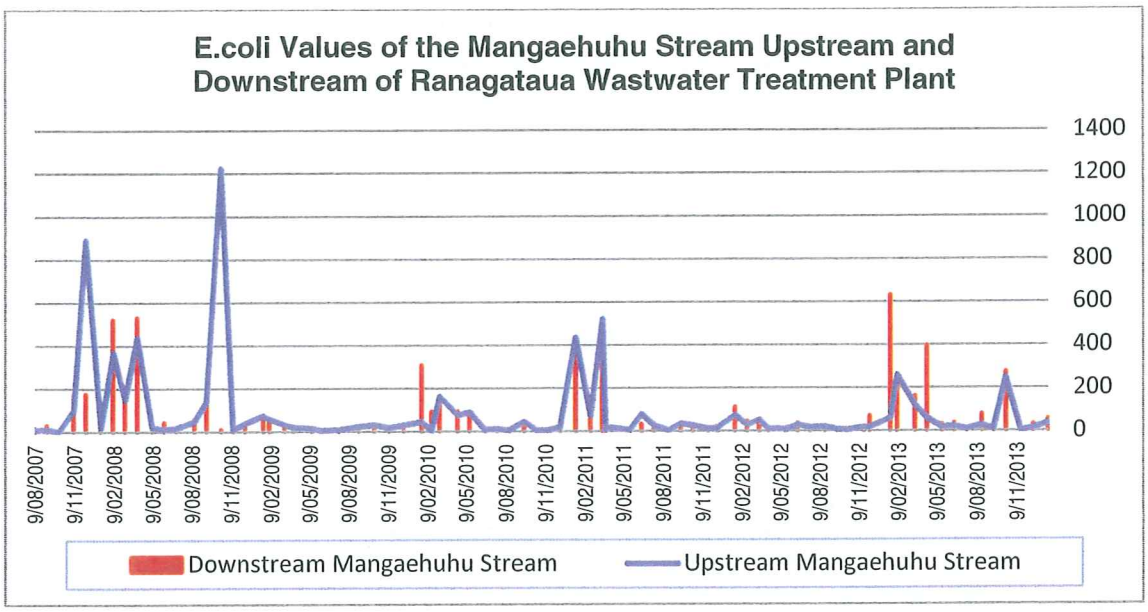


Figure 3 *E.Coli* Values in the Mangaehuehu Stream Upstream and Downstream of Rangataua wastewater Treatment Plant discharge.
Source: Horizons RC monitoring data.

The One Plan target is that the concentration of *Escherichia coli* must not exceed 260 per 100 millilitres 1 November – 30 April (inclusive) when the river flow is at or below the 550th *flow exceedance percentile*. The concentration of *Escherichia coli* must not exceed 550 per 100 millilitres year round when the river flow is at or below the 20th *flow exceedance percentile.* Generally this target has been met.

The *E.coli* levels have not been adjusted to reflect low flow and therefore results can only be assessed as the worst case scenario. Of the 78 samples plotted between 2007 and 2014 only two had *E.coli* values greater than 260 cfu/100ml downstream in comparison of upstream during the summer months. One value was higher in April (autumn). The monitoring data also indicates that there are other contributing sources of high *E.coli* entering the receiving environment upstream form the discharge.

The Mangaehuehu Stream and the drain are not fenced from stock which excretes this indicator parameter in their waste. Therefore limited conclusive values contributed from the Rangataua Wastewater Treatment Plant can be drawn. There is no reference notes, such as presence or absence of stock, which would help in assessing possible reasons for high *E.coli* results.

Land under direct control of the Ruapehu District Council that adjoins the Mangaehuehu Stream has been fenced to the river to prevent stock access direct to the river. This area has not been actively planted. It is envisaged that the area will eventually be self-seeded with plants from upstream in the catchment. Land immediately downstream form the lagoon where the discharge from the drain enters the Mangaehuehu Stream belongs to DOC and is grazed right to the steam edge. On a number of occasions during inspections by the applicant it appears the drain which the treated waste enters has been used as a disposal site for expired stock within Department of Conservation Land.

The Mangaehuehu Stream has not been listed as a bathing site on Horizons website. Baths are generally found in areas where there is easy public access. The area downstream from the discharge does not have public access which may encourage bathing. There is good public access from the paper road immediately adjacent to the Rangataua Wastewater Treatment Plant accessed by Rangataua residents. There is a swimming hole upstream of the plant below the rail bridge. This is the most likely spot for contract recreation in this area and the site is above any influences from the treatment plant. Results from *E.coli* monitoring, indicates bacterial contamination does not or may to a minor level place bathers health at risk from the Wastewater Treatment Plant.

ii. Periphyton.

Periphyton is the slime and algae found on the beds of streams and rivers. It is essential for the function of healthy ecosystems, but when it proliferates it can become a nuisance by degrading swimming and fishing spots, clogging irrigation and water supply intakes. Periphyton growth at high levels also impacts on fish and in stream invertebrate communities.

While growth of periphyton is natural the reasons why periphyton proliferates are a complex interaction of natural factors: light, temperature, river bed substrate, Hydrological disturbance, river velocity and nutrient inputs. These factors are both natural and impacted by human activities on the communities. A summary diagram of interaction has been included in Appendix D to demonstrate how complex the interaction is and more than one single component must be considered along with the Pohangina Environmental Consultants reports, 2008 and 2009 respectively.

Pohangina Environmental Consultants sampled the biological life during low flow in 2008 and 2009 respectively. The reports are in Appendix D. Figure 4 and Figure 5 are abstracts from the reports respectively.

In 2008

Death found periphyton biomass was not significantly different upstream and downstream of the discharge, however the percentage of stream substrate covered by diatoms upstream and 400m downstream exceeded limits recommended by the Ministry for the Environment for aesthetics.

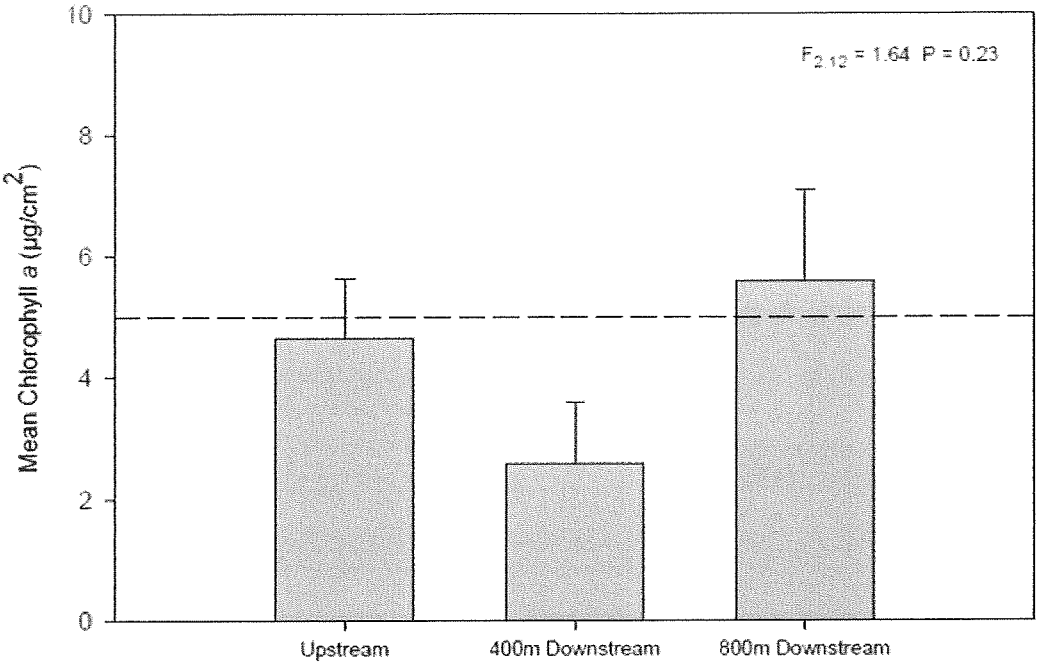


Figure 4 Chlorophyll-a in the Mangaehuehu Stream Upstream and Downstream of Rangataua wastewater Treatment Plant discharge. *Source Pohangina Environmental Consultants Ltd: Death, F (2008). Water Quality of the Mangaehuehu Stream at the Rangataua Wastewater Treatment Ponds.*

In 2009

Periphyton biomass was not significantly different upstream and downstream of the discharge. The percentage of stream substrate covered by diatoms upstream exceeded limits recommended by the Ministry for the Environment for aesthetics.

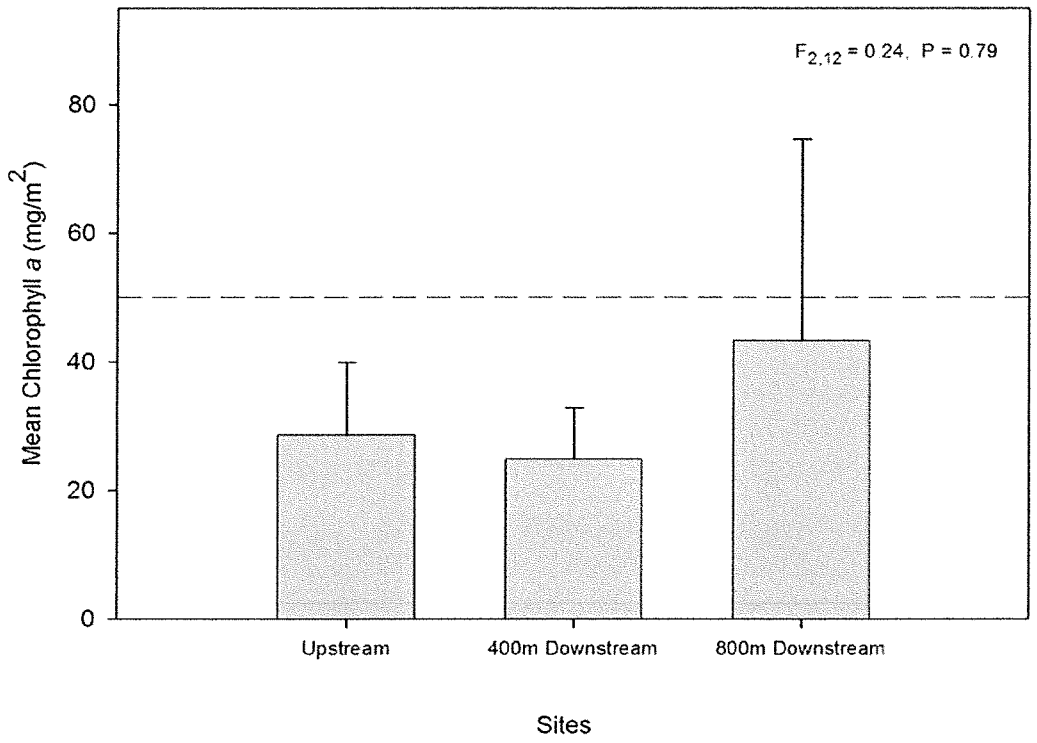


Figure 5 Chlorophyll-a in the Mangaehuehu Stream Upstream and Downstream of Rangataua wastewater Treatment Plant discharge. *Source Pohangina Environmental Consultants Ltd: Death, F (2009). Water Quality of the Mangaehuehu Stream at the Rangataua Wastewater Treatment Ponds.*

The Mean periphyton biomass, measured as chlorophyll *a* (mg/m2), collected from sites sampled on the Mangaehuehu Stream upstream and downstream of the wastewater treatment pond discharge at Rangataua in 2009. The dashed line represents the maximum level of chlorophyll *a* for 'clean water' benthic fauna (Biggs 2000).

The One Plan periphyton water quality target is measured by Chlorophyll a as 50 mg/m^2. Results show how targets were met in 2008 upstream and immediately downstream but were above target at 800 m downstream. 2009 results showed chlorophyll a levels were below target at all sites.

In conclusion the discharge is possibly having a minor impact on targets of periphyton levels for benthic fauna on some occasions. Enhancing the wetland area is likely to further reduce any affects in the Stream.

Other ecology factors in the stream also have an important role in keeping periphyton values in check such as insects grazing on the periphyton.

iii. Macroinvertebrates

The One Plan target requires:

- the Macroinvertebrate Community Index (MCI) must exceed 120, unless natural physical conditions are beyond the scope of application of the MCI.
- there must be no more than a 20% reduction in Quantitative Macroinvertebrate Community Index (QMCI) score between appropriately matched habitats upstream and downstream of discharges to *water*.

Pohangina Environmental Consultants sampled the biological life during low flow in 2008 and 2009 respectively. The reports are in Appendix D. Figure 6 and Figure 7 are abstracts from the reports respectively.

In 2008

Death found the discharge was having an adverse effect on the percentage of Ephemeroptera, Plecoptera and Trichoptera individuals present but did not appear to affect any other indices. Biotic indices indicate moderate to good water quality in this part of the Mangaehuehu Stream.

As highlighted in the site location there are a number of other environmental influences which enter immediately upstream. The actual influence after reasonable mixing falls about the discharge point which needs to be kept in mine when evelatuing this data.

Results from monitoring in 2008 met the target value of 120 MCI.

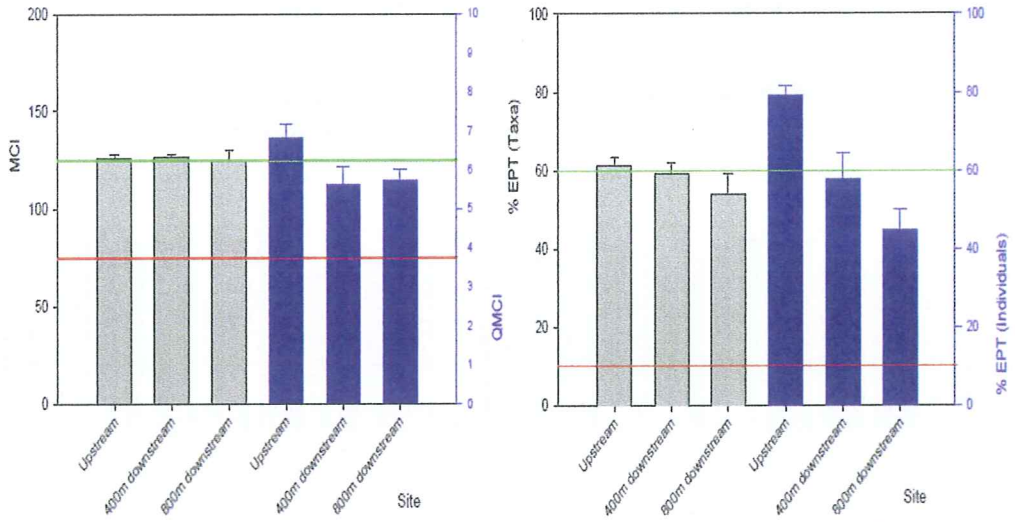


Figure 6 Plot of mean MCI (grey bars), QMCI (blue Bars), % EPT (taxa bars and % EPT (individuals).
Source Pohangina Environmental Consultants Ltd: Death, F (2008). Water Quality of the Mangaehuehu Stream at the Rangataua Wastewater Treatment Ponds

In 2009

Death found invertebrate communities indicated that this discharge was having no adverse effect on any of the biotic indices. Biotic indices indicate moderate to good water quality in this part of the Mangaehuehu Stream.

Results from monitoring in 2009 met the target value of 120 MCI. The QMCI value increased downstream indicating the target was met.

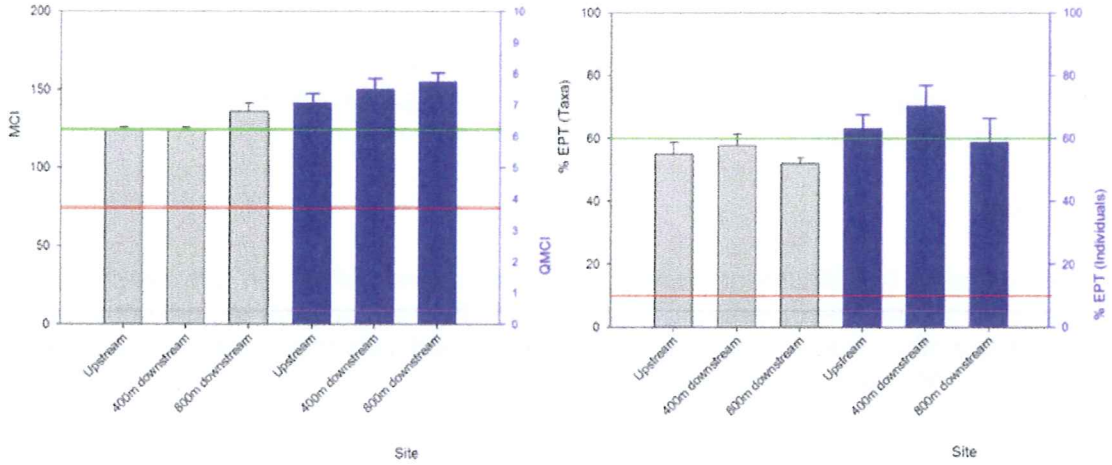


Figure 7 Plot of mean MCI (grey bars), QMCI (blue Bars), % EPT (taxa bars and % EPT (individuals).
Source Pohangina Environmental Consultants Ltd: Death, F (2008). Water Quality of the Mangaehuehu Stream at the Rangataua Wastewater Treatment Ponds

iv. pH

A pH range of 6.0 to 9.0 appears to provide protection for the life of freshwater fish and bottom dwelling invertebrates. One of the most significant environmental impacts of pH involves synergistic effects with other chemical constituents.

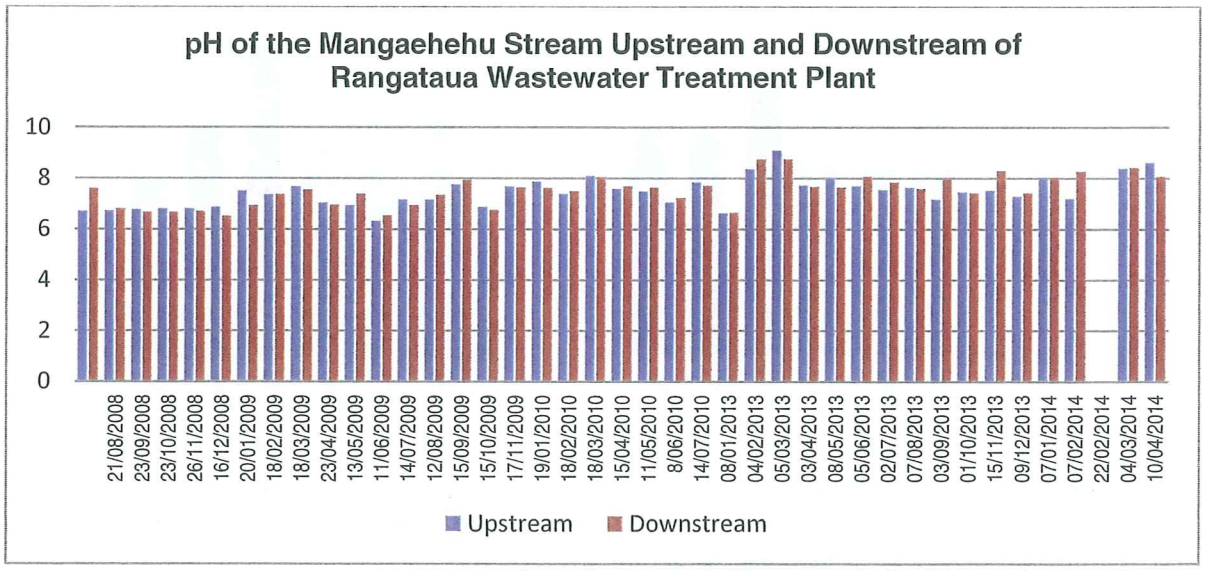


Figure 8 pH Levels Measured in the Mangaehuehu Stream.
Source: Horizons Regional Council Monitoring Data.

The One Plant states that the pH of the water must be within the range of 7 to 8.2 unless natural levels are already outside this range. The graph pH in Figure 8 shows that the stream can naturally reach pH 9 on occasions.

The pH of the water must not be changed by more than 0.5. Results show on four occasions the change was greater than 0.5 units between upstream and downstream. On each occasion the downstream value was elevated less than 1 unit. Given the other stream influences injected into the environment, such as the swamp drain, it is difficult to conclude the actual source of the effect as the other influences were not measured.

v. Temperature

Temperature influences water chemistry as the temperature increases the rate of chemical reactions increase, which inturn affects biological activity. Examples of the effects of temperature change, are the impacts it has on oxygen saturation in the water column. Warm water holds less oxygen than cool water, so it may be saturated with oxygen but still not contain enough for the survival of aquatic life. Also some chemical components such as ammonia become more toxic to aquatic life at highter temperatures.

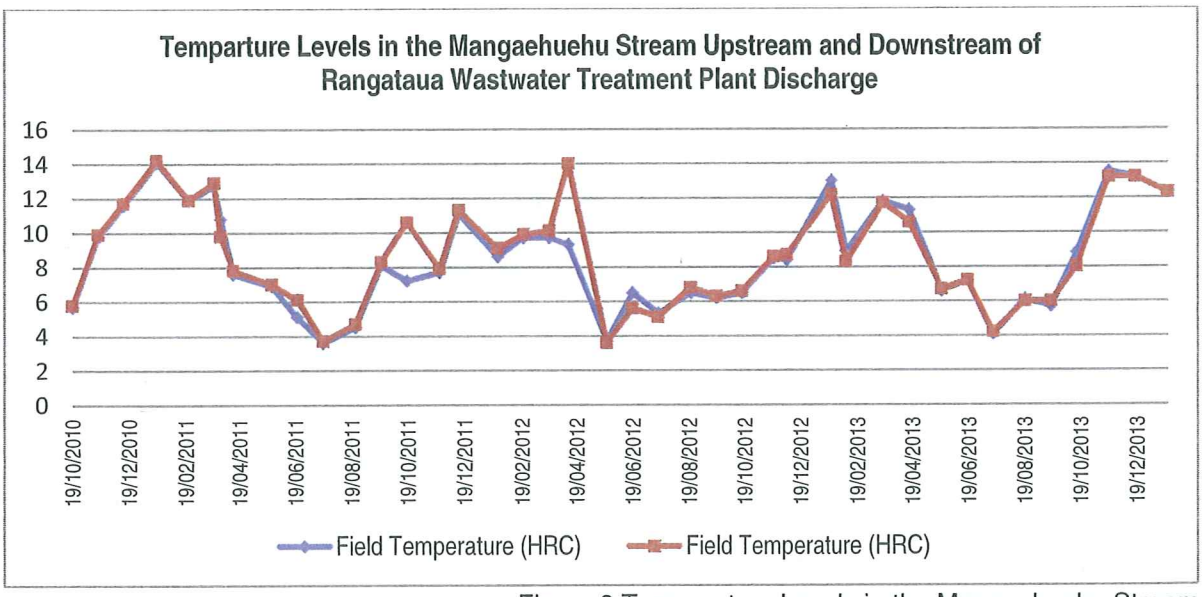


Figure 9 Temperature Levels in the Mangaehuehu Stream
Source: Horizons 0Regional Council Monitoring Data

The One Plan suggests that the temperature of the water must not exceed 19 degrees Celsius. Graphical results as displayed in Figure 9 show the temperature has not been found above 15°C. Both upstream and downstream results are very similar and do not change more than 2°C except for one result which had a difference of 3°C. Generally the target values stated in the One Plan are met.

vi. Dissolved Oxygen

Dissolved oxygen is a measure of the amount of oxygen gas dissolved in water. Aquatic ecosystems both produce and consume oxygen. It gains oxygen from the atmosphere and from plants as a result of photosynthesis during daylight hours. Respiration by aquatic animals, decomposition, and various chemical reactions consume oxygen. Oxygen is essential to all aquatic life. The presence of discharges with high oxygen demand (elevated BOD) can reduce dissolved oxygen in a water body. The presence of high algal growth increases dissolved oxygen during the day by photosynthesis. However, in the evening, particularly just before dawn, algae switch to respiration which reduces the dissolved oxygen content in the water column. This fluctuation in dissolved oxygen to low levels at night is a critical threshold for the survival of fish and aquatic invertebrates.

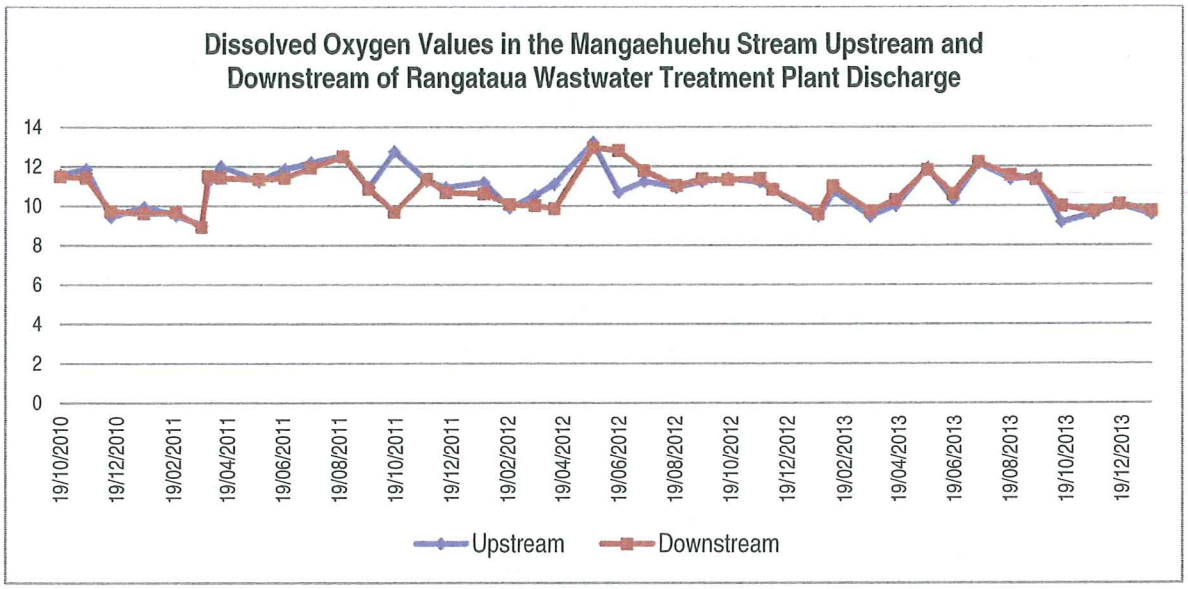


Figure 10 Dissolved Oxygen Levels in the Mangaehuehu Stream
Source: Horizons Regional Council Monitoring Data

Figure 10 graphically illustrates the dissolved oxygen values measured in the Mangaehuehu Stream. Generally values are similar between the sites. The dissolved oxygen, temperature and barametric pressure values taken in the field allows the percentage of saturation of dissolved oxygen in the water column. This is graphically illustrated in Figure 11. The One Plan target requires the dissolved oxygen saturation to remain above 80 and this was achieved.

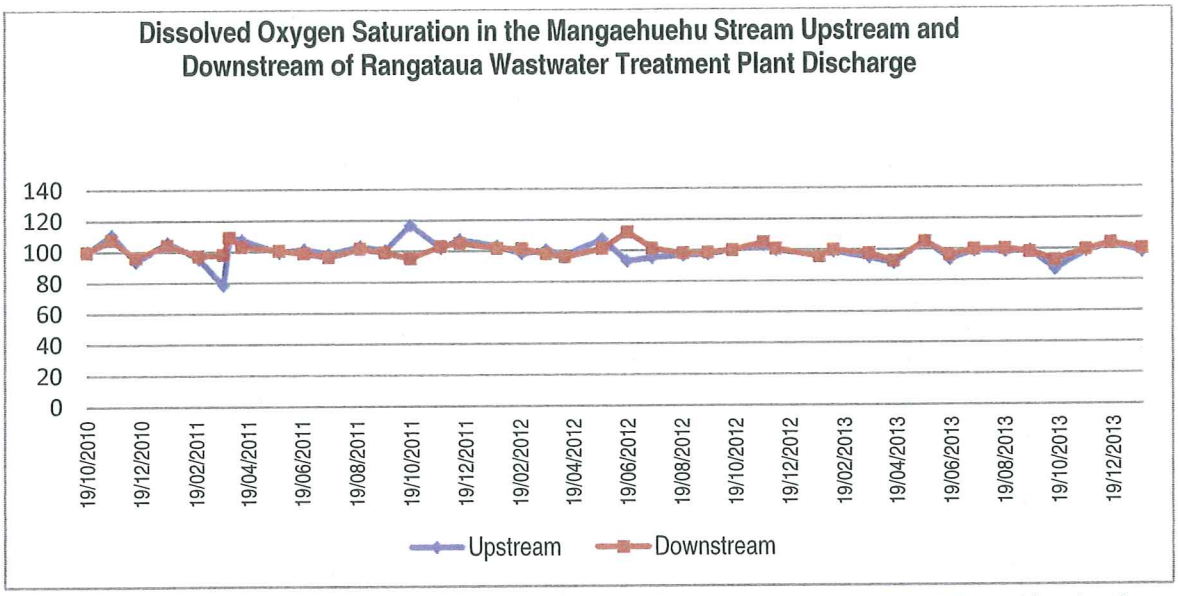


Figure 11 Dissolved Oxygen Saturation Levels in the Mangaehuehu Stream
Source: Horizons Regional Council Monitoring Data

vii. Biochemical oxygen demand

Carbonaceous biochemical oxygen demand measure the amount of oxygen required by bacteria to biologically oxide the carbonaceous fraction of organics and removes interference from nitrification. That is, there is not adequate supply of dissolved oxygen available for other organisms (fish) which live in the aquatic habitat. Effluent discharges can significantly increase BOD in the receiving waters. High BOD often indicates low dissolved oxygen is and can cause the growth of bacteria known as 'sewage fungus', further reducing dissolved oxygen availability.

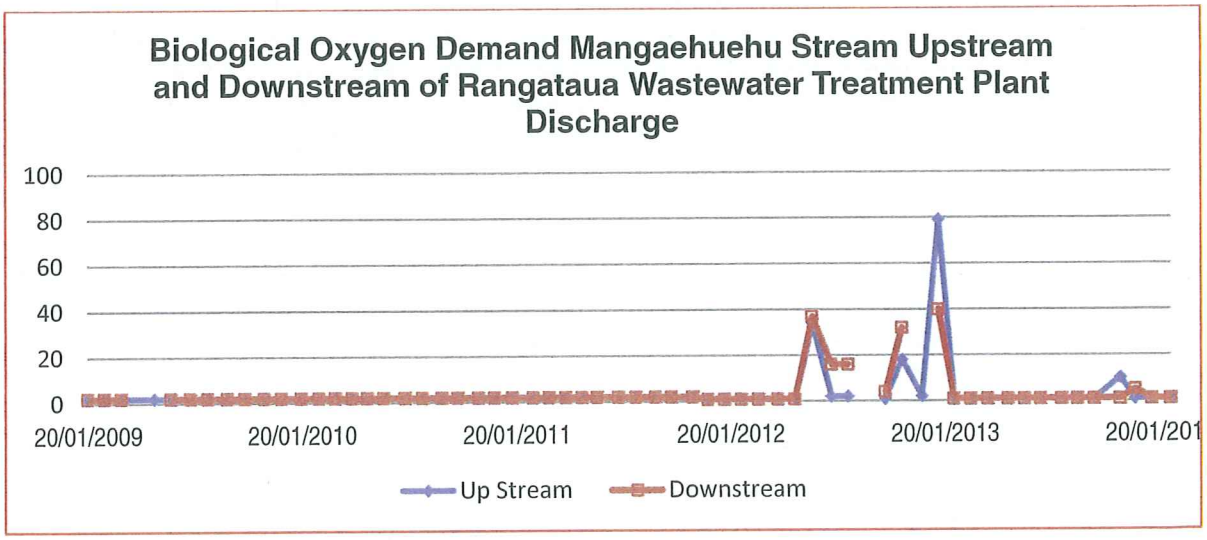


Figure 12 Carbonaceous Biological Oxygen Demand Levels in the Mangaehuehu Stream.
Source: Horizons Regional Council Monitoring Data.

Total Biological Oxygen Demand in the Mangaehuehu Stream upstream and downstream of the Rangataua Wastewater Treatment plant is plotted in Figure 12. Soluble Carbonaceous Biological Oxygen Demand data was only collected up until 19 July 2011. The majority of results are reported as 2 g/m3 both upstream and downstream of the wastewater plant discharge. Over the period of June 2012 to January 2013 there were a number of results which show contaminates entering the system between upstream and downstream sites.

The water quality targets for Whau_1c Carbonaceous Biological Oxygen Demand are less than 1.5 grams per metre cubed at or below the 20th *flow exceedance percentile*. Apart from the period June 2012 to January 2013 the results have been within targets except on two occasions. However, there was no flow monitoring in the receiving environment to enable assessment at 20th percentile flow. Assuming that all samples were at flows of the 20th percentile then the worst case situation has been taken into account. On 14 November 2013 the upstream value was recorded at 10 g/m3 and downstream at 1 g/m3, and 9 December 2013 where the upstream value was recorded at 1 and downstream at 5 g/m3 respectively.

Visual observations of stream bed have not found any sewage fungus growths at or past the discharge. No sewage fungus was noted in the two biological assessments made by Pohangina Environmental Consultants. This reinforces the conclusion that bacterial growth are not impacting on the available levels of dissolved oxygen for other organisms.

viii. Particulate Organic Matter (POM)

Particulate Organic Matter (POM) is a measure of the amount of organic solids that are present in a sample. High levels of POM can smother the bed and any aquatic invertebrates living there.

Particulate Organic Matter is carbon load that is also natural and it is usually what provides colour to water bodies, straw or brownish colour from high organic carbon loads. This colour comes from leaching of humic substances from plant and organic soils. This organic matter contributes acids to the stream, resulting in the yellow-brown coloration as well as weathering the soils. Organic carbon can be allochthonous, or sourced from outside the system (e.g. by atmospheric deposition or transported long distances via stream flow) or it can be autochthonous, or sourced from the immediate surroundings of the system (e.g. plant and microbial matter and sediments/soils within the catchment). High amounts of organic matter are common in low oxygen areas, such as bogs and wetlands.

The Mangaehuehu Stream flows from the slopes of Mount Ruapehu and has a number of high level bogs and swamps which discharge into the stream. One such swamp is in the forest and its discharge point is immediately upstream form the Rangataua Wastewater Treatment Plan. While this does not appear to lower the dissolved oxygen levels it may create slug releases of material into the stream.

The average concentration of particulate organic matter (POM) when the river flow is at or below the 50th *flow exceedance percentile* must not exceed 5 g/m^3 in the One Plan. There were 40 monitoring occasions. On 4 occasions the POM measure upstream was above 5 g/m3. There were two additional occasions were POM was elevated above 7 when downstream results were considered. This data is graphical demonstrated in Figure 13. Removed from the graph is the data of the 15 October 2013 where values were 15 upstream and 48 downstream which would result in lower values being masked. The 15 October values are significantly different for POM, turbidity, E. coli and conductivity indicating this was not an analysis or sampling error.

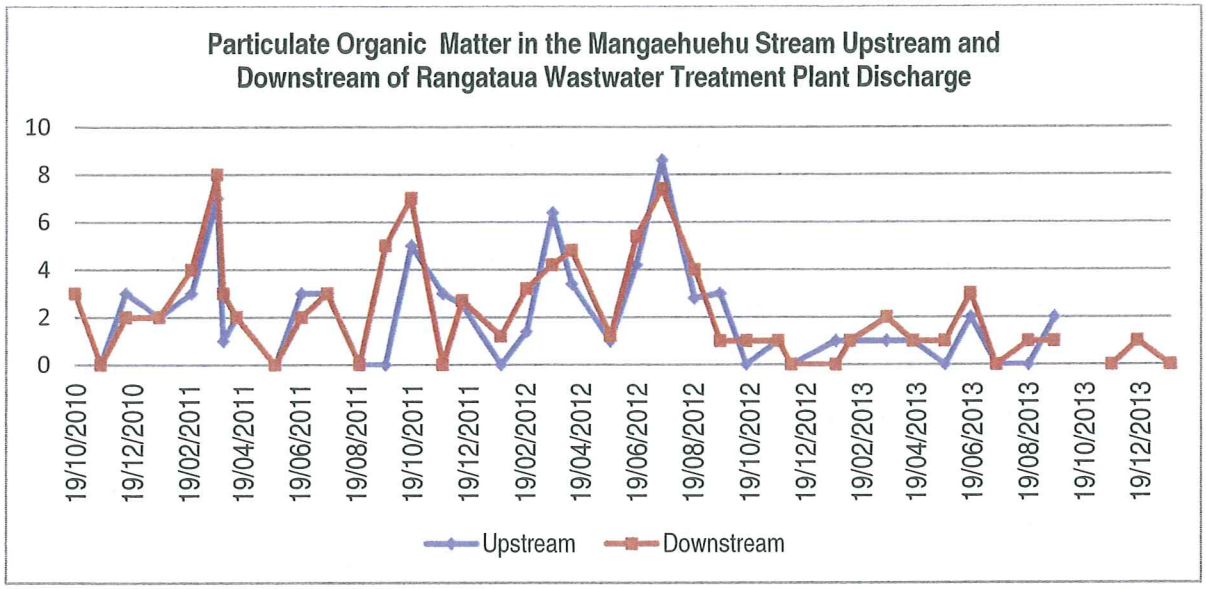


Figure 13 Particulate Organic Matter Levels in the Mangaehuehu Stream.
Source: Horizons Regional Council Monitoring Data.

ix. Dissolved Reactive Phosphorus

Dissolved Reactive Phosphorous (DRP) is the amount of phosphorus dissolved in water and is most immediately and readily absorbable for plant and algae growth. The Dissolved reactive phosphorus concentrations provide a useful indication of a water body's ability to support (nuisance) algal or plant growths, and therefore is controlled in the One Plan. But it is not the presence of nutrients alone which create nuisance growths of periphyton as discussed in the periphyton section.

The parent rock has high phosphorus values which results in natural phosphorous levels being present that are well above the dissolved reactive phosphorous target of 0.006 g/m3 set in the One Plan.

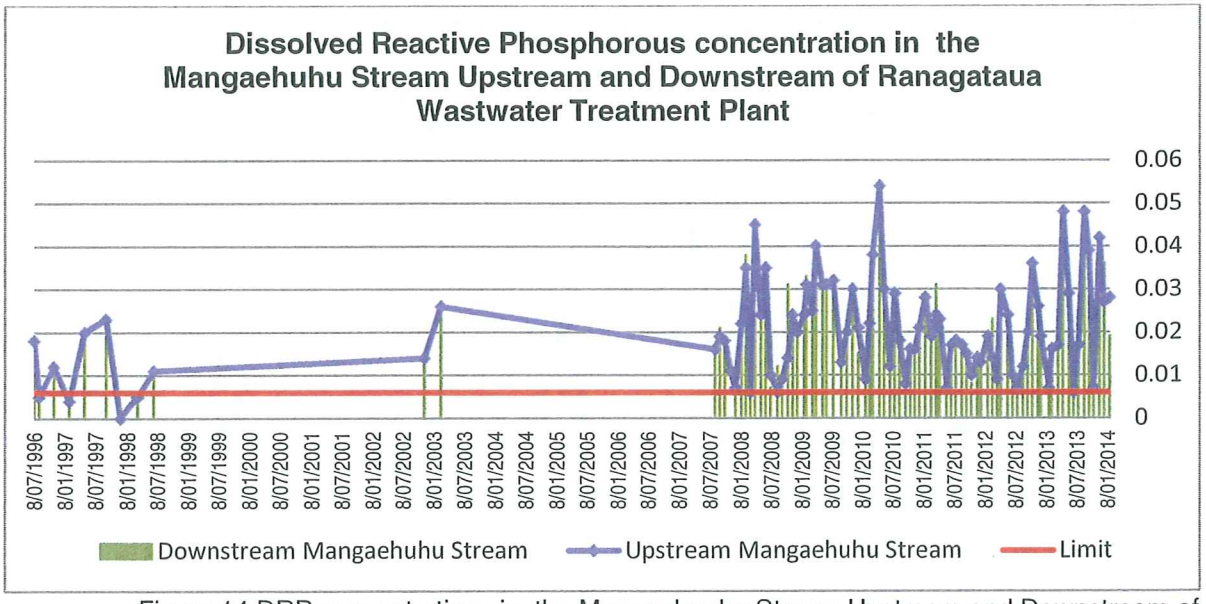


Figure 14 DRP concentrations in the Mangaehuehu Stream Upstream and Downstream of Ranagataua Wastewater Treatment Plant
Source: Horizons RC monitoring data.

