

Remediation NZ Limited
Monitoring Programme
Annual Report
2012-2013

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Executive summary

Remediation NZ Ltd (RNZ) operates worm farms (to produce vermicasts for fertiliser) at two sites: Waitara Road in the Waiongana catchment and Pennington Road, in the Waitara catchment. RNZ also operates a composting and vermiculture operation at Mokau Road, Uruti, in the Mimi catchment.

This report for the period July 2012-June 2013 describes the monitoring programme implemented by the Taranaki Regional Council to assess the Company's environmental performance during the period under review, and the results and environmental effects of the Company's activities.

The Company holds a total of seven resource consents that cover all operations carried out on the three sites. These consents include a total of 90 special conditions that set out the requirements that the Company must satisfy.

The Council's monitoring programme for the year under review included 10 inspections focussing on raw materials, leachate, stormwater, and odour control, 58 water samples, 12 discharge samples, four soil samples, six groundwater samples, one freshwater biomonitoring survey, and two odour surveys.

During the monitoring year, Council received three complaints in regards to odours in the vicinity of RNZ's Waitara Rd and Pennington Rd sites. All of these complaints were investigated and no breaches of consent conditions were found.

RNZ demonstrated a high level of environmental performance at its Waitara Road and Pennington Road sites and a good level of environmental performance at its Mokau Rd site at Uruti.

Overall, Remediation NZ demonstrated a good level of environmental performance.

For reference, in the 2012-2013 year, 35% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 59% demonstrated a good level of environmental performance and compliance with their consents.

This report includes recommendations for the 2013-2014 year.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is the Annual Report for the period July 2013-June 2014 by the Taranaki Regional Council on the monitoring programme associated with resource consents held by Remediation NZ Ltd (RNZ Ltd). The Company operates a worm farm at two sites; Waitara Road, Waitara, in the Waiongana catchment; and Pennington Road, Brixton, in the Waitara catchment. The Company also operates a composting and vermiculture facility at Mokau Road, Uruti, in the Mimi catchment.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by RNZ that relate to discharges of water and solids to land within the Waiongana and Waitara catchments, and the consents held by RNZ to cover emissions to air and discharges to land and water in the Mimi catchment.

One of the intents of the Resource Management Act (1991) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Taranaki Regional Council has generally integrated its environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the RNZ's use of water, land and air, and is the twelfth combined annual report by the Taranaki Regional Council for the sites.

1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about compliance monitoring under the Resource Management Act and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consents held by RNZ, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted at the Company's sites.

Section 2 presents the results of monitoring done during the period under review, including scientific /technical data and the results of inspections and incident investigations.

Section 3 discusses the results, their interpretation, and their significance for the environment.

Section 4 presents recommendations to be implemented in the 2013-2014 monitoring year.

A glossary of common abbreviations and scientific terms, and a bibliography, are presented at the end of the report.

1.2.1 The Resource Management Act (1991) and monitoring

The Resource Management Act primarily addresses environmental 'effects' which are defined as positive or adverse, temporary or permanent, past, present or future, or cumulative. Effects may arise in relation to:

- (a) the neighbourhood or the wider community around a discharger, and may include cultural and socio-economic effects;
- (b) physical effects on the locality, including landscape, amenity and visual effects;
- (c) ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;
- (d) natural and physical resources having special significance (e.g., recreational, cultural, or aesthetic);
- (e) risks to the neighbourhood or environment.

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Taranaki Regional Council is recognising the comprehensive meaning of 'effects' inasmuch as is appropriate for each discharge source. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the Resource Management Act to assess the effects of the exercise of consents. In accordance with section 35 of the Resource Management Act 1991, the Council undertakes compliance monitoring for consents and rules in regional plans; and maintains an overview of performance of resource users against regional plans and consents. Compliance monitoring, including impact monitoring, also enables the Council to continuously assess its own performance in resource management as well as that of resource users particularly consent holders. It further enables the Council to continually re-evaluate its approach and that of consent holders to resource management, and, ultimately, through the refinement of methods, to move closer to achieving sustainable development of the region's resources.

1.2.2 Evaluation of environmental performance

Besides discussing the various details of the performance and extent of compliance by the consent holder(s) during the period under review, this report also assigns an overall rating. The categories used by the Council, and their interpretation, are as follows:

- a **high** level of environmental performance and compliance indicates that essentially there were no adverse environmental effects to be concerned about, and no, or inconsequential (such as data supplied after a deadline) non-compliance with conditions.
- a **good** level of environmental performance and compliance indicates that adverse environmental effects of activities during the monitoring period were negligible or minor at most, or, the Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices, or, there were perhaps some items noted on inspection notices for attention but these items were not urgent nor critical, and follow-up inspections showed they have been dealt with, and any

inconsequential non compliances with conditions were resolved positively, cooperatively, and quickly.

- **improvement desirable (environmental) or improvement desirable (administrative compliance)** (as appropriate) indicates that the Council may have been obliged to record a verified unauthorised incident involving measurable environmental impacts, and/or, there were measurable environmental effects arising from activities and intervention by Council staff was required and there were matters that required urgent intervention, took some time to resolve, or remained unresolved at the end of the period under review, and/or, there were on-going issues around meeting resource consent conditions even in the absence of environmental effects. Abatement notices may have been issued.
- **poor performance (environmental) or poor performance (administrative compliance)** indicates generally that the Council was obliged to record a verified unauthorised incident involving significant environmental impacts, or there were material failings to comply with resource consent conditions that required significant intervention by the Council even in the absence of environmental effects. Typically there were grounds for either a prosecution or an infringement notice.

For reference, in the 2012-2013 year, 35% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 59% demonstrated a good level of environmental performance and compliance with their consents.

1.3 Process description

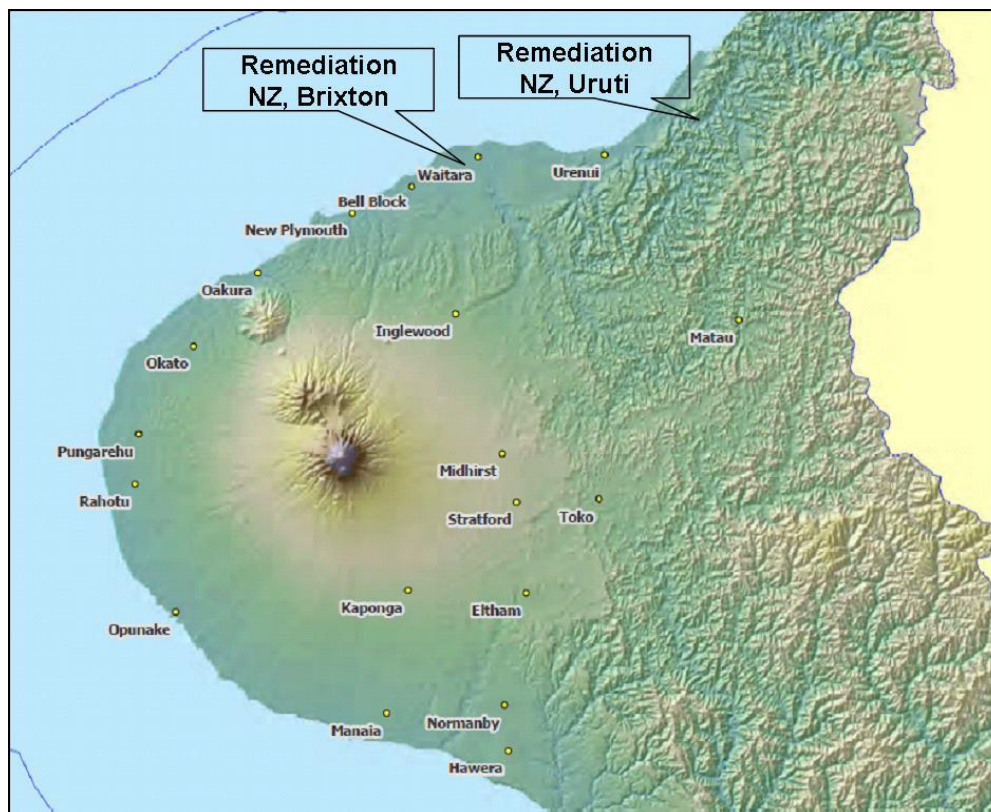


Figure 1 Regional map showing locations of Remediation NZ's Taranaki sites

RNZ produces organic fertiliser (worm casting) for national and international markets. A range of organic waste streams are processed and converted, via vermiculture and composting, into marketable biological products that can be safely used as a fertiliser and soil conditioner.

The operation consists of a composting and vermiculture operation at Mokau Road, Uruti, and vermiculture operations at Waitara Road and Pennington Road. The Waitara Road site also has a fertilising processing facility which blends and refines the finished products.

The Mokau Road, Uruti composting site was established in late 2001 following removal of composting operations from the old Winstone Aggregates quarry site, Manutahi Road, Bell Block (RNZ no longer operates at this site). Closure of the composting operations was due to the incompatible nature of the activity with surrounding land use (nearby residential houses), which resulted in odour incidents. The vermiculture production facilities have been operating at Waitara Road since 1998 and at the Pennington Road site since 2001.

1.3.1 Treatment Systems at Mokau Rd, Uruti

The composting operation and drilling mud processing at the Mokau Rd site generates a significant amount of leachate and contaminated stormwater from three main processing areas. These are the drilling wastes remediation pad and two composting pads (known as 'pad 1' and 'pad 2').

Synthetic hydrocarbon contaminated drilling muds and cuttings are piled up on the remediation pad and the liquids are allowed to drain. The runoff is treated in the series of ponds. Between each pond there is a baffle that skims off any floating hydrocarbons as the leachate passes through. These ponds also treat the leachate and stormwater from pad 1 where remediated drilling wastes are blended with green waste and other organic matter for composting. The treated liquid is held in the final pond and then irrigated to cut and carry pasture.

Run off and leachate from composting pad 2 is pumped up to the top of a seven tier wetland. Under dry conditions the wetland water from the bottom pond of the wetland is reticulated back to the top tier of the wetland. Under high flow conditions the wetland discharges the treated stormwater and leachate to a tributary of the Haehanga Stream.



Figure 2 RNZ site, Mokau Road, Uruti

1.4 Resource consents

Table 1 Consents held by Remediation NZ

Consent No.	Site	Purpose	Expiry Date	Review Date(s)
5838-2	Uruti	Discharge to land and water	June 2018	Yearly
5839-2	Uruti	Discharge emissions to air	June 2018	Yearly
5938-1	Uruti	Install culvert	June 2015	–
6211-1	Uruti	Divert stream	June 2021	June 2015
6212-1	Uruti	Install culvert	June 2021	June 2015
5892-2	Brixton	Discharge to land/water	June 2020	June 2014
5893-2	Brixton	Discharge to land/water	June 2021	June 2015

1.4.1 Air discharge permit

Section 15(1)(c) of the Resource Management Act stipulates that no person may discharge any contaminant from any industrial or trade premises into air, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations

RNZ holds air discharge permit **5839-2** to discharge emissions into the air, namely odour and dust, from composting operations between 1731704E-5685796N, 1733127E-5684809N, 1732277E-5685101N, 1732451E-5684624N and 1732056E-5684927N. This consent was issued to the consent holder on 30 June 2010.

The consent has 20 special conditions attached to it.

Special condition 1 requires that the consent holder adopt the best practical option.

Special conditions 2 to 4 set restrictions on the types of waste accepted and the size of the composting pads, and condition 5 requires that records be kept of incoming waste.

Special conditions 6 and 7 deal with the requirements for the submission of and adherence to a Site Practices Plan.

Special conditions 8 and 9 require an independent report on the management of the site in regards to practices and air emissions, and special condition 10 requires that any recommendations from the report be adhered to.

Special conditions 11, 12, and 13 set out the permitted limits on the effects of discharges to air arising from the exercise of this consent.

Special conditions 14 and 15 deal with the requirements for weather monitoring and odour surveys.

Special conditions 16 and 17 set out requirements for community liaison and complaints procedures.

Special condition 18 and 19 set out the requirements for site reinstatement.

Special condition 20 is a review condition.

A copy of the permit is attached to this report in Appendix I.

1.4.2 Discharges to land and water

Sections 15(1)(b) and (d) of the Resource Management Act stipulate that no person may discharge any contaminant onto land if it may then enter water, or from any industrial or trade premises onto land under any circumstances, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

RNZ holds water discharge permit **5838-2** to discharge: a) waste material to land for composting; and b) treated stormwater and leachate from composting operations; onto and into land in circumstances where contaminants may enter water in the Haehanga Stream catchment and directly into an unnamed tributary of the Haehanga Stream between 1731704E-5685796N, 1733127E-5684809N, 1732277E-5685101N, 1732451E-5684624N and 1732056E-5684927N. This consent was issued to the consent holder on 30 June 2010.

It has 28 special conditions.

Special condition 1 requires that the consent holder adopt the best practical option for reducing and minimising effects.

Special conditions 2 and 3 set restrictions on the types of waste accepted and the size of the composting pads, and condition 5 requires that records be kept for incoming waste.