The results show that there is little change between the upstream DRP and downstream DRP levels in the Mangaehuehu Stream as depicted in Figure 14. The target value of 0.006 g/m^3 was not achieved either upstream or downstream from the discharge. Perphyton monitoring results indicate that the contribution of nutrients from the Wastewater Treatment System are not triggering nuisance growths of periphyton.

Nutrients are also an influence factor in periphyton growth. It is thought that by limiting the nutrients within a stream then the periphyton growth can also be limited, however it assumes that the natural back ground levels are levels low enough to limit growth.

x. Suspended sediments

Total suspended solids measure the weight of dissolved solids held in suspension with a given water column. Suspended Sediment (SS) is the concentration of fine particulate matter suspended in a water sample that will cause discoloration of water and can be caused by heavy rainfall, disturbance of the riverbed or bank by heavy machinery or through direct effluent discharge.

The suspended solids values in the Mangaehuehu Stream upstream and downstream of the Rangataua Wastewater Treatment Plant are graphed in Figure 15. The lower level trend is masked by a two high level data sets which are removed.

The two high paired results that were removed from the graph had elevated levels upstream and downstream suggesting the stream was in high flow. On 10 July 2012 and 11 December 2012 upstream values were 990 and 320 g/m3 and downstream values were 2200 and 660 g/m3 respectively. In both cases downstream had significantly higher values. The field sheet provided no additional information which would account for the unusually high readings downstream to help with the assessment of the data and enable sampling difficulties under high flows and/or different flow characteristics to be ruled out as the cause.

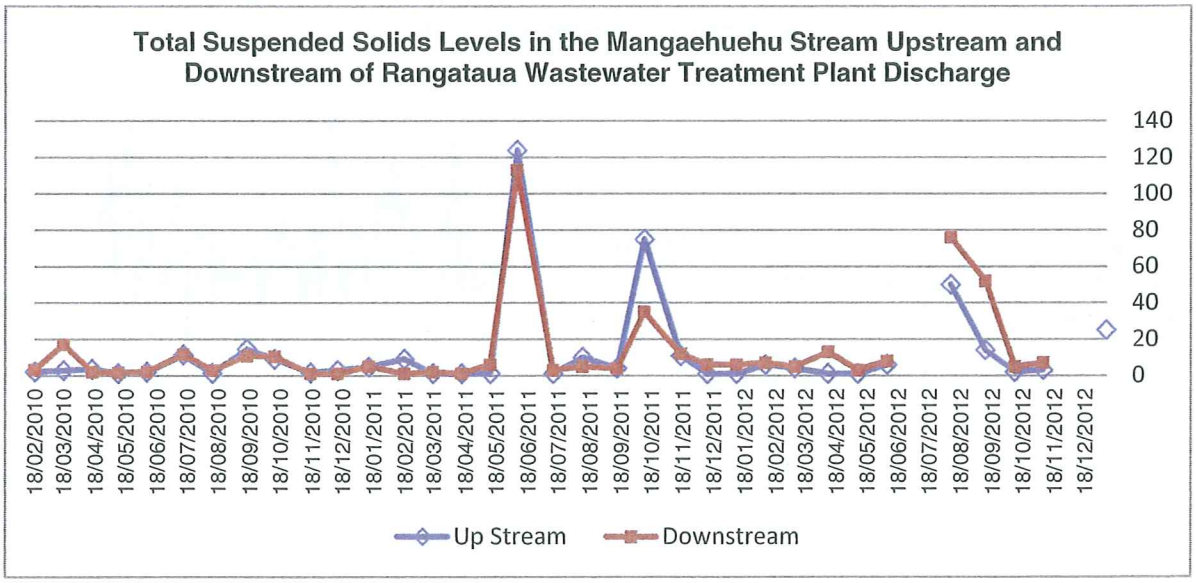


Figure 15 Suspended Solids Values in the Mangaehuehu Stream upstream and downstream of Rangataua Wastewater Treatment Plant discharge with high values removed .
Source: Horizons RC monitoring data

On removal of these high points from the graph, results show there is no significant trend data indicating that downstream is significantly increased to upstream values. Results downstream would be expected to be significantly higher if the Wastewater Treatment Plant was having an effect on the Mangaehuehu Stream. This is not the case.

xi Total Nitrogen

The One Plan states annual average concentration of total nitrogen must not exceed 0.07 grams per cubic metre. Total Nitrate values are graphically illustrated in Figure 16. Only on one occasion was the downstream value elevated to 0.088 g/m^3. Without field notes which discuss if stock were present or had recent access to the Mangaehuehu Stream it is not possible to rule out other contamination sources.

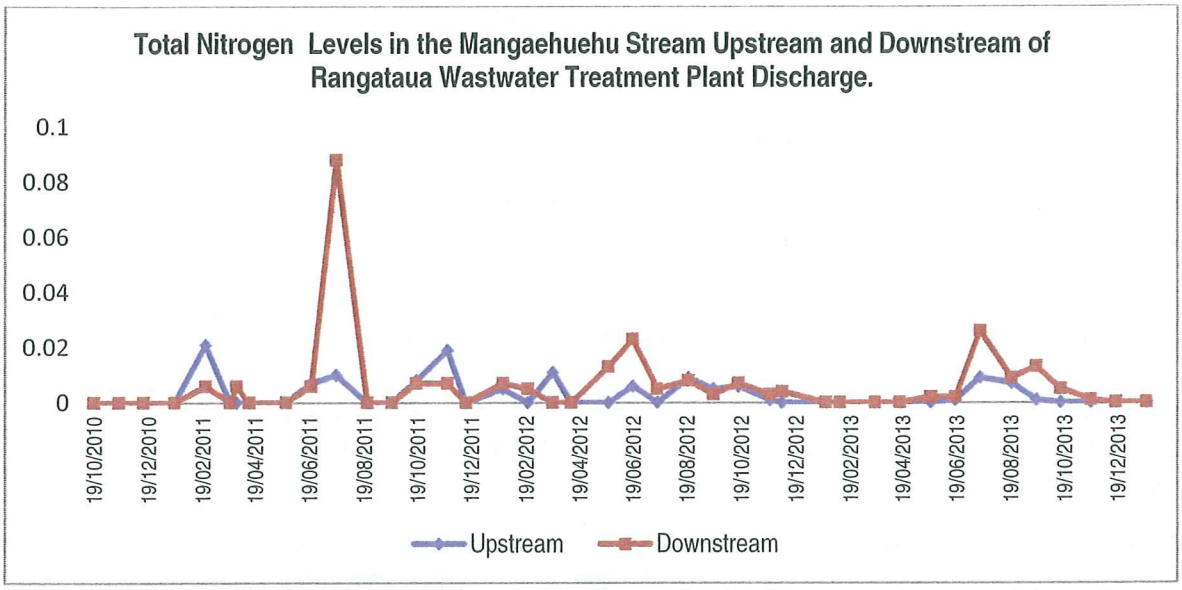
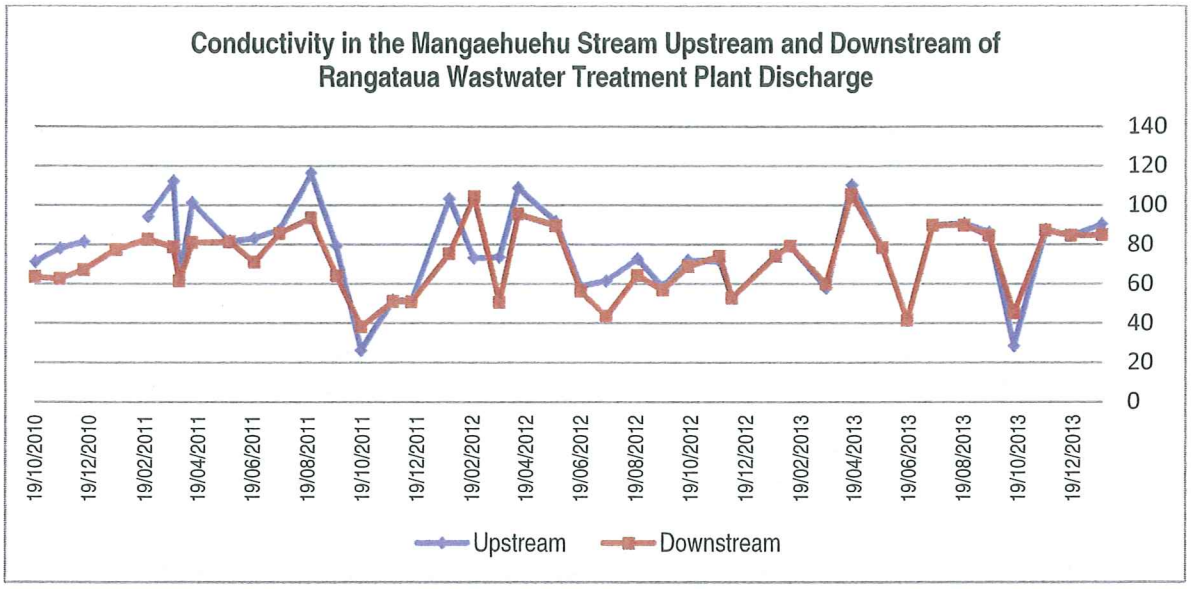


Figure 16 Total Nitrogen Values in the Mangaehuehu Stream upstream and downstream of Rangataua Wastewater Treatment Plant discharge with high values removed .
Source: Horizons RC monitoring data

xi. Conductivity

While conductivity is not a One Plan target it is a measure of the concentration of dissolved ions in water. Conductivity generally becomes more elevated as measurements are taken further and further downstream in a river. Some dissolved minerals provide nutrients for plants while others may limit plant metabolism and also interfere with animal metabolism.

It is useful to assess the conductivity values to provide an understanding of the dynamics that might be occuring within the stream. Figure 17 graphically depicts the conductivity results with the exception of the 18 January 2011 result of 849 was removed as it masked all lower results. The downstream result for this date was 77.4 suggesting an anomoly with sampling may have occurred. Generally the results do not raise concerns that the stream chemistry is particularly being altered.



Summary

Parameters were analysed against the One Plan targets. The assessment is described for each component in detail below. In general across the year the difference between the upstream and town stream is not significant indicating parameters have no or a minor change between measurement points.

The two monitoring points are not ideal as they can be influenced by other discharge points and are not easily distinguishable where the effect is coming from.

Table 3 summarises the water quality of the Mangaehuehu Stream downstream against the One Plan targets using all samples. The monitoring data was not adjusted for stream flow which would make the results a worst case scenario.

Parameter	Target	Flow conditions for Target	Water Quality (average-max)	Is this target met for average?
Temperature ^{0}C	<22	At all flows	8.7avg 14.2 max	Yes
Ammonia (g/m^3)	<0.320 average 1.7max	At all flows	0.01 avg 0.008 max	Yes Yes
Soluble Inorganic Nitrogen (g/m^3)	<0.070	≤20th percentile	0.10 avg 0.021 max	No
Soluble $cBOD_5$	1.5	≤20th percentile	<2avg <2 max	Yes
POM	5 average	≤50th percentile	3.7	Yes
Dissolved Reactive Phosphorus (g/m^3)	<0.006	≤20th percentile	0.02	No
E Coli	260 550	≤50th percentile flow ≤20th percentile flow	84 avg 630 max	Yes
pH	7-8.2	At all flows	7.6 avg 8.41max	Yes
DO	>80%		100%	Yes
Black disc	>20% change		Complies	Yes

Table 3 Water Quality Values and the One Plan Targets.

Source: Horizons Monitoring Results 19 October 20101 - 21 Jan 2014.

An analysis of the receiving environment using Horizons Data is provided below for these targets where they have not already been discussed under the RMA requirements.

2.3 One Plan Rules for Activity Status

The One Plan contains a default 'discretionary activity' rule for discharges to water. The rules that this application is considered against are as follows:

Rule 13-13 Human effluent storage and treatment facilities

The *discharge* onto or into *land* of human effluent pursuant to ss15(1) or 15(2A) RMA for the purpose of storing or treating the effluent in ponds and any ancillary *discharge* to air pursuant to s15(2A) RMA.

Advice Note:
This *rule* controls wastewater treatment and storage ponds but does not control *domestic wastewater* treatment and disposal, which is controlled under Rules 13-10, 13-11 and 13-12.

(f) All effluent storage and treatment facilities (including sumps and ponds) must be sealed to restrict seepage of effluent. The permeability of the sealing layer must not exceed $1x10^{-9}$ m/s.

(g) All effluent storage and treatment facilities (including sumps and ponds) must be located and managed in a manner which ensures at all times that:
  (i) effluent run-off from the area into surface *water* storage ponds but does not control *domestic wastewater** treatment and disposal, which is controlled under Rules 13-10, 13-11 and 13-12. *bodies*, *artificial watercourses* and the *coastal marine area* is prevented
  (ii) run-off from the surrounding catchment is prevented from entering the area.

(h) The *discharge* must not result in any offensive or objectionable odour beyond the boundary of the subject *property*.

(i) The *discharge* must comply with the following separation distances:
  (i) 150 m from any residential buildings, public places and amenity areas where people congregate, education facilities and public roads
  (ii) 50 m from *rare habitats, threatened habitats* and *at-risk habitats*
  (iii) 30 m from *bores* surface *water bodies*, *artificial watercourses* and the *coastal marine area*
  (iv) 50 m from *historic heritage* as identified in any *district plan* or *regional plan*.

Lagoons are considered to self-seal due to the settling of sludge on the lagoon bottom over time. Observations of the site show there is no visible evidence which suggests effluent from the lagoons is seeping into the stream during any inspection. Also the sampling upstream and downstream shows no effects or effects of a minor nature.

The treatment system is raised above the surrounding ground so no storm water enters into the lagoons from the surrounding grounds.

There is no record of offensive or objectionable odour beyond found in the customer request system or on file.

The separation distance is 250 metres from the nearest residential building and there is no historical heritage sites as identified by the district or regional plan within 50 metres.

There are no known bores within 30 metres of the treatment plant and its discharge.

Department of Conservation land is an adjacent neighbour as discussed under section 1.5 but the closest remnant bush is 500 metres from the lagoons.

The lagoons are historic and located within the 30m zone from the surface water body and were built before this plan became operative. As discussed above the results from testing the receiving water environment is showing no or effects of a minor nature. The relocation of the lagoons is not sustainable by this community and is considered of limited benefit given the effects are of less than minor in nature. The sludge seal can be maintained even when the lagoons need desludging using new vacuum technology to remove excess sludge.

The Rangataua Wastewater Treatment system does not meet all of the permitted activity rules as set out in rule 13-13. Rules not met are due to historic siting and development of the system. The plant has been shown in this application to have no effects or effects of a minor nature. This activity is not covered by the rules of the One Plan and therefore defaults to a discretionary activity under Rule 13-27.

Rule 13-27 Discharge of water or contaminants to land or water not covered by other rules in this Plan or chapter

The discharge of water or contaminants into surface water pursuant to s 15(1)(a) RMA or discharge of contaminants into or onto land pursuant to ss15(1)(b), 15(1)(d) or 15(2) which are not regulated by other rules in this Plan, or which do not comply with the permitted, controlled or restricted discretionary rules in this Plan, or which does not comply with the permitted activity, controlled activity or restricted discretionary activity rules in this chapter.

The application must be considered as **discretionary** when assessed against One Plan Chapter 13 rules.

Rule 14-13 Other discharges into air from industrial and trade premises

The discharge of contaminants into air and any subsequent discharge of contaminants onto land from activities which either:

(a) are located on industrial or trade premises and are not addressed by any other rule in this Plan, or

(b) do not comply with one or more conditions, standards or terms of a permitted activity rule, but which are not expressly classified as a discretionary or prohibited activity.

Resource consent for a discretionary activity is required under Rule 14-13 of the One Plan for discharge to air from an industrial premises not addressed by another rule within the plan.

2.4 Air Quality

The air quality of Rangataua township is clean and clear, being a rural town with low population density and no industrial emissions. There are no national regulations for air quality monitoring or reporting at this site.

The wastewater treatment plant is located historically some distance from the main town area. While there are no records of any complaints around odours form the lagoon. There is a risk of incompatible land use as rural lifestyle block move closer to the plant and reverse sensitivity comes into play.

2.5 Maori

Chapter 4 Te Ao Maori of the One Plan has provided guidance with objectives and policies. Council has considered these and have answered them under the Ngati Rangi Waterways Document 2002.

2.6.1 Ngati Rangi Waterways Document

The Ngati Rangi Waterways Document 2002 sets out a freshwater policy document to provide guidance on resource consent matters from the perspective of Ngati Rangi. "The thrust of this policy document is the management of freshwater resources within the rohe (tributary boundaries) of Ngati Rangi. It specifies:

- The environmental outcomes sought by Ngati Rangi; and
- The means by which Ngati Rangi is seeking to work with the resource management agencies to achieve these outcomes."

Part 2

Section 14 Freshwater Fisheries Habitat

The Mangaehuehu Stream is the primary stream with eels, crayfish and flax to provide for the sustainability of Mahinga kai. The treated nutrients discharge into an old drainage channel with lower Mahinga kai capacity.

Section 18 Waihi Tapu

Goal: To afford total protection to waters that are of particular spiritual significance to Ngati Rangi.

No wahi tapu sites have been identified in the process of previous applications for resource consents. Council recognises that water in itself holds a level of tapu and have moved the discharge from the main Mangaehuehu Stream to the natural wetland.

Section 19 Mauri

Goal: Restore, maintain and protect the Mauri of freshwater resources.

The Rangataua treated wastewater was originally discharged directly into the Mangaehuehu Stream but was moved in 1998 to the drain in recognition of the mauri of the stream.

The anaylsis in the previous part of this report shows that the discharge is not creating cumulative effects on the environment. Results from sampling the Mangaehuehu Stream show no effects or effects of a minor nature.

Enhancing and increasing the wetland area would provide more "natural treatment" over time. Currently the majority of the wastewater material does not discharge during summer months but passes back into the sky and down through the earth.

Section 20 Mahinga Kai

Goal: To maintain essential healthy mahinga kai populations and habitats capable of sustaining harvesting activity.

The recognition of the Mangaehuehu Stream as having high value includes the mahinga kai. The historic removal of the discharge directly into the Mangaehuehu Stream into a old drainage channel was to enchance the sustainability of the Stream. There are also no industries in this community contibuting heavy metals into the wastewater system.

Section 21 Kaitiakitanga and Section 15 Participation in Freshwater Management

Goal: To promote collaborative management initiatives that enable the active participation of Ngati Rangi in freshwater management.

Council has at other Wastwater Treatment Plants offered once a year the opportunity for all submitters to participate in a powerpoint presentation about the performance of the

treatment plant and results achieved during the year. At any stage during the year the data will be provided in its raw state as public information.

Council has indicated that it wishes to enhance the wetland area. Ngati Rangi and Council could work in partnership in the selection of plants and planting of this area. A nominal sum will be set aside for this plant every second year.

There is strong science that attest to the use of wetlands, overland flow paths and drains as a natural method of uptaking nutrients and so purifying wastewater as it passes through and between the plants. These methods are advocated in Farm Plans and Rangataua treated wastewater discharge is a reflection of nature in action. The Mangaehuehu receiving environment is not showing any discernable effects in receiving this wastewater.

Council has offered to work with iwi in assessing a "floating wetland mat" as a new technology which is an enhancement of a natural system as a possible future treatment methodology. As a mechanism to engage in increasing both Council and iwi understanding of this type of system. To this end two floating mats have been installed.

Ngati Rangi have indicated that 35 years is too long a timeframe under their mandate. Councils application has been adjusted to take into account their view along with an assessment of the catchment expiry or review dates now proposes a timefram of 25 years. With 10 year review dates and the opportunity for Ngati Rangi to participate in the reviews as part of an adaptive management approach to resource consents. Council has offerred a report with a matrix of values, goals and obligations as part of the review for dicision making purposes.

2.6 Notification

Section 95A of the Resource Management Act 1991 provides that the public notification of an application for resource consent shall be at the consent authority's discretion, unless it is decided that the effects of the activity will be more than minor; the applicant requests public notification or a rule or national environmental standard requires public notification.

Ruapehu District Council believes effects on the environment are minor, and does not require public notification.

3.0 Existing Rangataua Wastewater Scheme and Wastewater Treatment Plant

A description of the site location is provided in section 1.4 with section 1.6 describing the treatment plant. Full maps of the site, drawings of the plant and wetland area are provided in Appendix A and E.

3.1 Rangataua Wastewater Scheme

Rangataua is situated off State Highway 49, 7 minutes south of Ohakune Township and 20 minutes North of Waiouru. It has 189 properties serviced by the Ruapehu District. The normal residential use is 39.1% permanent residential with 60.9% being non-resident home owners. The population fluctuations are significant between winter ski season and the summer population.

Trends for population growth in the Waimarino rural area have been declining so permanent residential house use has also declined and the house stock have become holiday homes. A survey of non-residential homes show the average number of persons staying is 4.4 persons per night.

The normal residential population is estimated after a phone survey in 2011 to have 60 people in summer which is significantly different to a winter a peak population of 570 persons in the 210 properties in Rangataua. The rental batches have an average capacity of 5 with a peak capacity of 7 people. It is estimated that the summer population will lag significantly behind winter. Estimated current summer population peaks are 100 people present and estimated growth would be only 100 persons every five years into the township over summer.

3.2 History

In 1985 the former Waimarino County Council investigated a proposal for a wastewater reticulation system for the Rangataua Township. At this time each household had individual septic tank and effluent disposal field. The disposal fields were not working correctly creating problems in the Rangataua Township and Health Department concerns. In 1987 a water right was made by the Rangitikei-Wanganui Catchment Board for the establishment of a reticulation system and two wastewater treatment lagoons and subsidy for the scheme was approved by the Department of Health. In 1988 the consultant prepared plans and contract documents for the wastewater scheme.

There are no trade waste operations in the township and at the time of this application this is still the case today.

3.2.1 Performance Improvements

The Rangataua Wastewater Treatment Plant was commissioned in 1989. The discharge consent granted in 1995 required that improvements be made to the discharge point. Negotiation saw a wetland designed but not built as the agreement of placement was not reached between all parties until 2001. The wetland is fenced to exclude all stock.

Records show there have been occasional surcharges of wastewater in the township. In 2006/2007 a significant storm water inflow and ingression problem was observed. The town was smoke tested and physical inspections were undertaken in February 2008 and over 16 sections and the abandoned school were found to be contributing storm water into the wastewater network. The identified storm water inflow and ingression have now all been resolved. The final section of the school area was only found and removed in 2010.

In the Asset Management Plan 2009 it was identified that the Glazed Earthen Ware (GEW) mains on Nei and Kaha Street had significant inflow and ingression issues. These areas had the historic railway house reticulated by a GEW pipe (approximately 80 years) joining the new installed 150mm diameter uPVC sewer. In addition the area was not serviced by any storm water drains. In 2010-2012 a new uPVC main and concrete storm water reticulation was installed to replace the GEW wastewater pipe and facilitate storm water disposal.

The pump station has had a progressive upgrade with two Flight pumps with grinders replaced in 2006 and a second standby pump replaced in 2008. The combined pumping capacity is 29m3/hr.

The outlet pipe allowed for flow measurement by "v-notch" weir. In 2009 the weir was replaced with a Magflow to provide more accurate data. There have been some issues with loss of data due to logger failure.

Existing Outflow Chamber Removal 2009

Data logger for new flow meter, replaced by SCADA

Figure 10 Rangataua WWTP Improvements

Supervisory Control and Data Acquisition (SCADA) and logger has been installed at the Wastewater pumping station with high level alarms and pump hours. There is a remote link to the Lagoon outlet Magflow to collect data. All information is sent via telemeter to the base station at the Ohakune Water Treatment Plant. This information is currently available as batch files by electronic transfer to Horizons Regional Council. There is limited benefit in real time data delivery when set against the cost.

While Magflow are extremely accurate meters they require a full pipe to be accurate. Given on occasions there is no discharge from the lagoons it is expected that at these very low flows the accuracy will be compromised. From time to time rags may clog the line and will give inexplicable results and data will be lost. But for the majority of the time the majority of data will be accurate and provide the best indication of the volume entering the wetland system. Gathering of flow data by electronic means is not considered accurate at the receiving water due to a variety of environmental factors and land use.

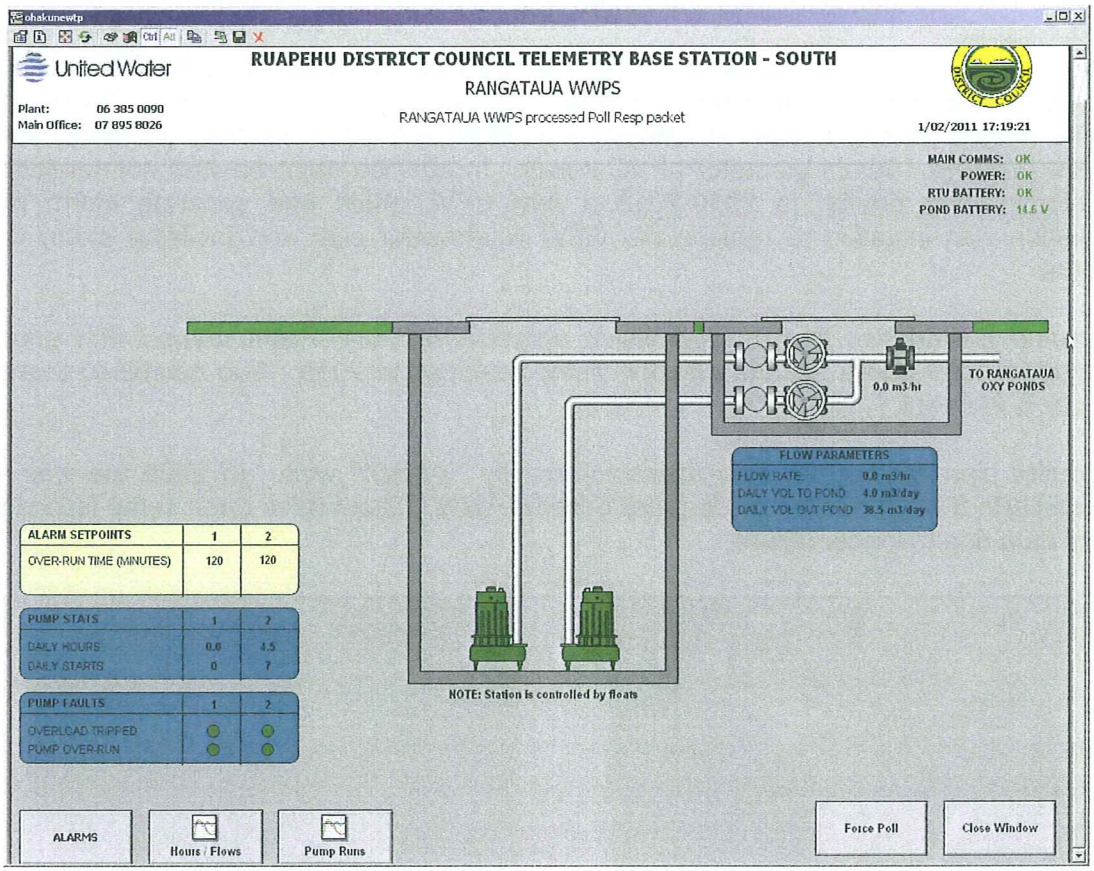


Figure ...SCADA snapshots

3.3 Infrastructure Condition

The Rangataua wastewater reticulation system involves approximately 4.342 kilometres of piping and utilises gravity to transport the waste to a central pumping station located on the corner of Marno Street and Kaha Streets.

Performance for the gravity reticulation network as assessed by United Water Infrastructural Asset 2008 Condition Assessment 2008 provided a grading of 3, or moderate for the Rangataua wastewater network. The wastewater reticulation mains are now on average 21 years old. The manhole condition has been assessed at a grade of 1, or good, for the Rangataua wastewater network. The average age of the manholes is 29 years and the integrity is high. The Rangataua wastewater Pump station condition has been assessed at a grade of 2, or good. Many of the wastewater pump station components are relatively new and overall in good condition. The wastewater treatment plant was installed in 1985 as a primary and secondary lagoon system with a wetland treatment being added in 1998. The condition has been rated as moderate.

All GEW pipe has been removed except for the rising main which transfers wastewater from the pumping station to the primary lagoon. The transfer GEW pipe is identified as a restriction in the ability to transfer wastewater to the lagoons. The inlet pipe with a length of 65m and diameter of 150mm and outfall of 0.75 is able to discharge at a rate of 16 l/s with a velocity of 0.92 l/s. This pipe will need to be replaced in the future.

The optimum replacement cost in 2010 dollars of the Rangataua system:

- pipe network $ 798,497.00,
- pumping station $ 54,900.00
- treatment plant $327,959.00

3.3.1 Infrastructure calculation factors

The wastewater reticulation system is largely gravity fed which has resulted in the network being graded from 0.5 metres to over 5 metres deep in places. The water table in the Rangataua Township is subject to increasing or decreasing levels relative to weather conditions. In wet weather the water table is at or just below the surface. Under such wet ground conditions there is considerable pressure on the pipes as the flex with the swelling of the soils. The potential for ingression and infiltration under such circumstances is extremely high. Literature proposes AWWF for systems from 2 to 7 times the ADWF. Council has used the AWWF calculation factor of 5 as the factor of 2 was considered too low given the ground conditions and high rainfall values in mountain environments and the factor of 7 being normally applied to high volume rain areas with old reticulation networks.

Hydrological characterisation is planned for 2015, subject to funding and growth of the population, which will help set trigger points of when ingression and infiltration assessments will be required in the future. In 2013 a condition assessment of the network stormwater mains, manholes and cesspits provided a performance grade of 1-2 and a condition grade of 2.

Year	Peak population	Average Dry Weather Flow	Average Wet Weather Flow (ADWF*2)	Average Wet Weather Flow (ADWF*5)
2012	570	142.5 m3/d	285 m3/d	712.500 m3/d
2017	670	167.5 m3/d	335 m3/d	837.5 m3/d
2022	770	192.5 m3/d	385 m3/d	962.5 m3/d
2027	870	217.5 m3/d	435 m3/d	1,087.5 m3/d
2032	970	242.5 m3/d	485 m3/d	1,212.5 m3/d
2037	1070	267.5m3/d	535 m3/d	1,337.5 m3/d
2042	1700	425 m3/d	850 m3/d	2125 m3/d

Table 4a Peak Population Growth Prediction
Source Ruapehu District Council Growth Assumptions

4.0 Consultation

This resource consent has been resubmitted and largely shows no or only minor effects. Only limited additional consultation has been undertaken.

Council seeks a long-term consent condition to provide for certainty for a sustainable community and the options for improvements. It is acknowledged there will be growth in the future population and the science will continue to develop and provide sustainable low cost solutions. This does not mean that consultation around changes in the population and the need for improved treatment systems should not be undertaken at intervals in the resource consent. The mechanism to capture the need for change are reviews.

It would be advantages to be granted long term consent with joint review at 10 year intervals with affected parties

Affected Parties have been considered and potential concerns have been considered below.

4.1 Fish and Game

The New Zealand Fish and Game Council provide co-ordination of the management, enhancement and maintenance of sports fish and game under Section 26 B of the Conservation Act 1987.

The Mangaehuehu Stream is currently not managed under the One Plan for trout spawning and habitat, mainly due to the relatively low use of the stream by Brown and Rainbow trout.
Section 2 and 3 information shows the lagoons placement and its discharge is not creating any adverse conditions for the life supporting capacity of aquatic biota.
The movement of the discharge from directly into the Mangaehuehu Stream to the drain, , enabling the development of a fenced wetland area is an acknowledgement of the high value New Zealand places on its natural rivers.

During lodgement of the last application Fish and Game opposed the consent due to lack of monitoring. This application shows monitoring has been undertaken (including biological monitoring). This monitoring shows no adverse environmental effects. Removing stormwater from the wetland will further enhance treatment and reduce the volumes entering the Mangaehuehu Stream. This appears to address their concerns and no further consultation has been undertaken.

4.2 Iwi

The Rangataua treatment system discharge point was modified during the last application recognising the effect the discharge of the treated wastewater to the Mangaehuehu Stream had on the mauri of that stream. An informal onsite visit was held with Keith Wood from Ngati Rangi to discuss the potential use of a floating wetland at the site and possible iwi involvement in its assessment. During the course of these discussions the general level of improvements to the infrastructure and sustainability of further upgrades were discussed. Mr Wood expressed a need to have wastewater move through the land. This discussion has also been held with the Ngati Rangi Environment Team.

The One Plan and Ngati Rangi Waterways Document 2002 were considered under sections 2.7 and 2.8 respectively. There is opportunity to move the discharge into the drain up higher and further enhances the wetland system. Consideration was given to the development of a gravel bed as a recognition that treated wastewater should pass through the earth. On reflection these do not appear to enhance the treatment but often drive blue green algal growths in the next phase of the process. The gravel systems are costly to install and maintain. The majority of the time the wastewater does not leave the wetland system over the summer months indicating that it is passing through the earth or evaporating back into the atmosphere. This original proposal has a gravel bed before the discharge to the wetland which has been removed from this application as Council considers it to be of limited value. Council will however discuss and take advisement from Nagti Rangi around this matter.

Council wish to use the site to look at the science of "natural systems" as they are modified and enhanced. The floating wetland technology is one such initiative that Council is keen to explore with iwi and this is supported by Ngati Rangi. Currently two wetland mats are installed in the primary pond. These can be used to compare to other wetland species offered as alternatives. Note this does not mean Council intends to install floating wetland as a treatment option at this site but rather use it as an engagement discussion tool for research.

4.3 Department of Conservation

The Department of Conservation has a duty to manage indigenous fish species within the Mangaehuehu Stream. An onsite meeting was held with the then Community Services Programme Manager, Barry Strong, and the general points are covered in section 1.5.
Generally the points covered are:

1. The fact that the Mangaehuehu stream was considered to be a watercourse of the highest value and movement of the direct discharge from this to the drain was seen as a positive.
2. Their main focus was on the remnant bush. The land around the lagoon is modified farm land and therefore seen as lower value.
3.

Use of the land by the lessee and their comments for or against surrounding land neighbour land uses will be part of the lease. All concerns need to be brought to Department of Conservation in the first instance.

The Department of Conservation would look at the plant species council has chosen to look at in the wetland. They felt the management and development should remain with Council. Generally, guidance was the need to remove the current willow and any noxious plants. Native species and those indigenous to the area would be best planted at the site.

Council has looked at the current quality of natural wetland plant and has taken the opportunity to remove all noxious species and willow from one bank. Council is now looking to replant over this plant season.

The Department of Conservation were offered the opportunity to manage the wetland area, however, they felt it was not a high priority wetland system. Only natural plants indigenous to the area will be planted. Guidance by Department of Conservation on the system will be taken over the life of the consent should they wish to offer any advice.

The Department of Conservation have indicated they are the owners of the land and have indicated no requirement for additional fencing of the land. As the lease is due for renewal no consultation with the current lessee has been undertaken.

4.4 MidCentral Health

The last consent was concerned with monitoring of the system and its effects on the Mangaehuehu Stream. The granting of resource consent under the Resource Management Act 1991 is in relation to environmental effects, not the actual treatment system. This application indicates there are no environmental effects or they are of a minor nature. No further consultation has been undertaken.

5.0 Compliance of Discharge with Existing Resource Consent Conditions and Proposed One Plan.

5.1 Existing Resource Consent Conditions

Veolia have undertaken compliance monitoring for Ruapehu District Council throughout a significant portion of the duration of the existing resource consent to discharge treated wastewater into the Mangaehuehu Stream. A copy of the existing consent (permit 4926) can be found in Appendix B of this report along with the latest compliance report. A summary of the Council's compliance record over the duration of the consent is summarised within this chapter.

1. Discharge Permit

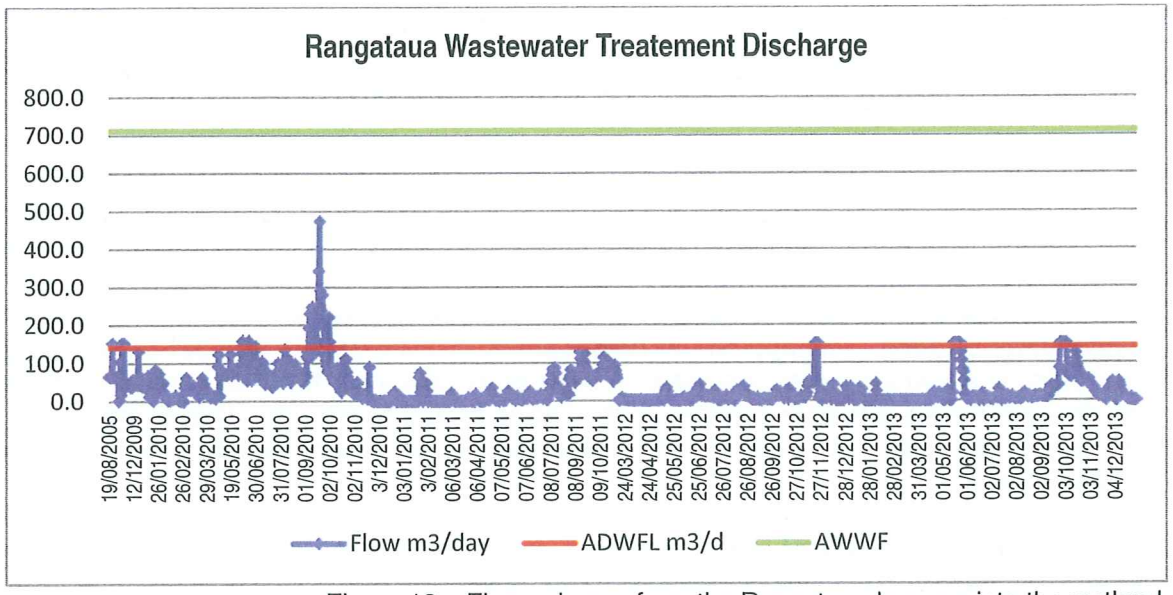


Figure 18a Flow volumes from the Rangataua lagoons into the wetland.
Source: Veolia Water Data.

Discharge volume consented is set at 29 m3/d.

The flow was originally measured using a v notch weir until 2006. In 2009 a magflow was installed to provide continuous monitoring of the discharge at the pump station. The flow data graphically displayed in Figure 18 shows an incomplete record since the installation of the magflow. The data recorder has been prone to failure resulting in a month's data being lost at one time. This is unacceptable and SCADA has been installed to ensure daily values are collected. This system now appears much more robust and failure is now only related to the failures around the Telecom network.

There are days during the summer when there is no registered flow through the magflow. The flow record from August 2005 to December 2010 with all zeros removed show a median

flow at 54.5 m^3/d with an average flow of 63.1 m^3/d, a minimum flow of 0.1 m^3/d and a maximum of 473.6 m3/d. This provides a worst case scenario of current discharges.

There is a significant peak in 2010 approximately when the last of the stormwater infiltration was removed. The consented value is extremely low against the system design values. The data has been re-plotted as Figure 18b shows with the extreme values removed to allow the lower values to be assessed.

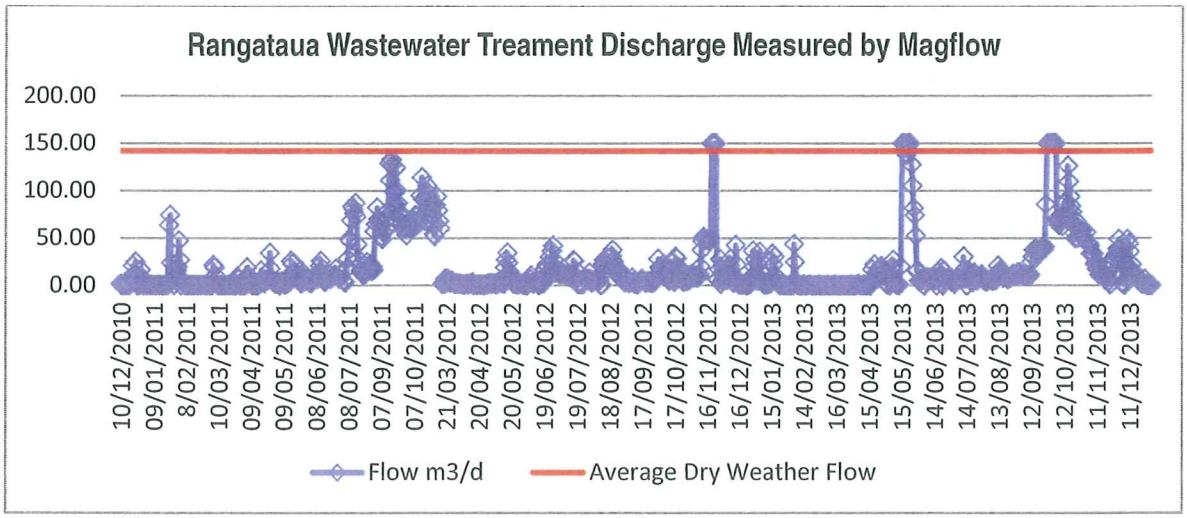


Figure 18b Flow volumes from the Rangataua lagoons into the wetland.
Source: Veolia Water Data.

The current resource consent provides for a maximum discharge of 29 m^3/day into the Mangaehuehu Stream. This appears to have been a mistake as it is well below the design of the plant even when it was installed. There is evidence on file that consultation was originally undertaken with flow volumes in the range of 425 to 960 l/s. This is more in line with figures discussed in section 3.1 Rangataua Wastewater System and 3.4 Flow Monitoring Data.

An analysis of the subset of flow data from January 2013 to May 2014 is graphically illustrated in Figure 18c. There are 489 data points on the graph of which 192 were registered as zero flow through the magflow. It is noted that the last two summers have been exceptionally dry and therefore the results may be on the low side for a normal summer. The average flow across the data points is 22.4 m3/d with a minimum of 0.5 m3/d and a maximum of 150 m3/d.

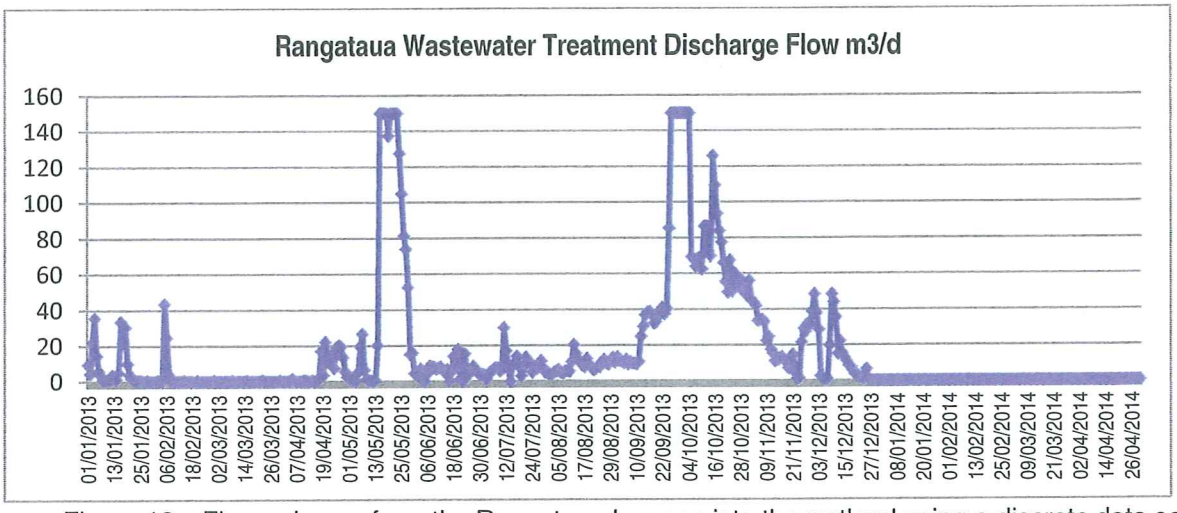


Figure 18c Flow volumes from the Rangataua lagoons into the wetland using a discrete data set.
Source: Veolia Water Data.

Resource Consent Parameters

Condition 4: The organic matter in the waste discharge,

a) Carbonaceous biochemical oxygen demand ($CBOD_5$), shall not exceed 30 g/m^3;
b) Suspended Solids (SS) 30 g/m^3.
c) Dissolved Oxygen content of at least 2g/m^3.

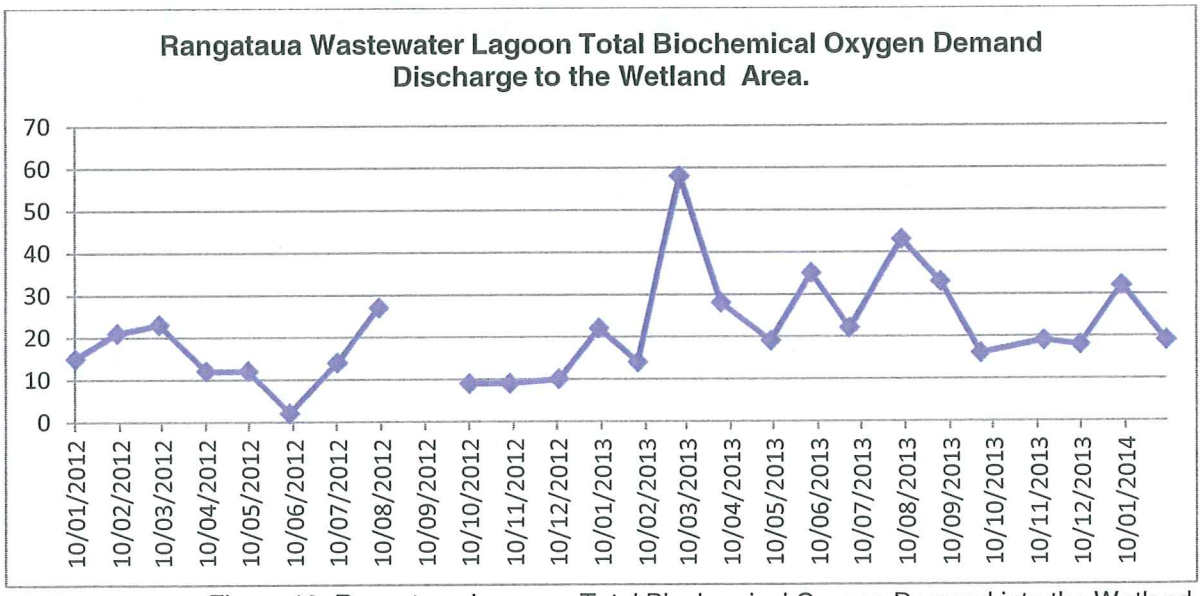


Figure 19 Rangataua Lagoons Total Biochemical Oxygen Demand into the Wetland.
Source: United Water Data

The carbonaceous biochemical oxygen demand (cBOD5) levels discharging from the lagoon into the wetland area is shown in Figure 19. This depicts the worst case scenario of effluent discharge as this is the value entering the wetland where it would be diluted and further treatment would occur. Also the drainage channel has watercress which will further remove the wastewater algae and there solid matter. Currently the watercress is harvested by the stock, particularly cattle that graze on the lush growth feed by the wastewater nutrients entering the channel. The monitoring in the river upstream and downstream shows no adverse effects.

The area is known as a wastewater treatment system and is on private land. The harvest of watercress for kai is not known to occur in this area. Signs prohibiting the collection of watercress could be added to the wetland area. There would be limited value in installing signs in grazed land as the stock rub on signs and they soon disappear.

In 2012 Total Biochemical Oxygen Demand was analysed from the secondary lagoon discharge which was in line with the resource consent. The total accounts for all components of biological contaminant removal and is subject to nitrification occurring in the test. This implies the result will be higher due to nitrogenous oxygen demand occurring in the laboratory incubation process rather than the actual demand in the lagoon. Again and enhanced wetland will reduce the actual volume discharging to the stream.

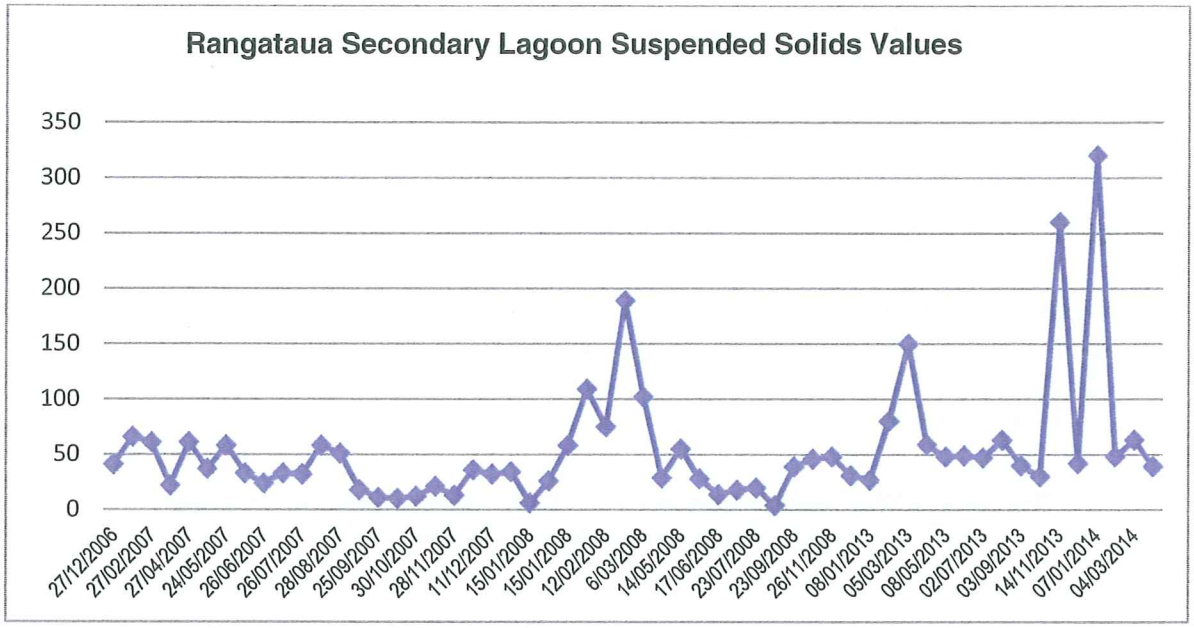


Figure 20 Rangataua Secondary lagoon suspended solids values entering the wetland.
Source: United Water Data.

The suspended solids (SS) levels discharging from the lagoon into the wetland area is shown in Figure 20. This depicts the worst case scenario of effluent discharge as this is the value entering the wetland where it would be further treatment. The suspended solids levels depict algal levels in lagoons. Monitoring results in the receiving environment, discussed in Section 2 show no effects in the Mangaehuehu Stream or effects of a minor nature.

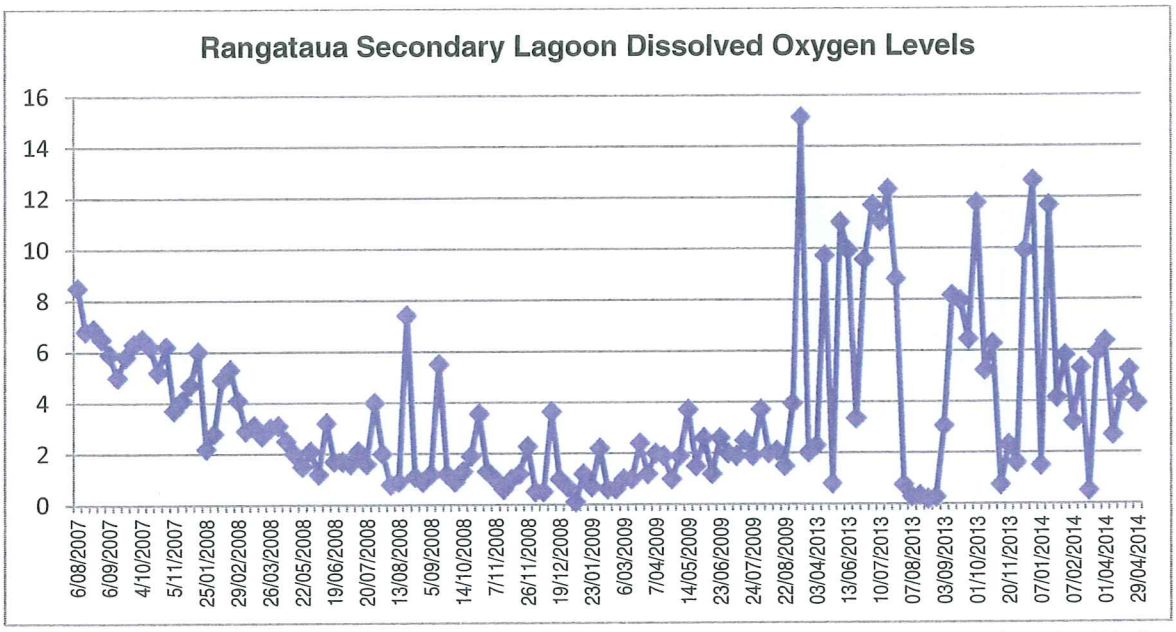


Figure 21 Rangataua Secondary Lagoon Dissolved Oxygen Values entering the Wetland.
Source: United Water Data.

Dissolved oxygen is an indicator of the lagoons remaining aerobic capacity. Non aerated lagoons commonly have a dissolved oxygen level below 2 g/m3 see Figure 21. The limit set on lagoons is 2 mg/m3 and is a historic figure used for as a tool when lagoons are generating odour issues. This is not achievable year round for natural aerated lagoons. Generally it is the meter reading ability which is a limiting factor to setting dissolved value lower rather than the performance of the lagoon.

There are no records that the lagoons have gone anaerobic, producing large volumes of foam, sludge upwelling, or algal population changes on any Council file or any lasting odour complaints. These are all symptoms of a lagoon system under stress with staving dissolved oxygen levels. Given that historically the system has not turned over during the summer, natural sources such as algal releasing dissolved oxygen into the lagoon and wind aeration must sustain the system.

Condition 5: Receiving Water

a) The downstream dissolved oxygen (DO) shall not be reduced by more than 1 g/m^3.
b) The downsteam CBOD5 shall not be increased by more than 1 g/m^3.
c) The downstream turbidity (NTU) shall not be increased by more than 2 NTU and
d) The downstream total ammoniacal nitrogen (NH4-N) shall not be increased by more than $0.05g/m^3$.

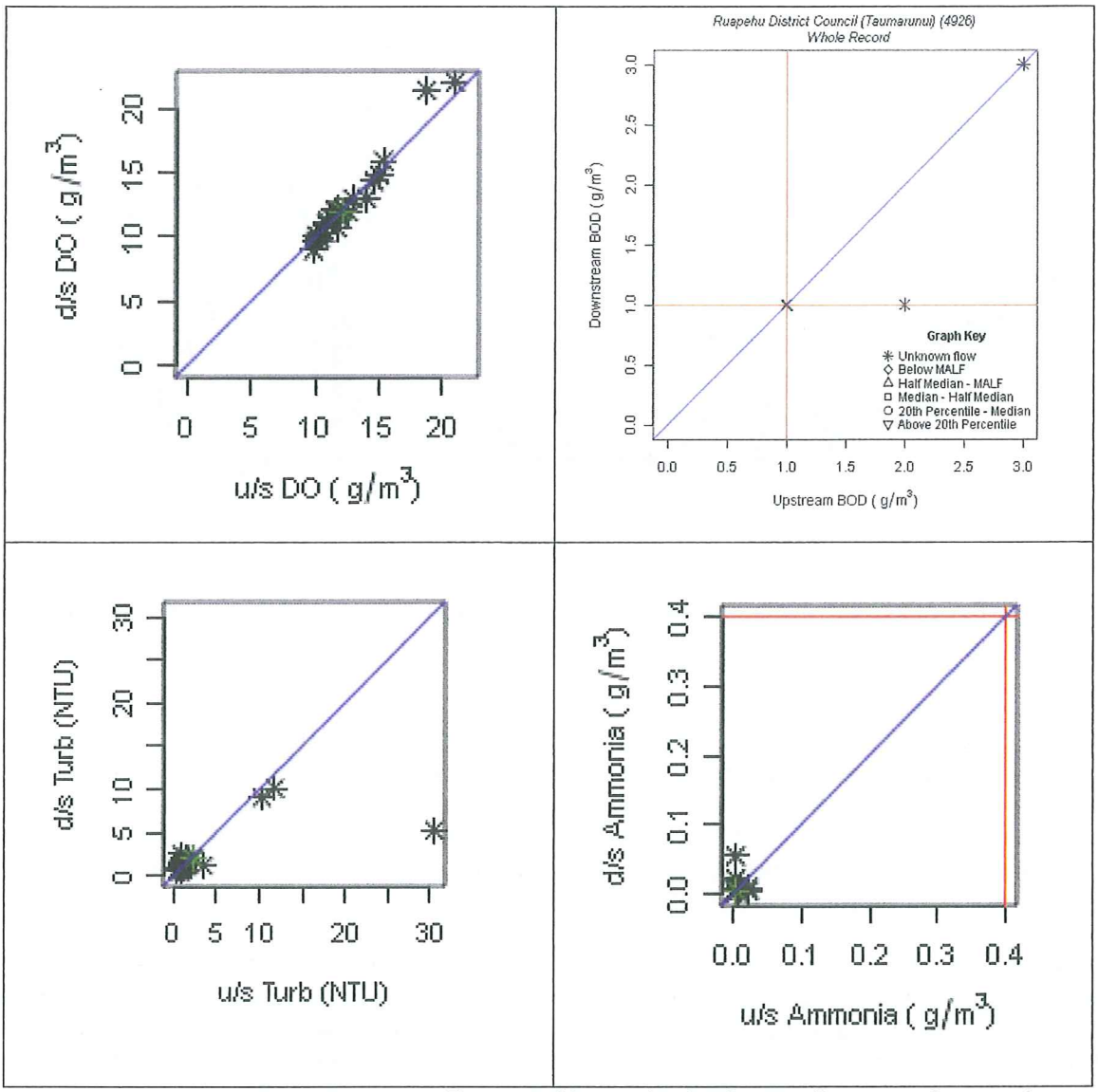


Figure 22 Mangaehuehu Stream Resource Consent Impacts

Source: http://www.horizons.govt.nz/managing-environment/resource-management/compliance-monitoring

Horizons have provided resouce consent compliance information on their website. The graphs show concentrations upstream of the discharge against downstream for each parameter, providing a summary of the impact of the discharge on downstream water quality at different river flows. This information is no longer avalaible on their website. Reference should be made to Section 2 which discusses the reveiving environment parameters.

Section 2 Figure 10 graphically shows the dissolved oxygen levels upstream and downstream in the receiving environment. On the 18 October 2011, 10 April 2012 the results showed a decrease in oxygen available of 3.07 and 1.25 g/m^3 respectively. On the and 19 June 2012, the results showed an increase downstream of 2.11 g/m^3.

CBOD5 is discussed and depicted in Section 2 Figure 12. Compliance was not always achieved although once the drainage enhancement was completed compliance was achieved.

Turbidity results are graphically depicted in Figure 23. Results show turbidity did not increase by more than 2 NTU with the exception of the 15 Ocboter 2013 where values were significantly different. Values downstream were 78 NTU higher than upstream. This was the only anomoly between results and was not ploted as it prevent other figures from being examined.

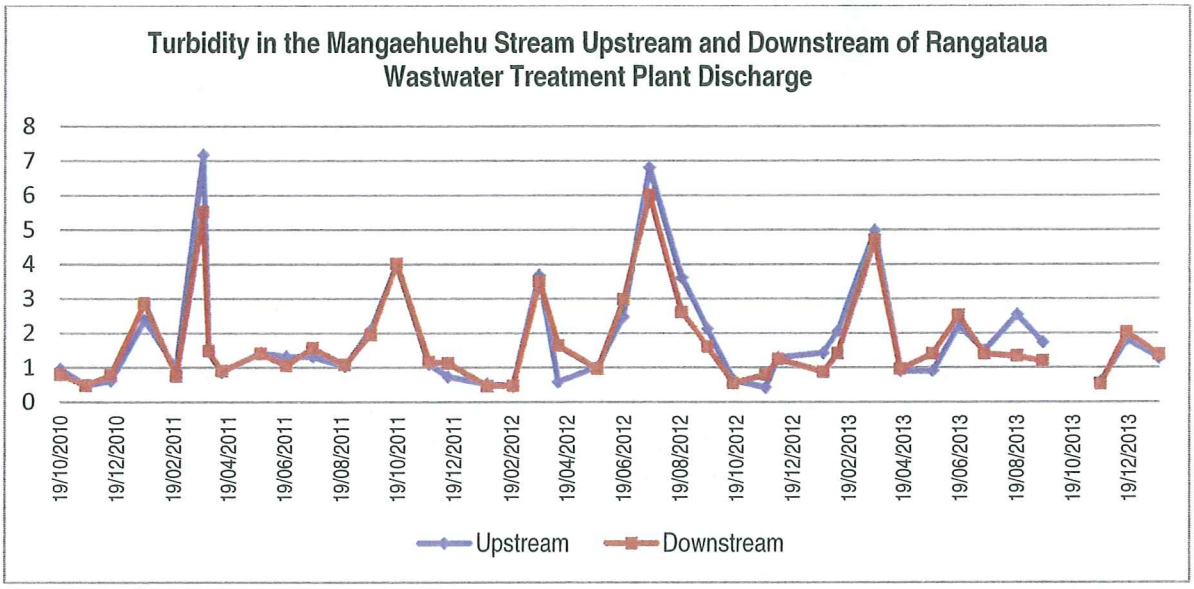


Figure 23 Turbidity Values in the Mangaehuehu Stream upstream and downstream of Rangataua Wastewater Treatment Plant discharge with high values removed .
Source: Horizons RC monitoring data

Ammonia nitrogen was depicted in Figure 2 and there were 11 occassions when the total ammonia nitrogen was increased by more than 0.05g/m3. Four of these occurances were for values greater than 1 g/m3 and the maxium increase was 1.7 g/m3.

Condition 6 Flow measuring device

A magflow was installed in 2009 to continuously log flow from the lagoon. A copy of the system has been installed. The data has been graphically illustrated in Figure 11 and improvements including the SCADA of data back to Ohakune Watetreatment Plant is discussed under Section 3.2.1 Plant Improvements.

Monitoring Generally
Some river monitoring has been undertaken by Manawatu-Wanganui Regional Council and United Water. The synergies between Council sampling are currently being explored.

Macro-invertebrate sampling is not required under the current consent. Pohangina Environmental Consultants sampled the biological life during low flow in 2008 and 2009 respectively to assess the background levels of biota currently in the stream and any potential effects. The perhiphyton and chlorophyll-*a* results have already been discussed under Section 2.3. The full reports are attached in Appendix D. The summary data for the two seasons is reproduced in Table 5 and 6 below. The results indicate there is no or only minor effects on the biota.

	Condition Upstream	Condition 400m downstream	Condition 800m downstream	ANOVA $F_{2, 12}$ value	Effect downstream
MCI	☺	☺	☺	0.10	No effect
QMCI	☺	😐	😐	3.63	No effect
EPT (taxa)	☺	😐	😐	1.10	No effect
EPT (individuals)	☺	😐	😐	**11.4**	Decreased
Chlorophyll *a*	☹	☹	☹	1.64	No effect

Condition (good ☺, moderate □, poor □) is based on thresholds in the figures below. Overall effect downstream is based on statistical significance at P=0.05 indicated in bold.

Table 5 Summary of water quality indices 2008. *Souce: Pohangina Environmental Consultants 2008*

The executive summary from Death 2008 stated:

1) Invertebrate and periphyton communities were sampled in the Mangaehuehu Stream upstream and downstream of the discharge from the wastewater treatment ponds at Rangataua to determine if the discharge was having any effect on stream biota.
2) The discharge was having an adverse effect on the percentage of Ephemeroptera, Plecoptera and Trichoptera individuals present but did not appear to affect any other indices.
3) Biotic indices indicate moderate to good water quality in this part of the Mangaehuehu Stream.
4) There was no significant change in the amount of periphyton biomass downstream of the discharge.
5) Diatom levels both upstream and 400 m downstream were above acceptable limits as recommended by the Ministry for the Environment for aesthetics.
6) In balance some aspects of the streams biota are affected by the discharge and others are not. This would suggest a mild effect of the discharge on the streams ecology.

	Condition Upstream	Condition 400m downstream	Condition 800m downstream	ANOVA $F_{2, 12}$ value	Effect downstream
MCI	😐	😐	☺	3.59	No effect
QMCI	☺	☺	☺	1.15	No effect
EPT (taxa)	😐	😐	😐	0.88	No effect
EPT (individuals)	☺	☺	😐	0.86	No effect
Chlorophyll *a*	☺	☺	☺	0.24	No effect

Condition (good ☺, moderate □, poor □) is based on thresholds in the figures below. Overall effect downstream is based on statistical significance at P=0.05 indicated in bold.

Table 6 Summary of water quality indices 2009. *Souce: Pohangina Environmental Consultants 2009*

The executive summary from Death 2009 stated:

1) Invertebrate and periphyton communities were sampled in the Mangaehuehu Stream upstream and downstream of the discharge from the wastewater treatment ponds at Rangataua to determine if the discharge was having any effect on stream biota.
2) Invertebrate communities indicated that this discharge was having no adverse effect on any of the biotic indices.
3) Biotic indices indicate moderate to good water quality in this part of the Mangaehuehu Stream.
4) There was no significant change in the amount of periphyton biomass downstream of the discharge.
5) Diatom levels downstream were within acceptable limits as recommended by the Ministry for the Environment for aesthetics however upstream, levels exceeded recommended limits.

6.0 Assessment of Alternative Discharge Options.

6.1 Best Practical Options

The Best Practical option for the Rangataua wastewater treatment plant which is sustainable has been considered. This report clearly demonstrates considerable efforts have been made to mitigate effects.

6.1.1 Impact of Stormwater on influent flows and Treatment

Incoming flows to the Rangataua wastewater treatment plant can be influenced by storm water infiltration into the network after rainfall. Historically this has been a significant problem at this plant. Section 3.2.1 Performance Improvements and section 3.3 Infrastructure, pipe condition highlights the efforts that have been undertaken to reduce the effects of inflow and ingression effects. All gully traps have been raised where they were identified as too low. Illegal connections have been removed where found.

The pipes are now PVC with the exception of the pumping main from the pump station to the lagoon. Manholes continue to be monitored under storm events to check them for ground water ingression. There is a rolling programme of asset condition assessments undertaken as part of the operations and maintenance programme to review the wastewater system in a formal manner. In addition to the data captured around repairs and maintenance, records were collected during the year.

6.1.2 Land Disposal Options

Rangataua township is built on high elevation swamp land. The site elevation of over 500m above sea level naturally receives elevated rainfall.

There is an iron pan running through the township which results in the water table being above or just below the ground during winter. The high groundwater table is evident by the level of iron staining naturally occurring on the land surface as the iron is mobilised from the iron pan and brought to the surface with rising ground water tables. The application of moving treated wastewater through land would result in the exacerbation of this saturated water table. Potentially it would result in more iron being mobilised and transported into the Mangaehuehu Stream. High levels of iron are toxic to aquatic insects and will have a detrimental effect on the Mauri and Mahinga Kai.

Currently during the summer months there are very low volumes of treated wastewater being discharged. The current volumes may not sustain a full wetland and the first planting will need to be tolerant of a range of conditions. It is envisioned that over time the wetland system will be increased down the channel with low cost solutions such as BioSocks which are used in sedimentation control sites to retain particulate matter and allow water to pass through them in the channel. Details can be found using the web site *newbiosolutions.com/index.php?option=com_content&view=article&id=...* Figure 24 provides details around biosocks construction and use.

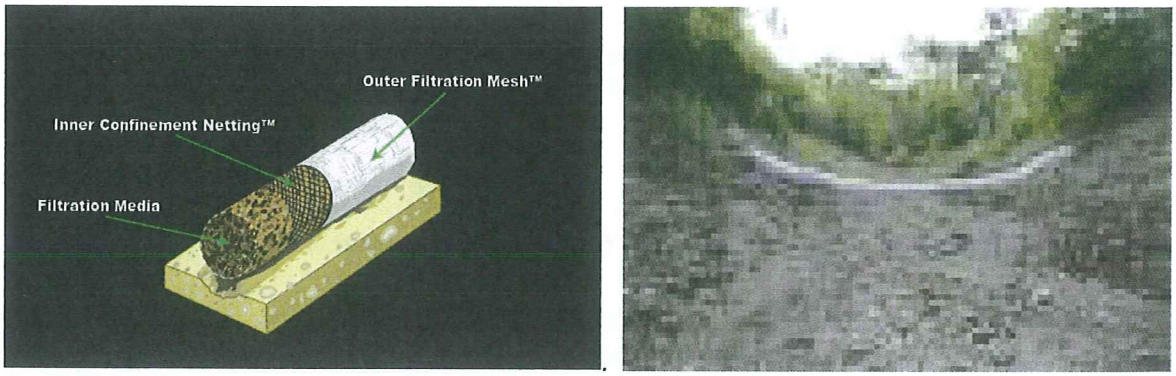


Figure 24 Biosocks construction and use.
Source newbiosolutions.com

The first stage of the wetland and planting will be completed within one year of the granting of the consent. The increase in the wetland to eventually extend the full 570 m will be undertaken in stages as the township grows or impacts appear to be increasing.

6.1.3 Discharge to the Mangaehuehu Stream

The discharge from Rangataua of treated wastewater direct to the Mangaehuehu River will have greater flow levels to dilute the loadings. The stream is considered to have high value as a natural waterway and would lower the Mauri of the waterway. Hence, the progressive upgrade from the moving of the discharge point into the wetland area is beneficial. The natural plants of the drain also provide further treatment before it discharges into the Mangaehuehu Stream.

6.1.4 Optimised Chemical Treatment Systems

The use of chemicals to remove nutrients is not necessary at the current volumes being treated and discharged. Only when the population increases and no other natural

technology treatment method has evolved will this be considered. Currently dissolved reactive phosphorous and Total Phosphorus levels are having no or minor effects on the receiving water.

The option of chemical dosing to remove nutrients in sludge is a new science which may generate more issues than it resolves. Council believes the current system is sustainable without chemical dosing for the next 10 years.

Currently the most affordable way to treat phosphorous is to add alum salts to the system to bind with the phosphorous. This alum will then need to be removed again from the environment as it can create biological harm in a soluble form. Also the bound component or sludge will also require removal. Long term effects of dosing, Aluminium Sulphate into the environment to lock up phosphorous has not been studied. Given the diurnal chemical changes in our river system the aluminium may not remain bound. Soluble aluminium can be toxic to aquatic organisms.

Chemical dosing and redevelopment of the treatment system is estimated to cost in the range of $500,000 to $900,000 as a capital outlay with a yearly operational cost at bout 10-20% of initial capital investment. This does not currently appear sustainable for a small community. Technological solutions continue to change and after the 10 year period there are likely to be significant advances in treatment systems which will need to be assessed closer to the time.

6.1.5 NIWA Advanced Pond System

Advanced Pond Systems (APS) combine anaerobic digestion of wastewater solids, intensive aerobic treatment, enhanced nutrient removal and natural disinfection with recovery of resources (nutrients, and energy). Council land foot print does not provide for this option of treatment and it would do little to meet iwi aspirations of disposal through the land. Given the current results, the installation of these lagoons are not necessary as the treatment system is assimilating the material onto and into the ground and air.

6.1.6 Pond Aeration

Aeration is beneficial for the removal of ammoniacal nitrogen because it converts ammonia to nitrite and nitrite to nitrate. It also prevents the lagoons from going anaerobic. The cost of running mechanical aeration will utilise large amounts of power and add considerable additional cost to operations for what appears to be little benefit at this time. There are no recorded complaints of odour and ammonia concentrations have little or no effect in the receiving water. Potentially the addition of floating wetland will achieve the same outcome of driving the ammonia equation to produce a nitrate product. The capital cost is in the region of $400,000 with additional ongoing maintenance.

One of the main bacterial for ammonia conversion to other N species requires warm conditions to prosper. Rangataua as a cold climate does not lead itself well to these species during the winter months.

Currently there are new diffuser aerator technologies entering the market that are much more efficient at delivering aeration into the lagoons, with low power consumption and it is expected this technology will be further refined over the next few years. These, along with nitrogen aqua mats, hold much greater promise for affordable aeration and nitrogen removal. These have recently been installed in a number of lagoons across the country and Council will take an active interest in their operational performance.

6.1.7 Floating Wetlands

Floating wetlands are a variation of typical ground surface wetlands, and plants are grown on the pond surface supported by an artificial mat. The plant roots play an important role in the treatment process via the uptake of nutrients and trapping of particles in the root system. The trapped material eventually drops and becomes part of the pond sediment layer. There is currently little information on the performance of floating wetlands for wastewater treatment systems, with much of the literature limited to improving lake water quality and for storm water treatment. Two wetland mats in the lagoon to assess their performance in Ruapehu's cold climate.

These are being added as an option to discuss the science with iwi only at this stage. Due to lack of buy in by parties and affordability of wastewater treatment floating wetlands are not considered the best alternative treatment method at this time. Exploration of how well they grow using native plants in an extreme weather setting such as Rangataua will be trialled to assess their future viability.

.2 Conclusion

In terms of disposal options, year round disposal to land was not considered to be a practical option because of high establishment costs and climatic and soil limitations, which would potentially cause undesirable contamination of the shallow groundwater resource surrounding Rangataua when soils are saturated.

Discharging directly to the Mangaehuehu Stream will have greater dilution. This would be against the Mauri of the stream.

Chemical addition to remove nutrients is considered an expensive option and would not meet the objectives of moving the treated wastewater through the land. The use of a NIWA Advanced Pond System, Aeration or Floating Wetlands is unlikely to produce any significant benefit in terms of existing effluent quality or improvements to the receiving environments more than would be achieved by the current proposal.

Effects of the discharge, growth of the population and affordability of new technologies will be assessed at intervals through-out this consent. The trigger for additional treatment will primarily be on effects on the environment, however at 10 year intervals it is proposed that a more formal assessment be made by the parties using a matrix to assess the treatment system and its impact on the environment.

7.0 Assessment of Environmental Effects

7.1 Biological Monitoring

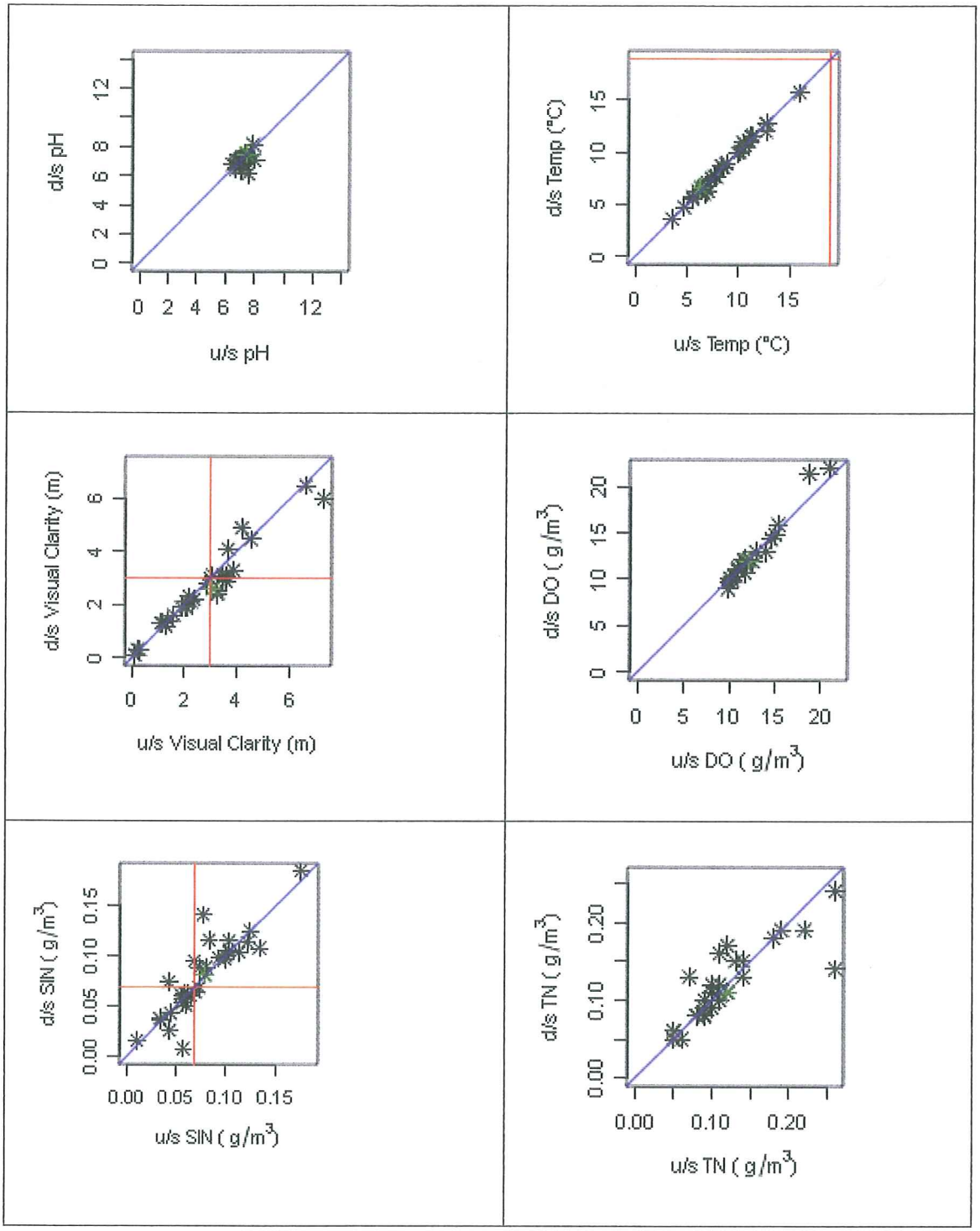
The current biological monitoring discussed in Sections 3 and 5 show no or minor effects on the Mangaehuehu Stream from the discharge.

7.2 Water Quality

Section 2.3.2 Monitoring data provides an analysis of: horizontal visibility, odour, water suitable for farm animal consumption, ammonia, carbonaceous biochemical oxygen demand, suspended solid, particulate organic matter, and Ecoli, and dissolved relative phosphorous. In most cases the effects were of a minor nature. The background phosphorous levels are higher than the One Plan Standard.