Special conditions 4, 5 and 6 set out requirements for the maintenance of treatment systems.

Special condition 7 requires the consent holder to keep irrigation records.

Special condition 8, 9 and 10 set limits on effects arising from the irrigation of wastewater.

Special conditions 11, 12 and 13 set out requirements for the monitoring and management of soil quality in the irrigation areas.

Special conditions 14 to 17 set out requirements for the monitoring and management of groundwater quality in the irrigation areas.

Special conditions 18 and 19 deal with the maintenance and management of the pond treatment system.

Special conditions 20 and 21 deal with the maintenance and management of the wetland treatment system.

Special conditions 22 and 23 sets limits on effects arising from the wetland discharge.

Special condition 24 requires that riparian planting be maintained in accordance with the riparian plan in place.

Special condition 25 requires that the consent holder keep records of all complaints.

Special conditions 26 and 27 deal with site reinstatement.

Special condition 28 is a review condition.

RNZ holds discharge permit **5892-1** to cover the discharge of stormwater from the worm farming operations onto and into land and into the unnamed tributary of the Waiongana Stream at the Waitara Road, Brixton site. This permit was originally issued by the Taranaki Regional Council on 6 November 2001 under Section 87(e) of the Resource Management Act. It expired on 1 June 2006, and a new consent was issued on 7 September 2006.

There are 10 special conditions attached to the consent.

Special condition 1 requires the consent be exercised in accordance with information submitted in the application.

Special condition 2 requires the consent holder adopt the best practicable option to prevent or minimise adverse effects on the environment.

Special condition 3 requires the provision, upon request, of records of the nature and volume of wastes.

Special condition 4 sets a maximum hydrocarbon content on solid drilling cuttings of 5%.

Special condition 5 requires that there is no contamination of groundwater or surface water while condition 7 gives contaminant concentrations not to be exceeded in the discharge.

Special condition 6 requires that the stormwater treatment system is maintained.

Special condition 8 requires notification prior to undertaking changes to processes or operations which would change the nature or quantity of contaminants emitted from the site.

Special condition 9 requires notification of reinstatement of the site and gives guidance as to how reinstatement should be carried out to minimise effects on stormwater.

Special condition 10 explains review provisions.

RNZ holds discharge permit **5893-1** to cover the discharge of solid hydrocarbon exploration drilling wastes onto land, and to discharge stormwater from the worm farming operations onto and into land and into the unnamed tributary of the Waitara River at the Pennington Road, Brixton site. This permit was originally issued by the Taranaki Regional Council on 6 November 2001 under Section 87(e) of the Resource Management Act. It expired on 1 June 2006, and a new consent was issued on 12 October 2006.

There are 11 special conditions attached to the consent.

Special condition 1 requires the consent be exercised in accordance with information submitted in the application.

Special condition 2 requires the consent holder adopt the best practicable option to prevent or minimise adverse effects on the environment.

Special condition 3 requires, upon request, records of the nature and volume of wastes.

Special condition 4 sets a maximum hydrocarbon content on solid drilling cuttings of 5%.

Special condition 5 requires that there is no contamination of groundwater or surface water.

Special condition 6 requires the stormwater treatment system to be maintained.

Special condition 7 gives contaminant concentrations not to be exceeded in the discharge while special condition 8 describes visual effects which must not be observed below a mixing zone.

Special condition 9 requires notification prior to undertaking changes to processes or operations which would change the nature or quantity of contaminants emitted from the site.

Special condition 10 requires notification of reinstatement of the site and gives guidance as to how reinstatement should be carried out to minimise effects on stormwater.

Special condition 11 explains review provisions.

1.4.3 Land use consents

RNZ hold three land use consents. Consent **5938-1** relates to a culvert in the Haehanga Stream. This consent was granted on 5 December 2001.

There are six special conditions attached to the consent.

Special condition 1 requires the consent holder to notify the Council prior to construction.

Special condition 2 requires that construction is in accordance with the application.

Special condition 3 requires the consent holder adopt the best practicable option to avoid or minimise discharge of silt or contaminants to the environment.

Special condition 4 deals with riverbed disturbance.

Special condition 5 requires the consent holder to reinstate the area when the structure is no longer required.

Special condition 6 deals with review of the consent.

Consent **6211** was granted as a retrospective consent on 26 September 2003. Relating to a diversion of the Haehanga Stream, the consent has six special conditions attached.

Special condition 1 requires the consent holder to notify the Council prior to works.

Special condition 2 requires that the realignment be carried out in accordance with the application.

Special conditions 3 and 4 require the consent holder adopt the best practicable option to avoid or minimise erosion, scouring and the discharge of silt or contaminants to water.

Special condition 5 deals with riverbed disturbance.

Special condition 6 deals with review of the consent.

Consent **6212** for a culvert in the Haehanga Stream was also granted as a retrospective consent on 26 September 2003.

There are eight special conditions included in the consent.

Special condition 1 requires the consent holder to notify the Council prior to removal of the temporary culvert and installation of the new culvert.

Special condition 2 requires that the temporary culvert be replaced by April 2004, and that the consent holder provide designs of the proposed culvert.

Special condition 3 required that the culvert be constructed in accordance with the application and be maintained to ensure the conditions are met.

Special condition 4 requires the adoption of best practicable option to avoid or minimise adverse effects on water quality.

Special condition 5 deals with riverbed disturbance.

Special condition 6 stipulates that the structure does not obstruct fish passage.

Special condition 7 requires reinstatement of the area once the structure is no longer required.

Special condition 8 deals with review of the consent.

Copies of the above permits are attached to this report in Appendix I.

1.5 Monitoring programme

1.5.1 Introduction

Section 35 of the Resource Management Act sets out an obligation for the Taranaki Regional Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region.

The Taranaki Regional Council may therefore make and record measurements of physical and chemical parameters, take samples for analysis, carry out surveys and inspections, conduct investigations, and seek information from consent holders.

The monitoring programme for the RNZ sites consisted of five primary components.

1.5.2 Programme liaison and management

There is generally a significant investment of time and resources by the Taranaki Regional Council in on-going liaison with resource consent holders over consent conditions and their interpretation and application, in discussion over monitoring requirements, preparation for any reviews, renewals, or new consents, advice on the Council's environmental management strategies and the content of regional plans, and consultation on associated matters.

1.5.3 Site inspections

Ten inspections were conducted over the monitoring period. With regard to consents for the discharge to contaminants to land and water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was also surveyed for environmental effects.

1.5.4 Chemical sampling

The Taranaki Regional Council undertook sampling in the Haehanga Stream system at numerous sites both up and down stream of the operations at the site at Mokau Road, Uruti. The Haehanga Stream was sampled on six occasions, with a total of 58 water samples taken. These samples were analysed for chloride, conductivity, pH, ammonia, BOD and suspended solids. Six samples were also taken of the wetland discharge (or from the wetland's lower pond if discharge not occurring) and a

further six samples were taken of the irrigation pond. Council also took six groundwater samples and four soil samples from the irrigation areas at the site.

Council also undertook benzene, toluene, ethyl benzene and xylene (BTEX) analysis on one soil sample, one groundwater sample, one irrigation fluid sample and one surface water sample.

1.5.5 Odour surveys

Taranaki Regional Council visited the Uruti site on two occasions to conduct odour surveys as required by consent conditions.

1.5.6 Biomonitoring surveys

Two macroinvertebrate biological surveys were performed across six sites on two occasions in the Haehanga Stream and its tributaries to determine whether or not the discharge of treated leachate from the site has had a detrimental effect upon the aquatic communities of the stream.

Table 2 Summary of monitoring activities

Activity	Uruti	Waitara and Pennington Rd
Inspections	7	3
Freshwater samples	57	-
Groundwater samples	6	-
Soil samples	4	-
Discharge samples	6	-
Irrigation pond samples	6	-
Odour surveys	2	-
Macro-invertebrate surveys	2	-

2. Results

2.1 Mokau Rd, Uruti

2.1.1 Inspections

Officers of the Taranaki Regional Council undertook site inspections of the Mokau Road site during the 2012-2013 monitoring period. The following observations were made during inspections:

2.1.1.1 16 August 2012

A site visit was made to conduct a compliance monitoring inspection and to take water and soil samples. There was a light intermittent drizzle at the time of the inspection with 21 mm rain over the previous 48 hours. The Haehanga Stream was at moderate to high flow at the time of the inspection. The wetland was discharging at approximately 1 L/s and the discharge had a dark brown tint and slight organic odour. The raupo had died off but had not been cut back, however the wetland terraces seemed to have more open water than in previous winters after the die off.

The new worm bed pad had the beginnings of grass growth on it and this should help slow down silt runoff. The silt trap on the left (looking uphill) was full and will need clearing out and the silt fence also needed to be fixed up.

There was a pile of dead goats (which appeared to have been shot at the site) that had been dumped at the top of the wetland, and these would need to be put into the compost system or removed from the site.

A reduced sampling run was undertaken due to the high flow of the stream and no significant effects were noted in receiving waters.

No odour issues were noted during the inspection.

The following action was to be taken:

- Check all drains and silt traps and clean out/repair if required.
- Remove dead goats

2.1.1.2 12 October 2012

A site visit was made to conduct a compliance monitoring inspection and to take water samples. It was fine at the time of the inspection with 7.5 mm rain over the previous 72 hours. The Haehanga Stream was at moderate to low flow at the time of the inspection. The wetland was discharging at approximately 2 L/min and the discharge had a dark brown tint and no odour. It was noted that the raupo in the lower terrace had vigorous re-growth, whilst the upper terrace had far less.

The silt retention structure on the new pad was found to be scouring out and needed further attention. The site manager was contacted and he undertook to modify the system so it would need less maintenance. He also undertook to encourage better grass cover on the pad to reduce siltation.

Pad one was inspected and there was only one small active compost pile, with the bulk of the pad being used for storage. A large pile of sawdust had also been placed at the rear of the pad. The stock pile of CCA contaminated soil was undisturbed and covered with thick cover of vegetation. There were no issues with odour around the pad one area.

The irrigation areas had lush grass growth and there were no areas of ponding or grass burn noted. A sample of the irrigation pond was taken for analysis.

No visual effects were noted in the Haehanga Stream during the inspection and only noticeable odours were noted on the site. No odours were noted on the site boundary.

The following action was to be taken:

- Continue to check and maintain drains and silt retention structures as required
- Repair scoured drain on the new worm pad



Photo 1 Spring regrowth of raupo in wetland

2.1.1.3 21 November 2012

A site visit was made to take groundwater and soil samples and to inspect the weather station. The weather was fine with no rain over the last 72 hours.

Soil samples were collected from both irrigation areas. Part of the sample from the lower irrigation area was sent away for BTEX analysis. Groundwater samples were collected from all three bores. Prior to purging the lower bore, the top 20 cm of water was collected and sent for BTEX analysis.

The weather station was removed from its mast and inspected. It was found that the unit was quite old and that the solar panel was only producing 2 volts (3 volts being needed to charge the battery). It was also found that the wind direction vane was not swinging freely. After discussions between Council staff and the consent holder it was decided that the whole sensor assembly was to be replaced.

During the site visit no objectionable odours were noted. It was also noted that the silt traps at the site had been cleaned out.

2.1.1.4 11 January 2013

A site visit was made to conduct a compliance monitoring inspection and to take water samples. It was fine at the time of the inspection with 0.5 mm rain over the previous 72 hours. The Haehanga Stream was at low flow at the time of the inspection. The wetland was discharging at a trickle rate.

A large amount of sawdust had been placed at the top end of the drilling waste pad and this was encroaching on the nearby drain and in some areas had fallen down the bank. This would need to be scraped back from the banks edge and some kind of retention bund erected to keep it out of the stream.

The irrigation areas had lush grass growth and there were no areas of ponding or grass burn noted. A sample of the irrigation pond was taken for analysis.

No visual effects were noted on the Haehanga Stream during the inspection and the only noticeable odours were on site. No odours were noted on the site boundary.

The following action was to be taken:

- Scrape back sawdust from stream bank

2.1.1.5 22 February 2013

A site visit was made to conduct a compliance monitoring inspection and to take water samples. It was fine at the time of the inspection with no rain over the previous 7 day. The Haehanga Stream was at low flow at the time of the inspection and the wetland was not discharging.

A retention bund had been erected (as requested) along the unnamed tributary running along the drill waste pad. This was being effective at keeping sawdust and other materials out of the water body. Bunding had also been erected around the track that runs behind pad one and this would provide effective containment of material and run-off from pad one.

The irrigation areas had been cut and baled and there was healthy regrowth on both areas.

A 15 minute odour survey was conducted at the down wind boundary and only transient faint earth-like odours were detected. Noticeable odours were noted on site, but only within the immediate vicinity of the operational areas.

The weather station array had been reinstalled, but the site manager said that they had not been able to get it to transmit to the base station. It was agreed that a Council technician would look at the unit.