Section 5 Compliance discussed the dissolved oxygen level, turbidity (NTU), and biochemical oxygen demand effects in the receiving water. All results were of a minor nature.

Further results covering PH, temperature, visual clarity and dissolved oxygen levels have been presented in Figure 18 and shows no or effects of a minor nature on the receiving environment using data Horizons had posted to the website. This data is no longer available on the web and hence has not been updated since 2010. Since this time data additional data has been collected and is graphed in Section 2. Generally the graphs of Section 2 tell a similar story to these depicted in Figure 25 below.


d/s pH
u/s pH
d/s Temp (°C)
u/s Temp (°C)
d/s Visual Clarity (m)
u/s Visual Clarity (m)
d/s DO (g/m3)
u/s DO (g/m3)
d/s SIN (g/m3)
u/s SIN (g/m3)
d/s TN (g/m3)
u/s TN (g/m3)

7.3 Cultural Effects

Council has met with Department of Conservation and Ngati Rangi representatives as a preliminary to develop this resource consent application.

Ngati Rangi and Council have had a number of touch points around this resource consent but a final sign off from their Environmental Committee has yet to be achieved. Section There have been a number of large projects which has consumed resources for both parties 2.5 provides details of how the cultural values have been considered and addressed by Council. Principally all items in this consent have been discussed. The gravel bed has been removed but will be discussed with Ngati Rangi around their requirement to for this system as understanding around the sciences has improved.

Department of conservation have supported the development of the wetland and iwi culture concerns as set out in section 1.6.3. Efforts have been made to ensure the Mangaehuehu Stream higher culture value has been maintained or enhanced as this consent was developed.

7.4 Physical Effects

The discharge causes minimal effect to the physical structure and geomorphology of the surrounding land. The system is located away from the township and discharges into an old drain which is being developed into a wetland.

The receiving environment shows no or only minor effects from the potential loss of untreated, partially treated and treated wastewater discharging through the base of the lagoons and from the lagoon. The physical discharge rarely reaches the receiving environment during low flows. After reasonable mixing it is not possible to see any physical change in colour or clarity in the receiving environment.

The values recorded in Section 2 demonstrate little change between the sampling points which can be attributed to the wastewater treatment system discharge.

7.5 Odour Effects

There has been no record of odour beyond the boundary and this is not considered to be a significant issue. The nearest dwellings are situated at a distance that ensures that any effects of odour are minimal.

The lagoons have no records of turning over, excessive foaming which would indicate anaerobic conditions occur to create major odour issues. Odour is not considered to be a significant effect and mitigation options have been proposed should it require them.

7.6 Visual Effects

The Rangataua wastewater treatment system is not screened; however it is not visible from the township and can only be seen from the surrounding rural land and the railway line.

The visual impact of the treatment plant site is considered to be not significant. All of the structures are non-intrusive and largely only viewable form an elevated position.

Screening would create an impediment to the natural aeration achieved and screen is likely to increase the risk of odour effects within the treatment system. While screen may remove visual sighting of the lagoon on balance it is likely to have a detrimental effect on the treatment plan performance and is therefore not provided for in this proposal.

7.8 Positive Effects

The Rangataua wastewater treatment plant was developed to provide treatment to the Rangataua community wastewater after septic tank systems were identified as inappropriate. The treatment facility discharge provides a service for the local community of Rangataua and ensures that domestic effluent is disposed of in a manner that ensures the health of the community is protected, whilst ensuring that the Mangaehuehu Stream remains suitable for contact recreation purposes, for aquatic life and Mauri. The consequence of not providing such a service is uncontrolled effluent disposal, which could cause far greater pollution to the streams surrounding the town and consequently the Mangaehuehu Stream.

Provision for essential infrastructure is considered a positive effect as it creates concentrated satellite community which utilises the land in a more efficient manner than sporadic builds.

8.0 Statutory Consideration

Chapter 11 of the One Plan sets the water management zone of the Upper Whanganui common catchment expiry and review date as 1 July 2009. Future dates for expiry or review of consent within that catchment must occur again every 10 years thereafter.

The next common date of 1 July 2019 provides a good date for a review and the consent should be reviewed to see if effects are more than minor at 1 July 2029. If they remain at minor level then the consent should continue for a further 10 years to 2039. The resource consent period sought is 25 years.

8.1. Resource Management Act 1991

Part II RMA 1991

Section 5 Purpose

(1) The purpose of this Act is to promote the sustainable management of natural and physical resources.

*(2) In this Act, **sustainable management** means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while—*

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

(c) avoiding, remedying, or mitigating

The purpose of the Resource Management Act 1991 is to promote the sustainable management of natural and physical resources within New Zealand. Section 5(2) of the Act outlines the meaning of sustainable management and what is required to achieve the purpose of the Act. When considering the application for resource consent for the Rangataua Wastewater Treatment Plant to discharge of treated domestic wastewater into the Mangaehuehu Stream against the purpose of the Resource Management Act 1991, an overall broad approach is required in balancing the various considerations within Section 5(2)(a) to (c). The quality of the discharge provides for the community's social and economic needs, whilst ensuring that the Sections 5(2)(a) and (c) are satisfied. The application provides for reviews to add improvements over time to ensure that future generations are able to utilise the receiving environment for contact recreation and food sources. The effect of the discharge on water quality within the Mangaehuehu Stream is such that its life supporting capacity for macro-invertebrates and various fish will be safeguarded, and the level of nutrients discharged does not cause the background levels within the stream to increase in the majority of circumstances. The discharge does not include toxicants or a level of pH that would affect the health of the waterway in the short or long term. In terms of Section 5(c), as the population increases the applicant will ensure that the effects of the discharge have been sufficiently mitigated and remedied.

Section 6 Matters of national importance

In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the following matters of national importance:

- *(a) the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development:*
- *(b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development:*
- *(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna:*
- *(d) the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers:*
- *(e) the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga:*
- *(f) the protection of historic heritage from inappropriate subdivision, use, and development:*
- *(g) the protection of recognised customary activities.*

The application is to discharge tertiary treated wastewater into a modified drain now deemed as a wetland area, rather than discharge directly into the Mangaehuehu Stream. This is constant with the matters of national importance, namely Section 6 (a) and (e).

Section 7 Other matters

In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall have particular regard to—

- *(a) kaitiakitanga:*
- *(aa) the ethic of stewardship:*
- *(b) the efficient use and development of natural and physical resources:*
- *(ba) the efficiency of the end use of energy:*
- *(c) the maintenance and enhancement of amenity values:*
- *(d) intrinsic values of ecosystems:*
- *(e) [Repealed]*
- *(f) maintenance and enhancement of the quality of the environment:*
- *(g) any finite characteristics of natural and physical resources:*
- *(h) the protection of the habitat of trout and salmon:*
- *(i) the effects of climate change:*
- *(j) the benefits to be derived from the use and development of renewable energy.*

The intrinsic value of the Mangaehuehu Stream ecosystem will not be significantly modified by the discharge and the stream will continue to support life. Council has signalled that environmental effects and population increases will trigger continued improvement to the treatment plant to ensure effects are of a minor nature.

Section 8 Treaty of Waitangi

In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi).

Ruapehu District Council has had a preliminary discussion with Ngati Rangi and have held a number of site visits with their representative to provide involvement in the consenting process. Ngāti Rangi have indicated a 20 year term is acceptable for any resource consent

but are not comfortable with 35 years. Council has taken into account the common catchment expiry or review dates in proposing a timeframe of 25 years.

Council has taken into account their cultural concerns through the One Plan chapter 4 and the Ngati Rangi Waterways document along with personal communications.

Council seeks to change this engagement of limited terms by incorporating Ngāti Rangi in the review process at 10 years, providing opportunities to be involved at the plant and emerging sciences. A matrix of factors has been developed to help guide the decision making process around review time. This not an inclusive or exclusive set of matrix parameters.

104D Particular restrictions for non-complying activities

(1) Despite any decision made for the purpose of section 95A(2)(a) in relation to adverse effects, a consent authority may grant a resource consent for a non-complying activity only if it is satisfied that either—

- *(a) the adverse effects of the activity on the environment (other than any effect to which section 104(3)(a)(ii) applies) will be minor; or*
- *(b) the application is for an activity that will not be contrary to the objectives and policies of—*
  - *(i) the relevant plan, if there is a plan but no proposed plan in respect of the activity; or*
  - *(ii) the relevant proposed plan, if there is a proposed plan but no relevant plan in respect of the activity; or*
  - *(iii) both the relevant plan and the relevant proposed plan, if there is both a plan and a proposed plan in respect of the activity.*

(2) To avoid doubt, section 104(2) applies to the determination of an application for a non-complying activity.

The effects of the Rangataua Wastewater Treatment Plant discharge on the Mangaehuehu Stream and air quality surrounding the site are considered to be no more than minor, and the activity is not contrary to the relevant objectives and policies of the relevant regional plans including the Regional Air Plan and Proposed One Plan. An assessment of the relevant objectives and policies is provided in the following sections of this report.

Section 107 RMA 1991

A discharge permit cannot be granted if, after reasonable mixing, the contaminant or water discharged (either by itself or in combination with the same, similar, or other contaminants or water), is likely to give rise to all or any of the following effects in the receiving waters:

- *(c) conspicuous oil or grease films, scums or foams, or floatable or suspended materials.*
- *(d) any conspicuous change in the colour or visual clarity.*
- *(e) any emission of objectionable odour.*
- *(f) the rendering of fresh water unsuitable for consumption by farm animals.*
- *(g) any significant adverse effects on aquatic life.*

The discharge from the Rangataua Wastewater Treatment Plant will not cause any of the above adverse effects to occur below the point where the drain discharges into the Mangaehuehu Stream. Monitoring suggests that there have been no conspicuous oil or grease films or change in visual clarity. It is very difficult to detect any odour from the lagoons themselves or the discharge. The wastewater discharged into the Mangaehuehu Stream will not cause the water downstream to be unsuitable for water consumption for farm animals because it meets the relevant water quality standards and the effects on aquatic life are considered minor.

8.2. Objectives and Policies of the Relevant Planning Document

One Plan

The One Plan provides guidance for the decisions around infrastructure by setting objectives and policies.

Policy 3-1: Benefits of *infrastructure* and other physical resources of regional or national importance

(a) The Regional Council and Territorial Authorities must recognise the following infrastructure as being physical resources of regional or national importance:

(vii) public or community wastewater treatment plants and associated reticulation and disposal systems

(viii) public water supply intakes, treatment plants and distribution systems

(ix) public or community drainage systems, including storm water systems

Rangataua township was established firstly with septic tank facilities which in were upgraded to a secondary treatment facility by a two stage oxidation lagoon under the Ministry of Health subsidy. These lagoons later had tertiary treatment added by discharge to a wetland area.

The Rangataua Wastewater Treatment Plant is a significant infrastructural asset within the Ruapehu District and Horizons region because it allows for human wastewater to be managed in a controlled manner ensuring the health:

- of citizens living within Rangataua,
- the surrounding area and
- communities downstream on the Mangaehuehu Stream.

The above policy recognises that public or community Wastewater Treatment Systems are of regional and national importance because they ensure that wastewater is managed efficiently and the potential environmental effects of ad-hoc effluent treatment and disposal are mitigated. There would be implications for other users of the surface and groundwater downstream of Rangataua if wastewater treatment were not provided. A treatment system provides for a sustainable community.

Objective 3-1B The strategic integration of infrastructure with land use.
Objective 3-1C Urban growth and rural residential subdivision on versatile soils.

This satellite community has urban development planning with set boundaries of associated infrastructure. It is important to support these communities and their facilities as they provide attractive pockets of rural lifestyle without impinging on the productive land and proliferating the development of small rural blocks.

This community has developed a network of collection pipework and pump station in recognition that it was original having a negative adverse impact on the environment including human health. Significant money has been spend replacing old infrastructure to enable future development without impacts on the environment.

In section 2.5 Council has identified the resource management issues of significance to Hapu and iwi as set out in chapter 4 of the One Plan.

Objective 4-1: Resource management

(a) To have regard to the mauri of natural and physical resources to enable hapū and iwi to provide for their social, economic and cultural wellbeing.

(b) Kaitiakitanga must be given particular regard and the relationship of hapū and iwi with their ancestral lands, water, sites, wāhi tapu and other taonga (including wāhi tūpuna) must be recognised and provided for through resource management processes.

Policy 4-1: *Hapū* and *iwi* involvement in resource management

The Regional Council must enable and foster kaitiakitanga and the relationship between hapū and iwi and their ancestral lands, water, sites, wāhi tapu and other taonga (including wāhi tūpuna) through increased involvement of hapū and iwi in resource management processes including:

- *(a) recognition of existing arrangements and agreements between resource users, local authorities and hapū or iwi,*
- *(b) development of catchment-based forums, involving the Regional Council, hapū, iwi, and other interested groups including resource users, for information sharing, planning and research,*
- *(g) involvement of hapū or iwi in resource consent decision-making and planning processes in the ways agreed in the memoranda of partnership and joint management agreements developed under (a) and (e) above,*
- *(h) the Regional Council advising and encouraging resource consent applicants to consult directly with hapū or iwi where it is necessary to identify:*
  - *(i) the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga (including wāhi tūpuna), and*
  - *(ii) the actual and potential adverse effects of proposed activities on those relationships.*

Council has been strengthening relationships and partnerships to involve iwi more actively in managing the environment. In particular this consent has set out to address concerns in resource management planning and consent processes to give a voice in decision using an adaptive management approach.

Policy 4-2: *Wāhi tapu, wāhi tūpuna* and other *sites* of significance

- *(a) Wāhi tapu, wāhi tūpuna and other sites of significance to Māori identified:*
- *(i) in district plans,*
- *(ii) as historic reserves under the Reserves Act 1977,*
- *(iii) as Māori reserves under the Te Ture Whenua Māori Act 1993,*
- *(iv) as sites recorded in the New Zealand Archaeological Association's Site Recording Scheme, and*
- *(v) as registered sites under the Historic Places Act 1993 must be protected from inappropriate subdivision, use or development that would cause adverse effects on the qualities and features which contribute to the values of these sites.*

Council is not aware or has not been made aware that any of the land or any surround land is Wahi tapu.

Policy 4-4: Other resource management issues

The specific issues listed in 4.2 which were raised by hapū and iwi must be addressed in the manner set out in Table 4.1 (not included).

> *Table 4.1 highlights issues of significance to the Region's hapū and iwi, provides explanations in the context of Māori belief and demonstrates how the Regional Council must address these matters. The issues and explanations do not in any way represent a complete picture of hapū and iwi concerns, but they offer possible explanations as to the depth of feeling and connection hapū and iwi have with the Region's natural resources.*

Ngati Rangi have published a Natural Waterways document which has been used as a guideline along with discussions with an iwi representative to ensure that the Mauri of the Mangaehuehu Stream and Whangaehu River is not compromised.

The Mahi Tautara (wastewater) has been removed from a direct discharge into the stream as this act in itself is regarded as 'poke'. The discharge has been moved into a drain in which wetland species have been planted. During summer months the treatment plant commonly does not discharge. The measurement point is at the discharge into the wetland. Enhancement of the wetland will further reduce the likelihood of the treated wastewater entering the Stream except for prolong or heavy rain events. For the majority of the time wastewater is either evaporated and/or passes through the ground.

Objective 6-1: *Water* management Values

Surface water bodies and their beds are managed in a manner which has regard to the Values in Schedule AB1.

Objective 6-2: *Water* quality

(a) Surface water quality is managed to ensure that:

- *(i) water quality is maintained in those rivers and lakes where the existing water quality is at a level sufficient to support the Values in Schedule AB*
- *(ii) water quality is enhanced in those rivers and lakes where the existing water quality is not at a level sufficient to support the Values in Schedule AB*
- *(iv) the special values of rivers protected by water conservation orders are maintained.*

(b) Groundwater quality is managed to ensure that existing groundwater quality is maintained, or enhanced where it is degraded.

Schedule D are the water quality targets relating to schedule AB values for the management zone. These targets inform the management of surface water quality as set by policies 6.3 to 6.4. They are targets because an exhaustive assessment of each river has not been undertaken in the formulation of these values. They are assumed values using water quality results from the Manawatu River and its 5 major tributaries sampling as the parameters which, managed at these levels will provide the outcomes of schedule AB. These targets must be individually assessed for their appropriate use against the actual water quality found at each niche across the management zone. The quality of wastewater discharged from the Rangataua wastewater treatment plant is having no or minor impacts on the water quality.

Policy 6-1: *Water Management Zones* and Values

For the purposes of managing water quality, water quantity, and activities in the beds of rivers and lakes, the catchments in the Region have been divided into Water Management Zones and Water Management Sub-zones in Schedule AA.2 Groundwater has been divided into Groundwater Management Zones in Schedule C.3
The rivers and lakes and their beds must be managed in a manner which has regard to the Schedule AB Values when decisions are made on avoiding, remedying or mitigating the adverse effects of activities. The individual Values and their associated management objectives are set out in the Schedule AB Surface Water Management Values Key and repeated in Table 6.2.

Setting water management zones and subzones of the rivers allows management to give effect to objective 6-1. Rangataua Wastewater Treatment Plant falls in Whau_1C water management zone as set out in schedule AA.

Schedule AB values provides guidance on when decisions are made on avoiding, remedying or mitigation the adverse effects of the activity, or any other RMA function. The values are set out in Table 7 as a summary of achievement against the objective.

Value Group	Individual Values		Management Objective	Compliance and Comment
Ecosystem Values	LSC - UVA	Life supporting capacity: Upland Volcanic Acidic	The water body and its bed support healthy aquatic life	Periphyton and QMCI values indicate the WWTP effects are not significant
	NS	Natural State	The river and its bed are maintained in their natural state	Achieved
	SOS-A		Sites of significance for indigenous aquatic biodiversity are maintained or enhanced -whio	Not applicable as this section of river does not support the fast flowing run riffle pool habitat preferred by blue duck
	SOS-R		Sites of significance for indigenous riparian biodiversity are maintained or enhanced	No dottlerel have been observed in this zone
	TF III	Other Trout Fishery	The *water body* and its *bed* sustain healthy rainbow or brown trout fisheries	Trout have been observed
	TS	Trout Spawning	The *water body* and its *bed* meet the requirements of rainbow and brown trout spawning and larval and fry development	Temperature, pH, NH4 and bed cover have not been significantly altered to prevent spawning in this zone.
Recreation and Cultural values	AE	Aesthetic Values	The aesthetic values of the water body and its bed are maintained or enhanced	Largely achieved
	CR	Contact Recreation	The water body and its bed are suitable for contract recreation.	Largely achieved
	Mau	Mauri	The mauri of the water body and the bed is maintained or enhanced.	Largely achieved

Water Use	IA	Industrial abstraction	The water is suitable as a water source for industrial abstraction or use, including for hydroelectricity generation	Achieved
	I	Irrigation	The water is suitable as a water source for irrigation	Achieved
	SW	Stock Water	The water is suitable as a supply for drinking water for live stock	Achieved
Social/ Economic Values	EI	Existing Infrastructure	The integrity of existing infrastructure is not compromised	Achieved
	CAP	Capacity to Assimilate Pollution	The capacity of water body and its bed to assimilate pollution is not exceeded	Achieved

Policy 6-2: *Water* quality targets

In Schedule D4, water quality targets relating to the Schedule AB Values (repeated in Table 6.2) are identified for each Water Management Sub-Zone.
Other than where they are incorporated into permitted activity rules as conditions to be met, the water quality targets in Schedule D must be used to inform the management of surface water quality in the manner set out in Policies 6-3, 6-4 and 6-5.

The water quality targets within Schedule D (Appendix C) have been used to assess the effects of the discharge within the Assessment of Environmental Effects contained within Chapter 7 of this application for resource consent.

Policy 6-4: Enhancement where *water* quality targets are not met

(a) In each case where the existing water quality does not meet the relevant Schedule D water quality targets within a Water Management Sub-zone, activities must be managed in a manner which, beyond the zone of reasonable mixing:

- *(i) enhances existing water quality where that is reasonably practicable, or otherwise maintains it, and*
- *(ii) has regard to the likely effect of the activity on the relevant Schedule AB Value that the water quality target is designed to safeguard.*

(b) For the avoidance of doubt:

- *(i) in circumstances where the existing water quality of a Water Management Sub-zone does not meet all of the water quality targets for the Sub-zone, (a) applies to every water quality target for the Sub-zone*
- *(ii) in circumstances where the existing water quality of a Water Management Sub-zone does not meet some of the water quality targets for the Sub-zone, (a) applies only to those targets not met.*

The monitoring results show the water quality targets have not been adversely affected by the discharge and at least maintain the water quality when the targets are not met.

Policy 6-6: Maintenance of groundwater quality

(a) Discharges and land use activities must be managed in a manner which maintains the existing groundwater quality, or enhances it where it is degraded.

(aa) An exception may be made under (a) where a discharge onto or into land better meets the purpose of the RMA than a discharge to water, provided that the best practicable option is adopted for the treatment and discharge system.

(b) Groundwater takes in the vicinity of the coast must be managed in a manner which avoids saltwater intrusion.

The discharge of treated effluent to land is not anticipated to best meet the purpose of the RMA in providing a balance between costs to the Rangataua community and ensuring that groundwater is protected from potential contamination. Potentially any discharge to land may have an adverse effect on mobilising the iron pan layer and causing it to move into the nearest water body.

Policy 6-8: Point source *discharges* to *water*

(a) The management of point source discharges into surface water must have regard to the strategies for surface water quality management set out in Policies 6-3, 6-4 and 6-5, while having regard to:

(i) the degree to which the activity will adversely affect the Schedule AB Values for the relevant Water Management Sub-zone

(ii) whether the discharge, in combination with other discharges, including non-point source discharges will cause the Schedule D water quality targets to be breached

(iii) the extent to which the activity is consistent with contaminant treatment and discharge best management practices

(iv) the need to allow reasonable time to achieve any required improvements to the quality of the discharge

(iva) whether the discharge is of a temporary nature or is associated with necessary maintenance or upgrade work and the discharge cannot practicably be avoided

(ivb) whether adverse effects resulting from the discharge can be offset by way of a financial contribution set in accordance with Chapter 18

(ivc) whether it is appropriate to adopt the best practicable option.

Policy 6-9: Point source *discharges* to *land*

Discharges of contaminants onto or into land must be managed in a manner which:

(b) does not result in pathogens or other toxic substances accumulating in soil or pasture to levels that would render the soil unsafe for agricultural, domestic or recreational use

(c) has regard to the strategies for surface water quality management set out in Policies 6-3, 6-4 and 6-5, and the strategy for groundwater management set out in Policy 6-6

(d) maximises the reuse of nutrients and water contained in the discharge to the extent reasonably practicable

(e) results in any discharge of liquid to land generally not exceeding the available water storage capacity of the soil (deferred irrigation)

(f) ensures that adverse effects on rare habitats, threatened habitats and at-risk habitats are avoided, remedied or mitigated.

Policy 6-11: Human wastewater *discharges*

Notwithstanding other policies in this chapter:

(a) before entering a surface water body all new discharges of treated human wastewater must:
- *(i) be applied onto or into land, or*
- *(ii) flow overland, or*
- *(iii) pass through a rock filter, or*
- *(iv) pass through a wetland treatment system, or*
- *(v) pass through an alternative system that mitigates the adverse effects on the mauri of the receiving water body, and*

(b) all existing direct discharges of treated human wastewater into a surface water body must change to a treatment system described under (a) by the year 2020.

The discharge will not significantly affect the values of the Mangaehuehu Stream, such as life-supporting capacity, contact recreation, aesthetics, *mauri* and irrigation purposes. The Rangataua wastewater treatment plant has adopted best management practice, including the addition of a gravel filter and wetland system to mitigate the adverse effects.

Objective 8-1: *Ambient air* quality

A standard of ambient air quality is maintained which is not detrimental to amenity values, human health, property or the life-supporting capacity of air and meets the national ambient air quality standards.

Policy 8-2: Regional standards for *ambient air* quality

In addition to the National Environmental Standards set out in Policy 8-1, ambient air quality must be managed in accordance with the regional standards set out in Table 8.3.

Table 8.3** Regional Standards for Ambient Air Quality* ***Contaminant Regional Standard

Odour - A discharge must not cause any offensive or objectionable odour beyond the property boundary.

Dust - A discharge must not cause any noxious, offensive or objectionable dust beyond the property boundary.

Policy 8-3: Regulation of *discharges* to air

Discharges of contaminants into air will be generally allowed, provided:

(a) the effects of the discharge are consistent with the approach set out in Policy 8-1 for implementing the National Environmental Standards for ambient air quality, and

(b) the discharge is consistent with the regional standards for ambient air quality set out in Policy 8-2.

The discharge to air from the Rangataua Wastewater Treatment Plant is not considered to be offensive or objectionable beyond the property boundary. It is not anticipated that any discharge of odour from the plant will be detrimental to amenity values of surrounding properties, human health or the life supporting capacity of air, because there has been no history of complaints over the duration of the current resource consent and there is very minimal discernible odour when standing at the boundary of the site.

Policy 13-1: Consent decision-making for *discharges* to *water*

When making decisions on resource consent applications, and setting consent conditions, for discharges of water or contaminants into water, the Regional Council must have regard to:

(a) the objectives and policies of Chapter 6 regarding the Schedule AB Values and the water quality targets in Schedule D,

(b) avoiding discharges which contain any persistent contaminants that are likely to accumulate in a water body or its bed,

(c) the appropriateness of adopting the best practicable option to prevent or minimise adverse effects in circumstances where:

(i) it is difficult to establish discharge parameters for a particular discharge that give effect to the management approaches for water quality and discharges set out in Chapter 6, or

(ii) the potential adverse effects are likely to be minor, and the costs associated with adopting the best practicable option are small in comparison to the costs of investigating the likely effects on land and water, and

(d) the objectives and policies of Chapters 3, 4, 7, 10 and 11A to the extent that they are relevant to the discharge.

Policy 13-2B: Options for *discharges* to surface *water* and *land*

When applying for consents and making decisions on consent applications for discharges of contaminants into water or onto or into land, the opportunity to utilise alternative discharge options, or a mix of discharge regimes, for the purpose of mitigating adverse effects where reasonably practicable, must be considered, including but not limited to:

(a) discharging contaminants onto or into land as an alternative to discharging contaminants into water,

(b) withholding from discharging contaminants into surface water at times of low flow, and

(c) adopting different treatment and discharge options for different receiving environments or at different times (including different flow regimes or levels in surface water bodies).

The Rangataua Wastewater Treatment Plant discharge quality shows no effects on the surface water quality of the Mangaehuehu Stream or those of a minor nature. The discharge does not contain any persistent contaminants and the utilising of two oxidation ponds, gravel bed, wetland and natural wetland discharge is considered to be the best practicable option, ensuring that the effects of the discharge on the Mangaehuehu Stream and Whangaehu River are less than minor and also cost effective for the local community.

Policy 13-4: Monitoring requirements for consent holders

Point source discharges of contaminants to water must generally be subject to the following monitoring requirements:

(a) the regular monitoring of discharge volumes on discharges smaller than 100 m3/day and making the records available to the Regional Council on request,

(b) the installation of a pulse-count capable meter in order to monitor the volume discharged for discharges of 100 m3/day or greater,

(c) the installation of a Regional Council compatible telemetry system on discharges of 300 m3/day or greater, and

(d) monitoring and reporting on the quality of the discharge at the point of discharge before it enters surface water and the quality of the receiving water upstream and downstream of the point of discharge (after reasonable mixing) may also be required. This must align with the Regional Council's environmental monitoring programme where reasonably practicable to enable cumulative impacts to be measured.

Ruapehu District Council already has a flow meter on the discharge outflow and monitoring is undertaken upstream and downstream of the confluence of the unnamed tributary with the Mangaehuehu Stream. Trigger points for upgrades and general specification of the nature of upgrade have been provided in the consent conditions.

Policy 14-2: Consent decision-making for other *discharges* into air

When making decisions on resource consent applications and setting consent conditions for discharges of contaminants into air, the Regional Council must have regard to:

(a) the objectives and policies of Chapter 8,

(b) the guidelines in Section 14.2 for managing noxious, dangerous, offensive and objectionable effects,

(c) any national policy statements, national regulations, or nationally-accepted guidelines or codes of practice relevant to the activity,

(d) the location of the discharge in relation to, and any associated effects on, sensitive areas including, but not limited to:

- *(i) residential buildings,*
- *(ii) public places and amenity areas where people congregate,*
- *(iia) education facilities,*
- *(iib) public roads,*
- *(iii) surface water bodies,*
- *(iv) wāhi tapu, marae and other sites of significance to hapū and iwi,*
- *(v) domestic, commercial and public water supply catchments and intakes,*
- *(vi) are habitats, threatened habitats and at-risk habitats, and*
- *(vii) sensitive crops or farming systems (including certified organically farmed properties and greenhouses),*

(e) effects on scenic, landscape, heritage and recreational values,

(f) the appropriateness of adopting the best practicable option to prevent or minimise adverse effects in circumstances where:

- *(i) numerical guidelines or standards establishing a level of protection for a receiving environment are not available or cannot easily be established,*
- *(ii) insufficient monitoring data is available to establish the existing air quality with sufficient certainty, or*
- *(iii) the likely adverse effects are minor, and the costs associated with adopting the best practicable option are small in comparison to the costs of investigating the likely effects on air quality,*

(g) the need for contingency measures to avoid accidental discharges, including discharges arising from mechanical failure, and

The Rangataua Wastewater Treatment plant produces minimal odour, and certainly not to an extent that would significantly effect neighbouring dwellings or landowners. There are no complaints of odour from the lagoon on Council files.

Turbidity also measures the quality of the water. However the readings are influenced by particle size, shape and colour. This measure must be correlated to Total Suspended Solids because there are conditions that tend to suspend large particles though water motion (eg the increase in a stream current or wave action).

Turbidity is a much more repeatable parameter than black disc.

9. Consent Conditions

Ruapehu District Council is willing to work to establish other appropriate conditions, where practical and feasible, to ensure that any potential effects and concerns of submitters are sufficiently mitigated or alleviated.

A long term consent gives effect under policy 3 as it recognises infrastructure as being a physical resource of regional importance. It allows satellite communities, within boundaries, methods of restricting land development on versatile soils while providing a rural atmosphere. Long term resource consents are required to provide for certainty and sustainability within the community. This also allows for finances, for upgrades to treatment systems as required, to ensuring effects are of a minor nature.

The next common date of 1 July 2019 provides a good date for a review and the consent should be reviewed to see if effects are more than minor as at 1 July 2029. If they remain at minor level then the consent should continue for a further 10 years to 2039. The resource consent period sought is 25 years.

Ruapehu District Council believes that affected parties, in particular Ngati Rangi, under Policy 4 and the Department of Conservation, actively participate in the resource consent process, and reviews. A copy of documents should be available when they are produced and an opportunity to actively discuss the process and operation of the treatment system be provided for. This has been facilitated in the past by a power point presentation when iwi have had time to participate.

The decision on agreed variations to the consent is developed by a matrix which accounts for the purpose of the Local Government Act 2001 (Subpart 1 section 10) and the Resource Management Act 1991 (Part 2 section 5) purposes and principals to maintain and enhance the quality of the environment and the reasonably foreseeable needs of future generations.

The matrix needs to cover:

- The sustainability of the community
- Effects on the environment
- Cultural well-being
- Technology improvement

Water Management Values are obtained by a well maintained treatment system. To this end there should be an adaptive management approach to the development of the treatment system and addition of technologies over time.

Environmental monitoring will show the plant is having no or only minor effects by measuring the water quality targets.

9.1. Proposed Resource Consent Conditions

Consent Period
The resource consent term be granted for 25 years with reviews at 10 year intervals reflective of the common catchment expiry date of 1 July 2039 to discharge onto and into land, discharge to air and discharge to the Mangaehuehu Stream.

The activities authorised by these permits shall be for:

- A flow of (average dry weather flow (267.5) * 2) 535 $m^{3/}d$.
- No maximum flow but if average dry weather flow is exceeded by a factor of 5 this will trigger an investigation of inflow and ingression. Or, should there be sustained flows greater than an average of ADWF *3.5.

The volume to discharge from the secondary treatment lagoon shall be measured by a continuous measure devise capable of recording volume at 15 minute intervals such as a magflow or similar device. The unit will provide a certificate of manufactures calibration only and installed after the secondary Lagoon but before the wetland and final river discharge.

Flow will be electronically recorded and report via electronic means at intervals meaningful to Horizons Regional Council.

1. Treatment system Parameters measured in or at the secondary lagoon:
    - Dissolved Oxygen
    - Temperature
    - ScBOD5
    - Flow

2. Wetland Treatment sampling will be taken at the discharge point just before it enters into the Mangaehuehu Stream. Monitoring to be undertaken monthly and samples collected where there is a discharge only. Parameters should be for Temperature, NH4-N, SIN, ScBOD5, POM, DRP, E Coli, pH, turbidity.

3. Mangaehuehu Stream sampling points as designated on the map as Horizons Monitoirng Points.
4. Sampling to be undertaken monthly for all parameters listed as One Plan targets except for those with flow values at or below 20%
5. Sampling to be undertaken between the months of November to March where stream flows are below the 20% for SIN, ScBOD5, DRP and Ecoli, DO
6. Black disc sampling will be substituted with Turbidity and extrapolated to One Plan Target for clarity.
7. During all monitoring of the receiving environment an assessment of the production of films, scums and foams will be made.

Parameters to be sampled.

Parameter	Target	Flow conditions for Target
Temperature ^0C	<22	At all flows
Ammonia (g/m^3)	<0.320 average 1.7max	At all flows
Soluble Inorganic Nitrogen (g/m^3)	<0.070	≤20th percentile
Soluble $cBOD_5$ see advice note 5	1.5	≤20th percentile
POM	5 average	≤50th percentile
Dissolved Reactive Phosphorus (g/m^3)	<0.006	≤20th percentile
E Coli	260 550	≤50th percentile flow ≤20th percentile flow
pH	7-8.2	At all flows
DO	>80%	At all flows
Black disc Advice note 6	>20% change	At all flows

Table 3 Water Quality Values and the One Plan Targets

Macro-invertebrate sampling will be taken above 400m below and 800m below the wetland treatment system during December and March (summer) in the Mangaehuehu Stream but not within 3 weeks of a significant flood event once every second year. Should sampling not be possible during that period due to flow conditions the consent holder will contact Horizons Regional Council and a new monitoring period will be set or transferred to the next summer.

Periphyton and algae assessment of the percentage cover, biomass, chlorophyll a and community composition of the periphyton, filamentous algae and cyanobacterial mates in the riffle habitat close to the macro invertebrate sampling points will be undertaken.

The periphyton and algae assessment shall be undertaken on one occasion in the months of January, March, May, September and November every second year to coincide with macro invertebrate monitoring

Monitoring results will be automatically upload by Horizons Regional Council and an annual monitoring report will be provided except as exceptional reporting.

The first stage of the wetland and planting will be completed within one year of the granting of the consent.

Advice notes:

1. Wastewater flow monitoring has a significant inaccuracy in comparison to water supply and will not achieve a field accuracy of ± 5%.
2. The recording and electronic data transfer, while improving, is reliant on technology which in remote sites is subject to a variety of communication failures. Their delivery of data may not always be achieved within specified timeframes which will not constitute a noncompliance.
3. Mangaehuehu Stream flows are measured by Horizons Regional Council at State Highway bridge. Ruapehu District Council will read the staff gauge to provide the datum point at which sampling was completed.
4. Mangaehuehu Stream natural water quality values are known to exceed One Plan targets for temperature, pH, bacterial and algae growths, DRP, SIN, ScBOD5
5. $ScBOD_5$ is commonly reported by laboratories as < 1 g/m^3, <2 g/m^3 or < 5 g/m^3 as the detection limit accuracy is subject to each Bach test blank. While laboratories aim to report lower levels due to the nature of the test this accuracy level is raised to values found it the blank. The One Plan target is set at 1.5 g/m^3 and does not account for the laboratory reporting methods as set under their quality registration certificate. The lowest accuracy reading report by the laboratory should be considered as compliant if it's above the One Plan Target.
6. Black Disc factors as a tool that assess upstream and downstream clarity is subject to environmental factors such as light, shading, water turbulence and human error. It would be more appropriate to substitute this measure with turbidity.

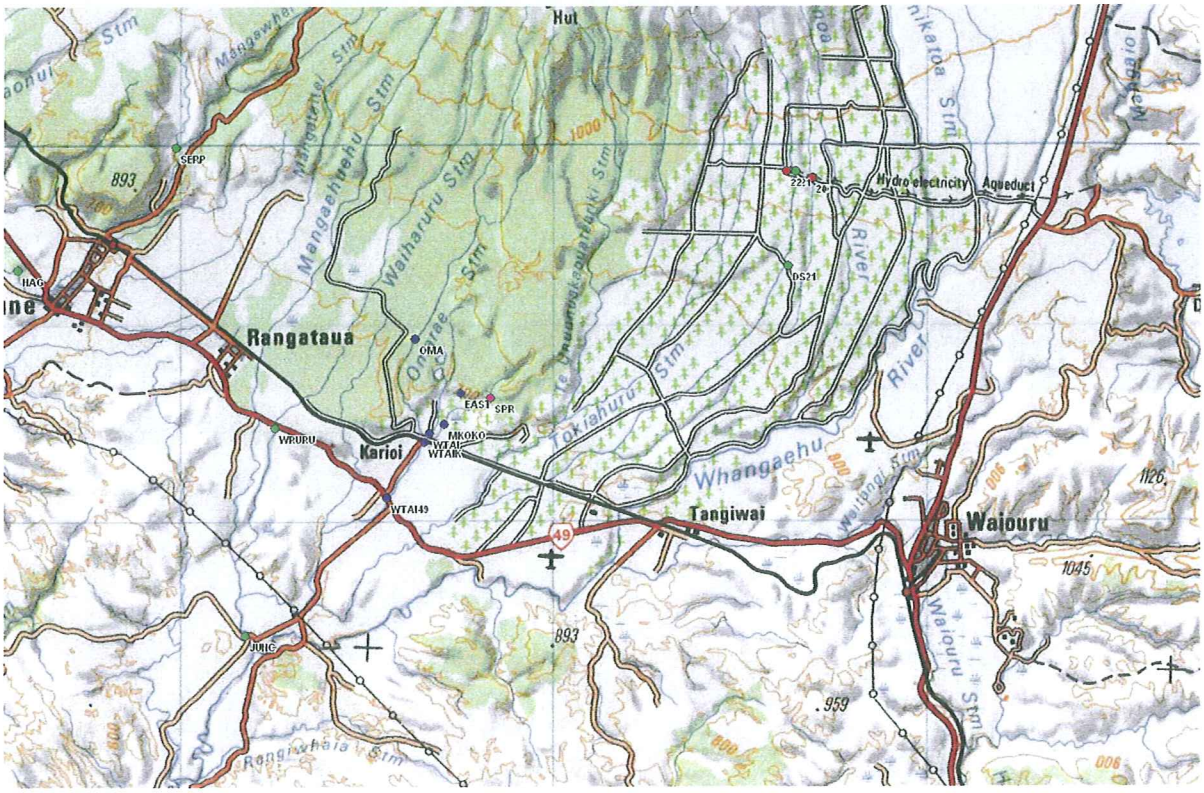
Reviews

The consent review discussion with Department of Conservation, Ngati Rangi and Horizons covers:

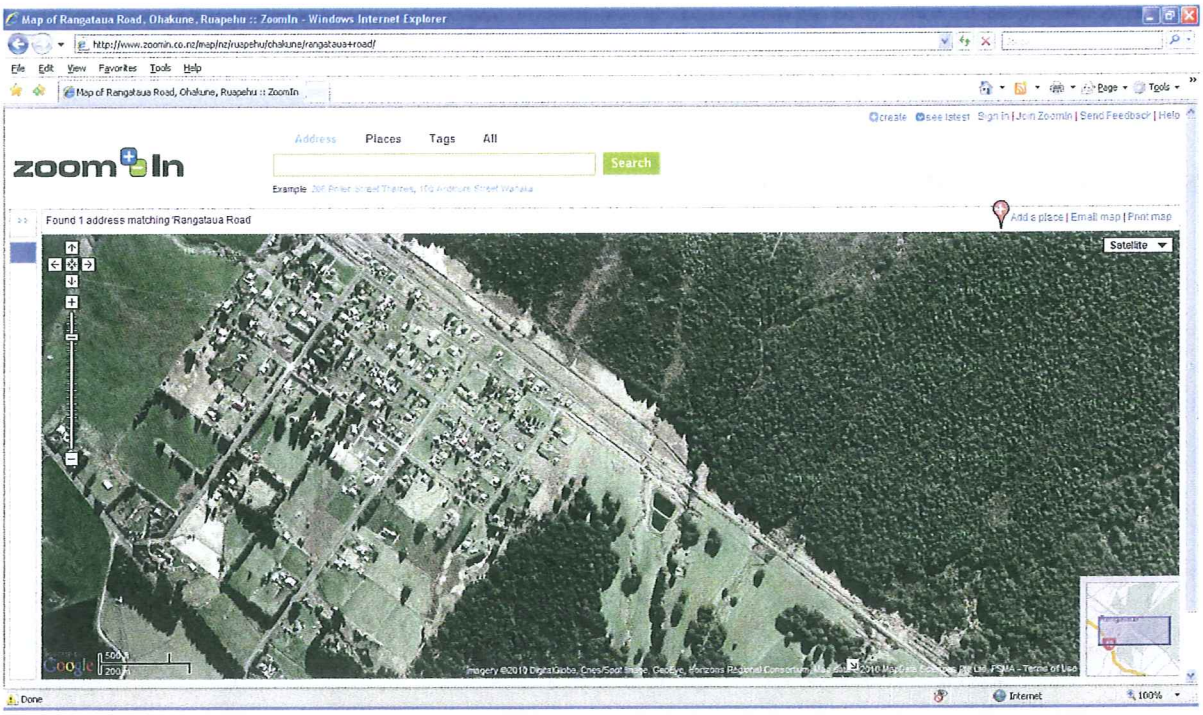
- Current technology available to treat wastewater
- The quality of treatment achieved by the Rangataua system
- The environmental analysis of effects on the receiving water
- Sustainability of the community.
- A Matrix of values
  - The cost and benefits of implementing new technology at Rangataua
  - Weight will be placed on environmental achievements
  - Alignment with Cultural desires

6 months before the review date there will be a report that covers the matrix which will be sent to all parties.