Photo 2 New retention bund along stream bank next to drilling waste pad



Photo 3 New retention bunding on track around pad one

2.1.1.6 18 April 2013

A site visit was made to conduct a compliance monitoring inspection and to take water samples. It was fine at the time of the inspection with 17 mm rain over the previous 24 hours.

A 30 minute odour survey was conducted at the down wind boundary of the site and no odours were detected. There was a slight southerly breeze at the time.

The Haehanga Stream was at moderate-low flow at the time of the inspection. The wetland was discharging at approximately 8 L/min and the discharge had a brown tint and organic odour. There was a minor amount of discolouration at the downstream site. The wetland appeared healthy with only small patches of raupo browning off. The bottom pond had a heavy layer of duck weed.

A new track was being cut along the bluff above the upper irrigation area. Silt retention works had been done but a flume would need to be installed on the larger discharge to prevent scouring.

The irrigation areas had lush grass growth and there were no areas of ponding or grass burn noted. A sample of the irrigation pond was taken for analysis and was found to have a green tint which possibly could be the result of an algal bloom.

No visual effects were noted in the main stem of the Haehanga Stream during the inspection.

2.1.1.7 14 June 2013

A site visit was made to conduct a compliance monitoring inspection and to take water, groundwater and soil samples. It was fine at the time of the inspection with 1.0 mm rain over the previous 24 hours.

The Haehanga Stream was at moderate-low flow at the time of the inspection. The wetland was discharging at approximately 0.5 L/s and the discharge had a brown tint and no odour. There was a minor amount of discolouration at the downstream site. The wetland appeared healthy; however there were large areas of raupo browning off for winter. The bottom pond had a heavy layer of duck weed.

A large amount of drilling waste had been accepted recently and this was being treated with sawdust. The bund along the tributary adjacent the drill waste drop off area was eroding near the culvert and the site manager had some concrete blocks ready to shore it up.

The irrigation areas had lush grass growth and there were no areas of ponding or grass burn noted. A sample of the irrigation pond was taken for analysis and was found have a strong hydrocarbon and anaerobic odour. There was also grey scum around the edges of the pond.

Conductivity readings were taken at every stream site and the highest level found was 26.5 mS/m at site HHG000150. Small amounts of foam were noted to be in the stream at this site also. No odour issues were noted at the boundary.

2.1.2 Wetland discharge monitoring results

Table 3 shows the results of sampling of the wetland discharge taken during the monitoring year. When the pond was discharging, a sample was taken from the discharge pipe itself to assess the nature of the liquid entering the stream. When the pond was too low for discharge to occur, a sample was taken from the pond itself to monitor the general characteristics of any potential discharge.

Table 3 Results wetland discharge monitoring

Site	CBODF	Chloride	Conductivity	Unionised ammonia	Ammoniacal nitrogen	pH	Suspended solids	Temp
	g/m ³	g/m ³	mS/m	g/m ³	g/m ³	pH	g/m ³	Deg C
16 Aug 2012	13	29.0	80.2	0.214	37	7.4	17	10.2
12 Oct 2012	14	56.6	96	2.262	46.7	8.1	98	17.6
11 Jan 2013	20*	21.5	29.6	0.025	1.29	7.6	46	20.7
22 Feb 2013	11	54.5	102	0.778	46.6	7.6	140**	18.4
18 Apr 2013	10	64.6	92.5	0.41312	31.3	7.6	150	15.2
14 Jun 2013	4.9	42.6	62.7	0.09657	19.1	7.4	18	8.4
<i>Consent limit</i>	-	-	-	-	-	6-9	100	-

* Unfiltered sample

** sampled from pond (wetland not discharging)

Consent 5838-2 states the discharge shall have a pH of between 6.0 and 9.0 pH and have no greater than 100 g/m³ suspended solids. The consent limit on suspended solids in the discharge was exceeded on one occasion, on 18 April 2013. Subsequent sampling showed that the levels of suspended solids had dropped back to under the consent limit of 100 g/m³.

2.1.3 Irrigation fluid results

A sample of the irrigation pond was taken during each inspection and monitored for a range of parameters. This sampling is undertaken in part for compliance monitoring and also as part of an on-going study of the treatment system. Analysis for copper, chromium, and arsenic was also undertaken as the Company stored and processed soil contaminated with timber treatment chemicals within the system's catchment.

Table 4 Results irrigation fluid monitoring

Parameter	Unit	16 Aug 2012	12 Oct 2012	11 Jan 2013	22 Feb 2013	18 Apr 2013	14 Jun 2013
Arsenic	g/m ³	0.006	0.004	0.006	0.009	0.005	0.006
BOD	g/m ³	67	580	18	48	35	540
Chloride	g/m ³	875	3550	3650	3940	4170	5630
Conductivity @ 20 Deg. C	mS/m	340	102	1096	1110	1530	1480
Total chromium	g/m ³	<0.03	0.03	<0.03	<0.03	<0.05	0.09
Total copper	g/m ³	0.01	0.005	0.002	0.005	<0.001	0.019
Hydrocarbons	g/m ³	<0.5	3.4	0.8	2.2	<0.5	76

Parameter	Unit	16 Aug 2012	12 Oct 2012	11 Jan 2013	22 Feb 2013	18 Apr 2013	14 Jun 2013
Potassium	g/m ³	281	651	7.1	829	35	540
Sodium	g/m ³	241	1220	1250	1400	852	1350
Unionised ammonia -N	g/m ³ -N	0.33384	0.12223	1.14787	0.63315	0.34264	0.18884
Ammoniacal nitrogen-N	g/m ³ -N	52.1	87.7	37.0	30.0	17.6	35.2
pH	pH	74	76	110	230	7.7	7.4
Suspended solids	g/m ³	11.6	15.8	20.7	21.6	220	110
Temperature	Deg. C	0.006	0.004	0.006	0.009	17.4	9.2

Consent 5838-2 requires that irrigation fluid shall not be discharged if it has a hydrocarbon level in excess of 5% (or 50000 g/m³). The sampling shows that this condition is being comfortably complied with and that the upstream treatment systems are effective at removing any hydrocarbons in the waste stream. The results also show that the levels of copper, chromium and arsenic have been consistently low over the monitoring period indicating that little or no contamination leached from contaminated soils that were processed at the site.

Other results of note are the high levels of nutrients which are expected in such a waste stream and these are in effect treated by the process of irrigation. The high level of chloride which are present as result of the drilling waste that is being treated are more problematic. Chloride levels are discussed in more detail in the freshwater and groundwater results (sections 2.1.4 and 2.1.4).

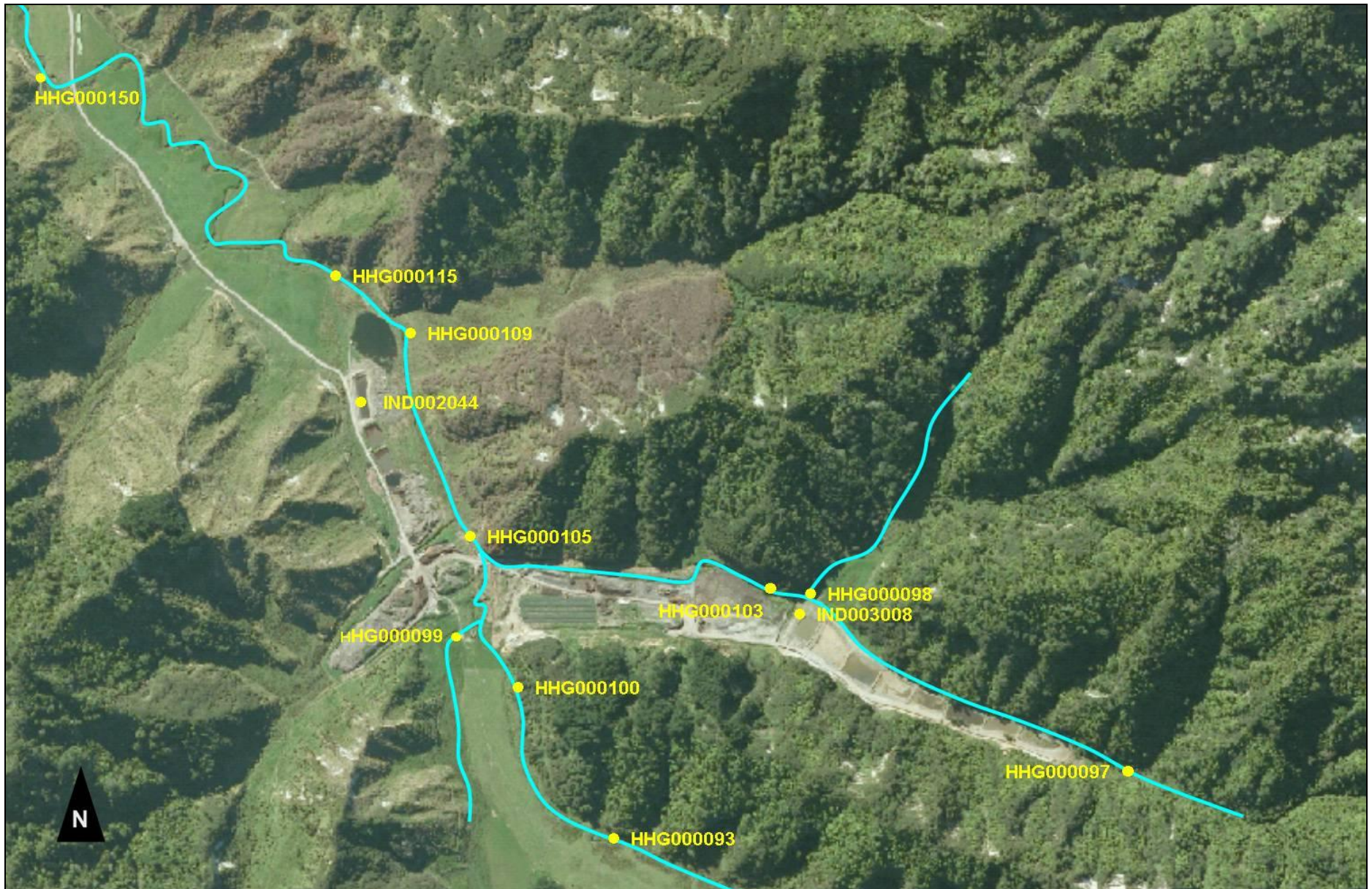


Figure 3 Aerial image of RNZ's site at Mokau Rd, Uruti showing the surface water sampling site positions

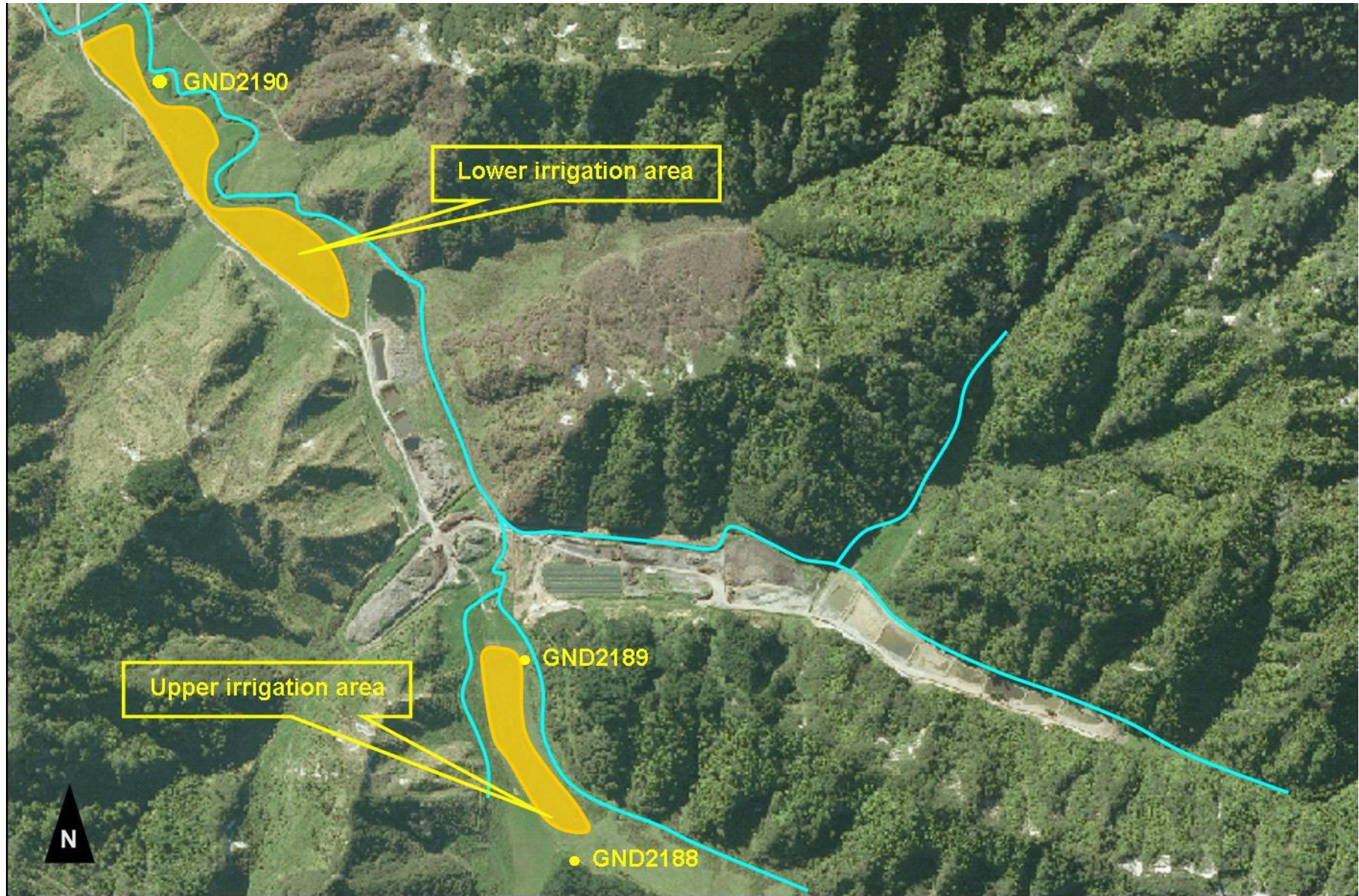


Figure 4 Irrigation sites and groundwater monitoring bores at RNZ's Mokau Rd, Uruti site

2.1.4 Results of receiving environment monitoring

Consent conditions require that the wetland discharge shall not cause a rise of carbonaceous biochemical oxygen demand of 2.00 g/m³ and or cause ammonia levels to exceed 0.025 g/m³ at site HHG000103 (40 m downstream of the discharge). The discharge itself is required to have a suspended solid level of less than 100 g/m³ and a pH of between 6.0 and 9.0.