Appendix A Maps and Plans

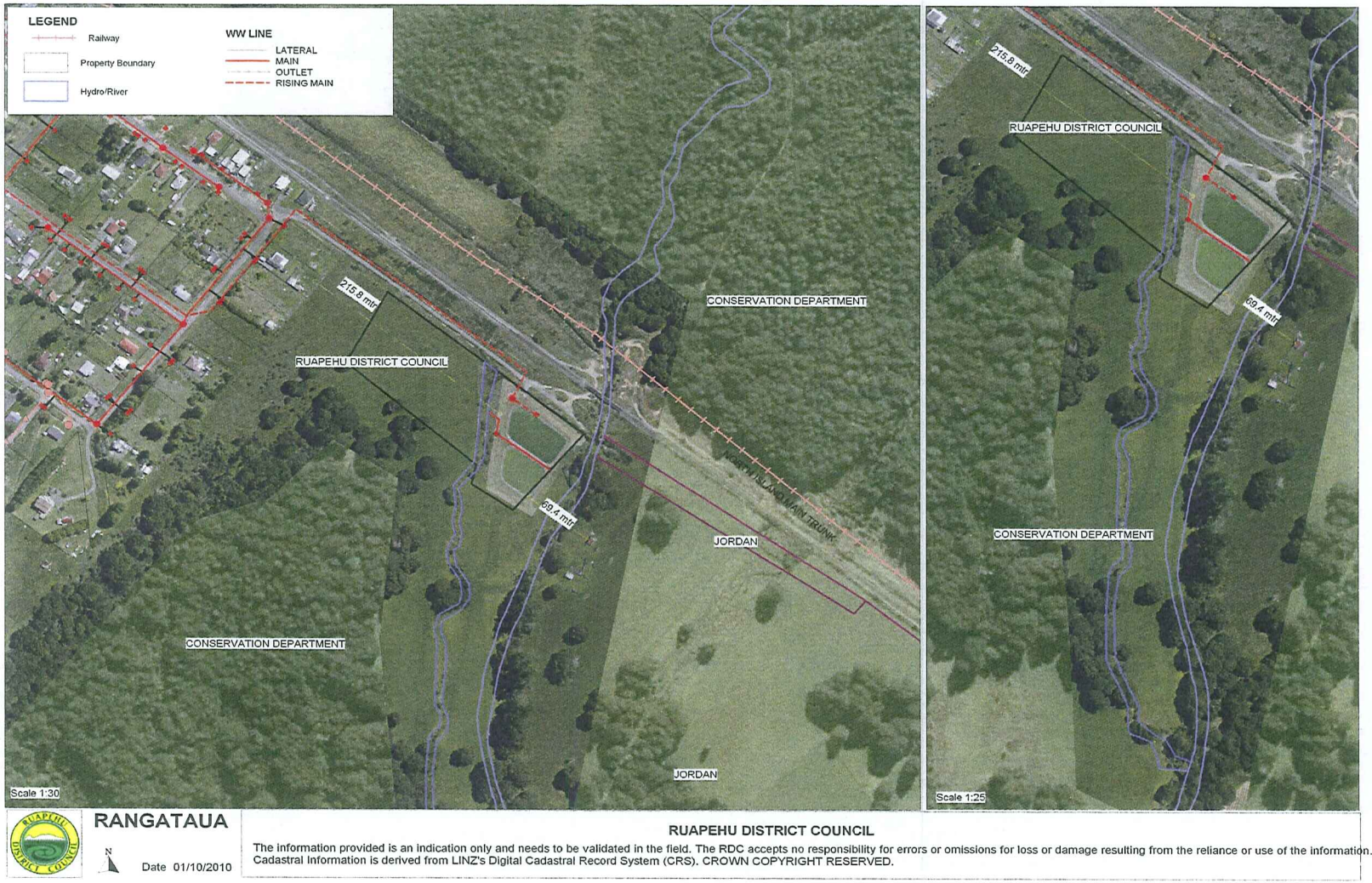


Topographical Map of Rangataua.



Township of Rangataua and lagoons.

Souce Google Earth.



Map showing neighbours

RANGATAUA WATER SERVICES

SCALE 1:3000

RUAPEHU DISTRICT COUNCIL

NORTH

03/03/

Reticulation area of Raetihi

	
Wetland area	Area for gravel bed between white pipe and fence

Appendix B Resource Consent

7/1/RDC
CMT:FAC

14 December 2000

Resource Management Act 1991

Decision on an Application to Change Conditions of Resource Consent

Applicant:
Ruapehu District Council
Private Bag 1001
TAUMARUNUI

Application No:	4926 Change No. 2 (Discharge Permit)
Location:	Nei Street, Rangataua
Catchment No:	331321
Legal Description:	Pt Sec 33 Blk V Karioi SD
Valuation No:	12700/253/01
Map Reference:	S20:221-943
Regional Policy Statement Policies: 11.2 and 11.3	
Regional Plan:	Transitional Regional Plan
	Proposed Land and Water Regional Plan
Regional Rule:	DL Rule 12
	DSW Rule 7

This notified application for a Change of Conditions of Discharge Permit 4962 is made under the provisions of Section 127 of the Act.

The Application

The Ruapehu District Council has applied for a variation to Condition 2 of Discharge Permit 4926 to construct a wetland, proposed as part of Rangataua Sewage Treatment Plant.

The Ruapehu District Council was granted a resource consent in 1995 for continued discharge of treated sewage from Rangataua Sewage Treatment Plant to the Mangaehuehu Stream.

The Rangataua Sewage Treatment Plant system operates as a two pond system receiving sewage from the Rangataua township located approximately one kilometre to the northwest.

Consent was granted for a discharge volume of 29 cubic metres per day (ultimate peak dry weather flow) to the Mangaehuehu Stream. Condition 2 of the consent required the Permit Holder to construct a wetland by 31 October 1996.

The Permit Holder sought a variation in 1997 to the Permit to allow for an extended time period for the construction of the wetland. The variation changing condition 2 was granted in June 1997 and extended the time which the Permit Holder constructed the wetland to 30 April 1998.

The current application made in October 1998 seeks to change the location of the proposed wetland as well as the date by which it must be constructed.

The Permit Holder now proposes to utilise a naturally occurring wetland on the Rangataua flank of the pond. They consider this location to be more environmentally sound than that previously proposed which was to be located between the existing ponds and the Mangaehuehu Stream. This is because the new location will not result in any direct discharge of treated effluent to the Mangaehuehu Stream.

The Applicant approached the original submitters on Application 4926 and obtained written approvals of three of the parties. These included the Department of Conservation, Mrs Y P Jordan and Fish and Game New Zealand. The written approval of Ngati Rangi, who had originally agreed to the proposed wetland, was not obtained. Further consultation did not result in a written approval so the Permit Holder requested the application be publicly notified.

Notification

The application for the change of conditions was publicly notified on 21 August 2000. All original submitters on application 4026 were notified, including those whose written approvals for this application had been obtained.

One submission was received from the Public Health Unit, MidCentral Health, Wanganui who supported the application for the changed location of the wetland. MidCentral Health noted they supported the initial proposal of wetland treatment rather than direct disposal of effluent into the Stream. They support the proposal to utilise a natural wetland rather than creating a new wetland and do so see any potential health concerns from the proposal.

Following notification of the application, **horizons.mw** was contacted by Ruapehu District Council's Consents Section regarding the need for the District Council to also notify a Land Use Consent for the changed location of the proposed wetland. This is because the proposed location, while on land owned by Ruapehu District Council, is not part of the designated site of the Treatment Ponds.

Ruapehu District Council requested **horizons.mw** place the application on hold following closure of the submission period. This would enable both authorities to determine if a Joint Hearing was required following the closure of submissions on the application made to Ruapehu District Council.

On the closure of the Ruapehu District Council Land Use Consent submission period, the District Council further requested **horizons.mw** application remain on hold. This was because the District Council was to address submissions made on their application by a Hearing of the application by the District Council Resources Committee. It was determined a Joint hearing was not necessary, however they requested **horizons.mw** application to remain on hold until the outcome of the District Council hearing process was determined.

horizons.mw were advised on 21 November 2000 that the District Council had granted the Land Use Consent and processing of the application made to **horizons.mw** could proceed.

Environmental Effects

horizons.mw's Environmental Scientist and Investigating Officer (Compliance) have assessed this application for a variation to the location of the proposed wetland.

The Scientist reports that the proposal involves the construction of a small wetland system in an old stream channel using a series of three 300mm high timber weirs at approximately 11 metre spacings. The wetland system is to be constructed entirely on District Council property and stock fenced.

The effluent discharge to the wetland would be controlled by way of a manhole and valve and an 11 metre long diffuser pipe. The small flow from the wetland will travel approximately 500-600 metres in an old stream channel before joining the Mangaehuehu Stream.

The Scientist reports that the wetland will result in improved water quality for the Mangaehuehu Stream, as it will provide some additional 'polishing' treatment. He notes there may be some minor impacts with respect to seepage, aesthetics and odour associated with the pond and wetland system. However overall it will create improved habitat as well as improved water quality in the stream.

The Scientist considers the combined effect of the wetland treatment and flow in the old stream channel will improve the quality of the effluent. The removal of the current discharge directly to the Mangaehuehu Stream and the improved treatment of the discharge through the wetland will result in effects of water quality in the Mangahuehu Stream being minimal. In addition the large dilution factor of the stream (1500 fold) will easily assimilate the wetland treated discharge.

The Scientist also considers the new proposed location will eliminate potential overtopping of the wetland by flooding of the Stream. The proposal has potential to cause adverse effects on the old stream bed during construction of the wetland. These effects will be minor and the site will be reinstated. The site will also be stock-fenced to ensure potential for adverse effects to occur from stock entering the stream bed are avoided.

The Investigating Officer however notes that few details have been provided about the exact wetland design. Although the design is not a major part of the effluent treatment system in reducing the effects of the discharge, the wetland should be designed to a standard capable of improving the discharge, for example, by ensuring adequate denitrification zones within the system and reduction of solids in the system. Such parameters can be easily reversed in an inadequately designed system.

The Officer recommends the Permit Holder provide **horizons.mw** with a Plan of actual wetland design, operation and maintenance as a condition of consent prior to construction.

The Scientist also considers that all aspects of the wetland including the 'structures' or works undertaken to form the wetland as well as its plantings, water quality and potential for odour and insects, will require effective management. He recommends regular inspections and maintenance of the wetland, stream channel and outfall will be required to ensure the system is operating efficiently.

The Scientist considers that the proposed new location has environmental benefits over the location originally proposed. He recommends consent be granted and Condition 2 be varied to change the Plan of the proposed wetland, and its date for construction.

He also recommends the inclusion of Condition 8 is an additional condition for the wetland design and maintenance imposed to avoid, remedy or mitigate any effects that have the potential to be significant.

Costs

Section 36 of the Act provides for the recovery of extra costs from an applicant when an application deposit is inadequate to meet the actual and reasonable costs of processing the application. In this case the Applicant paid a deposit of $112.50 (Incl GST).

The costs incurred by **horizons.mw** in processing this application were:

Staff Time	
Senior Consents Planner 4.5 hours @ $65.00 per hour	$ 292.50
Environmental Scientist 4 hours @ $65.00 per hour	$ 260.00
Team Leader Consents 0.25 hours @ $65.00 per hour	$ 16.25
Advertising	$ 54.26
Administration 2 hours @ $50.00 per hour	$ 100.00
Sub Total (Excl GST)	$ 723.01
GST	$ 90.38
TOTAL (Incl GST)	$ 813.39
Less Deposit Paid	$ 112.50
Total Costs Owing (Incl GST)	**$ 700.89**

The Decision

The Director of Resources of the Manawatu-Wanganui Regional Council (trading as **horizons.mw**) has considered this notified application. On .. December 2000 the Director, pursuant to delegated authority under Section 34 of the Resource Management Act grants Change No 2 to Discharge Permit 4926, pursuant to Section 105 and Section 127 of the Act, to Ruapehu District Council to change Condition 2 and add Condition 8 as follows:

Condition 2 of Discharge Permit 4926 shall now read:

2. **A wetland shall be constructed by 31 May 2001 in general accordance with Plans C 4926/2 A, B and C attached to and forming part of this consent.**

8. **The Permit Holder shall submit a report to horizons.mw's Team Leader Compliance by 16 February 2001, including a plan of the final wetland design, and an outline of the operation and maintenance of the wetland once completed. The plan shall include details of:**

   - **effluent – pretreatment;**
   - **plants – selection, establishment and ongoing care;**

- **inlet and outlet structures and water level, including maintenance and monitoring;**
- **fencing; and**
- **measures to be undertaken to avoid nuisances such as odour and insects.**

Construction of the wetland shall not commence until the report has been submitted and approved by horizons.mw's Team Leader Compliance.

B. The Director of Resources resolved that the Permit Holder shall pay $700.89 (Incl GST) being the actual and reasonable costs incurred with the processing of Resource Consent No. 4926 Change No. 2.

Reasons for this Decision

In making his decision on this application pursuant to Section 105(1)(c) of the Resource Management Act the Director of Resources had regard to matters as required by Section 104 of the Act. In particular the Director considered the actual and potential effects on the environment with granting Change No. 2.

The Director is satisfied that this change will not have any additional adverse effects that cannot be mitigated, to those authorised by the original activity, nor will they be inconsistent with the matters approved by affected parties in the original consultation.

The potential for adverse effects will be minimised provided the mitigation measures are complied with Condition No 8 is imposed to ensure that the wetland system is designed to operate effectively and reduce the effects of the discharge of treated effluent on the receiving waters.

The Director considered that the application for a change in conditions is not inconsistent with the requirements of Section 127(1) of the Act.

The Director is satisfied that the costs imposed under Section 36 of the Act are both fair and reasonable.

The Director is satisfied that with the conditions imposed, the activities authorised by this consent will not conflict with the provisions of the Regional Policy Statement for the Manawatu-Wanganui Region, the Proposed Land and Water Regional Plan, or the Transitional Regional Plan.

Brent Cowie
DIRECTOR OF RESOURCES

14 December 2000

For the purposes of clarity, the conditions of Discharge Permit 4926 now read:

1. Charges, set in accordance with Section 36(1)c of the Resource Management Act 1991 and Section 690 A of the Local Government Act 1974, shall be paid to the Regional Council for the carrying out of its functions in relation to the administration, monitoring and supervision of this resource consent, and for the carrying out of its functions under Section 35 (duty to gather information, monitor, and keep records) of the Act.

   Section 36(1)c of the Act provides that Council may from time to time fix charges payable by holders of resource consents. The procedure for setting administrative charges is governed by Section 36(2) of the Act and is currently carried out as part of the formulation of the Council's Annual Plan.

2. **A wetland shall be constructed by 31 May 2001 in general accordance with Plans C4926/2 A, B and C attached to and forming part of this consent.**

3. From the date of granting this consent and until the commissioning of the wetland the following conditions shall apply:

   (a) The organic matter in the discharge, as measured by the five day carbonaceous biochemical oxygen demand ($CBOD_5$), shall not exceed 70 g/m^3
   (b) The suspended solids as measured by the Whatman GF/C filter paper or equivalent levels in the effluent discharged shall not exceed 100 g/m^3
   (c) The waste discharge shall have a dissolved oxygen content of at least $2g/m^3$

4. Six months after the date of commissioning of the wetland conditions 3(a), (b) and (c) shall be replaced by:

   (a) The organic matter in the waste discharge from the wetland, as measured by the five day carbonaceous biochemical oxygen demand ($CBOD_5$), shall not exceed $30g/m^3$.
   (b) The suspended solids in the waste discharge from the wetland, as measured by the Whatman GF/C filter paper or equivalent, shall not exceed $30g/m^3$.
   (c) Effluent discharged to the wetland shall have a Dissolved Oxygen of $\geq 2g/m^3$.

5. Notwithstanding Conditions 3 and 4 above, when a water quality measurement is carried out at a site immediately upstream of the treated sewage outfall and this is compared to another measurement taken 50 metres downstream of the outfall then:

   a) the downstream dissolved oxygen shall not be reduced by more than 1 g/m^3.
   b) the downstream CBOD (as measured by the five day carbonaceous biochemical oxygen demand ($CBOD_5$ test) shall not be increased by more than 1g /m3.
   c) the downstream turbidity (NTU) shall not be increased by more than 2 NTU.
   d) the downstream total ammoniacal nitrogen (NH4-N) shall not be increased by more than 0.05 g/m3.

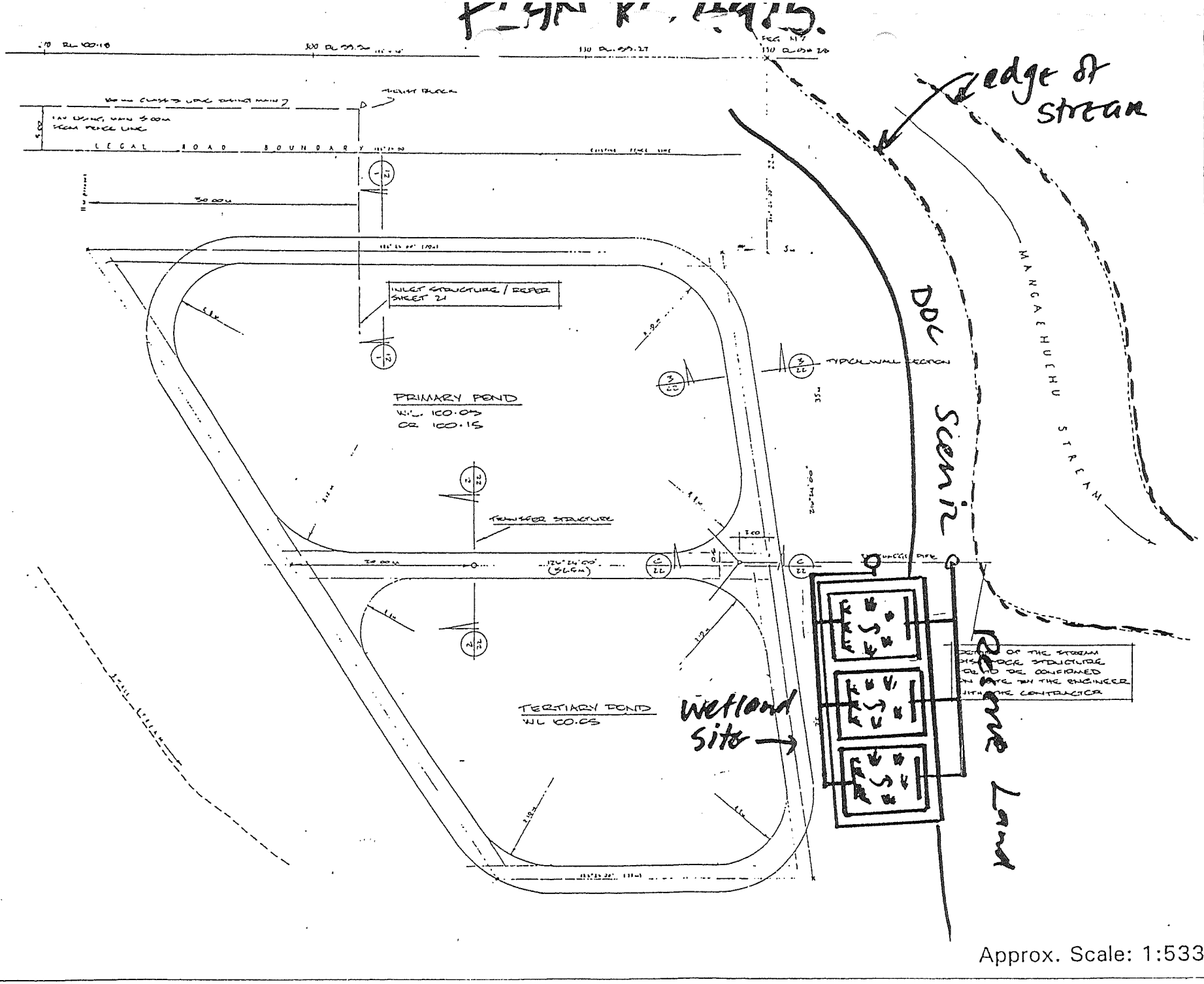
6. The Consent Holder shall install a suitable flow measuring device in the discharge line prior to the discharge to the wetland. This flow shall be logged over a twelve month period within the first three years of the granting of this consent.

7. Under the provisions of Section 128 of the Act the Manawatu-Wanganui Regional Council may review the conditions of this consent in July 1998 and July 2003 to deal with any adverse effects on the environment which may arise from the exercise of this consent and which it is appropriate to deal with at a later stage.

8. **The Permit Holder shall submit a report to horizons.mw's Team Leader Compliance by 16 February 2001, including a plan of the final wetland design, and an outline of the operation and maintenance of the wetland once completed. The plan shall include details of:**

- **effluent – pretreatment;**
- **plants – selection, establishment and ongoing care;**
- **inlet and outlet structures and water level, including maintenance and monitoring;**
- **fencing; and**
- **measures to be undertaken to avoid nuisances such as odour and insects.**

Construction of the wetland shall not commence until the report has been submitted and approved by horizons.mw's Team Leader Compliance.



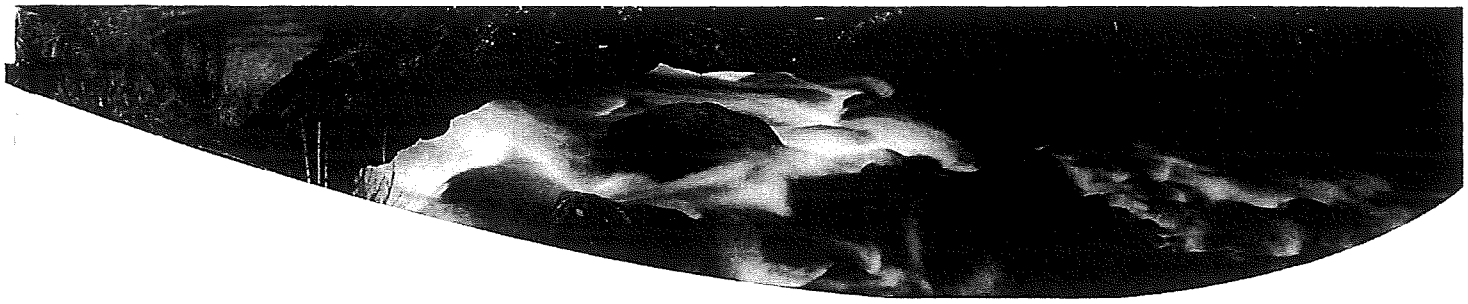
NOTES:

PAYNE SEWELL LTD
CONSULTING ENGINEERS · SURVEYORS · PLANNERS

OXIDATION POND
RANGATAUA TOWNSHIP

WAIMARINO COUNTY COUNCIL

SCALE 1:200		
THE CONTRACTOR SHALL CHECK ALL DIMENSIONS ON SITE		
DESIGNED DL SMART	DRAWN LOREEN CLIMPSON	CHECKED
APPROVED		DATE 5.88
SHEET 20 OF 26 SHEETS		
REV O	JOB No 0102172	



Compliance Inspection Report

Compliance Indicator yes ☑

no ☐

25 March 2012

Ruapehu District Council (Taumarunui)
Private Bag 1001
TAUMARUNUI 3946

File ref: 7/1/RDC
Consent number: 4926/2
RR

Attention: Anne Marie Westcott

Location: RANGATAUA SEWAGE TREATMENT PLANT NEI STREET RANGATAUA

Performance Assessment:

Did I comply with the conditions of my consent? Yes

A routine inspection of the Rangataua Sewage Treatment Plant (RSTP) on 11 October 2012. The purpose of this inspection was to assess compliance with resource consents 4926/2.

This report relates to the above inspection and information held on our files covering the period 9 September 2011 to 11 October 2012. Below are copies of the relevant consent conditions along with comments from the inspection relating to compliance.

GENERAL CONDITIONS APPLICABLE TO PERMITS 4926/2

1. *Charges, set in accordance with Section 36(1)c of the Resource Management Act 1991 and Section 690 A of the Local Government Act 1974, shall be paid to the Regional Council for the carrying out of its functions in relation to the administration, monitoring and supervision of this resource consent, and for the carrying out of its functions under Section 35 (duty to gather information, monitor, and keep records) of the Act.*

I am not aware of any outstanding invoices.
Comply

2. *A wetland shall be constructed by 31 May 2001 in general accordance with*

Plans C4926/2 A, B and C attached to and forming part of this consent.

At the time of the site inspection, a wetland had been constructed. This wetland was in general accordance with the plans attached as C4926/2 A,B and C.
Comply

3. *From the date of granting this consent and until the commissioning of the wetland the following conditions shall apply:*

   (a) The organic matter in the discharge, as measured by the five day carbonaceous biochemical oxygen demand ($CBOD_5$), shall not exceed 70 g/m^3
   (b) The suspended solids as measured by the Whatman GF/C filter paper or equivalent levels in the effluent discharged shall not exceed 100 g/m^3
   (c) The waste discharge shall have a dissolved oxygen content of at least 2g/m^3

The wetland has been commissioned and therefore these conditions are no longer applicable.
Not applicable

4. *Six months after the date of commissioning of the wetland conditions 3(a), (b) and (c) shall be replaced by:*

   (a) The organic matter in the waste discharge from the wetland, as measured by the five day carbonaceous biochemical oxygen demand ($CBOD_5$), shall not exceed 30g/m^3.

The highest scBOD5 level detected post ponds pre wetland during this assessment period was 7.3g/m^3. Therefore it is assumed that the scBOD5 concentration will be less
Complied

   (b) The suspended solids in the waste discharge from the wetland, as measured by the Whatman GF/C filter paper or equivalent, shall not exceed 30g/m^3.

The highest suspended solids concentration detected out of the ponds according to HRC database was 80g/m^3. The limits are based on post wetland and therefore this condition can not be assessed.
Not assessed

Complied

(c) *Effluent discharged to the wetland shall have a Dissolved Oxygen of ≥2g/m^3.*

No data available.
Not assessed

5. *Notwithstanding Conditions 3 and 4 above, when a water quality measurement is carried out at a site immediately upstream of the treated sewage outfall and this is compared to another measurement taken 50 metres downstream of the outfall then:*

a) *the downstream dissolved oxygen shall not be reduced by more than 1 g/m^3.*

No data available, previously no difference has been detected.
Not assessed

b) *the downstream CBOD (as measured by the five day carbonaceous biochemical oxygen demand (CBOD$_5$ test) shall not be increased by more than 1g /m3.*

When the upstream and downstream CBOD5 levels are compared during this assessment period no change was detected
Comply

c) *the downstream turbidity (NTU) shall not be increased by more than 2 NTU.*

Turbidity NTU does not exist, however turbidity EPA is the equivalent measure. The biggest change detected during this assessment period was 1.05 EPA (see table below)

Turbidity			
Date	Down Stream	Up Stream	Change
20-Sep-11	1.95	2.1	0.15
18-Oct-11	4	4	0
22-Nov-11	1.16	1.09	-0.07
13-Dec-11	1.12	0.73	-0.39
24-Jan-12	0.46	0.52	0.06
21-Feb-12	0.47	0.46	-0.01
20-Mar-12	3.49	3.68	0.19
10-Apr-12	1.63	0.58	-1.05
22-May-12	0.96	1.02	0.06
19-Jun-12	2.97	2.47	-0.5
17-Jul-12	6	6.8	0.8
21-Aug-12	2.6	3.6	1
18-Sep-12	1.6	2.12	0.52
16-Oct-12	0.544	0.645	0.101
20-Nov-12	0.786	0.416	-0.37
4-Dec-2012	1.24	1.29	0.05

Comply

d) *the downstream total ammoniacal nitrogen (NH4-N) shall not be increased by more than 0.05 g/m3.*

Ammonical Nitrogen			
Date	Down Stream	Up Stream	Change
20-Sep-11	0.005	0.005	0
18-Oct-11	0.007	0.008	0.001
22-Nov-11	0.007	0.019	0.012
13-Dec-11	0.005	0.005	0
24-Jan-12	0.007	0.005	-0.002
21-Feb-12	0.005	0.005	0
20-Mar-12	0.005	0.011	0.006
10-Apr-12	0.005	0.005	0
22-May-12	0.013	0.005	-0.008
19-Jun-12	0.023	0.006	-0.017
17-Jul-12	0.005	0.005	0
21-Aug-12	0.008	0.009	0.001
18-Sep-12	0.003	0.005	0.002
16-Oct-12	0.007	0.006	-0.001
20-Nov-12	0.003	0.001	-0.002
4-Dec-2012	0.004	0	-0.004

The largest negative change detected during this assessment period was 0.017g/m^3.

Comply

6. *The Consent Holder shall install a suitable flow measuring device in the discharge line prior to the discharge to the wetland. This flow shall be logged over a twelve month period within the first three years of the granting of this consent.*

The flows coming out of the Rangataua STP are measured by a suitable measuring device.

Comply

7. *Under the provisions of Section 128 of the Act the Manawatu-Wanganui Regional Council may review the conditions of this consent in July 1998 and July 2003 to deal with any adverse effects on the environment which may arise from the exercise of this consent and which it is appropriate to deal with at a later stage.*

NO review was initiated during this assessment period.
Not applicable

8. *The Permit Holder shall submit a report to horizons.mw's Team Leader Compliance by 16 February 2001, including a plan of the final wetland design, and an outline of the operation and maintenance of the wetland once completed. The plan shall include details of:*

- *effluent – pre-treatment;*
- *plants – selection, establishment and on going care;*
- *inlet and outlet structures and water level, including maintenance and monitoring;*
- *fencing; and*
- *measures to be undertaken to avoid nuisances such as odour and insects.*

Construction of the wetland shall not commence until the report has been submitted and approved by horizons.mw's Team Leader Compliance.

On 7 March 2001 Horizons Regional Council (HRC) received the above report
On 9 March 2011 HRC sent Ruapahu District Council (RDC) a letter advising that the submitted report satisfied the requirements of condition 8 of the consent.
Comply

Recommendations:

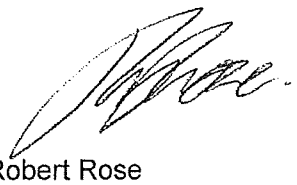
Thank you for complying with the above conditions.

As discussed in previous reports it is important to get a new consent. The current consent expired on 20 December 2005. The following upgrades may wish to be considered and could be done with minimal cost:

- Divert the artificial waterway
- Extend the wetland
- Fence the wetland area

If you have any queries about this report, please contact me on 0508 800 800 extension 862, 0212477341 or email Robert.Rose@horizons.govt.nz.

Yours sincerely



Robert Rose

ENVIRONMENTAL PROTECTION OFFICER

Inspection details:

Officer: Robert Rose

Inspection type: Routine

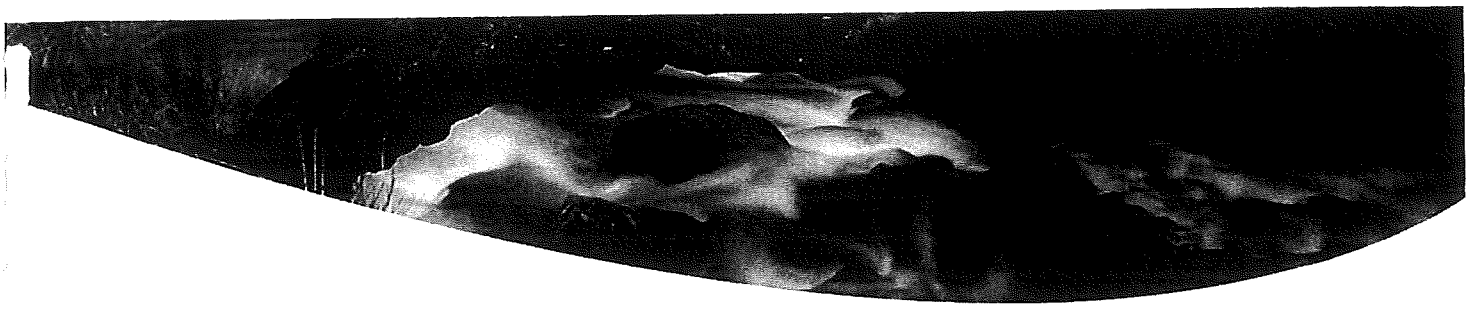
Consent no: 4926

Inspection time: 09/09/2011 15:00

Cost of inspection (excl. GST): $0.00

Consent type: Discharge Permit

horizons regional council
11-15 Victoria Avenue
Private Bag 11 025
Manawatu Mail Centre
Palmerston North 4442
T 0508 800 800
F 06 952 2929
help@horizons.govt.nz
www.horizons.govt.nz



Compliance Inspection Report

20 June 2013

Compliance Indicator yes ☑ no ☐

Ruapehu District Council (Taumarunui)

Private Bag 1001
TAUMARUNUI 3946

File 7/1/RDC

Consent 4926/2

RUAPEHU DISTRICT COUNCIL No 1
RECEIVED
25 JUN 2013
REF AMW
FILE 527-0007
DOC
OPENED BY

53 595 115 A3

Attention: Anne-Marie Westcott

Location: RANGATAUA SEWAGE TREATMENT PLANT NEI STREET RANGATAUA

☑ FILE ☐ E.Y.I ☐ COPY ☑ REPLY

Performance Assessment:

Did I comply with the conditions of my consent? Yes

Dear Anne Marie

On 19 June 2013 I visited the Rangataua Wastewater Treatment Plant (RWWTP). The purpose of this inspection was to assess compliance with resource consents 4926/2.

This report relates to the above inspection and information held on our files covering the period 2 May 2012 to 19 June 2013. Below are copies of the relevant consent conditions along with comments from the inspection relating to compliance.

GENERAL CONDITIONS APPLICABLE TO PERMITS 4926/2

1. *Charges, set in accordance with Section 36(1)c of the Resource Management Act 1991 and Section 690 A of the Local Government Act 1974, shall be paid to the Regional Council for the carrying out of its functions in relation to the administration, monitoring and supervision of this resource consent, and for the carrying out of its functions under Section 35 (duty to gather information, monitor, and keep records) of the Act.*

horizons regional council

I am not aware of any outstanding invoices.

Condition Compliance Status = Comply

2. *A wetland shall be constructed by 31 May 2001 in general accordance with Plans C4926/2 A, B and C attached to and forming part of this consent.*

At the time of the site inspection, a wetland had been constructed. This wetland was in general accordance with the plans attached as C4926/2 A, B and C.

Condition Compliance Status = Comply

3. *From the date of granting this consent and until the commissioning of the wetland the following conditions shall apply:*

   (a) The organic matter in the discharge, as measured by the five day carbonaceous biochemical oxygen demand ($CBOD_5$), shall not exceed 70 g/m^3
   (b) The suspended solids as measured by the Whatman GF/C filter paper or equivalent levels in the effluent discharged shall not exceed 100 g/m^3
   (c) The waste discharge shall have a dissolved oxygen content of at least 2g/m^3

The wetland has been commissioned and therefore these conditions are no longer applicable.

Condition Compliance Status = Not applicable

4. *Six months after the date of commissioning of the wetland conditions 3(a), (b) and (c) shall be replaced by:*

   (a) The organic matter in the waste discharge from the wetland, as measured by the five day carbonaceous biochemical oxygen demand ($CBOD_5$), shall not exceed 30g/m^3.

During this assessment the highest CBOD5 level detected prior to entering the wetland was 5.1g/m^3. Given that the wetland will provide additional treatment this condition has been given a fully compliant rating.

Condition Compliance Status = Comply

(b) *The suspended solids in the waste discharge from the wetland, as measured by the Whatman GF/C filter paper or equivalent, shall not exceed 30g/m^3.*

During this assessment period the highest Total Suspended Solids concentration detected prior to entering the wetland was 75g/m3 with an average of 32.2g/m3. It should be noted that these samples have not been filtered. Further treatment within the wetland will occur. As a result HRC are unable to assess this condition.

Condition Compliance Status = Not assessed

(c) *Effluent discharged to the wetland shall have a Dissolved Oxygen of ≥2g/m^3.*

HRC does not measure the Dissolved Oxygen concentration of the wastewater.

Condition Compliance Status = Unable to assess

5. *Notwithstanding Conditions 3 and 4 above, when a water quality measurement is carried out at a site immediately upstream of the treated sewage outfall and this is compared to another measurement taken 50 metres downstream of the outfall then:*

a) *the downstream dissolved oxygen shall not be reduced by more than 1 g/m^3.*

During this assessment period the Dissolved Oxygen concentration on average increased by 0.3g/m^3. The maximum reduction recorded during this assessment period was 0.25g/m^3.

Condition Compliance Status = Comply

b) *the downstream CBOD (as measured by the five day carbonaceous biochemical oxygen demand ($CBOD_5$ test) shall not be increased by more than 1g /m3.*

During this assessment period the sCBOD did not change between the up stream and downstream sampling points. HRC does not analyse the samples for Total CBOD5

Condition Compliance Status = Unable to assess

c) *the downstream turbidity (NTU) shall not be increased by more than 2 NTU.*

The maximum turbidity increase during this assessment period was 0.3 NTU.