Consent conditions also require that the irrigation of pond fluids shall not cause a rise of carbonaceous biochemical oxygen demand of 2.00 g/m³ and or cause ammonia levels to exceed 0.025 g/m³ at site HHG000100 and site HHG000150. The consent also states that the irrigation of pond fluids shall not cause an adverse rise in chloride in the Haehanga Stream.

2.1.4.1 16 August 2012

The sampling run done on 16 August 2012 was done under high flow conditions with 21 mm rain falling over the previous 48 hours. As a result, a reduced run was undertaken. CBODF levels in the discharge were quite low and this is reflected in the water quality down stream of the discharge. On this occasion all the levels of CBODF and unionised ammonia were in compliance with consent conditions at all sampling sites. Suspended solid levels were high at all sites, however this was a result of the stream being in fresh.

Table 5 Chemical analyses of samples collected on 16 August 2012

Site	CBODF	Chloride	Conductivity	Unionised ammonia	Ammoniacal nitrogen	pH	Suspended solids	Temp
	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	pH	g/m ³	Deg C
HHG000097	0.6	8.8	12.4	0.00008	0.017	7.3	780	9.7
HHG000098	0.6	9.7	10	0.00005	0.017	7.1	490	9.7
HHG000103	0.9	12.5	11.3	0.00082	0.231	7.2	460	9.8
HHG000150	0.8	14	12.7	0.00062	0.178	7.2	330	9.5

Key: *= Not measured. CBODF= filtered carbonaceous biological oxygen demand

2.1.4.2 12 October 2012

The sampling done on 12 October 2012 was done under low conditions with 7.5 mm rain over the previous 72 hours. The wetland was discharging at 3 L/s and the discharge had no odour. The CBODF and ammonia levels at site HHG000103 were in compliance. As with the previous survey there was also a moderate rise in chloride levels between sampling up and downstream of the operations.

Table 6 Chemical analyses of samples collected on 12 October 2012

Site	CBODF	Chloride	Conductivity	HC	Unionised ammonia	Ammoniacal nitrogen	pH	Suspended solids	Temp
	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	pH	g/m ³	Deg C
HHG000093	<0.5	9.76	14.2	<0.5	0.00018	0.022	7.4	4	14.6
HHG000097	<0.5	9.71	17.1	*	0.00033	0.089	7.2	3	10.3
HHG000098	0.6	10.6	15.9	*	0.00031	0.059	7.3	3	11.8
HHG000099	0.5	13.8	17.1	*	0.00014	0.022	7.3	3	14.8
HHG000100	0.5	16.5	16	<0.5	0.00017	0.037	7.2	4	13.1

Site	CBODF	Chloride	Conductivity	HC	Unionised ammonia	Ammoniacal nitrogen	pH	Suspended solids	Temp
	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	pH	g/m ³	Deg C
HHG000103	1.4	22.3	24	*	0.01682	2.53	7.4	12	12.1
HHG000106	0.5	22	20.6	*	0.00164	0.77	6.9	11	12.2
HHG000109	0.7	20.1	19.3	*	0.00091	0.193	7.2	5	13.6
HHG000115	0.5	29.6	21.6	<0.5	0.0011	0.295	7.1	5	13.6
HHG000150	0.7	32.3	22.2	<0.5	0.00073	0.222	7	10	15
HHG000190	*	28.2	20.6	*	0.00062	0.122	7.2	*	14.7
IND003008	14	56.6	96	*	2.262	46.7	8.1	98	17.6

Key: *= Not measured. CBODF= filtered carbonaceous biological oxygen demand
 HC = hydrocarbons

2.1.4.3 11 January 2013

The sampling done on 11 January 2013 was done under low flow conditions with 9.5 mm of rain falling on the area over the previous 72 hours. The wetland was discharging at a trickle rate at the time of sampling. On this occasion the discharge was found to have moderate levels of CBODF and unionised ammonia. At the compliance point (HHG000103), the levels of unionised ammonia and CBODF were below those required by consent conditions.

Table 7 Chemical analyses of samples collected on 11 January 2013

Site	CBODF	Chloride	Conductivity	HC	Unionised ammonia	Ammoniacal nitrogen	pH	Suspended solids	Temp
	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	pH	g/m ³	Deg C
HHG000093	0.6	8.8	15.6	<0.5	0.00007	0.012	7.1	2	19.3
HHG000097	1.0	10.5	19.0	*	0.00080	0.142	7.2	23	16.0
HHG000098	1.1	11.1	17.9	*	0.00059	0.096	7.2	16	17.3
HHG000099	0.9	21.7	21.7	*	0.00095	0.120	7.3	4	17.5
HHG000100	0.8	9.6	18.3	*	0.00011	0.020	7.1	3	18.3
HHG000103	0.7	16.7	17.5	<0.5	0.00017	0.019	7.3	5	19.2
HHG000105	1.2	46.0	30.6	*	0.00719	1.76	7.0	81	17.9
HHG000109	0.9	31.0	23.8	*	0.00126	0.181	7.2	8	18.9
HHG000115	0.7	57.4	32.0	<0.5	0.00240	0.666	6.9	10	19.3
HHG000150	0.6	66.0	32.4	<0.5	0.00004	0.007	7.1	8	20.6
HHG000190		47.2	27.3	*	0.00003	<0.003	7.3		19.9
IND003008	20	21.5	29.6	*	0.02549	1.29	7.6	46	20.7

Key: *= Not measured. CBODF= filtered carbonaceous biological oxygen demand
 HC= Hydrocarbons

2.1.4.4 22 February 2013

The sampling done on 22 February 2013 was done under low to moderate flow conditions. There had been no rain over the 72 hours prior to sampling and the wetland was discharging very slowly. The sites downstream of the wetland discharge showed no significant increase in CBODF. The level of ammonia at site HHG000103 was just below the consented limit of 0.025 g/m³ and all sites further downstream had far lower levels.

Chloride levels downstream of the PTS (site HHG000115) showed far higher than usual chloride level. The level was still within stock drinking water standards and within the 600 g/m³ instantaneous Canadian guideline (see section 2.1.6). The levels dropped away quickly in the samples taken downstream. A leaking irrigation pipe was discovered at a later date and this may have been what caused the increase at this site.

Table 8 Chemical analyses of samples collected on 22 February 2013

Site	CBODF	Chloride	Conductivity	HC	Unionised ammonia	Ammoniacal nitrogen	pH	Suspended solids	Temp
	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	pH	g/m ³	Deg C
HHG000093	0.5	10.8	16.8	<0.5	0.00007	0.016	7.0	10	18.3
HHG000097	0.6	11.6	21.0	*	0.00097	0.314	7.0	9	14.1
HHG000098	<0.5	13.4	23.0	*	0.00193	0.569	7.0	4	15.4
HHG000103	1.6	17.9	29.0	*	0.01308	2.28	7.2	19	16.3
HHG000099	0.6	18.1	23.2	*	0.00023	0.060	7.0	16	16.8
HHG000100	0.6	34.3	24.6	<0.5	0.00015	0.030	7.1	11	17.5
HHG000109	1.3	146	61.6	*	0.00114	0.421	6.8	29	18.6
HHG000115	0.6	295	105	<0.5	0.00304	3.38	6.3	13	19.2
HHG000150	2.0	90.7	51.7	<0.5	0.00776	1.10	7.2	72	19.1
HHG000190	*	66.4	42.0	*	*	0.493	7.2	*	*
IND003008	11	54.5	102	*	0.77806	46.6	7.6	140	18.4

Key: *= Not measured. CBODF= filtered carbonaceous biological oxygen demand
HC = hydrocarbons

2.1.4.5 18 April 2013

The sampling done on 18 April 2013 was done under moderate flow conditions with 17 mm rain falling in the previous three days. The wetland was discharging at approximately 8 L/min. The levels of CBODF and ammonia at site HHG000103 were in compliance with consent conditions. Elevated chloride levels were present downstream of the irrigation areas however the high levels found at site HHG000115 during the last sampling were not present on this occasion.

Table 9 Chemical analyses of samples collected on 18 April 2012

Site	CBODF	Chloride	Conductivity	HC	Unionised ammonia	Ammoniacal nitrogen	pH	Suspended solids	Temp
	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	pH	g/m ³	Deg C
HHG000093	1.8	18.3	22.9	<0.5	0.00006	0.021	6.9	9	16.1
HHG000097	<0.5	13.9	27.1	*	0.00027	0.072	7.1	6	13.5
HHG000098	0.9	14.6	24.2	*	0.00011	0.027	7.1	6	14.3
HHG000099	1	16	21.2	*	0.00003	0.01	7.0	4	14.7
HHG000100	1.2	20.8	23.2	<0.5	0.00008	0.023	7.0	6	16.1
HHG000103	1.3	24.2	33.1	*	0.0109	2.22	7.2	11	14.2
HHG000106	0.6	49.1	37.6	*	0.00321	1.5	6.8	6	15.4
HHG000109	1.4	43.5	33.1	*	0.0009	0.213	7.1	7	15.2
HHG000115	1.2	44.4	32.1	<0.5	0.00075	0.225	7.0	7	15.1
HHG000150	1.4	38.2	28.8	<0.5	0.00014	0.042	7.0	8	15.5
HHG000190	1.7	36.6	28.6	*	0.00014	0.032	7.1	8	15.9
IND003008	10	64.6	92.5	*	0.41312	31.3	7.6	150	15.2

Key: *= Not measured. CBODF= filtered carbonaceous biological oxygen demand
HC = hydrocarbons

2.1.4.6 8 June 2012

The sampling done on 8 June 2012 was done in moderate to low flow conditions with 1 mm of rain falling over the previous 24 hours. The wetland was discharging at approximately 30 L/min. On this occasion all sites were in compliance and all sites had chloride levels below 50 g/m³.

Table 10 Chemical analyses of samples collected on 14 June 2013

Site	CBODF	Chloride	Conductivity	HC	Unionised ammonia	Ammoniacal nitrogen	pH	Suspended solids	Temp
	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	pH	g/m ³	Deg C
HHG000093	0.6	18.1	17.6	<0.5	0.00059	0.111	7.4	3	9.1
HHG000097	<0.5	13.3	19.5	*	0.00039	0.073	7.4	4	9
HHG000098	<0.5	13.8	18.8	*	0.00032	0.078	7.3	5	8.5
HHG000099	0.9	22.5	25	*	0.00624	1.54	7.3	23	8.5
HHG000100	0.6	16.8	18.1	*	0.00017	0.039	7.3	4	9.1
HHG000103	<0.5	21.6	20.6	<0.5	0.00021	0.079	7.1	6	9.2
HHG000106	<0.5	24	21.6	*	0.00106	0.496	7	17	9.2
HHG000109	1	36.6	25.1	*	0.001	0.294	7.2	5	9.3
HHG000115	0.6	38.8	26	<0.5	0.00092	0.352	7.1	4	8.8
HHG000150	0.6	47.1	27.2	<0.5	0.00061	0.267	7	5	10
HHG000190	*	40.8	26.3	*	0.00063	0.206	7.1	*	10.8
IND003008	4.9	42.6	62.7	*	0.09657	19.1	7.4	18	8.4

Key: *= Not measured. CBODF= filtered carbonaceous biological oxygen demand
HC = hydrocarbons

2.1.5 Summary of water quality monitoring

Figures 5 to 8 show that during the monitoring year the levels of filtered carbonaceous oxygen demand and unionised ammonia at compliance points HHG000103, HHG000100 and HHG000150 were within consent limits on all sampling occasions. Overall this represents an improvement in compliance when compared to previous years.