Condition Compliance Status = Comply

d) *the downstream total ammoniacal nitrogen (NH4-N) shall not be increased by more than 0.05 g/m3.*

During this assessment period the largest recorded increase in ammoniacal nitrogen was 0.017g/m^3.

Condition Compliance Status = Comply

6. *The Consent Holder shall install a suitable flow measuring device in the discharge line prior to the discharge to the wetland. This flow shall be logged over a twelve month period within the first three years of the granting of this consent.*

The flows coming out of the Rangataua STP are measured by a suitable measuring device. The application to replace this consent will need to have details of the flow meter.

Condition Compliance Status = Comply

7. *Under the provisions of Section 128 of the Act the Manawatu-Wanganui Regional Council may review the conditions of this consent in July 1998 and July 2003 to deal with any adverse effects on the environment which may arise from the exercise of this consent and which it is appropriate to deal with at a later stage.*

The above specified dates do not coincide with this assessment period and therefore this condition is not applicable.

Condition Compliance Status = Not applicable

8. *The Permit Holder shall submit a report to horizons.mw's Team Leader Compliance by 16 February 2001, including a plan of the final wetland design, and an outline of the operation and maintenance of the wetland once completed. The plan shall include details of:*

- *effluent – pre-treatment;*
- *plants – selection, establishment and on going care;*
- *inlet and outlet structures and water level, including maintenance and monitoring;*
- *fencing; and*
- *measures to be undertaken to avoid nuisances such as odour and insects.*

Construction of the wetland shall not commence until the report has been submitted and approved by horizons.mw's Team Leader Compliance.

On 7 March 2001 Horizons Regional Council (HRC) received the above report. On 9 March 2011 HRC sent Ruapahu District Council (RDC) a letter advising that the submitted report satisfied the requirements of condition 8 of the consent.

Condition Compliance Status = Comply

Other Matters

The road side drain has been extended to reduce the effects of stormwater on the wastewater wetlands. RDC may want to consider the risk of erosion in the bottom of this drain. If erosion is likely to be an issue it should be evi

RECOMMENDATIONS

Thank you for complying with the above conditions.

As discussed it is important to get the application in to renew this consent. In support of the application RDC may wish to take some samples from the drain prior to entering the stream.

If you have any queries about this report, please contact me on 0508 800 800 extension 862, 0212477341 or email Robert.Rose@horizons.govt.nz.

Regards

Robert Rose

ENVIRONMENTAL PROTECTION OFFICER

Inspection details:

horizons regional council

Appendix C Water Quality Parameters

Receiving water quality data

u/s Rangataua STP													
	Date	Time	BDISC	BP	CBOD5-2	COND-S	DO	DO %	DRP	E COLI	ENT	FC	FLOW
Sample No	Collected	Collected	m	mbar	g/m3	mS/m @ 25C	g/m3	%	g/m3	MPN/100mL	MPN/100mL	MPN/100mL	m3/s
950414	31/03/1995	14:00											
960685	8/07/1996	11:00	*		?<0.5	8.9	13.3		0.018		4		
960788	5/08/1996	12:20	*		<0.5	12	11.8		0.005		<2		
961215	4/11/1996	9:45			<0.5	9.9	11.7		0.012		7		
970152	3/02/1997	9:50			<0.5	11.5	10.7		0.004		50		
970551	5/05/1997	11:00	*		<0.5	9.7	12.2		0.02		14		
971047	8/09/1997	12:25	4.2		<0.5	9.2	11.8		0.023		13		
971360	1/12/1997	10:25	*		<0.5	3.2	11.2		<0.001		50		
980354	9/03/1998	10:10	*		<0.5	8.8	10.6		0.005		50		
980864	15/06/1998	10:30			<0.5	7.1	11.6		0.011		8		
989728	12/11/2002	9:35	1.89		<0.5	6.8	12.4		0.014	N/A			
990205	20/02/2003	12:05	3		<0.5	7.7	10.47		0.026	60		54	
997935	9/08/2007	14:15	2.04		<3	46	15.06		0.016	9			0.955
998085	6/09/2007	14:15	2.1		<1	63	14.63		0.019	10			0.752
998236	4/10/2007	12:50	2.1		<1	58	15.36		0.018	<10			0.708
998444	8/11/2007	12:10	2.2		<1	55	10.74		0.011	100			0.848
998712	6/12/2007	11:30	<0.1		<1	28	10.9		0.007	890			
998966	10/01/2008	13:00	2.4		<1	68	12.94		0.022	20			0.609

999231	7/02/2008	12:25	3.3		<1	75	12.13		0.035	365			0.305
999501	6/03/2008	11:45	3.3		<1	53	10.33		0.006	150			0.618
999824	3/04/2008	11:50	3		<1	78	11.33		0.045	435			0.26
1000185	8/05/2008	12:45	3.5		<1	56	11.58		0.024	20.2			0.5405
1000407	5/06/2008	12:40	3.5		<1	68	11.88		0.035	10.9			0.355
1000622	3/07/2008	13:00	4.55		2	95	10.97		0.01	14.8			
1000995	14/08/2008	11:45	1.4		<1	81	18.76		0.006	44.8			
1001246	11/09/2008	12:00	0.3		<1	38	21.02		0.009	137.4			
1001492	16/10/2008	10:05	1.2		<1	93	14.02		0.014	1223			
1001819	13/11/2008	10:31	1.6		<1	85	10.09		0.024	9.8			
1002028	11/12/2008	9:45	1.9		<1	74	10.05		0.02	35.4			
1002232	21/01/2009	10:40	2.9		<1	211	11.67		0.024	73			
1002324	4/02/2009	10:25	4.2		<1	118	9.87		0.031	58			
1002614	12/03/2009	11:05	7.3		1				0.025	32			
1002742	2/04/2009	11:30	6.6		<1	125	11.71		0.04	19			
1003010	13/05/2009	11:35	3.7		<1	90	11.79		0.031	15.5			
1003126	4/06/2009	11:50	3.9		1	79	12.61		0.031	4			
1003445	16/07/2009	11:50	3.6		<1	50	12.11		0.032	8			
1003743	2/09/2009	11:20	2.3	940	<1		10.75	88.1	0.013	22			
1003968	7/10/2009	11:10	2.1	939	<1		10.33	80.3	0.02	30			
1004297	11/11/2009	10:15	3.1	930	<1		10.39	86.9	0.03	17			
1004918	15/12/2009	10:20	1.3	1000	<1		9.93	97.6	0.021	28.4			
1005136	26/01/2010	9:20	0.2	943	<1		10.62	96.5	0.009	43.4			
1005428	18/02/2010	9:35	1.1	932	<1		9.95	93.6	0.022	3			
1005559	9/03/2010	9:25	3.6	942	<1		11.01	93.2	0.038	161			
1006005	20/04/2010	10:55	3.6	938	<1		10.17	87.6	0.054	74			
1006341	18/05/2010	10:30	3.1	932	<1		11.02	89.2	0.03	88.5			

u/s Rangataua STP																
	Date	NH4	NNN	NO2-1	NO2-3	NO3	PH	POM	SCOND	SS	TEMP	TN	TON-1	TP	TURB	VS-1
Sample No	Collected	g/m3	g/m3 NO3-N	g/m3	g/m3	g/m3	pH	g/m3	uS/cm	g/m3	C	g/m3	g/m3	g/m3	NTU	g/m3
950414	31/03/1995														1.3	
960685	8/07/1996	<0.01		<0.001		0.16	7.5			<1	3.8				0.85	
960788	5/08/1996	<0.01		<0.001		0.1	7.2			4	7.6				1.7	
961215	4/11/1996	0.01		<0.001		0.12	7.4			2	7.2				1.2	
970152	3/02/1997	<0.01		<0.001		0.08	7.3			8	11.2				4	2
970551	5/05/1997	<0.01		<0.001		0.12	7.4			7	7				1.7	3
971047	8/09/1997	<0.01		<0.001		0.11	7.7			2	7.4				0.85	<5
971360	1/12/1997	<0.01		<0.001		0.02	6.2			343	8.3				115	18
980354	9/03/1998	<0.01		<0.001		0.08	7.2			16	11.9				6.2	3
980864	15/06/1998	<0.01		<0.001		0.06	7.1			67	7				14	15
989728	12/11/2002	0.012				0.2	7.4	<3			6.7				2.1	
990205	20/02/2003	0.012				0.1	7.5	<3			11.5				1	
997935	9/08/2007	<0.01				0.12	6.99	<3		<3	6.95	0.1		0.03	0.914	
998085	6/09/2007	<0.01				0.17	6.71	<3		<3	7.35	0.14		0.03	1.07	
998236	4/10/2007	<0.01	0.109				7.16	<3		<3	7.02	0.12		0.03	1.01	
998444	8/11/2007	<0.01	0.099				7.27	<3		4	10.14	0.07		0.02	1.65	
998712	6/12/2007	<0.01	0.039				7.04	<3		63	11.01	0.22		0.05	11.8	
998966	10/01/2008	<0.01	0.069				7.21	<3		3	15.99	0.09		0.03	0.838	
999231	7/02/2008	<0.01	0.095				7.51	<3		2	12.69	0.11		0.05	1.14	
999501	6/03/2008	<0.005	0.059				7.54	<3		3	10.43	0.09		0.03	0.707	
999824	3/04/2008	0.023	0.111				7.9	<3		1	9.88	0.26		0.07	0.942	
1000185	8/05/2008	0.011	0.093				6.9	<3		2	6.67	0.11		0.03	1.05	
1000407	5/06/2008	0.011	0.111				7.12	<3		2	5.52	0.13		0.04	0.905	
1000622	3/07/2008	<0.005	0.04				6.69	<3		9	6.45	0.11		0.03	3.53	
1000995	14/08/2008	<0.005	0.081				6.92	<3		5	5.54	0.19		0.03	1.48	
1001246	11/09/2008	<0.005	0.031				6.49	8		43	6.55	0.26		0.05	10.3	
1001492	16/10/2008	0.005	0.073				7.34	<3		4	8.56	0.1		0.04	1.08	
1001819	13/11/2008	0.006	0.059				6.93	<3		3	11.39	0.09		0.02	0.964	

1002028	11/12/2008	0.005	0.04				7.05	<3		3	11.23	0.09		0.02	1.09	
1002232	21/01/2009	<0.005	0.056				7.01	<3		2	10.45	0.08		0.04	1.13	
1002324	4/02/2009	<0.005	0.058				6.97	<3		2	12.73	0.06		0.04	1.27	
1002614	12/03/2009	<0.005	0.059					<3		3	7.9	0.08		0.03	1.42	
1002742	2/04/2009	<0.005	0.091				7.44	<3		1	6.71	0.11		0.07	0.93	
1003010	13/05/2009	<0.005			<0.005	0.067	6.72			2	6.03	0.05	0.071	0.04	0.957	<3
1003126	4/06/2009	0.005			<0.005	0.092	7.01			1	3.51	0.14	0.096	0.05	0.881	<3
1003445	16/07/2009	0.008			<0.005	0.045	7.33			2	6.43	0.12	0.049	0.05	1.03	<3
1003743	2/09/2009	0.007			<0.005	0.045	7.15		57.7	10	6.7	0.18	0.049	0.02	1.65	<3
1003968	7/10/2009	<0.005			<0.005	0.062	7.28		75.8	2	4.7	0.09	0.066	0.02	1.48	<3
1004297	11/11/2009	0.007			<0.005	0.07	7.46		93.4	2	7.6	<0.05	0.074	0.04	0.451	<3
1004918	15/12/2009	0.024			<0.005	0.03	7.09		54.1	4	10.6	<0.05	0.034	0.02	1.08	<3
1005136	26/01/2010	<0.005			<0.005	<0.005	6.98		44.4	17	11	<0.05	0.008	0.03	30.5	<3
1005428	18/02/2010	<0.005			<0.005	0.028	7.29		62.2	3	12.7	0.05	0.032	0.03	0.801	<3
1005559	9/03/2010	<0.005			<0.005	0.063	7.95		92.4	3	8.3	0.1	0.067	0.05	0.796	<3
1006005	20/04/2010	<0.01			<0.002	0.05	7.49		93.1	1	8.8	0.1	0.0519	0.05	0.578	<3
1006341	18/05/2010	0.006			<0.005	0.07	7.49		94.1	7	6.3	0.12	0.074	0.05	2.34	<3

Mangaehuehu at u/s Rangataua STP

Date	DRP (HRC)	Ammoniacal-N (HRC)	TSS (HRC)	TDP Phosphate (HRC)	TN (HRC)	TON (HRC)	Nitrate (HRC)	Nitrite (HRC)	TP (HRC)	Turbidity EPA (HRC)	Black Disc (HRC)	sCBOD5 (HRC)	E. coli by MPN (HRC)	Volatile Matter (HRC)	Total Coliforms (HRC)	Field Temperature (HRC)	Field Baro Pressure (HRC)	Field DO Saturation (HRC)	Field DO Concentration (HRC)	Field Conductivity (HRC)	Field pH (HRC)	Turbidity ISO-FAU (HRC)	SSC (HRC)
24/05/2011 10:20	0.007	<0.0050	2		0.07	0.097	0.095	<0.0020	0.018	1.42		<1.000	5	<1.000	326	6.9	942.7	99.3	11.25	81.3	7.22		5
21/06/2011 10:40	0.017	0.007	3		0.1	0.089	0.087	<0.0020	0.023	1.32	3.6	<1.000	77	3	291	5.1	931.8	101.3	11.86	71	8.17		4
19/07/2011 10:20	0.018	0.01	3		0.16	0.116	0.114	<0.0020	0.023	1.32		<1.000	26	3	326	3.6	950.2	98.2	12.2	85.6	7.33		<1.0000
23/08/2011 10:45	0.017	<0.0050	<1.000		0.21	0.192	0.19	<0.0020	0.024	1.04	2.3		3	<1.000	162	4.5	953.5	103	12.53	93.5	8.04		<2.0000
20/09/2011 10:40	0.015	<0.0050	<1.000		0.2	0.104	0.102	<0.0020	0.028	2.1	1.6		35	<1.000	1553	8.1	934.7	100.4	10.93	64.1	7.41		2
18/10/2011 9:15	0.01	0.008	26		0.54	0.05	0.048	<0.0020	0.021	4	0.3		25	5	548	7.2	925.9	116.6	12.75	38.1	7.33		13
22/11/2011 9:40	0.014	0.019	4		0.23	0.071	0.069	<0.0020	0.021	1.09	1.95		10	3	310	7.7	939.7	102.1	11.3	51	8.72		8
13/12/2011 9:35	0.013	<0.0050	4		0.074	0.07	0.061	0.009	0.011	0.73			13	2.5	770	11.1	940.7	107.2	10.93	50.9	7.28		5.6
24/01/2012 9:35	0.019	0.005	<1.000		0.19	0.13	0.13	<0.0020	0.014	0.52	3.1		73	<1.000	580	8.6	942.4	103.1	11.18	75.3	7.78		1.3
21/02/2012 9:25	0.014	<0.0050	1.4		0.14	0.14	0.14	<0.0020	0.023	0.46	2.6		28	1.4	1700	9.7	946.1	98.3	9.91	104.2	8.21		2.7
20/03/2012 9:25	0.009	0.011	8.8		0.14	0.051	0.051	<0.0020	0.022	3.68	0.85		51	6.4	1000	9.7	934.9	100.4	10.54	50.5	7.41		7.7
10/04/2012 10:40	0.03	<0.0050	3.4		0.2	0.17	0.17	<0.0020	0.03	0.58	4		11	3.4	650	9.3	942.2	96.7	11.1	95.4	8.01		<1.4000
22/05/2012 11:10	0.024	<0.0050	1		0.19	0.17	0.17	<0.0020	0.068	1.02	3.45		9	1	340	3.7	944.5	107.4	13.21	89.5	7.57		4
19/06/2012 10:25	0.01	0.006	5.6		0.14	<0.0020	<0.0020	<0.0020	0.032	2.47	3		27	4.2	610	6.5	924.4	93.1	10.69	56.2	7.3		2
17/07/2012 10:45	0.007	<0.0050	66		0.16	0.072	0.069	0.0028	0.021	6.8	2		17	8.6	300	5.3	939.8	95.3	11.23	43.5	7.13		230
21/08/2012 10:40	0.012	0.009	13	0.011	0.18	0.12	0.12	<0.0020	0.017	3.6	2.5		19	2.8	580	6.5	931.4	96.7	10.94	64.2	7.4		1.9
18/09/2012 10:50	0.02	0.005	41	0.019	0.237	0.1021	0.0983	0.0038	0.033	2.12	1.6		8	3		6.2	943.2	97.5	11.24	56.8	7.38		22
16/10/2012 10:05	0.036	0.006	0	0.042	0.22	0.0258	0.0248	0.001	0.042	0.64	2.5		4	0		6.5	935.4	100.2	11.38	68.8	7.44		1
20/11/2012 10:00	0.026	0.001	8	0.027	0.186	0.0761	0.0705	0.0056	0.028	0.42	3.3		16	1		8.5	941.5	103.1	11.21	74	7.6		5
4/12/2012 9:35	0.019	0	3	0.021	0.1	0.0304	0.0283	0.0021	0.02	1.29	1		16	0		8.4	934.5	100	10.81	52.8	7.27		4
22/01/2013 10:45	0.007	0	10	0.008	0.195	0.043	0.0398	0.0032	0.028	1.43	2.2		58	1		13	945.4	96.3	9.47	74.2	7.49		3

Downstream

	Date	Time	BDISC	BP	CBOD5-2	CBOD5-3	CBOD5F-1	COND_US	COND-S	DO	DO %	DO	DRP	E COLI	ENT	FLOW
Sample No	Collected	Collected	m	mbar	g/m3	g/m3	g/m3	uS/cm	mS/m @ 25C	g/m3	%	mg/l	g/m3	mpn/100mL	MPN/100mL	m3/s
950415	31/03/1995	14:10														
960686	8/07/1996	11:05	*		?<0.5			8.9		13.3			0.02		<2	
960789	5/08/1996	12:25	*		<0.5			12.1		12			0.01		<2	
961217	4/11/1996	10:00			<0.5			9.9		11.5			0.01		13	
970154	3/02/1997	10:05			<0.5			11.5		10.7			0		11	
970553	5/05/1997	11:15	*		<0.5			9.8		12.3			0.02		7	
971049	8/09/1997	12:50	3.6		<0.5			9.1		11.8			0.02		17	
971362	1/12/1997	10:30	*		<0.5			3.1		11.9			<0.001		80	
980355	9/03/1998	10:25	*		<0.5			8.8		10.4			0.01		80	
980866	15/06/1998	10:45			<0.5			7.1		11.6			0.01		<2	
989729	12/11/2002	10:10	2.05		0.5			6.9		12			0.01			
990203	20/02/2003	11:45	3.37		0.8			7.5		10.44			0.02	50		
997936	9/08/2007	15:10	1.92					46		14.79			0.02	15		
998086	6/09/2007	15:10	1.9		<3			64		14.33			0.02	30		
998235	4/10/2007	12:40	1.9		<1			57		15.92			0.02	<10		
998445	8/11/2007	12:25	2.3		<1			55		10.38			<0.005	175		
998713	6/12/2007	11:50	<0.1		<1			32		11.01			0.01	175		
998967	10/01/2008	13:20	2.2		<1			68		12.98			0.02	10		
999232	7/02/2008	12:40	2.4		<1			74		12.06			0.04	520		
999502	6/03/2008	12:30	2.5		<1			55		9.96			0.01	150		
999825	3/04/2008	12:35	3		<1			78		11.44			0.02	530		
1000186	8/05/2008	12:22	3.1		<1			55		12.05			0.02	30.6		
1000408	5/06/2008	13:20	3		<1			68		11.65			0.04	41.3		
1000623	3/07/2008	12:45	4.475		<1			72		11.22			0.01	8.5		
1000996	14/08/2008	11:20	1.4		1			70		21.39			0.01	58.3		
1001247	11/09/2008	12:15	0.3		<1			39		22.04			0.01	125.9		
1001493	16/10/2008	9:41	1.3		<1			70		13.01			0.03	8.6		
1001820	13/11/2008	10:49	1.6		<1			112		10.13			0.02	6.3		
1002029	11/12/2008	10:10	1.9		<1			109		9.71			0.02	35		
1002233	21/01/2009	11:05	2.8		<1			307		12.11			0.02	63		
1002325	4/02/2009	10:40	4.9		<1			227		8.97			0.03	58		
1002615	12/03/2009	11:25	6		<1								0.03	26		

1002743	2/04/2009	11:50	6.5		<1			203		10.71			0.04	17		
1003011	13/05/2009	11:55	4.1		<1			114		11.61			0.03	15		
1003127	4/06/2009	12:05	3.3		<1			81		11.94			0.03	6		
1003446	16/07/2009	12:15	3.1		<1			54		12.01			0.03	3		
1003744	2/09/2009	11:40	2.1	939.7	<1			84.6			94.6	11.71	0.01	21		
1003969	7/10/2009	10:50	2.1	940.1	<1			81.6			81.1	10.69	0.02	32		
1004298	11/11/2009	10:35	3.1	931.1	<1			96.1			88.4	10.61	0.03	11		
1004919	15/12/2009	10:40	1.2	1000.1	<1			86.9			94.1	9.46	0.02	4		
1005137	26/01/2010	9:40	0.3	944.6	<1			44.5			94.9	10.47	0.01	308		
1005429	18/02/2010	9:50	1.3	932.6	<1			67.6			91.9	9.81	0.02	91		
1005560	9/03/2010	9:45	2.9	944.6	<1			114.6			81.9	9.02	0.04	154		
1006006	20/04/2010	11:10	3.1	937.7	<1			112.1			81.4	8.61	0.06	93		
1006342	18/05/2010	11:15	2.6	938.1	<1			110.6			86.4	10.11	0.03	86		

NH4	NNN	NO2-1	NO2-3	NO3	NO3-4	PH	POM	SCOND	SS	TEMP	TN	TON-1	TP	TURB	VS-1
g/m3	g/m3	g/m3	g/m3	g/m3	g/m3	pH	g/m3	uS/cm	g/m3	C	g/m3	g/m3	g/m3	NTU	g/m3
														1.4	
<0.01		<0.001		0.16		7.5			<1	3.8				0.95	
<0.01		<0.001		0.11		7.2			6	7.6				2	
<0.01		<0.001		0.12		7.4			2	6.3				1.2	
<0.01		<0.001		0.08		7.3			8	11.5				4	2
<0.01		<0.001		0.12		7.4			8	7.1				2	2
<0.01		<0.001		0.1		7.6			2	7.7				0.9	<5
<0.01		<0.001		0.02		6.1			344	8.2				115	40
<0.01		<0.001		0.08		7.2			16	12.1				6.4	3
0.02		<0.001		0.06		7.1			62	7				10	11
0.013				0.2		7.5	3			6.8				1.9	
0.012				0.1		7.2	<3			11.3				1.3	
<0.01				0.12		6.87	31		55	7.05	0.11		0.028	2.49	
<0.01				0.18		7.02	<3		<3	7.5	0.15		0.029	1.37	
<0.005	0.1011					7.26	<3		3	6.26	0.17		0.026	1.6	
<0.01	0.101					7.1	<3		3	10.03	0.13		0.025	1.8	
<0.01	0.021					6.41	10		64	11.02	0.19		0.044	10.1	
<0.01	0.064					7.19	<3		2	15.72	0.08		0.032	1.02	
<0.01	0.092					7.17	<3		1	12.01	0.1		0.047	1.12	
0.006	0.056					6.15	<3		3	10.95	0.1		0.032	0.884	
0.01	0.098					8.15	<3		2	9.96	0.14		0.052	1.13	
0.01	0.105					6.98	<3		2	6	0.16		0.028	1.18	
0.009	0.105					7.2	<3		4	5.75	0.15		0.036	1.05	
0.022	0.052					6.82	<3		4	6.32	0.12		0.025	1.17	
0.007	0.109					7.05	<3		7	5.49	0.19		0.029	2.16	
<0.005	0.035					6.77	6		34	6.61	0.24		0.043	9.06	
0.055	0.086					7.22	<3		4	8.55	0.12		0.041	0.748	
<0.005	0.058					7.01	<3		3	11.61	0.09		0.021	0.797	
<0.005	0.04					6.91	<3		3	11.51	0.08		0.024	1.04	
<0.005	0.06					7.06	<3		2	10.39	0.08		0.046	1.15	
<0.005	0.048					7.01	<3		4	12.71	0.05		0.041	1.32	
<0.005	0.058						<3		3	7.6	0.08		0.017	1.17	
<0.005	0.095					7.51	<3		1	6.71	0.11		0.06	0.646	
0.007		<0.005		0.077		6.49			3	6.29	0.05	0.081	0.038	0.658	<3

<0.005		<0.005		0.093		7.11			2	3.61	0.13	0.097	0.048	1.13	<3
0.008		<0.005		0.041		7.31			2	6.51	0.11	0.045	0.047	0.987	<3
0.006		<0.005		0.051		7.02			12	6.8	0.18	0.055	0.023	1.6	<3
<0.005		<0.005		0.088		7.21			3	4.7	0.08	0.092	0.024	1.33	<3
0.006		<0.005		0.079		7.41			2	7.7	<0.05	0.083	0.034	0.552	<3
<0.005		<0.005		0.001		7.08			3	10.7	<0.05	0.005	0.021	0.752	<3
0.008		<0.005		<0.005		6.91			19	11.1	0.06	0.008	0.028	5.24	<3
<0.005		<0.005		0.029		7.16			2	12.8	0.06	0.033	0.029	0.914	<3
<0.005		<0.005		0.057		7.69			1	8.7	0.09	0.061	0.048	0.54	<3
<0.01		<0.002		0.05		7.51			<1	8.9	0.11	0.0519	0.052	0.838	<3
0.005		<0.005		0.072		7.51			25	6.6	0.11	0.076	0.044	1.98	4

Mangaehuehu at d/s Rangataua STP

Date	DRP (HRC)	Ammoniacal-N (HRC)	TSS (HRC)	TDP Phosphate (HRC)	TN (HRC)	TON (HRC)	Nitrate (HRC)	Nitrite (HRC)	TP (HRC)	Turbidity EPA (HRC)	Black Disc (HRC)	sCBOD5 (HRC)	E. coli by MPN (HRC)	Volatile Matter (HRC)	Total Coliforms (HRC)	Field Temperature (HRC)	Field Baro Pressure (HRC)	Field DO Saturation (HRC)	Field DO Concentration (HRC)	Field Conductivity (HRC)	Field pH (HRC)	Turbidity ISO-FAU (HRC)	SSC (HRC)
24/05/2011 10:55	0.007	<0.0050	2		0.07	0.101	0.099	<0.0020	0.019	1.4		<1.000	5	<1.000	435	7	943	100.4	11.34	81.6	7.3		6
21/06/2011 11:20	0.017	0.006	2		0.14	0.088	0.086	<0.0020	0.026	1.05	1.9	<1.000	32	2	108	6.1	933.2	98.7	11.41	83.2	8.01		<1.0000
19/07/2011 10:52	0.017	0.088	3		0.19	0.155	0.153	<0.0020	0.024	1.56		<1.000	35	3	228	3.7	951.1	96.2	11.92	87.6	7.37		<1.0000
23/08/2011 11:00	0.017	<0.0050	<1.000		0.22	0.191	0.189	<0.0020	0.023	1.08	1.9		3	<1.000	225	4.7	954.1	101.6	12.49	116.4	7.91		<2.0000
20/09/2011 10:55	0.014	<0.0050	5		0.21	0.105	0.103	<0.0020	0.029	1.95	1.3		21	5	866	8.3	934.6	99.1	10.86	79.3	7.61		2
18/10/2011 9:35	0.008	0.007	27		0.58	0.054	0.052	<0.0020	0.021	4	0.2		30	7	248	10.6	925	95.2	9.68	26.3	7.09		24
22/11/2011 10:15	0.015	0.007	5		0.08	0.072	0.07	<0.0020	0.017	1.16	1.4		15	<1.000	330	7.9	940.5	102.9	11.34	51.7	8.37		7
13/12/2011 10:10	0.013	<0.0050	7.5		0.078	0.072	0.063	0.009	0.014	1.12			23	2.7	690	11.3	941.5	104.9	10.67	51.4	7.32		1.9
24/01/2012 10:15	0.019	0.007	1.2		0.19	0.13	0.13	<0.0020	0.014	0.46	1.9		110	1.2	610	9.1	944.8	101.7	10.61	103.2	8.01		2.2
21/02/2012 10:05	0.023	0.005	3.2		0.14	0.13	0.13	<0.0020	0.026	0.47	2.15		45	3.2	600	9.9	947.1	101.2	10.06	73.1	8.41		1.8
20/03/2012 9:50	0.01	<0.0050	12		0.12	0.051	0.051	<0.0020	0.018	3.49	0.9		39	4.2	250	10.1	934.6	97.9	10	73.6	7.61		4.6
10/04/2012 11:00	0.029	<0.0050	9		0.2	0.17	0.17	<0.0020	0.033	1.63	3.65		11	4.8	550	14	941.4	96	9.85	108.8	7.78		5.8
22/05/2012 11:35	0.025	0.013	2.8		0.21	0.18	0.18	<0.0020	0.046	0.96	3.5		5	1.2	230	3.6	946.1	101.2	12.96	91.6	7.68		4.6
19/06/2012 10:55	0.012	0.023	7.2		0.16	0.09	0.09	<0.0020	0.021	2.97	2.15		36	5.4	980	5.6	924.7	111.8	12.8	58.7	7.34		3.4
17/07/2012 11:05	0.007	0.005	52		0.17	0.074	0.071	0.003	0.013	6	1.55		6	7.4	290	5.1	940.1	101.2	11.78	61.5	7.01		55
21/08/2012 11:05	0.012	0.008	8.2	0.013	0.18	0.12	0.12	<0.0020	0.019	2.6	1.9		18	4	1000	6.8	932.5	98.1	11.01	72.6	7.21		4
18/09/2012 11:15	0.02	0.003	1	0.02	0.142	0.1205	0.1164	0.0041	0.023	1.6	2.2		4	1		6.3	944	98.5	11.35	58.4	7.47		2
16/10/2012 10:25	0.036	0.007	1	0.04	0.187	0.0519	0.0505	0.0014	0.041	0.54	2		4	1		6.6	936.2	100	11.32	72	7.4		1
20/11/2012 10:25	0.026	0.003	1	0.029	0.178	0.1133	0.1062	0.0071	0.024	0.79	2		12	1		8.6	942.3	104.9	11.38	71.3	7.7		3
4/12/2012 10:08	0.02	0.004	2	0.018	0.084	0.0294	0.0274	0.002	0.019	1.24	1		68	0		8.7	934.7	100.8	10.82	52.9	7.35		1
22/01/2013 10:25	0.009	0	2	0.009	0.168	0.0603	0.0579	0.0024	0.025	0.87	2.8		630	0		12.2	946.2	95.7	9.57	74.7	7.52		1

Rangataua STP at Secondary oxpond waste

Date	DRP (HRC)	Ammoniacal-N (HRC)	TSS (HRC)	TDP Phosphate (HRC)	TN (HRC)	TON (HRC)	Nitrate (HRC)	Nitrite (HRC)	TP (HRC)	Turbidity EPA (HRC)	Black Disc (HRC)	sCBOD5 (HRC)	E. coli by MPN (HRC)	Volatile Matter (HRC)	Total Coliforms (HRC)	Field Temperature (HRC)	Field Baro Pressure (HRC)	Field DO Saturation (HRC)	Field DO Concentration (HRC)	Field Conductivity (HRC)	Field pH (HRC)	Turbidity ISO-FAU (HRC)	SSC (HRC)
24/05/2011 10:30	1.354	7	70		13	0.796	0.555	0.241	2.43	41.3		1.2	26130	63	51720								63
21/06/2011 10:55	1.887	12.5	20		15	0.152	0.138	0.014	2.72	20.9		5.6	93	20	11870								11
19/07/2011 10:35	1.127	12	12		90	0.314	0.28	0.034	1.56	9.09		3.5	548	11	17850								8
23/08/2011 11:15	1.947	17.9	49		26	0.336	0.308	0.028	2.87	15		5.6	1120	49	43520								33
20/09/2011 11:05	2.143	15.8	69		24	0.3	0.259	0.041	3.77	20.4		5.8	4430	52	57940								64
18/10/2011 9:50	2.906	19	53		33	0.281	0.237	0.044	4.45	22.3		6.3	770	52	>241960								47
22/11/2011 10:00	2.413	14.6	42		29	0.617	0.5	0.117	3.32	10.1		7.3	170	42	22000								24
13/12/2011 9:50	3.2	14	32		16	0.077	0.045	0.032	3.8	7.23		5	40	31	9600								37
24/01/2012 10:35	2.2	7.5	80		14	0.18	0.11	0.062	3.6	15.1		6.7	34	78	16000								64
21/02/2012 10:25																							
20/03/2012 10:10	2.3	4.2	55		11	0.16	0.084	0.074	3.3	25.6		3.2	1600	54	>240000								49
10/04/2012 11:15	2.2	7.3	33		12	0.7	0.61	0.09	3.2	14.9		2.4	1600	32	52000								48
22/05/2012 11:55	1.6	11	33		14	0.39	0.35	0.044	2.1	15.1		4.7	86	33	6700								31
19/06/2012 11:25	1.3	16	28		19	0.28	0.25	0.03	2.3	12.9		5.1	4000	28	73000								34
17/07/2012 11:35																							
21/08/2012 11:25	1.4	17	53	1.4	22	0.18	0.15	0.033	2.2	16		4.4	340	53	24000								52
18/09/2012 11:40	2.051	18.004	7	2.057	20.745	0.116	0.0875	0.0285	2.45	5.24		2	1164	6									5
16/10/2012 10:50	2.702	22.165	16	2.809	24.696	0.2449	0.2042	0.0407	3.263	6.34		5	96	16									14
20/11/2012 10:55	2.061	9.255	23	2.404	14.435	1.5507	1.2476	0.3031	2.922	10.9		2	160	16									13
4/12/2012 9:50	1.786	5.491	22	1.869	10.567	1.3217	1.0715	0.2502	2.22	8.38		2	4	20									20
22/01/2013 10:00	4.07	3.75	37	3.773	11.191	1.2493	0.7346	0.5147	5.022	23.6		4	149	34									39

Water Quality Standards applicable for the Waterbodies that the Ruapehu District Council Sewage Treatment Plants discharge into. Rangataua Wastewater Treatment Plant in the Water Quality Mangement Sub-zone Tokiahuru (Whau_1c) Schedule D surface water quality targets.

Region-wide *Water^* Quality Standards that apply to all natural streams and *rivers^*:[1]						
Management Zone	Sub-Zone	*E.coli* /100 ml		Periphyton Cover	Diatom or Cyanobacterial Cover	QMCI %Δ[2]
		≤ 50th %ile	≤ 20th%ile			
All *Water Management Zones**	All Water Management Sub- Zones	260	550	30%	60%	20

Water Quality Standards for Rivers and Streams in each applicable Water Management Sub Zones.:														
STP Site	Water Quality Management Sub-zone	pH		Temp (°C)		DO (%SAT)	scBOD$_5$ (g/m^3)	POM (g/m^3)	Periphyton	DRP (g/m^3)	SIN (g/m^3)	MCI[3]	Ammoniacal Nitrogen (g/m^3)	Tox.
		Range	Δ	<	Δ[4]	>	<	<	Chl *a* (mg/m^2)	<	<	≥	<	%
Rangataua	Tokiahuru (Whau_1c)	7 to 8.2	0.5	19	2	80	1.5	5	50	0.006	0.070	120	0.320	99

1 Note that this is not new information, just the Additional Water Quality Standards placed in table format

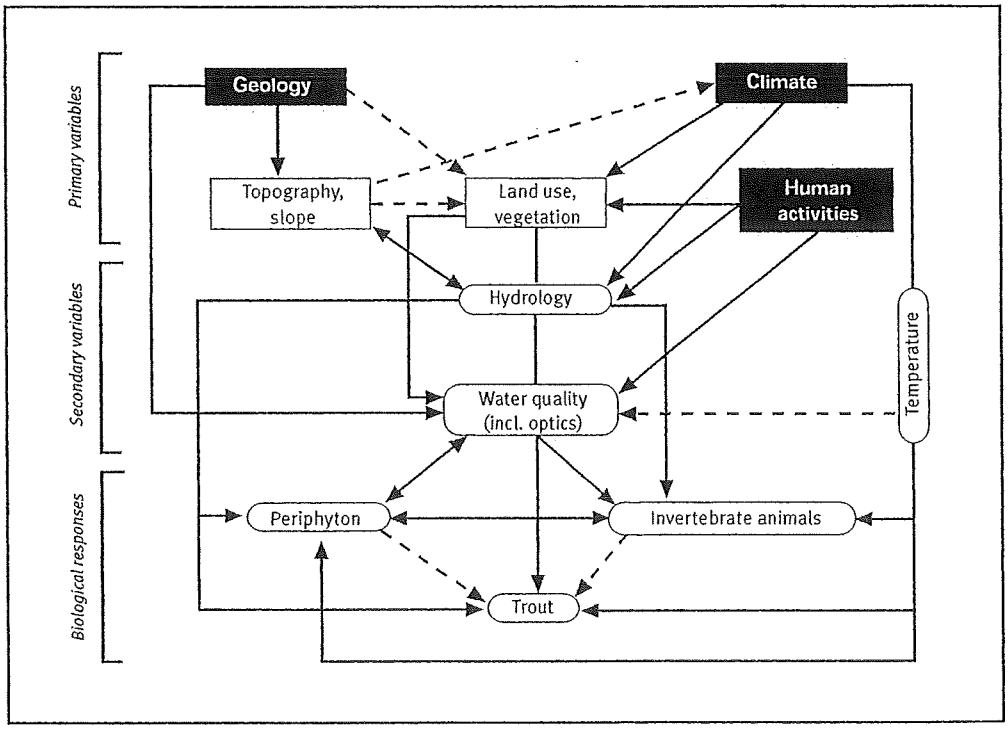
2 This standard is only relevant for measuring the percentage change in Quantitative Macroinvertebrate Community Index (QMCI) upstream and downstream of activities, such as discharges to water, for the purposes of measuring the effect of *discharges^* on aquatic macroinvertebrate communities, it is not an appropriate standard for the measurement of the general state of macroinvertebrate communities in each Water Management Sub-zone.

3 The Macroinvertebrate Community Index (MCI) standard applies only for State of the Environment monitoring purposes to determine if the aquatic macroinvertebrate communities are adequate to provide for and maintain the values in each WMSZ, this standard is not appropriate for monitoring the effect of activities such as discharges to water on macroinvertebrate communities upstream and downstream of the activity.

4 Changes in temperature resulting from habitat improvement and/or riparian restoration are exempt from the temperature change standard.

Appendix D Biological Surveys

Figure 7: A summary of the hierarchy of controllers of periphyton development and composition in streams. Strong causal effects are shown as solid arrows and weaker interactions are shown as dashed arrows. Double arrows indicate feedback relationships. Not all conceivable interactions are shown. For example, land use affects periphyton apart from through nutrients, notably with regard to riparian shading, but this interaction is not shown (modified from Biggs et al, 1990 with permission from *New Zealand Journal of Marine and Freshwater Research*).

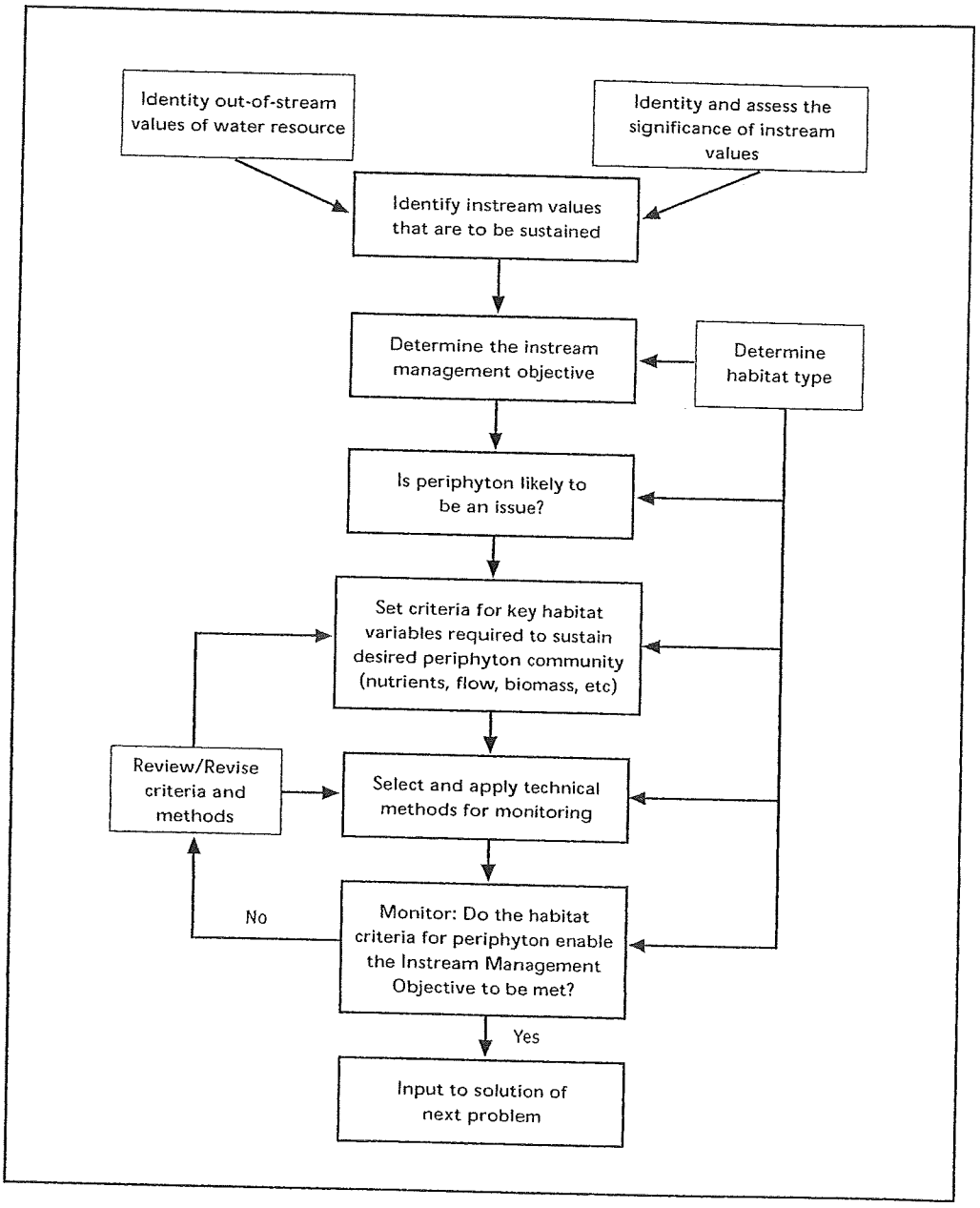


Human activities in catchments and within the stream channel can have some profound effects on periphyton community development through their influence on the fundamental variables that control the growth and composition of mats (Table 4).

Table 4: Primary variables controlling periphyton community biomass accrual, general human activities that may influence these variables and the overall effects on periphyton biomass in shallow, stony streams.

Controlling variable	Human activity	Potential effects on biomass
Hydrological disturbance	flow regulation (reducing flow variability and increasing bed stability)	increase
	flow regulation (increasing flow variability)	decrease, but depends on pre-regulation conditions
	gravel abstraction (bed destabilisation)	decrease, particularly if gravel removal is from within the wetted channel
	intensification of land use, forest/scrub removal (increased runoff and bed destabilisation)	decrease, particularly if catchment is steep
Nutrient supply	wastewater discharges (increased nutrient supply)	increase, particularly if from effluent ponds/treatment systems into shallow, stony bedded oligotrophic and mesotrophic streams
	intensification of land use, forest/scrub removal (increased nutrient supply)	increase, providing it is not accompanied with excessive siltation
Light supply	riparian vegetation removal (increased light)	increase, in 1st- to 3rd-order streams
	intensification of land use, forest/scrub removal (increased suspended sediment)	decrease, through increased siltation
Invertebrate grazing	intensification of land use, forest/scrub removal (increased siltation)	increase, if siltation of invertebrate interstitial habitat decreases grazing activity
Baseflow velocity	abstraction/diversion (decreasing velocities)	increase, if filamentous green algae; increase or decrease, if stalked diatom/short filamentous communities; decrease, if mucilaginous communities
Baseflow temperature	abstraction/diversion (increased temperature)	increase, particularly if there is no riparian shade

Figure 2: General procedures for planning, setting consent criteria and verifying appropriateness of consent criteria for managing instream values in relation to periphyton (based on Figure 9 of the *Flow Guidelines for Instream Values* (MfE, 1998)).



Water Quality of the Mangaehuehu Stream at the Rangataua Sewage Treatment Ponds

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Prepared for Ruapehu District Council
June 2008

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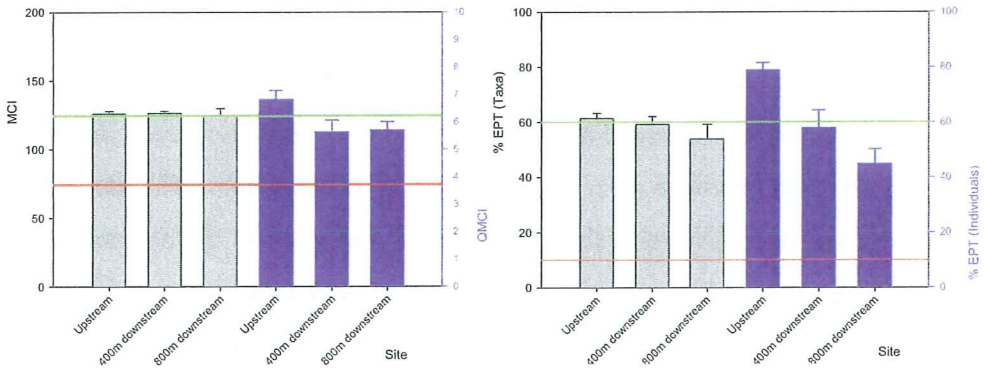
Executive Summary

1) Invertebrate and periphyton communities were sampled in the Mangaehuehu Stream upstream and downstream of the discharge from the sewage treatment ponds at Rangataua to determine if the discharge was having any effect on stream biota.
2) The discharge was having an adverse effect on the percentage of Ephemeroptera, Plecoptera and Trichoptera individuals present but did not appear to affect any other indices.
3) Biotic indices indicate moderate to good water quality in this part of the Mangaehuehu Stream.
4) There was no significant change in the amount of periphyton biomass downstream of the discharge.
5) Diatom levels both upstream and 400 m downstream were above acceptable limits as recommended by the Ministry for the Environment for aesthetics.
6) In balance some aspects of the streams biota are affected by the discharge and others are not. This would suggest a mild effect of the discharge on the streams ecology.

Summary of water quality indices.

Condition (good ☺, moderate 😐, poor ☹) is based on thresholds in the figures below. Overall effect downstream is based on statistical significance at P=0.05 indicated in bold.

	Condition Upstream	Condition 400m downstream	Condition 800m downstream	ANOVA $F_{2, 12}$ value	Effect downstream
MCI	☺	☺	☺	0.10	No effect
QMCI	☺	😐	😐	3.63	No effect
EPT (taxa)	☺	😐	😐	1.10	No effect
EPT (individuals)	☺	😐	😐	**11.4**	Decreased
Chlorophyll *a*	☹	☹	☹	1.64	No effect



Plot of mean MCI (grey bars), QMCI (blue bars), % EPT (taxa) (grey bars), and % EPT (individuals) (blue bars). Thresholds indicative of good water quality sites are plotted in green and those of poor water quality in red.

1. Introduction

The Ruapehu District Council operates a sewage treatment plant at Rangataua near Ohakune. Oxidation pond treated wastewater is discharged via a wetland to the Mangaehuehu Stream. A condition of resource consents for such discharges normally requires Councils to undertake monitoring of the stream biota upstream and downstream of the discharge point during low flow periods. This report has been prepared to correspond with such a requirement. It assesses the biodiversity and water quality of the Mangaehuehu Stream upstream and downstream of the sewage treatment pond discharge at Rangataua.

1.1. Why monitor macroinvertebrates?

Macroinvertebrates are widely used as indicators of water quality in New Zealand (Stark 1985, Winterbourn 1999) and overseas (Rosenberg & Resh 1993, Hynes 1994). The fact that these organisms are usually in high abundance, easily sampled and identified and have long life cycles, long enough to record cumulative effects of stress and exposure over time, are good reasons for their use as bioindicators. Macroinvertebrate taxa show a range of responses to differences in water quality (Stark, 1985). For example, Chironomidae and Gastropoda (Fig. 1) are generally considered to be pollution tolerant taxa while Plecoptera and Megaloptera (Fig. 2) are sensitive to pollution.

a) Midge larvae b) Snail

Figure 1. Pollution tolerant taxa: a) Chironomidae (midge larvae) and b) Gastropoda (snail). (Photo: S.N.A.C, 2000).

a) Stonefly nymph b) Dobsonfly nymph

Figure 2. Examples of pollution sensitive taxa: a) Plecoptera (stonefly nymph) and b) Megaloptera (dobsonfly nymph). (Photo: S.N.A.C, 2000).

Compared to spot chemical testing, macroinvertebrate indicators of water quality have the advantage of being able to integrate and monitor the effects of a wide variety of potential pollutants over an extended period of time (Rosenberg & Resh 1993). While a pollutant may only exist in the environment for a short period of time, its effect on the stream's ecology may be more long term. In this way, the presence or absence of key macroinvertebrates may be indicative of pollution, even if the responsible contaminant is no longer present or detectable in the environment. The macroinvertebrate community at a given site may be considered a result of the prevailing water quality at that site. Macroinvertebrates are a product of the food supply (periphyton) and predators (fish) of a river ecosystem and as such they may be the best single indicators of water quality in river systems.

Periphyton is the algae living on the surface of the river substrate. It often forms unsightly mats of filamentous 'slime', which can degrade the aesthetic and recreational qualities of a river. Periphyton has been shown to indicate the state of nutrients in the surrounding water (Biggs 2000). The Ministry for the Environment has guidelines for periphyton to meet the aesthetic, recreational and life supporting capacity requirements of a river system (Biggs 2000).

2. Stream sites sampled

Three locations on the Mangaehuehu Stream were selected for sampling of invertebrates and assessment of algae; one upstream, one approximately 400 m downstream and one approximately 800 m downstream of the discharge from the sewage treatment ponds at Rangataua. Map coordinates for the sites are listed below in Table 1 and their positions mapped in Figure 3.

Table 1 Sites sampled in 2008 and their map coordinates.

Site:	Easting:	Northing
Upstream	2722020	6193918
400 m downstream	2721861	6193428
800 m downstream	2721864	6193243

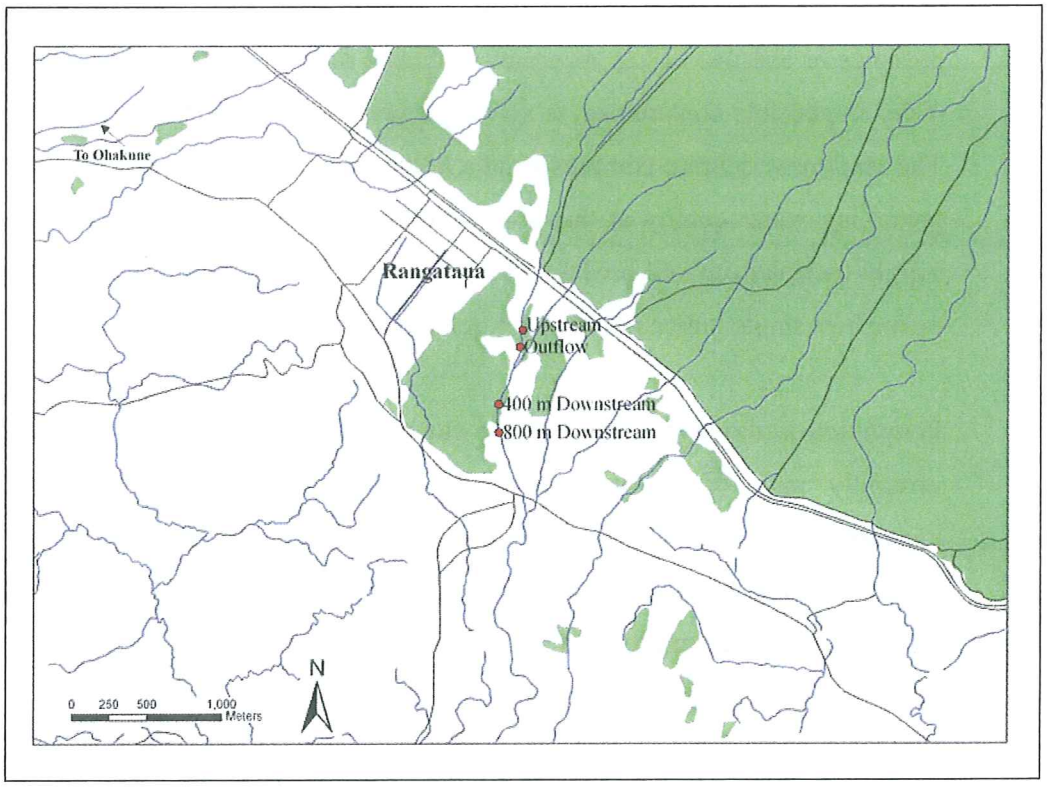


Figure 3. Map of study site locations.

Sites sampled in 2008 are shown in Plates 1-3.

Plate 1. Mangaehuehu Stream upstream of Rangataua sewage treatment ponds

Plate 2. Mangaehuehu Stream 400 m downstream of Rangataua sewage treatment ponds

Plate 3. Mangaehuehu Stream 800 m downstream of Rangataua sewage treatment ponds

3. Methods

3.1. Sample collection

Samples were collected during "typical" low flow conditions on 6 March 2008.

3.2. Invertebrate and periphyton sampling

Sampling was confined to riffle areas, or where these were absent, to runs. Riffle areas are generally considered to be species rich and have communities that provide good baseline data upon which to assess water quality trends (Winterbourn 1985). Furthermore, many of the indices adopted for using invertebrates in water quality assessment are only appropriate for riffle habitats (Stark 1993).

From these riffle areas, five replicate 0.1 m^2 Surber samples (250 μm mesh) were collected at each site and stored in 10% formalin. In the laboratory, samples were filtered through a 500 μm sieve and invertebrates collected in the sieve were identified and counted. Where possible, invertebrates were identified to species level using available keys. If taxa could not be named, they were differentiated into apparent morphospecies.

Periphyton abundance was assessed by collecting 5 stones alongside each Surber sample, which were kept dark and cool in the field until freezing back in the laboratory. In the laboratory, pigments were extracted by soaking the stones in 90% acetone for 24 h at 5°C in the dark. Absorbency readings were taken using a Cary 50^{TM} Conc UV-Visible spectrophotometer and chlorophyll *a* was calculated using the method of Steinman and Lamberti (1996). At each site the percentage of substrate covered by algae was also visually assessed. The Ministry for the Environment guidelines for acceptable periphyton biomass are presented in Table 2.

Table 2. Provisional biomass and cover guidelines for periphyton growing in gravel/cobble bed streams for three main instream values. Reproduced from Table 14 Ministry for the Environment guidelines (Biggs 2000).

Instream value/variable	Diatoms/ cyanobacteria	Filamentous algae
Aesthetics/recreation (1 November – 30 April)		
Maximum cover of visible stream bed	60 % > 0.3 cm thick	30% > 2 cm long
Maximum chlorophyll a (mg/m^2)	N/A	120
Benthic biodiversity		
Mean monthly chlorophyll a (mg/m^2)	15	15
Maximum chlorophyll a (mg/m^2)	50	50
Trout habitat and angling		
Maximum cover of whole stream bed	N/A	30% > 2 cm long
Maximum chlorophyll a (mg/m^2)	200	120

3.3. Environmental measures

The environmental characteristics of each site were measured at the time of sample collection. Water quality parameters measured *in situ* included conductivity, temperature and pH, all measured using a YSI 556 multi-probe meter. Stream width, depth and current velocity were measured in the thalweg of the stream channel at five equidistant points along the study reach, the latter using a velocity headrod. Substrate composition was visually assessed and categorised into the groups listed in Table 3. Embeddedness was subjectively assessed as loose, moderate, or tight.

Table 3. Substrate size classes used to assess stream and river substrate composition (see Quinn & Hickey 1990).

Bedrock	
Boulders	> 300 mm
Large cobbles	129-300 mm
Small cobbles	65-128 mm
Pebbles	17-64 mm
Gravel	8-16 mm
Sand and silt	< 8 mm

The percentage of backwater, pool, run, riffle or rapid was visually estimated over each reach surveyed. Riffles were classified as areas of fast, shallow water with a broken-surface appearance; pools were areas of slow deep water with a smooth surface appearance, whereas runs were intermediate in character. Rapids were areas of fast cascading deep water.

3.5. Biotic Indices

A number of biological indices were calculated to assess the relationship between the invertebrate communities collected at a study site and the water quality. Four standard biotic indices are used in this report:

- **MCI** – the Macroinvertebrate Community Index (MCI) (Stark 1985) is an index based on the presence of macroinvertebrate taxa which are assigned a score based on their tolerance to organic pollution (1= highly tolerant, 10 = highly sensitive). MCI scores greater than 125 are considered 'pristine' and scores less than 75 are 'severely polluted' (Wright-Stow & Winterbourn 2003). This index must be used with caution as it was originally designed to indicate eutrophication (high nutrient levels) in high country streams with cobble substrates (Table 4).

- **QMCI** – the Quantitative Macroinvertebrate Community Index (QMCI) is similar to the MCI, but also takes into account the number of individuals of each species collected (Stark 1993). The MCI uses the presence or absence of species while the QMCI uses densities and is not sensitive to finding taxa only represented by one or two animals. As some species may reach densities of tens of thousands per square meter of streambed, this may be important and this index is therefore given more weight in assessing any potential effects (Table 4).

Table 4. Interpretation of MCI and QMCI values (after Wright-Stow & Winterbourn 2003) for stony streams.

Interpretation	MCI	QMCI
Clean water	125-200	6.2-10
Mild pollution	105-115	5.2-5.7
Moderate pollution	85-95	4.2-4.7
Severe pollution	<75	0-3.7

- **%EPT taxa** – Ephemeroptera, Plecoptera and Trichoptera (mayflies, stoneflies and caddisflies) are three groups of insects that are generally sensitive to pollution. The percentage of EPT taxa is the proportion of all taxa collected from a stream that belong to one of these groups. Thus, a score of 100% would indicate that all of the animals collected belonged to one of these three pollution sensitive groups, suggesting that the stream is very healthy. In contrast, a score of 0% would indicate that no mayflies, stoneflies or caddisflies were collected, leading to the conclusion that the stream is highly polluted. The caddisflies *Oxyethira* and *Paroxyethira* were excluded from this analysis, as they are relatively insensitive to pollution. The presence of EPT taxa may also be dependent on the natural characteristics of the stream. Values of 60 and 10 corresponding to good and bad have been added. These scores are based on the authors' experience and are not established thresholds.

- **%EPT individuals** – this index is similar to %EPT taxa. It measures the proportion of the individuals collected that are mayflies, stoneflies and caddisflies. *Oxyethira* and *Paroxyethira* were also excluded from this analysis. Values of 60 and 10 corresponding to good and bad have been added. These scores are based on the authors' experience and are not established thresholds.

Differences in parameters between sites were evaluated with Analysis of Variance.

4. Results

4.1. Habitat Characteristics

The three sites sampled were along stretches of the Mangaehuehu Stream upstream and downstream of the discharge from the sewage treatment ponds at Rangataua. The sites were between 5 and 6 m wide and 24 to 34 cm deep. Conductivity ranged from 63 to 65 µS/cm and all sites had substrates dominated by a mixture of small cobbles and pebbles. The environmental characteristics recorded at each of the sites are presented in Table 5.

Table 5. Environmental characteristics of sites sampled in 2008

Site name	Upstream	400m downstream	800m downstream
Date sampled	6-Mar-08	6-Mar-08	6-Mar-08
Easting	2722020	2721861	2721864
Northing	6193918	6193428	6193243
Chemical			
Conductivity (µS/cm)	65	63	64
Temperature (°C)	12	9	10
pH	7.7	6.7	8.1
Time	2.13 pm	12.20 pm	1.10 pm
Physical			
Mean Width (m)	5	6	5
Mean Depth (cm)	24	26	34
Mean Velocity (m/s)	0.72	0.71	0.59
Substrate			
Embeddedness	Moderate	Loose	Loose
Bedrock	0	0	0
% Boulders (>300 mm)	20	2	1
% Large cobbles (129 - 300 mm)	5	3	0
% Small Cobbles (65 - 128 mm)	25	60	50
% Pebbles (17 -64 mm)	50	30	40
% Gravel (8 -16 mm)	0	0	0
% Sand & silt (< 8 mm)	0	5	9
Channel			
% pool	0	0	0
% riffle	20	50	30
% run	60	50	70
% rapid	20	0	0
% debris jam	0	0	0
% macrophytes	0	0	0
% undercut	30	0	0

4.2. Macroinvertebrates

Biotic index scores for each of the sites surveyed are presented in Figure 4. There were significant decreases in the mean number of animals and % EPT (individuals) between sites upstream and downstream of the discharge, indicating that the discharge is having an effect on these indices. No other indices were significantly different between sites. The index scores indicate mildly polluted to clean water in this stretch of the Mangaehuehu Stream.

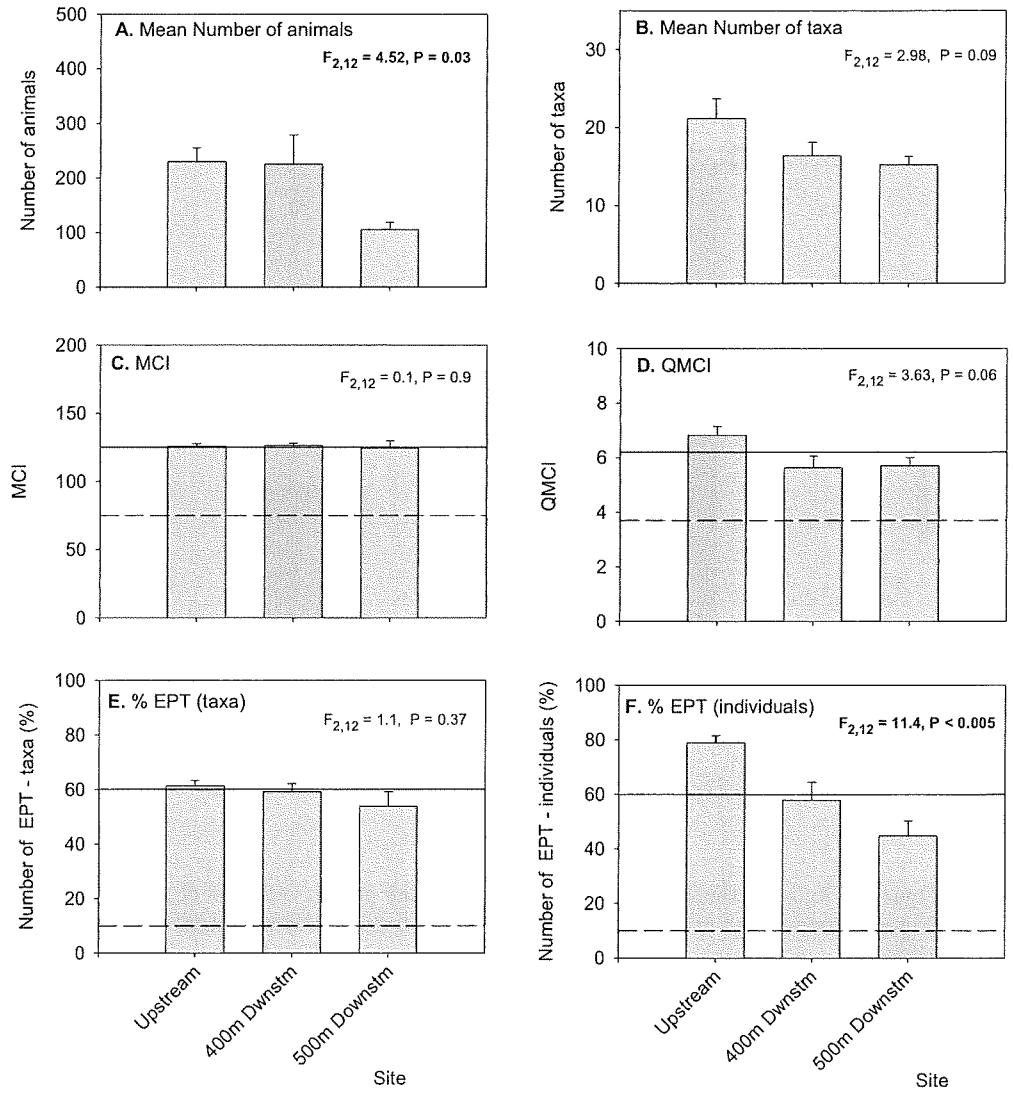


Figure 4. Mean (± 1 SE) A. Number of animals, B. Number of taxa, C. MCI, D. QMCI, E. % EPT (taxa), and F. % EPT (individuals) for the sites sampled on the Mangaehuehu Stream upstream and downstream of the discharge from the sewage treatment ponds at Rangataua in 2008. For MCI, QMCI and % EPT, thresholds indicative of good water quality are plotted as a solid line and those of poor water quality as a dashed line. Refer Table 4. F values from Analysis of Variance evaluating site differences are presented in the figure.

The different invertebrate taxa collected at each site are presented in Appendix 1 and the relative abundance of the main groups of invertebrates at these sites is presented in Figure 5. All three sites show similar patterns in community structure. Upstream of the discharge the mayfly *Deleatidium* sp. dominates, while at the two downstream sites, communities are dominated by *Deleatidium* sp. (in decreasing numbers) and Orthocladiinae.

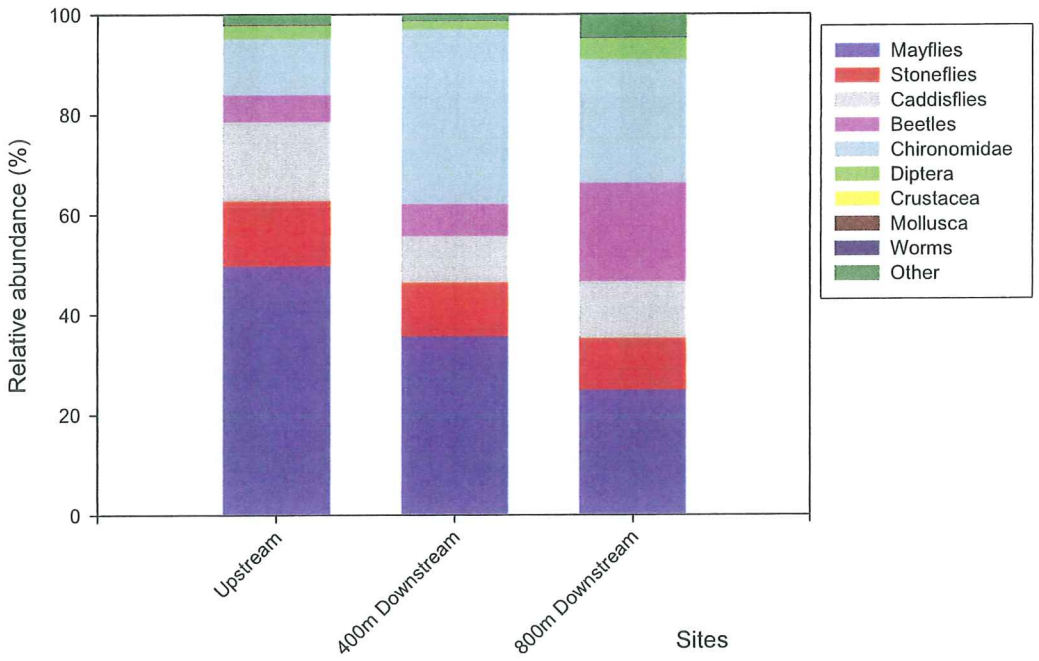


Figure 5. Relative abundance of the main taxonomic groups collected at sites on the Mangaehuehu Stream upstream and downstream of the discharge from the sewage treatment ponds at Rangataua in 2008.

4.3. Periphyton

Mean periphyton biomass, measured as chlorophyll *a* ($\mu g/cm^2$), for each site is shown in Figure 6. There is no significant difference in chlorophyll *a* levels between sites upstream and downstream of the discharge. Periphyton biomass levels however, do exceed acceptable limits as recommended by the Ministry for the Environment for 'clean water' fauna (Biggs 2000) at the site 800 m downstream.

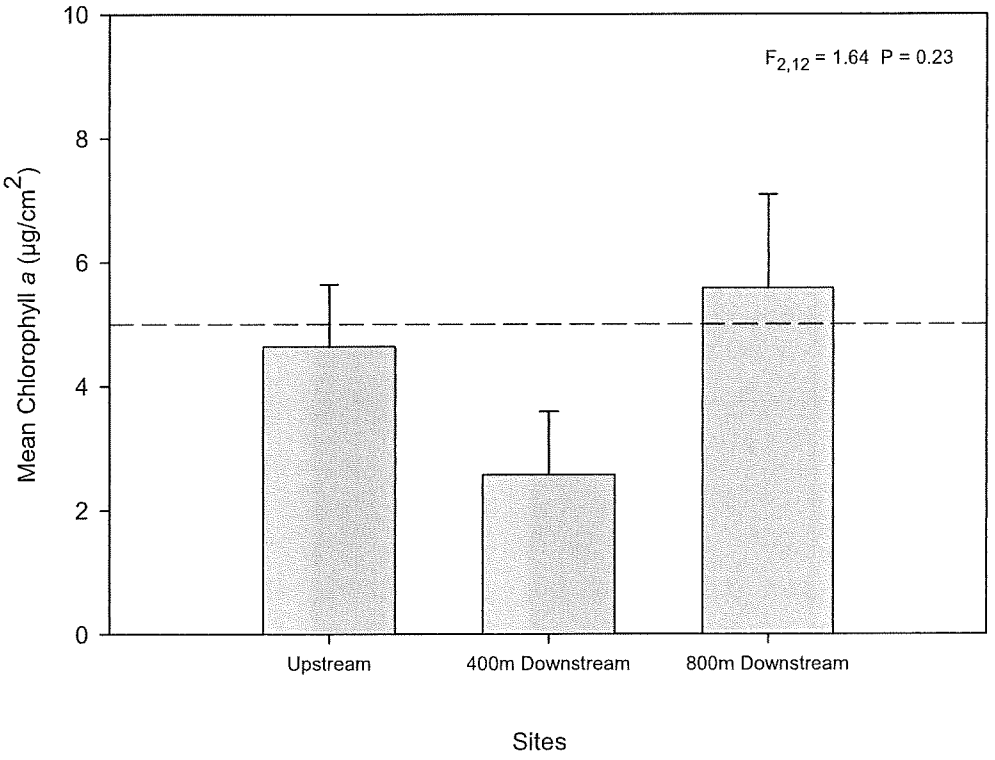


Figure 6. Mean periphyton biomass, measured as chlorophyll *a* ($\mu g/cm^2$), collected from sites sampled on the Mangaehuehu Stream upstream and downstream of the sewage treatment pond discharge at Rangataua in 2008. The dashed line represents the maximum level of chlorophyll *a* for 'clean water' benthic fauna (Biggs 2000). F values from Analysis of Variance evaluating site differences are presented in the figure.

A visual assessment of the type of periphyton cover at each site (Fig. 7) indicates diatoms to be the dominant algal cover at sites upstream and 400 m downstream of the discharge. These sites had levels of periphyton cover above acceptable limits as recommended by the Ministry for the Environment for aesthetics. At the site 800 m downstream of the discharge, diatoms were still present however substrate here was covered with a film of sediment.

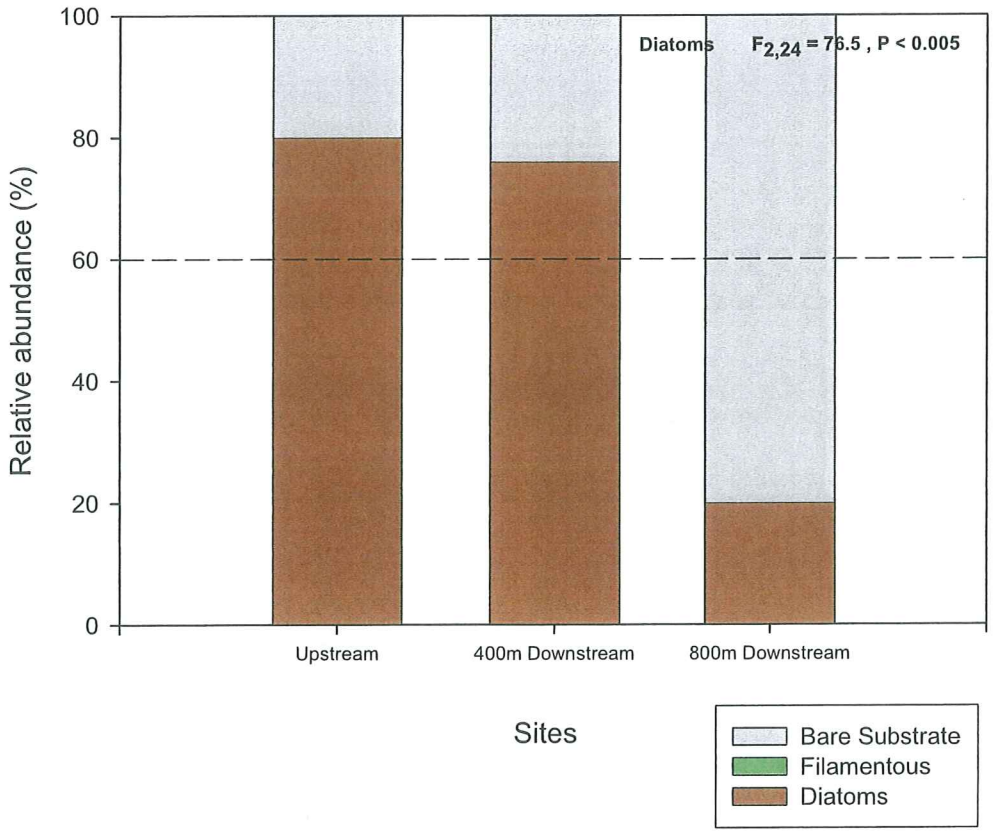


Figure 7. Relative abundance of periphyton visually assessed at sites sampled on the Mangaehuehu Stream upstream and downstream of the discharge from the sewage treatment ponds at Rangataua in 2008. The dashed line indicates the acceptable level of diatom cover for aesthetics. F values from Analysis of Variance evaluating site differences are presented in the figure.

5. Conclusions

- Taxonomic composition of invertebrate communities was similar upstream and downstream of the discharge point from the sewage treatment ponds at Rangataua.
- The discharge reduced the percentage of EPT individuals, however no other indices were affected.
- Biotic indices show moderate to good water quality in this part of the Mangaehuehu Stream.
- Periphyton biomass was not significantly different upstream and downstream of the discharge, however the percentage of stream substrate covered by diatoms upstream and 400 m downstream exceeded limits recommended by the Ministry for the Environment for aesthetics.

7. Appendices

Appendix 1. Mean density of invertebrates collected in 5 ($0.1m^2$) Surber samples at sites on the Mangaehuehu Stream upstream and downstream of the sewage treatment ponds at Rangataua in 2008.

Taxa	MCI score	Site 1 (upstream)	Site 2 (400m downstream)	Site 3 (800m downstream)
Mayflies				
Coloburiscus humeralis	9	1.6	1	0.2
Deleatidium sp.	8	104.6	73.2	23.2
Nesameletus ornatus	9	5.4	4.2	2.4
Zephlebia dentata	7	2.8	1.8	0.4
Stoneflies				
Austroperla cyrene	9	4.4	0.6	0.6
Megaleptoperla sp.	9	2	2.2	0.8
Stenoperla prasina	10	0.6	0	0
Zelandobius furcillatus	5	11.2	11.8	8.4
Zelandoperla sp.	10	11.8	9.8	1.2
Caddisflies				
Aoteapsyche sp.	4	11.8	10.2	6
Beraeoptera roria	8	4.8	0.8	0.4
Costachorema xanthopterum	7	0.2	0	0
Hydrobiosidae (early instar)	6	4	3.6	2.2
Hydrobiosis charadraea	6	0.2	0	0
Hydrobiosis parumbripennis	6	0.8	0.2	0
Neurochorema forsteri	6	0.2	0	0
Olinga feredayi	9	2	0.8	0.4
Oxyethira albiceps	2	0.6	0.2	0.2
Psilochorema sp.	8	0	0.4	0.2
Pycnocentria sp.	7	7.8	1	2.4
Pycnocentrodes sp.	5	3.4	0	0
Caddis pupae	5	0.4	3.4	0
Beetles				
Elmidae	6	12.4	14	20
Ptilodactylidae	8	0	0	0.2
Scirtidae	8	0.2	0.6	0.6
Chironomidae				
Chironominae	1	4.6	2.4	1.6
Maoridiamesa sp.	3	0	0.4	0
Orthocladiinae	2	18.6	75.4	22.8
Tanypodinae	5	0.4	0	0.4
Chironomid pupae	1	1.8	0	1
Diptera				
Aphrophila neozelandica	5	0.4	0.6	0.6
Austrosimulium sp.	3	2	1.4	0.4
Empididae	3	0.2	0	0.2
Eriopterini	9	1.8	1.8	3.4
Limonia nigrescens	6	0.2	0	0
Mischoderus sp.	4	1	0.2	0
Neocurupira hudsoni	7	0.6	0	0
Diptera pupae	5	0.2	0	0
Mollusca				
Potamopyrgus antipodarum	4	0.4	0	0

Taxa	MCI score	Site 1 (upstream)	Site 2 (400m downstream)	Site 3 (800m downstream)
Worms				
Oligochaeta (small)	1	0.2	0.4	0.2
Other				
Archichauliodes diversus	7	4.4	2.6	4.8
Number taxa		**21**	**16**	**15**
Number animals		**230**	**225**	**105**
MCI		**126.0**	**126.4**	**124.4**
QMCI		**6.83**	**5.63**	**5.70**
% EPT (taxa)		**61**	**59**	**54**
% EPT (individuals)		**79**	**58**	**45**

Water Quality of the Mangaehuehu Stream at the Rangataua Wastewater Treatment Ponds

Pohangina Environmental Consulting Ltd

Prepared for Ruapehu District Council
June 2009

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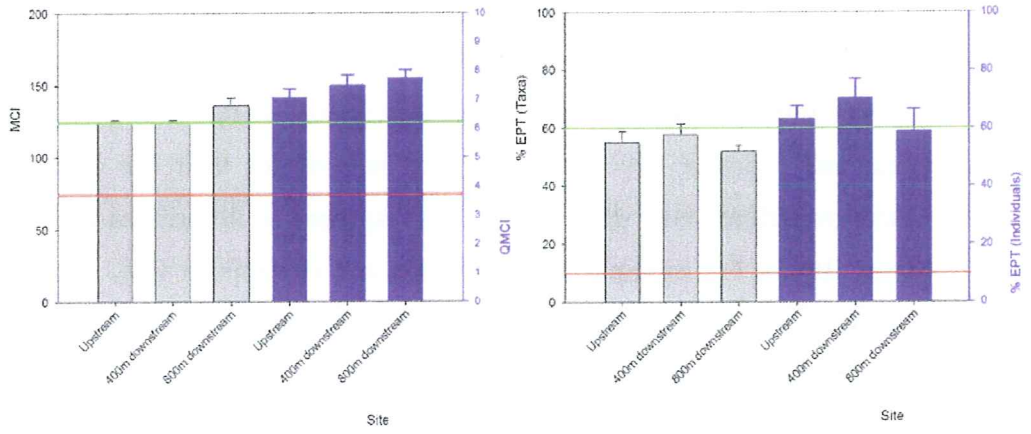
Executive Summary

1) Invertebrate and periphyton communities were sampled in the Mangaehuehu Stream upstream and downstream of the discharge from the wastewater treatment ponds at Rangataua to determine if the discharge was having any effect on stream biota.
2) Invertebrate communities indicated that this discharge was having no adverse effect on any of the biotic indices.
3) Biotic indices indicate moderate to good water quality in this part of the Mangaehuehu Stream.
4) There was no significant change in the amount of periphyton biomass downstream of the discharge.
5) Diatom levels downstream were within acceptable limits as recommended by the Ministry for the Environment for aesthetics however upstream, levels exceeded recommended limits.