It should be noted that for Figures 5, 7 and 8 the consent limits shown are derived by applying the provision of consent conditions which state that the discharge shall not raise the instream filtered carbonaceous oxygen demand by more than 2.00 g/m³. Subsequently the consent limit lines shown in Figures 5, 7, and 8 are derived by adding 2 g/m³ to the filtered carbonaceous biological oxygen demand result obtained from the site immediately upstream of the discharges.

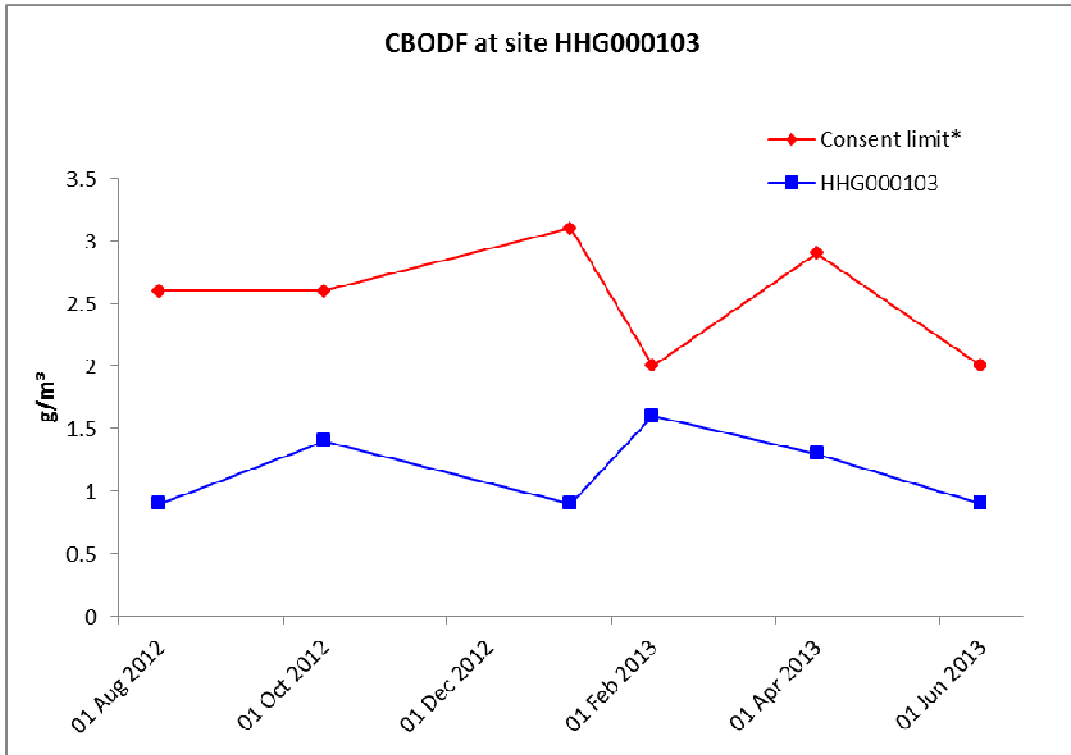


Figure 5 Graph showing CBODF levels at compliance point HHG000103 in relation to consent condition limits
 (* limit is derived from CBODF level at site HHG000098 + 2.0 g/m³)

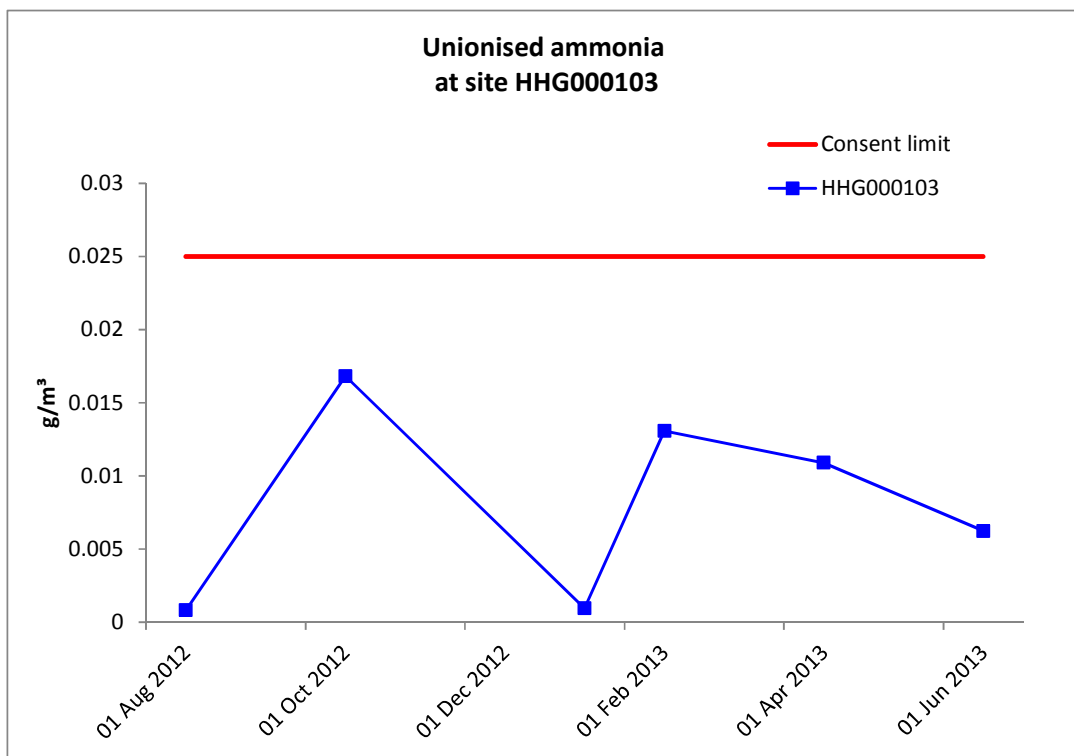


Figure 6 Graph showing unionised ammonia levels at compliance point HHG000103 in relation to consent condition limits

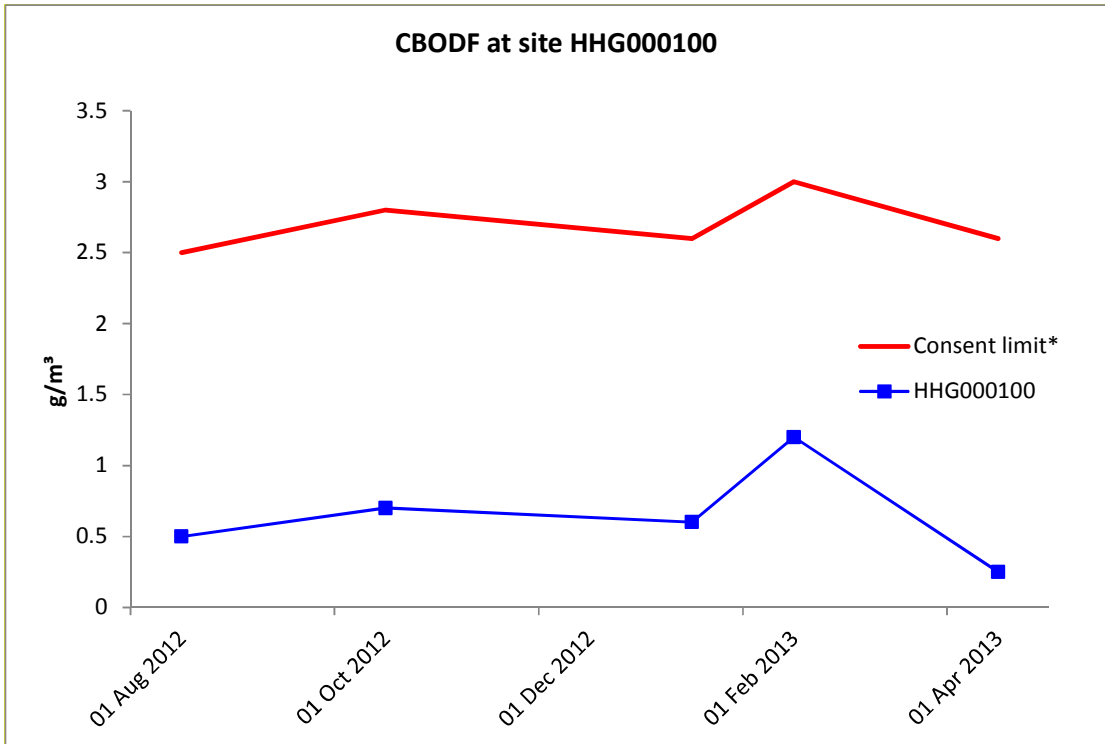


Figure 7 Graph showing CBODF levels at compliance point HHG000100 in relation to consent condition limit

(* limit is derived from CBODF level at site HHG000097 + 2.0 g/m³)

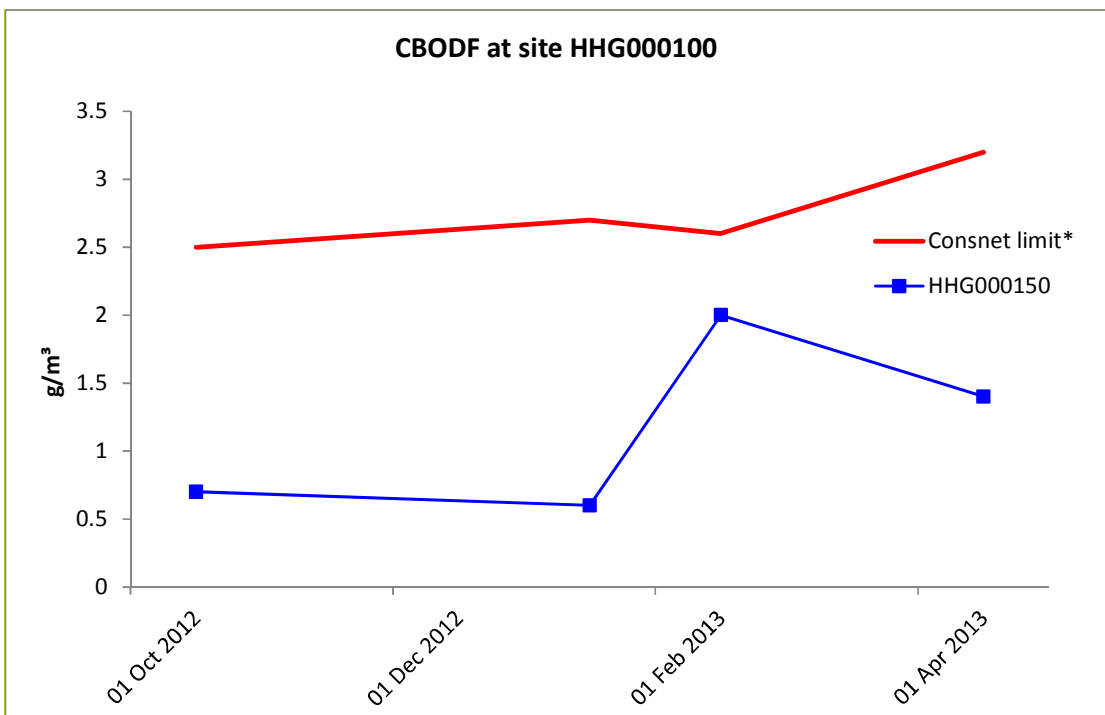


Figure 8 Graph showing CBODF levels at compliance point HHG000150 in relation to consent condition limits

(* limit is derived from CBODF level at site HHG00115 + 2.0 g/m³).

Chloride levels in the stream increase down stream of the irrigation areas (especially the lower irrigation area). A general limit for acceptable instream chloride is 150 g/m³ and on one occasion the levels in the Haehanga exceeded this.

Both the irrigation and the wetland discharges can contribute to this. In Section 2.1.6 that discusses groundwater it is noted that the chloride level in the groundwater in the lower irrigation area bore is far higher than those in the control bore in the upper irrigation area and this almost certainly plays a large role in the elevated levels found in the stream. The wetland discharge also contributes to chloride levels, however there are no consent conditions in relation to this.

Generally the chloride levels stayed below 50 g/m³ which is considered the upper natural range for small coastal streams. There is no adopted freshwater guideline for chloride levels in New Zealand, however Figure 11 shows how chloride levels found at all sites over the monitoring period compare with the guidelines produced by the Government of British Columbia, Canada. One result at HHG000115 was the highest found at any site previously and the cause is unknown. There was also an elevated level at site HHG000109. These sites are situated near the irrigation pump and holding ponds and a leaking pipe and or pond seepage may have been causing the level of chloride to rise. As the graph shows the levels returned to normal upon resampling the sites.

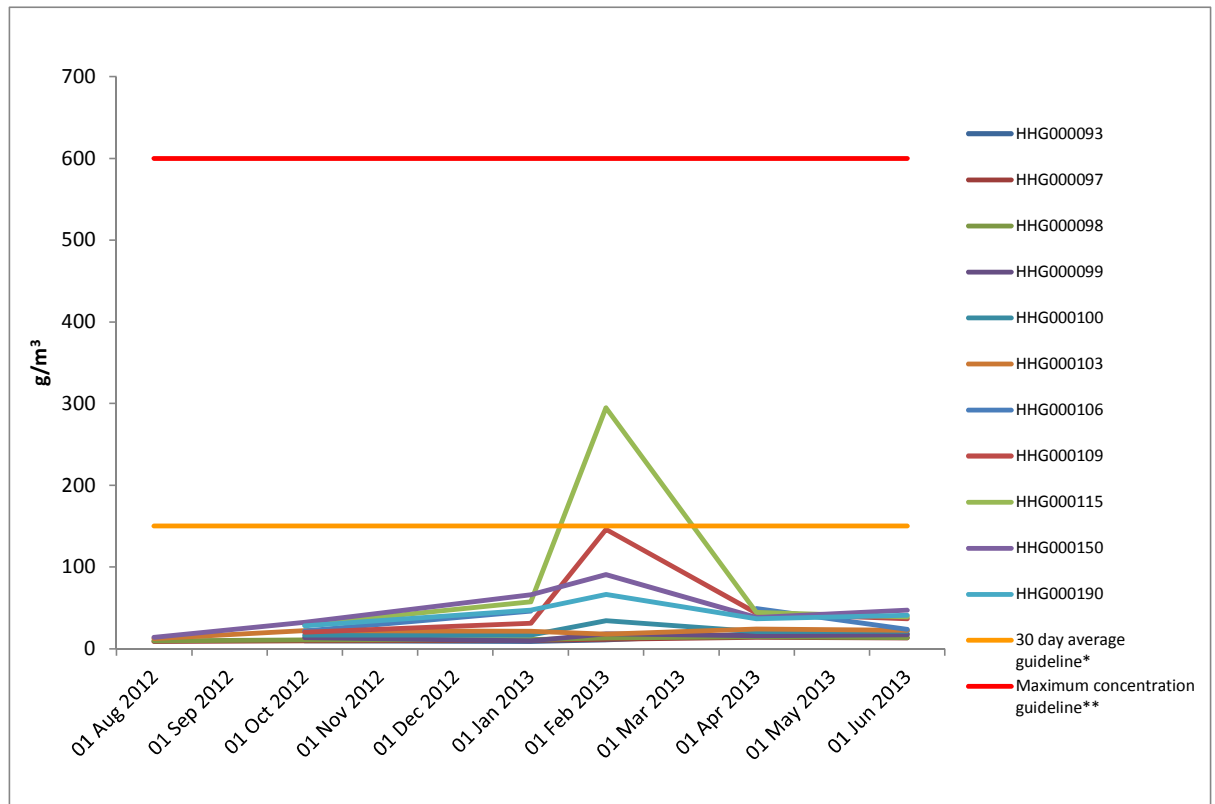


Figure 9 Graph showing chloride levels in the Haehanga Stream system

*Guideline for 30 day average chloride level for protection of aquatic life, Government of British Columbia of 150 g/m³

**Guideline for instantaneous maximum chloride levels for protection of aquatic life, Government of British Columbia of 600 g/m³

2.1.6 Biomonitoring results

Two biomonitoring surveys were conducted during the period under review. Summaries of the survey reports are given below and full copies of the reports are provided in the appendix.

2.1.6.1 29 May 2013

The Council's standard 'sweep net' and 'kick-sampling' techniques were used at seven established sites to collect streambed macroinvertebrates from the Haehanga Stream catchment in order to assess whether the Remediation (NZ) Ltd composting areas have had any adverse effects on the macroinvertebrate communities of these streams. Samples were processed to provide number of taxa (richness), MCI, and SQMCI_s scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

The macroinvertebrate survey conducted on 29 November 2012 found water flows in the Haehanga catchment to be low to very low, with a steady to very slow water speed, and community richnesses similar to the median for each site. Overall, this survey found that macroinvertebrate communities at all sites were near to or above average health. No undesirable heterotrophic growths were recorded at any of the five sites in this survey.

The two sites in the unnamed tributary were sampled for the fifth time in the current survey, and exhibited a community typical of this kind of habitat. In addition, a juvenile banded kokopu was recorded at site T2, illustrating how such small streams can support important ecological values. Site T2 and site T3 had similar MCI and SQMCI_s scores, which was reflective of good preceding water quality conditions. There were only three significant changes in abundance from site T2 to site T3, none of which were necessarily indicative of impacts caused by the discharge from the wetland. Previous surveys have frequently recorded oligochaete worms, ostracod seed shrimps and *Chironomus* blood worms increasing significantly in abundance downstream of the discharge. These taxa are often associated with organically enriched discharges. In the current survey only oligochaete worms increased in abundance, while *Chironomus* blood worms and ostracod seed shrimps increased slightly to be common and rare respectively. In addition, the number of abundant 'sensitive' taxa increased from 4 to 6, and the 'highly sensitive' mayfly *Deleatidium* remained abundant. Overall, these observations indicate that the discharge has not had an impact on the communities. This is especially encouraging, as the discharge was noted as entering the stream at the time of the survey, and had been recorded as entering the tributary at a rate of 20 l/min that morning.

Some previous water quality results indicate that unionised ammonia concentrations in the unnamed tributary have at times been toxic enough to reduce the abundance of, or eliminate entirely, some of the sensitive species usually found in this stream. Results of sampling undertaken in the year prior to this survey show that all six samples taken contained concentrations of unionised ammonia below the toxicity threshold of 0.025 g/m³. This shows good management of the unionised ammonia concentrations in the effluent being discharged. However, should unionised ammonia concentrations return to high levels in the winter period, an additional macroinvertebrate survey at this time may be warranted. At the very least, the water quality monitoring will need to continue so as to assist with the interpretation of macroinvertebrate results.

In general the communities in the Haehanga Stream sites had low proportions of sensitive taxa. This is expected in small, silty bottomed streams such as the Haehanga Stream and the numbers of taxa were generally similar to other lowland hill country streams surveyed at similar altitude. MCI values recorded in the Haehanga Stream indicated that the macroinvertebrate communities were in similar or better health when compared with other small lowland hill country streams in the region.

Site 5 has exhibited poorer macroinvertebrate communities in the past compared to other sites upstream. This has suggested some level of impact from the composting operation, although the extent of adverse effects has been difficult to determine due to poor habitat quality. During the current survey, the MCI score for site 5 was four units less than the median score for this site, and significantly less than that recorded at the next upstream Haehanga Stream site. The SQMCI_s score on the other hand did not indicate deterioration, being a significant 1.1 units higher than the median, and not significantly different to that recorded upstream. There was a significant increase in the abundance of four 'tolerant' taxa, including oligochaete worms, and this was coupled with a significant decrease in one 'moderately sensitive' taxon. Overall, this may indicate the presence of a very subtle impact, reflecting organic enrichment of this reach of the stream. However, if there was organic enrichment of the stream, it was relatively minor and not considered to be a significant adverse impact on the macroinvertebrate community.

Site 6, which consisted of a riffle with coarse and fine gravels, recorded an MCI score that was not significantly different to the medians for the other Haehanga Stream sites, although it was significantly lower than that recorded at site 2, but not site 5 in the current survey. The SQMCI_s score however did indicate some deterioration from upstream, being significantly less than that recorded at any upstream site. Overall the differences in the macroinvertebrate communities can be attributed to a change in habitat, with the appearance of axe head caddisfly and increased abundance of orthoclad midge larvae attributable to increased periphyton growth and reduced *Paracalliope* abundance related to increased water speeds. However, the appearance of *Chironomus* blood worms at this site may suggest a deterioration of water quality. Overall, unless physicochemical sampling indicates a reduction in water quality at this site, it appears that the irrigation of wastewater upstream of this site has not led to a reduction in invertebrate health at this site.

The lowest site (site 7) was sampled for the eleventh time in this survey. There were nine significant changes in abundance between sites 6 and 7, although the MCI score

shows little change at this site, as did the SQMCI_s score. When compared with historical data the community at site 7 was in average health, and indicative of little change in water quality from previous surveys.

Of some concern during certain previous surveys was the abundance of *Chironomus* blood worms at various sites. Abundance of this taxon is usually an indication of an organic discharge, although low dissolved oxygen in the stream can also allow this taxon to dominate the community, especially when this is associated with low flows. It may be then that the sporadic appearance of *Chironomus* in abundance is at least in part related to the dissolved oxygen concentrations. Dissolved oxygen concentrations in the Haehanga have been found to be depressed at times, and during the warmer months, when there is more aquatic weed growth, dissolved oxygen may be significantly depleted at night. This is a natural occurrence in some streams that are slow flowing and weedy. Any macroinvertebrate surveys undertaken when such conditions exist could potentially record a community with fewer sensitive species, and a more abundant population of *Chironomus*. During the current survey *Chironomus* was only present at sites T3, 6 and 7, and no more than 19 individuals were recorded at any site. This indicates that water quality in the Haehanga catchment may have improved, possibly contributed to by on-going works to the leachate and stormwater treatment system, and improved management of the riparian margin. These works are likely to lead to an improvement in freshwater macroinvertebrate communities below the discharges, and should continue to be encouraged.

2.1.6.2 8 April 2013

The Council's standard 'sweep net' technique was used at seven established sites to collect streambed macroinvertebrates from the Haehanga Stream catchment in order to assess whether the Remediation (NZ) Ltd composting areas have had any adverse effects on the macroinvertebrate communities of these streams. Samples were processed to provide number of taxa (richness), MCI, and SQMCI_s scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

The macroinvertebrate survey conducted on 8 April 2013 found water flows in the Haehanga catchment to be very low, with a very slow water speed noted at all sites. These flow conditions were the primary influence on the community, with the loss of some flowing-water taxa, such as the 'highly sensitive' mayfly *Deleatidium*, which was frequently recorded in abundance in previous surveys, and the inclusion of some still-water species such as cladoceran water fleas and mosquito larvae. Community richnesses were similar to the median for three sites, while the remaining four either equalled or exceeded their previous maximum richnesses recorded.

Overall, this survey found that macroinvertebrate communities at all sites were in average health. No undesirable heterotrophic growths were recorded at any of the five sites in this survey.

The two sites in the unnamed tributary were sampled for the sixth time in the current survey, and exhibited a community typical of this kind of habitat. In addition, the presence of freshwater crayfish, a frequently recorded invertebrate considered 'at risk' nationally, was recorded at site T2, illustrating how such small streams can support important ecological values. Site T2 and site T3 had similar MCI and SQMCI_s scores, which was reflective of good preceding water quality conditions. There were no significant changes in abundance from site T2 to site T3, and the more subtle changes in taxon abundance were not necessarily indicative of impacts caused by the discharge from the wetland. Previous surveys have frequently recorded oligochaete worms, ostracod seed shrimps and *Chironomus* blood worms increasing significantly in abundance downstream of the discharge. These taxa are often associated with organically enriched discharges. In the current survey only oligochaete worms and ostracod seed shrimps increased in abundance, while *Chironomus* blood worms were absent at both sites. In addition, the number of 'sensitive' taxa increased from 11 to 13. Overall, these observations indicate that the discharge has not had an impact on the communities. This is consistent with the discharge records, which indicate that no discharge had entered the stream in the 17 days preceding this survey.

Some previous water quality results indicate that unionised ammonia concentrations in the unnamed tributary have at times been toxic enough to reduce the abundance of, or eliminate entirely, some of the sensitive species usually found in this stream. Results of sampling undertaken in the year prior to this survey show that all six samples taken contained concentrations of unionised ammonia below the toxicity threshold of 0.025 g/m³. This shows good management of the unionised ammonia concentrations in the effluent being discharged. However, should unionised ammonia concentrations return to high levels in the winter period, an additional macroinvertebrate survey at this time may be warranted. At the very least, the water quality monitoring will need to continue so as to assist with the interpretation of macroinvertebrate results.

In general the communities in the Haehanga Stream sites had low proportions of sensitive taxa. This is expected in small, silty bottomed streams such as the Haehanga Stream and the numbers of taxa were generally similar to other lowland hill country streams surveyed at similar altitude. MCI values recorded in the Haehanga Stream indicated that the macroinvertebrate communities were in similar health when compared with other small lowland hill country streams in the region.

Site 5 has exhibited poorer macroinvertebrate communities in the past compared to other sites upstream. This has suggested some level of impact from the composting operation, although the extent of adverse effects has been difficult to determine due to poor habitat quality. During the current survey, the MCI score for site 5 was three units less than the median score for this site, and six units less than that recorded at the next upstream Haehanga Stream site. A similar insignificant deterioration was recorded for the SQMCI_s score, and neither score was a clear indication of deterioration. The results from the current survey indicate that *Chironomus* blood worms were once again abundant. In total significant changes in abundance were

recorded for eight taxa, the most important of which was an increase in water flea and mosquito larvae abundance. The fact that these two taxa were extremely and very abundant respectively indicates that the water at this site was near to stagnant. The fact that this water was stagnant helps explain the abundance of *Chironomus* blood worms, although the results in general may still indicate the presence of a very subtle impact, reflecting organic enrichment of this reach of the stream. However, if there was organic enrichment of the stream, it was relatively minor and not considered to be a significant adverse impact on the macroinvertebrate community.