Summary of water quality indices.

Condition (good, moderate, poor) is based on thresholds in the figures below. Overall effect downstream is based on statistical significance at P=0.05 indicated in bold.

	Condition Upstream	Condition 400m downstream	Condition 800m downstream	ANOVA $F_{2, 12}$ value	Effect downstream
MCI	😐	😐	☺	3.59	No effect
QMCI	☺	☺	☺	1.15	No effect
EPT (taxa)	😐	😐	😐	0.88	No effect
EPT (individuals)	☺	☺	😐	0.86	No effect
Chlorophyll *a*	☺	☺	☺	0.24	No effect



Plot of mean MCI (grey bars), QMCI (blue bars), % EPT (taxa) (grey bars), and % EPT (individuals) (blue bars). Thresholds indicative of good water quality sites are plotted in green and those of poor water quality in red.

1. Introduction

The Ruapehu District Council operates a sewage treatment plant at Rangataua near Ohakune. Oxidation pond treated wastewater is discharged via a wetland to the Mangaehuehu Stream. A condition of resource consents for such discharges normally requires Councils to undertake monitoring of the stream biota upstream and downstream of the discharge point during low flow periods. This report has been prepared to correspond with such a requirement. It assesses the biodiversity and water quality of the Mangaehuehu Stream upstream and downstream of the wastewater treatment pond discharge at Rangataua.

1.1. Why monitor macroinvertebrates?

Macroinvertebrates are widely used as indicators of water quality in New Zealand (Stark 1985, Winterbourn 1999) and overseas (Rosenberg & Resh 1993, Hynes 1994). The fact that these organisms are usually in high abundance, easily sampled and identified and have long life cycles, long enough to record cumulative effects of stress and exposure over time, are good reasons for their use as bioindicators. Macroinvertebrate taxa show a range of responses to differences in water quality (Stark, 1985). For example, Chironomidae and Gastropoda (Fig. 1) are generally considered to be pollution tolerant taxa while Plecoptera and Megaloptera (Fig. 2) are sensitive to pollution.

a) Midge larvae b) Snail

Figure 1. Pollution tolerant taxa: a) Chironomidae (midge larvae) and b) Gastropoda (snail). (Photo: S.N.A.C, 2000).

a) Stonefly nymph b) Dobsonfly nymph

Figure 2. Examples of pollution sensitive taxa: a) Plecoptera (stonefly nymph) and b) Megaloptera (dobsonfly nymph). (Photo: S.N.A.C, 2000).

Compared to spot chemical testing, macroinvertebrate indicators of water quality have the advantage of being able to integrate and monitor the effects of a wide variety of potential pollutants over an extended period of time (Rosenberg & Resh 1993). While a pollutant may only exist in the environment for a short period of time, its effect on the stream's ecology may be more long term. In this way, the presence or absence of key macroinvertebrates may be indicative of pollution, even if the responsible contaminant is no longer present or detectable in the environment. The macroinvertebrate community at a given site may be considered a result of the prevailing water quality at that site. Macroinvertebrates are a product of the food supply (periphyton) and predators (fish) of a river ecosystem and as such they may be the best single indicators of water quality in river systems.

Periphyton is the algae living on the surface of the river substrate. It often forms unsightly mats of filamentous 'slime', which can degrade the aesthetic and recreational qualities of a river. Periphyton has been shown to indicate the state of nutrients in the surrounding water (Biggs 2000). The Ministry for the Environment has guidelines for periphyton to meet the aesthetic, recreational and life supporting capacity requirements of a river system (Biggs 2000).

2. Stream sites sampled

Three locations on the Mangaehuehu Stream were selected for sampling of invertebrates and assessment of algae; one upstream, one approximately 400 m downstream and one approximately 800 m downstream of the discharge from the wastewater treatment ponds at Rangataua. Map coordinates for the sites are listed below in Table 1 and their positions mapped in Figure 3.

Table 1 Sites sampled in 2009 and their map coordinates.

Site:	Easting:	Northing
Upstream	2722051	6194110
400 m downstream	2721859	6193413
800 m downstream	2721865	6193283

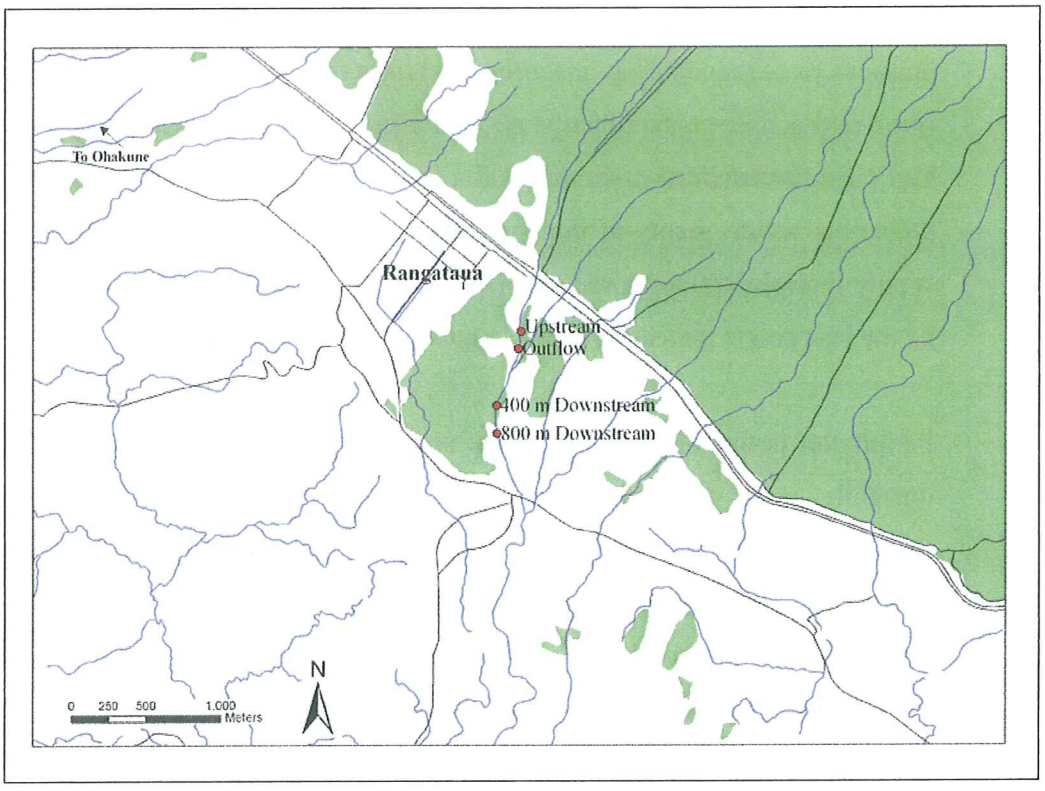


Figure 3. Map of study site locations.

Sites sampled in 2009 are shown in Plates 1-3.

Plate 1. Mangaehuehu Stream upstream of Rangataua wastewater treatment ponds

Plate 2. Mangaehuehu Stream 400 m downstream of Rangataua wastewater treatment ponds

Plate 3. Mangaehuehu Stream 800 m downstream of Rangataua wastewater treatment ponds

3. Methods

3.1. Sample collection

Samples were collected during "typical" low flow conditions on 23 March 2009.

3.2. Invertebrate and periphyton sampling

Sampling was confined to riffle areas, or where these were absent, to runs. Riffle areas are generally considered to be species rich and have communities that provide good baseline data upon which to assess water quality trends (Winterbourn 1985). Furthermore, many of the indices adopted for using invertebrates in water quality assessment are only appropriate for riffle habitats (Stark 1993).

From these riffle areas, five replicate 0.1 m^2 Surber samples (250 μm mesh) were collected at each site and stored in 70% Isopropanol. In the laboratory, samples were filtered through a 500 μm sieve and invertebrates collected in the sieve were identified and counted. Where possible, invertebrates were identified to species level using available keys. If taxa could not be named, they were differentiated into apparent morphospecies.

Periphyton abundance was assessed by collecting 5 stones alongside each Surber sample, which were kept dark and cool in the field until freezing back in the laboratory. In the laboratory, pigments were extracted by soaking the stones in 90% acetone for 24 h at 5°C in the dark. Absorbency readings were taken using a Cary 50^{TM} Conc UV-Visible spectrophotometer and chlorophyll *a* was calculated using the method of Steinman and Lamberti (1996). At each site the percentage of substrate covered by algae was also visually assessed. The Ministry for the Environment guidelines for acceptable periphyton biomass are presented in Table 2.

Table 2. Provisional biomass and cover guidelines for periphyton growing in gravel/cobble bed streams for three main instream values. Reproduced from Table 14 Ministry for the Environment guidelines (Biggs 2000).

Instream value/variable	Diatoms/ cyanobacteria	Filamentous algae
Aesthetics/recreation (1 November – 30 April)		
Maximum cover of visible stream bed	60 % > 0.3 cm thick	30% > 2 cm long
Maximum chlorophyll a (mg/m^2)	N/A	120
Benthic biodiversity		
Mean monthly chlorophyll a (mg/m^2)	15	15
Maximum chlorophyll a (mg/m^2)	50	50
Trout habitat and angling		
Maximum cover of whole stream bed	N/A	30% > 2 cm long
Maximum chlorophyll a (mg/m^2)	200	120

3.3. Environmental measures

The environmental characteristics of each site were measured at the time of sample collection. Water quality parameters measured *in situ* included conductivity, temperature and pH, all measured using a YSI 556 multi-probe meter. Stream width, depth and current velocity were measured in the thalweg of the stream channel at five equidistant points along the study reach, the latter using a velocity headrod. Substrate composition was visually assessed and categorised into the groups listed in Table 3. Embeddedness was subjectively assessed as loose, moderate, or tight.

Table 3. Substrate size classes used to assess stream and river substrate composition (see Quinn & Hickey 1990).

Bedrock	
Boulders	> 300 mm
Large cobbles	129-300 mm
Small cobbles	65-128 mm
Pebbles	17-64 mm
Gravel	8-16 mm
Sand and silt	< 8 mm

The percentage of backwater, pool, run, riffle or rapid was visually estimated over each reach surveyed. Riffles were classified as areas of fast, shallow water with a broken-surface appearance; pools were areas of slow deep water with a smooth surface appearance, whereas runs were intermediate in character. Rapids were areas of fast cascading deep water.

3.5. Biotic Indices

A number of biological indices were calculated to assess the relationship between the invertebrate communities collected at a study site and the water quality. Four standard biotic indices are used in this report:

- **MCI** – the Macroinvertebrate Community Index (MCI) (Stark 1985) is an index based on the presence of macroinvertebrate taxa which are assigned a score based on their tolerance to organic pollution (1= highly tolerant, 10 = highly sensitive). MCI scores greater than 125 are considered 'pristine' and scores less than 75 are 'severely polluted' (Wright-Stow & Winterbourn 2003). This index must be used with caution as it was originally designed to indicate eutrophication (high nutrient levels) in high country streams with cobble substrates (Table 4).

- **QMCI** – the Quantitative Macroinvertebrate Community Index (QMCI) is similar to the MCI, but also takes into account the number of individuals of each species collected (Stark 1993). The MCI uses the presence or absence of species while the QMCI uses densities and is not sensitive to finding taxa only represented by one or two animals. As some species may reach densities of tens of thousands per square meter of streambed, this may be important and this index is therefore given more weight in assessing any potential effects (Table 4).

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- **%EPT taxa** – Ephemeroptera, Plecoptera and Trichoptera (mayflies, stoneflies and caddisflies) are three groups of insects that are generally sensitive to pollution. The percentage of EPT taxa is the proportion of all taxa collected from a stream that belong to one of these groups. Thus, a score of 100% would indicate that all of the animals collected belonged to one of these three pollution sensitive groups, suggesting that the stream is very healthy. In contrast, a score of 0% would indicate that no mayflies, stoneflies or caddisflies were collected, leading to the conclusion that the stream is highly polluted. The caddisflies *Oxyethira* and *Paroxyethira* were excluded from this analysis, as they are relatively insensitive to pollution. The presence of EPT taxa may also be dependent on the natural characteristics of the stream. Values of 60 and 10 corresponding to good and bad have been added. These scores are based on the authors' experience and are not established thresholds.

- **%EPT individuals** – this index is similar to %EPT taxa. It measures the proportion of the individuals collected that are mayflies, stoneflies and caddisflies. *Oxyethira* and *Paroxyethira* were also excluded from this analysis. Values of 60 and 10 corresponding to good and bad have been added. These scores are based on the authors' experience and are not established thresholds.

Differences in parameters between sites were evaluated with one way Analysis of Variance using Statistix9.

4. Results

4.1. Habitat Characteristics

The three sites sampled were along stretches of the Mangaehuehu Stream upstream and downstream of the discharge from the wastewater treatment ponds at Rangataua. The sites were between 3 and 6 m wide and 22 to 30 cm deep. Conductivity ranged from 89 to 91 µS/cm and all sites had substrates dominated by a mixture of small cobbles and pebbles. The environmental characteristics recorded at each of the sites are presented in Table 5.

Table 5. Environmental characteristics of sites sampled in 2009.

Site name	Upstream	400m downstream	800m downstream
Date sampled	23-Mar-09	23-Mar-09	23-Mar-09
Easting	2722051	2721859	2721865
Northing	6194110	6193413	6193283
Chemical			
Conductivity (µS/cm)	90	89	91
Temperature (°C)	9	9	9
pH	5.5	4.9	4.8
Time	2.30 pm	3.20 pm	4.05 pm
Physical			
Mean Width (m)	5	6	3
Mean Depth (cm)	30	22	23
Mean Velocity (m/s)	0.40	0.57	0.52
Substrate			
Embeddedness	Loose	Loose	Loose
Bedrock	0	0	0
% Boulders (>300 mm)	20	2	1
% Large cobbles (129 - 300 mm)	5	3	0
% Small Cobbles (65 - 128 mm)	25	60	50
% Pebbles (17 -64 mm)	50	30	40
% Gravel (8 -16 mm)	0	0	0
% Sand & silt (< 8 mm)	0	5	9
Channel			
% pool	0	0	0
% riffle	100	100	95
% run	0	0	5
% rapid	0	0	0
% debris jam	0	0	5
% macrophytes	0	0	0
% undercut	0	25	0

4.2. Macroinvertebrates

Biotic index scores for each of the sites surveyed are presented in Figure 4. There were no significant differences between sites for any of the biotic indices, indicating that this discharge is having no effect on the stream's ecology. The index scores indicate mildly polluted to clean water in this stretch of the Mangaehuehu Stream.

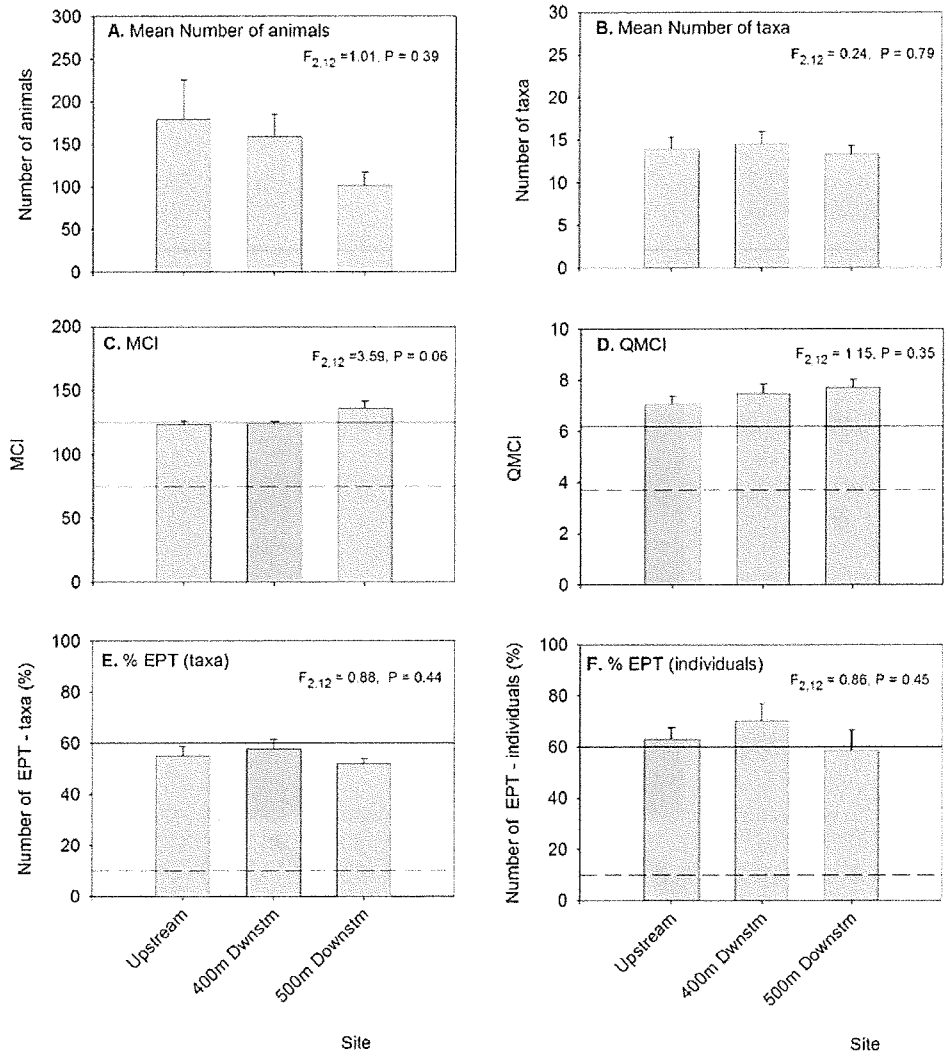


Figure 4. Mean (± 1 SE) A. Number of animals, B. Number of taxa, C. MCI, D. QMCI, E. % EPT (taxa), and F. % EPT (individuals) for the sites sampled on the Mangaehuehu Stream upstream and downstream of the discharge from the wastewater treatment ponds at Rangataua in 2009. For MCI, QMCI and % EPT, thresholds indicative of good water quality are plotted as a solid line and those of poor water quality as a dashed line (Refer Table 4). F values from Analysis of Variance evaluating site differences are presented in the figure.

The different invertebrate taxa collected at each site are presented in Appendix 1 and the relative abundance of the main groups of invertebrates at these sites is presented in Figure 5. All three sites show similar patterns in community structure. Communities were dominated by the stonefly *Zelandoperla* spp., the mayfly *Deleatidium* sp. and the beetle Elmidae. Compared with other sites, the upstream site had higher numbers of the chironomid Orthocladiinae while the site 400 m downstream had higher numbers of the caddisfly *Aoteapsyche* sp..

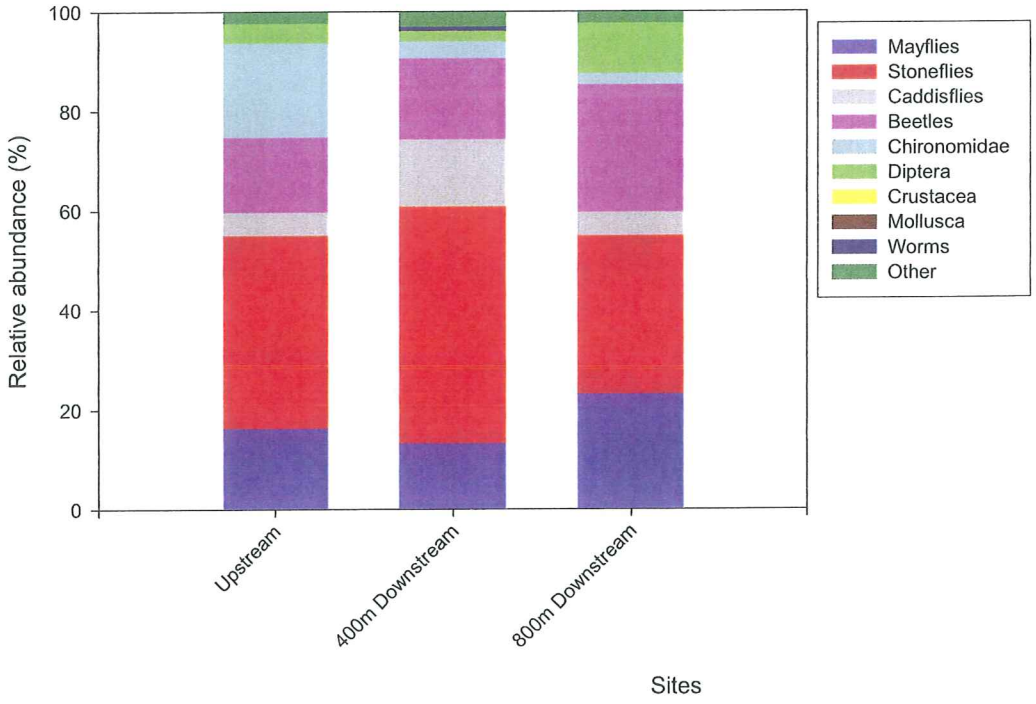


Figure 5. Relative abundance of the main taxonomic groups collected at sites on the Mangaehuehu Stream upstream and downstream of the discharge from the wastewater treatment ponds at Rangataua in 2009.

4.3. Periphyton

Mean periphyton biomass, measured as chlorophyll *a* (mg/m^2), for each site is shown in Figure 6. There is no significant difference in chlorophyll *a* levels between sites upstream and downstream of the discharge. Periphyton biomass levels are all within acceptable limits as recommended by the Ministry for the Environment for 'clean water' fauna (Biggs 2000).

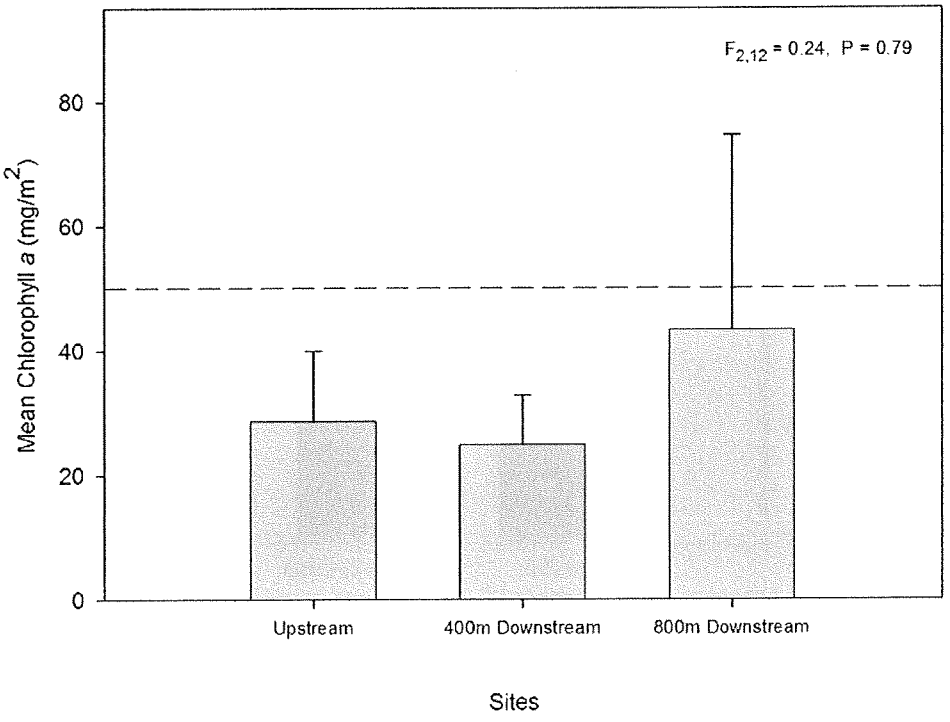


Figure 6. Mean periphyton biomass, measured as chlorophyll *a* (mg/m^2), collected from sites sampled on the Mangaehuehu Stream upstream and downstream of the wastewater treatment pond discharge at Rangataua in 2009. The dashed line represents the maximum level of chlorophyll *a* for 'clean water' benthic fauna (Biggs 2000). F values from Analysis of Variance evaluating site differences are presented in the figure.

A visual assessment of the type of periphyton cover at each site (Fig. 7) indicates diatoms to be the dominant algal cover at sites upstream and downstream of the discharge. The upstream site had levels of periphyton cover above acceptable limits as recommended by the Ministry for the Environment for aesthetics.

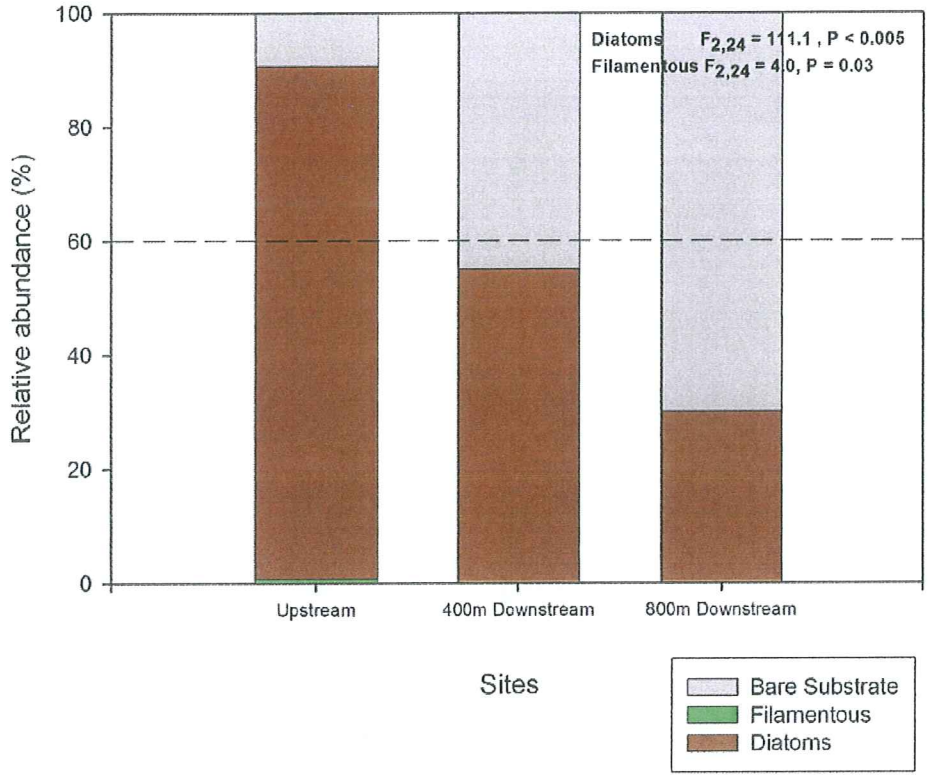


Figure 7. Relative abundance of periphyton visually assessed at sites sampled on the Mangaehuehu Stream upstream and downstream of the discharge from the wastewater treatment ponds at Rangataua in 2009. The dashed line indicates the acceptable level of diatom cover for aesthetics. F values from Analysis of Variance evaluating site differences are presented in the figure.

5. Conclusions

- Taxonomic composition of invertebrate communities was similar upstream and downstream of the discharge point from the wastewater treatment ponds at Rangataua.
- The discharge from the ponds is having no adverse effect on the biological state of this stream.
- Biotic indices show moderate to good water quality in this part of the Mangaehuehu Stream.
- Periphyton biomass was not significantly different upstream and downstream of the discharge.
- The percentage of stream substrate covered by diatoms upstream exceeded limits recommended by the Ministry for the Environment for aesthetics.

7. Appendices

Appendix 1. Mean density of invertebrates collected in 5 ($0.1m^2$) Surber samples at sites on the Mangaehuehu Stream upstream and downstream of the wastewater treatment ponds at Rangataua in 2009.

Taxa	MCI score	Site 1 (upstream)	Site 2 (400m downstream)	Site 3 (800m downstream)
Mayflies				
Austroclima sepia	9	0.4	0	0
Coloburiscus humeralis	9	0.6	0.4	0.2
Deleatidium sp.	8	27.4	20.6	23.4
Nesameletus ornatus	9	0.8	0.2	0.2
Stoneflies				
Acroperla sp.	5	0.4	0	1
Austroperla cyrene	9	0	2	0
Megaleptoperla grandis	9	0.6	0.4	0.4
Stenoperla sp.	10	0.4	0	0.2
Zelandobius confusus	5	0	4.8	3
Zelandobius furcillatus	5	11.8	0	0
Zelandoperla spp.	10	56.4	68.8	28
Caddisflies				
Aoteapsyche sp.	4	2.8	15.6	1.6
Confluens hamiltoni	5	0	0.6	0
Hydrobiosidae (early instar)	6	1.6	1.4	1.4
Neurochorema confusum	6	0	0.2	0
Olinga feredayi	9	0.6	0.4	0.4
Periwinkla sp.	7	3	2.2	0.6
Psilochorema spp.	8	0	0.6	0
Pycnocentria sp.	7	0.4	0.4	0.8
Beetles				
Elmidae	6	26.8	26	24.6
Hydraenidae	8	0.2	0.2	0.4
Scirtidae	8	0.2	0	1.4
Chironomidae				
Chironominae	1	2.4	0	0
Orthocladiinae	2	31.2	5	1.4
Podonominae	8	0	0	0.6
Chironomid pupae	1	0.2	0.2	0.2
Diptera				
Aphrophila neozelandica	5	1.2	0.6	0.2
Austrosimulium sp.	3	2.2	0.2	0.6
Empididae	3	0	0.4	0
Eriopterini	9	3.6	1.4	8.2
Mischoderus sp.	4	0	0.8	1.2
Neocurupira sp.	7	0	0	0.2
Diptera pupae	5	0.2	0	0
Worms				
Oligochaeta (small)	1	0	1.4	0
Other				
Archichauliodes diversus	7	4.2	4.8	2.4

Number taxa		14	15	13
Number animals		180	160	103
MCI		124	124	136
QMCI		7.07	7.50	7.74
% EPT (taxa)		55	58	52
% EPT (individuals)		63	70	59

Appendix E Gravel Bed and Wetland Planting

The gravel bed can provide for cultural values in provideing movement through the earth and some nutrient removal. The final design has yet to be completed but the concept is to put the bed on in the area between the fence and the current dispersion pipe.

Wastewater will be dispersed over the gravel bed before entering the natural wetland area.

Wetland Planting

Planting

New Zealand Institute of Water and Atmosphere produced a wetland planting guidelines. The guideline covers the:

- Role of plants in treatment wetlands
- Plant selection and tolerance

In discussions with both Department of Conservation and Iwi there is an agreement to plant only native wetland species. This plant will be undertaken in Autumn each year in a staged manner until it is fully established. Planting has been budget over time to ensure it is sustained and not serverely influenced by one poor season. A wetland plant species list was complied by Nicholas Singers and will be used to select species along with guideance from experts such as the Department of Conservation.

The area is to be developed as a natural wetland, hence it is an attempt to replicate nature planting and not implimented in rows. The water level within the channel bed will not controled and so planting should commence at the edge of the channel and allowed to naturally spread into the channel to reduce the loss of plants. The open waters currently has duckweed on the surface which is a natural floating wetland species.

A planting diagram is provided.

Weeds

At the time of planting uncontrolled weeds often compet and suppress established. The maintenance programme for weed control will be:

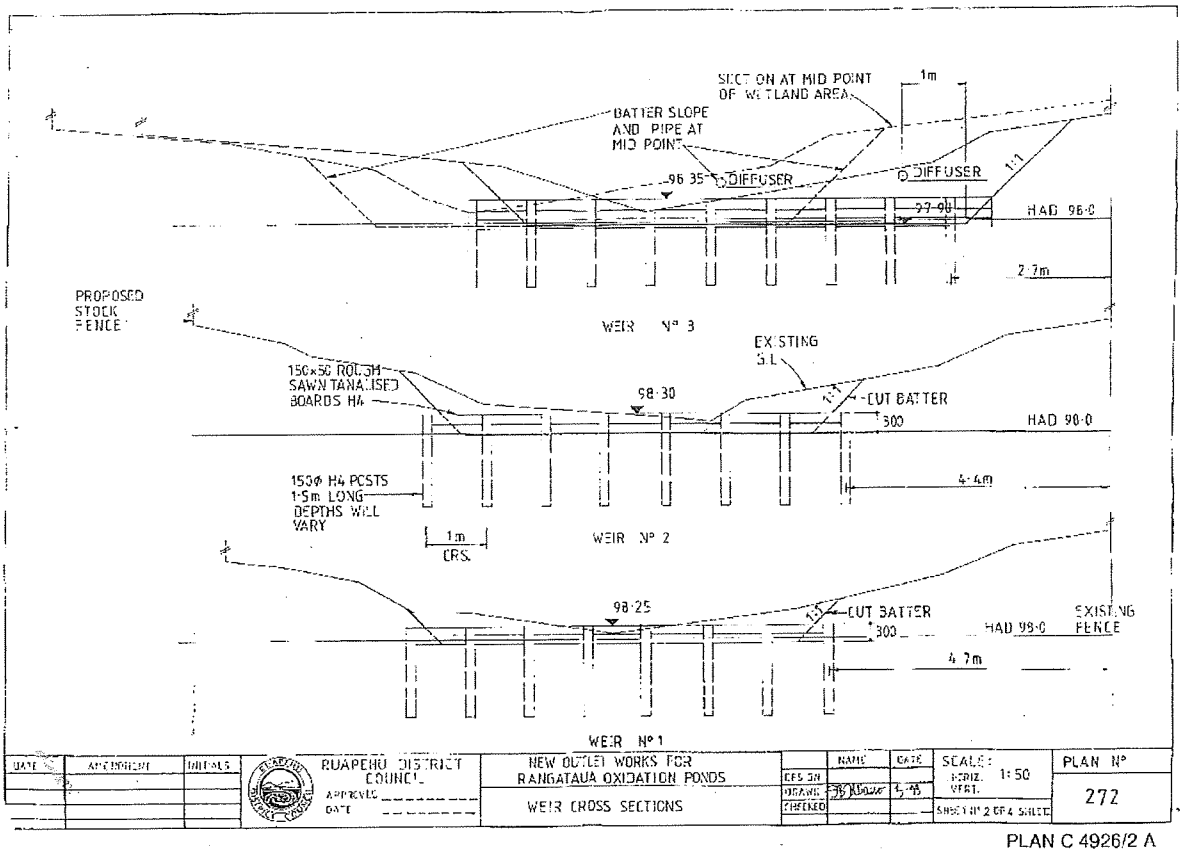
1. Monthly inspections for the first 4-6 months
2. Three monthly inspection will be then undertaken for the next 12 months
3. Reducing to 2 times per year control thereafter.

Fencing

The wetland area is fenced and will remained fenced to protect the wetland from any stock entering the lagoon area.

Weir

The wetland has been artifically created by adding rough sawn timber as batters to slow the flow of both natural and wastewater through this section of channel. A diagram of the section is included for completeness.



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A weir section will be planted each season with plants highlighted in the table of plant species. Further species will be identified with the help of Department of Conservation.

Mangaehuehu Stream Wetland Plant Species List
This Species list was compiled by Nicholas Singers on 4 January 2003 and 22 January 2008 and also includes vegetation along the Paramanawera track.

Dicot trees and shrubs	**Ferns and fern allies**
**Berberis dawinii* Darwin's barberry *Coprosma propinqua subsp. propinqua* mingimingi *Coprosma rugosa* divaricaring coprosma *Cyathodes juniperina* mingimingi *Androstoma empetrifolia* *Dracophyllum subulatum* monoao *Elaeocarpus hookerianus* pokaka *Erica lusitanica* Spainish heath *Helichrysum lanceolatum* hells bells *Leptospermum scoparium* manuka *Olearia virgata* twiggy–tree daisy *Salix fragilis* crack willow	*Azolla filiculoides* var. *rubra* pacific azolla *Blechnum minimus* small kiokio *Blechnum penna–marina* alpine water fern *Gleichenia dicarpa* tangle fern
Sedges and rushes	**Grasses**
Baumea rubiginosa *Baumea tenax* *Carex demissa* European yellow sedge *Carex dipsacea* *Carex dissita* *Carex echinata* *Carex maorica* sedge *Carex secta* niggerhead, pukio a *Empodisma minus* wire rush *Eleocharis acuta* spike sedge *Eleocharis gracilis* spike sedge	**Agrostis stolonifera* creeping bent *Carpha alpina* *Cortaderia fulvida* toetoe **Glyceria striata* *Holcus lanatus* Yorkshire fog *Hierochloe redolens* Holy grass *Rytidosperma* sp. danthonia

Gahnia xanthocarpa *Isolepis prolifer* u **Juncus articulatus* jointed rush **Juncus acuminatus* **Juncus effusus* *Juncus gregiflorus* *Lepidosperma australe* square sedge *Schoenus pauciflorus* bog rush, sedge tussock *Triglochin striata* arrow sedge	
Dicot herbs including composites *Celmisia gracilenta* u *Celmisia graminifolia* *Celmisia setacea* mountain daisy *Cirsium palustre* marsh thistle *Craspedia uniflora* agg. wooly head o *Drosera binata* scented sundew o *Epilobium rotundifolium* willowherb u *Epilobium pallidiflorum* willowherb u *Geranium microphyllum* geranium u *Gonocarpus aggregatus* o *Hypochoeris radicata* catsear lc *Hydrocotyle novae-zelandiae* hydrocotyle *Hydrocotyle pterocarpa* hydrocotyle *Lotus pedunculatus* lotus la **Mimulus guttatus* monkey musk l **Mimulus moschatus* monkey musk u **Myosotis laxa* var. *caespitosa* water forget-me-not o **Potentilla reptans* **Prunella vulgaris* selfheal o *Ranunculus amphitrichus* water buttercup	**Monocot herbs (other than orchids, grasses, sedges and rushes)** *Astelia grandis* astelia l *Phormium tenax* flax, harakeke a *Potamogeton suboblongus*

Ranunculus glabrifolius water buttercup c *Scleranthus uniflorus* u *Viola cunninghamii* violet o	
Mosses Sphagnum moss	**Monocot trees** *Cordyline australis* cabbage tree, ti-kouka