Site 6, where the sample is usually collected from of a riffle with coarse and fine gravels, was sampled in the current survey by sweeping macrophyte beds. This was as a direct result of the low flows preventing sampling of the riffle habitat. The current survey recorded an MCI score that was not significantly different to the medians for the other Haehanga Stream sites, and it was similar to that recorded at the three upstream main stem sites. The SQMCI₅ score also did not indicate any deterioration from upstream, although it was significantly less than that recorded at site 1 (but not that recorded at sites 2 and 5). Due to the change in sampling technique from previous surveys, the results were not directly comparable to the other sites, and interestingly, they did not differ significantly from that recorded in the previous two surveys. Overall, unless physicochemical sampling indicates a reduction in water quality at this site, it appears that the irrigation of wastewater upstream of this site has not led to a reduction in invertebrate health at this site.

The lowest site (site 7) was sampled for the twelfth time in this survey. There was little difference in MCI score between sites 7 and sites 5 and 6, although there was a significant increase in SQMCI₅ score from site 6. This was related to the fact that there were seven significant changes in abundance between sites 6 and 7, the most important of which being a significant increase in *Potamopyrgus* snails and a significant decrease in ostracod seed shrimps. When compared with historical data the community at site 7 was in average to above average health, and indicative of little change in water quality from previous surveys.

Of some concern during certain previous surveys was the abundance of *Chironomus* blood worms at various sites. Abundance of this taxon is usually an indication of an organic discharge, although low dissolved oxygen in the stream can also allow this taxon to dominate the community, especially when this is associated with low flows. It may be then that the sporadic appearance of *Chironomus* in abundance is at least in part related to the dissolved oxygen concentrations. Dissolved oxygen concentrations in the Haehanga have been found to be depressed at times, and during the warmer months, when there is more aquatic weed growth, dissolved oxygen may be significantly depleted at night. This is a natural occurrence in some streams that are slow flowing and weedy. Any macroinvertebrate surveys undertaken when such conditions exist could potentially record a community with fewer sensitive species, and a more abundant population of *Chironomus*.

During the current survey *Chironomus* was only present at sites 5, 6 and 7, and it was recorded in abundance at site 5. This is considered to be most likely related to the very low flows recorded in this survey, and this is supported by the changes in some other taxa. This indicates that water quality in the Haehanga catchment has not deteriorated from the previous survey, and overall continues to improve, possibly contributed to by on-going works to the leachate and stormwater treatment system,

and improved management of the riparian margin. These works are likely to lead to an improvement in freshwater macroinvertebrate communities below the discharges, and should continue to be encouraged.

2.1.7 Groundwater monitoring

Conditions 14 -17 of consent 5838 requires that the consent holder install groundwater bores and monitor groundwater down gradient of the irrigation areas. A control bore was also established up gradient of the irrigation areas.

The bores were sampled on two occasions and the results are given in the tables below. The positions of the groundwater bores are shown in Figure 4.

Table 11 Groundwater results from samples taken on 21 November 2012

Parameter	Unit	GND2188 Control	GND2190 Lower irrigation area	GND2189 Upper irrigation area
Chloride	g/m ³	58.4	716	224
Conductivity	mS/m	65.2	216	80.5
Water level	mbgl*	1.27	0.74	0.75
Unionised ammonia	g/m ³	0.00195	*	0.00013
Ammoniacal nitrogen	g/m ³	0.91	0.593	0.219
Nitrate/Nitrite	g/m ³	0.34	0.09	<0.01
pH	pH	6.8	5.5	6.3
Temperature	Deg.C	15.4	*	13.5
Total dissolved solids	g/m ³	504.5	1671.2	622.8

*Meters below ground level

Table 12 Groundwater results from samples taken on 14 June 2013

Parameter	Unit	GND2188 Control	GND2190 Lower irrigation area	GND2189 Upper irrigation area
Chloride	g/m ³	71.3	601	68.6
Conductivity	mS/m	46.7	187	33.1
Hydrocarbons	g/m ³	<0.5	<0.5	<0.5
Water level	m	0.83	0.595	0.61
Unionised ammonia	g/m ³	0.00001	0.00011	0.00011
Ammoniacal nitrogen	g/m ³	0.023	0.231	0.168
Nitrate/Nitrite	g/m ³	7.76	0.01	0.01
pH	pH	6.3	6.2	6.4
Temperature	Deg.C	14.3	14.3	12.3
Total dissolved solids	g/m ³	361.3	1446.8	256.1

These result showed that the groundwater in both irrigation areas had elevated levels of chloride when compared to that found in the control bore. These increased levels are almost certainly the result of the irrigation of fluids drained from drilling wastes that accumulated in the irrigation pond (see section 2.1.3). Elevated chloride levels have been noted in the Haehanga Stream during the monitoring year and these are commented on in section 2.1.3.

Total dissolved solids levels indicate that the groundwater is suitable for stock watering with the upper level found only on one occasion (in the historical data) being above the minimum guideline taken from Table 4.3.1 of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality for palatability. Generally stock will tolerate significantly higher levels of total dissolved solids without loss of condition.

Groundwater sampling will continue on a biannual basis and if warranted Council can request that the consent holder submit a Groundwater Management Plan under consent 5838.

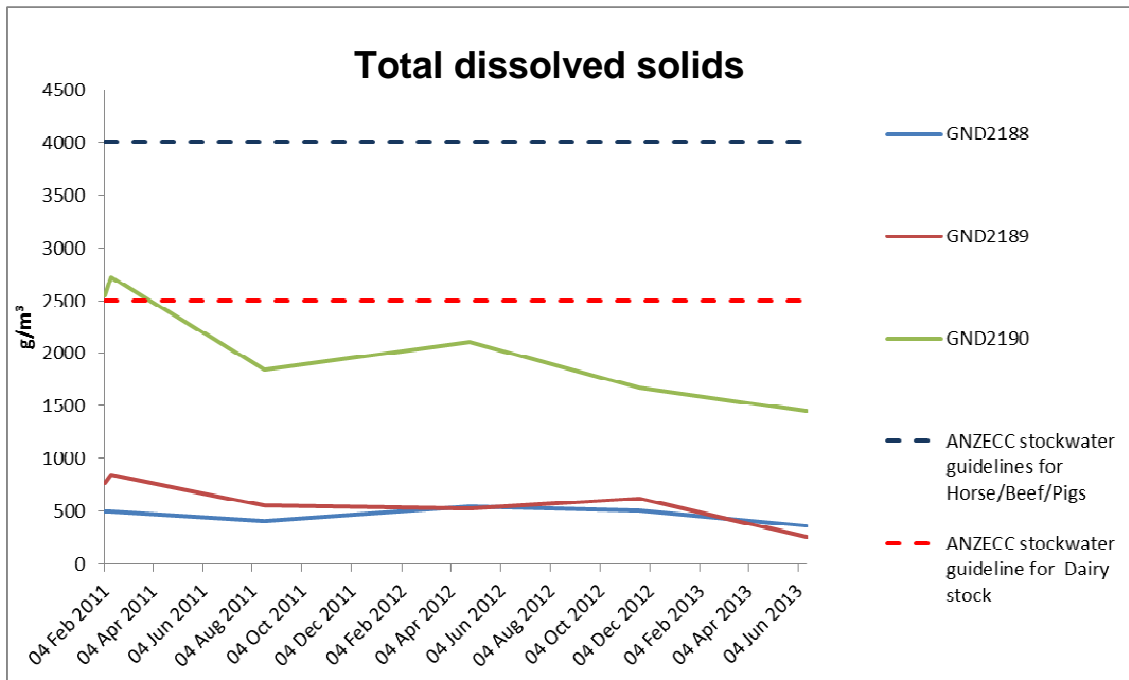


Figure 10 Historical total dissolved levels in groundwater

2.1.8 Soil sampling

Conditions 11 and 12 of consent 5838-2 require that soil samples be taken twice every year and analysed. This sampling was built into the site specific monitoring programme run by Council.

The results show that there are low levels of hydrocarbons in the soil at both sites, and these levels are well below the guideline level for agricultural use. The soil samples were found to have a sodium absorption ratio of between 3 and 4 which indicate that they are still fit for growing pasture by a wide margin.

Soil sampling will continue on a biannual basis and if warranted Council can request that the consent holder submit a Soil Management Plan under consent 5838.

Table 13 Results of soil samples taken on 21 November 2012

Parameter	Unit	SOL000176 Upper irrigation area	SOL000177 Lower irrigation area
Calcium	mg/kg	82.6	74.3
Chloride	mg/kg	379	224
Conductivity	mS/m	147	111
Hydrocarbons	mg/kg	21	<5
Potassium	mg/kg	110	147
Magnesium	mg/kg	6.7	4.6
Sodium	mg/kg	136	86.4
Nitrate/nitrite	mg/kg	1.22	1.75
pH	pH	5.9	6.7
Sodium Absorbance Ratio	-	3.87	2.63

Table 14 Results of soil samples taken on 14 June 2013

Parameter	Unit	SOL000176 Upper irrigation area	SOL000177 Lower irrigation area
Calcium	mg/kg	60	121
Chloride	mg/kg	174	116
Conductivity	mS/m	75.5	68
Hydrocarbons	mg/kg	39	37
Potassium	mg/kg	52	131
Magnesium	mg/kg	6.6	6.9
Sodium	mg/kg	78	67
Nitrate/nitrite	mg/kg	2.5	7.3
pH	pH	5.9	7.0
Sodium Absorbance Ratio	-	2.55	1.60

2.1.9 BTEX sampling

Council undertook benzene, toluene, ethyl benzene and xylene (BTEX) analysis on one soil sample, one groundwater sample, one irrigation fluid sample and one surface water sample. The sites were selected on the basis of where the largest effect (if any) would be found.

BTEX was detected in the irrigation pond and a very low level of meta-xylene was found in the groundwater of the lower irrigation area. The levels of BTEX found in all samples complied with either the New Zealand Drinking Water Standards or MfE soil acceptance criteria. Council will continue with BTEX analysis on an annual basis.

Table 15 Results of BTEX analysis

Parameter	Unit	HHG000150 d/s lower irrigation area	IND002044 Irrigation pond fluid	GND2190 lower irrigation area groundwater	SOL000177 Lower irrigation area soil	Guideline Value (soil)*	Guideline Value (water)**
		12 Oct 2012	12 Oct 2012	21 Nov 2012	21 Nov 2012		
Benzene	ppm	<0.0005	0.022	<0.0005	<0.08	1.7	0.01
Ethyl benzene	ppm	<0.0005	0.0058	<0.0005	<0.08	210	0.3
Toluene	ppm	<0.0005	0.052	<0.0005	<0.08	110	0.3

Parameter	Unit	HHG000150 d/s lower irrigation area	IND002044 Irrigation pond fluid	GND2190 lower irrigation area groundwater	SOL000177 Lower irrigation area soil	Guideline Value (soil)*	Guideline Value (water)**
meta-Xylene	ppm	<0.0005	0.032	0.001	<0.08	160 (combined)	0.6 (combined)
para-Xylene	ppm	<0.0005	0.0137	<0.0005	<0.08		

* MfE Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in, Soil acceptance criteria, for silty clay based soils, Table 4.11

** MAV's from New Zealand Drinking Water Standards

2.1.10 Air inspections

Air inspections were carried out in conjunction with water sampling and compliance monitoring inspections.

The nature of the RNZ's operations at the Mokau site can create potentially serious odour issues. The odours noted on site were often strong and reflected the nature of the waste being processed. No offensive or objectionable odours were noted beyond the boundary during routine inspections.

As part of the site management regime stipulated by consent 5839-2, Council conducted two odour surveys on 22 February 2013 and 18 April 2013.

The survey was based on the German VDI 3940 "*Determinants of odour by field inspection*" method. This entails an odour calibrated officer being positioned at the downwind boundary of the site for a 15-30 minute period and recording odour observations every 10 seconds.

The unannounced surveys were undertaken in the morning during cool clear conditions when there was a prevailing very light southerly breeze. It was determined that most of the complaints received in the previous monitoring periods occurred during such conditions. The survey was conducted at the northern boundary of the site on SH3 near the Haehanga Bridge. Only very faint odours were detected at any time during the surveys.

2.1.11 Data review

During the period under review the consent holder provided site input data which Council reviewed to assess compliance in regards to the types of waste being accepted. The data review in conjunction with observations made during site inspections found no evidence that unacceptable wastes were being discharged at the Uruti site.

2.2 Waitara Road and Pennington Road, Brixton

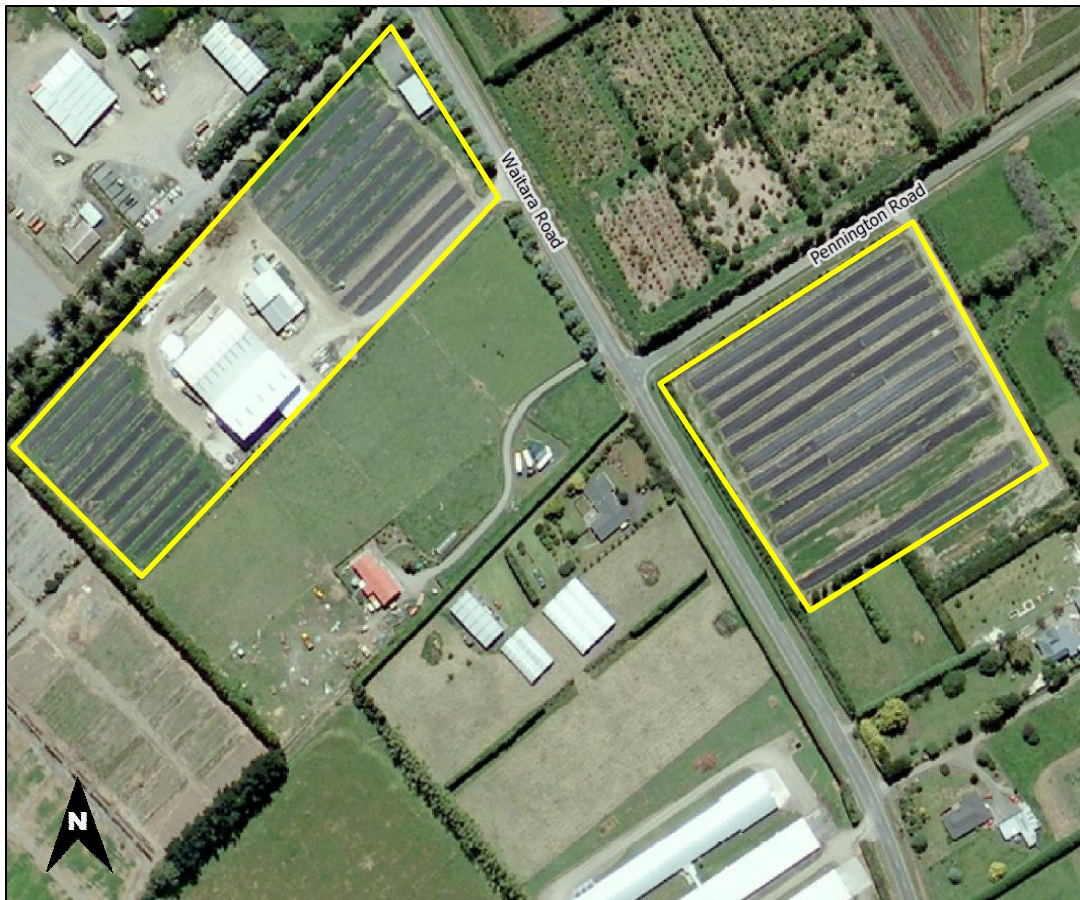


Figure 11 Aerial view of Remediation NZ's Waitara and Pennington Rd sites

2.2.1 Inspections

Two inspections were carried during the monitoring period. The inspections focussed on odour, dust, stormwater discharges and the health of the receiving environment.

2.2.1.1 12 October 2012

A site visit was made to conduct a compliance monitoring inspection. There had been 2.5 mm rain in the 72 hours prior to the inspection and intermittent showers at the time of the inspection.

Waitara Rd: All of the worm beds were covered at the time of the inspection and the areas between the worm beds were well grassed. There were no issues in regards to run-off or leachate noted. Intermittent noticeable odours were detected in and around the processing sheds, but no odour was detectable along the downwind boundary.

Pennington Rd: The worm beds had new covers and the site was quite tidy. The silt retention structure at the end of the entrance track appeared to be working well. No discharges were occurring at the time of the inspection.

2.2.1.2 3 May 2013

A site visit was made to conduct a compliance monitoring inspection. There was 5 mm rain in the 72 hours prior to the inspection and intermittent showers at the time of the inspection.

Waitara Rd: All of the worm beds were covered at the time of the inspection and the areas between the worm beds had good grass growth. There were no issues in regards or run-off or leachate noted. Intermittent noticeable odours were detected in and around the processing sheds and noticeable odours were detected at the boundary downwind of the shed.

Pennington Rd: Some of the worm beds had their covers partly removed and there was a pile of product against the fence. No discharges were occurring at the time of the inspection and no odours were detected.

2.2.1.3 28 June 2013

A site visit was made to conduct a compliance monitoring inspection. There had been no rain in the 72 hours prior to the inspection and there was a changeable wind at the time of the inspection.

Waitara Rd: All of the worm beds were covered at the time of the inspection and the areas between the worm beds had good grass growth. There were no issues in regards or run-off or leachate noted. The greenwaste mulcher was on site and working. Delays in getting the mulcher working meant that it was mulching partially composted greenwaste. Noticeable odours were detected in and around the mulcher and at the downwind boundary.

Pennington Rd: No discharges were occurring at the time of the inspection and no odours were detected

2.2.2 Air quality

Odours at the vermiculture sites are usually associated with either harvesting of vermicasts or when the worms are being fed. The processing plant tends to emit odour whenever it is in operation, but the odours are usually localised to the entrances of the buildings. No objectionable or offensive odours were detected beyond the boundaries of these properties during routine inspections.

There were three complaints in regard to odour from these sites during the monitoring period, none of which was substantiated (see Incidents - Section 2.3).

2.3 Investigations, interventions, and incidents

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the consent holder.

During the year matters may arise which require additional activity by the Council eg provision of advice and information, or investigation of potential or actual courses of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

The Taranaki Regional Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The Unauthorised Incident Register (UIR) includes events where the company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

Complaints may be alleged to be associated with a particular site. If there is potentially an issue of legal liability, the Council must be able to prove by investigation that the identified company is indeed the source of the incident (or that the allegation cannot be proven).

There were no incidents recorded by the Council that were associated with non-compliance by Remediation NZ with conditions in resource consents or provisions in Regional Plans.

There were three complaints received by Council in regards to odour from the Brixton plant, however these complaints were not substantiated by investigating officers. Details of the complaints and investigations are given below.

2.3.1 3 December 2012

An odour survey was undertaken as the result of a complaint. Strong noticeable composting odours were found along Waitara Road.

The following action was to be taken:

- Ensure that no objectionable or offensive odours are found beyond the boundary of the property.

2.3.2 29 April 2013

An odour survey was undertaken as the result of a complaint regarding worm farm odours. The odour survey found constant noticeable odours along Waitara Road and Pennington Road. Operations were finished for the day during the odour survey.

The following action was to be taken:

- Ensure no objectionable or offensive odours are found beyond the boundary of the property.

2.3.3 13 May 2013

A site inspection was conducted in response to an odour complaint. No noticeable odour was found beyond the boundary of the site. Inspection found site to be working within consent conditions

3. Discussion

3.1 Discussion of site performance

3.1.1 Mokau Road, Uruti

Overall this site showed significant improvement in site practices and the consent holder was cooperative in responding to any issues raised by Council. There were no complaints or incidents recorded in regards to this site. The weather station remains inoperative and this is still in the process of being addressed. Inspections noted that there were some issues with general house keeping such as the cleaning of silt traps and placement of waste, however these were addressed in a timely manner by the consent holder.

3.1.2 Pennington Road and Waitara Road sites

Both sites generally appeared tidy and well managed when inspected and the three odour complaints received were not substantiated.

3.2 Environmental effects of exercise of consents

3.2.1 Mokau Road, Uruti

During the year under review the Company complied with the consent conditions in regards to ammonia level in the unnamed tributary of the Haehanga below the wetland discharge. The level of ammonia in the tributary was below the guideline value for aquatic health of 0.025 g/m³ on all the occasions it was sampled during the year. The biomonitoring surveys undertaken indicated that no significant impacts were occurring on aquatic ecosystems.

Chloride levels were found to be elevated in the stream system and this is likely to be a result of irrigation and wetland discharges. The highest level of chloride found during the monitoring period was 295 g/m³, which was unusually high for this site and may have been caused by a leaky irrigation pipe. The median level for site downstream of irrigation areas and discharges was 33 g/m³ and the average level was 46 g/m³ which in the context of the referenced guideline values are not considered to be adverse [The Ambient Water Quality Guidelines for chloride (Ministry for the Environment, British Columbia) have guideline values of 600 g/m³ (maximum instantaneous concentration) and 150 g/m³ monthly average for long term protection of aquatic ecosystems).

The groundwater results from the irrigation areas also have elevated chloride levels (especially the lower area) but as discussed above, this is not currently having a significantly adverse effect of the local stream system. Total dissolved solids levels found in the groundwater indicate that the groundwater is fit for livestock consumption.

Based on the results, the activities at the site are not having significant adverse effects on the receiving waters. Whilst there was some elevation in the levels of chloride during the year no significant adverse effects were found by the biomonitoring surveys.

During the monitoring period no significant effects were noted in regards to dust or odour emissions during inspections, nor were any complaints received about the Uruti site.

3.2.2 Pennington Road and Waitara Road sites

No adverse environmental effects were observed as a result of activities at the two sites. The sites are now used purely as worm farms fed with composted materials from the Mokau Road site. As RNZ no longer incorporates drilling wastes directly into the worm food in situ at the worm farms, this greatly reduces the likelihood of any environmental effects.

3.3 Evaluation of performance

A tabular summary of the Company's compliance record for the year under review is set out in Tables 17-23.

Table 16 Summary of performance for Consent 5838-2 - discharge of waste to land and treated stormwater and leachate to water at Mokau Rd Uruti

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adopt best practical option	Programme management/site inspections	Yes
2. Only acceptable waste accepted onto site	Site inspections/review of supplied records	Yes
3. DAF residue not to be accepted	Site inspections/review of supplied records	Yes
4. Maintenance of stormwater systems	Site inspections	No – Council requested maintenance
5. Maintenance of treatment systems	Site inspections	Yes
6. Adequate pond construction	Site inspections	Yes
7. Keep and supply irrigation records	Data supplied and reviewed	Yes
8. No direct discharges to occur as a result of irrigation	Site inspections /sampling	Yes
9. Irrigated fluids not to exceed 5% hydrocarbon content	Site inspections /sampling	Yes
10. Discharges not to exceed adverse effects at site HHG000150	Sampling/inspection	Yes
11. Soil sampling to be undertaken	Undertaken by Council	Yes
12. Submit a Soil Management Plan if requested by Council	Plan not requested	N/A
13. Adhere to Soil Management Plan	N/A	N/A
14. Establish groundwater monitoring bores	Site inspections	Yes
15. Groundwater sampling to be undertaken	Undertaken by Council	Yes
16. Submit a Groundwater Management Plan if requested by Council	Plan not yet requested	N/A
17. Adhere to Groundwater Management Plan	N/A	N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
18. Prepare a Pond Treatment System Management Plan	Plan received and reviewed	Yes
19. Adhere Treatment System Management Plan	Inspection	Yes
20. Prepare a Wetland Treatment System Management Plan	Plan received and reviewed	Yes
21. Adhere to Wetland Treatment System Management Plan	Inspection	Yes
22. Wetland discharge not to exceed certain parameters	Sampling	1 suspended solid non-compliance
23. Wetland discharge not to cause certain effects at site HHG000103	Sampling	Yes
24. Maintain Riparian plantings	Inspection	Yes
25. Notify Council of significant incidents on site	No notifications received	N/A
26. Prepare a Site Reinstatement Plan prior to site closure	N/A	N/A
27. Adhere to Site Reinstatement Plan	N/A	N/A
28. Optional Review	Review not required	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

N/A = not applicable

Table 17 Summary of performance for Consent 5839-2 - discharge of emissions to air, at Mokau Rd, Uruti

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adopt best practical option	Programme management/site inspections	Yes
2. Composting area not to exceed certain limits	Programme management/site inspections	Yes
3. Only acceptable waste brought onto site	Site inspections/review of supplied records	Yes
4. DAF residue not to be accepted	Site inspections/review of supplied records	Yes
5. Maintain and supply an inwards good register	Data received and reviewed	Yes
6. Prepare a Site Practices Plan	Plan received and reviewed	Yes
7. Adhere to Site Practices Plan	Site inspections	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
8. Arrange professional assessment of Site Practices Plan	Assessment received and reviewed	Yes
9. Submit Proposed Implementation Plan	Plan received and reviewed	Yes
10. Adhere to Proposed Implementation Plan	Proposals adopted and incorporated into other plans	Yes
11. Dust deposition not to exceed certain limits	Not monitored- dust not noted as an issue during inspections	N/A
12. PM10 and suspended not to exceed certain limits	Not monitored- dust not noted as an issue during inspections	N/A
13. No offensive or objectionable odour beyond the boundary	Inspection/odour surveys	Yes
14. Install a weather station and provide data	Data received and reviewed	No- station still not completely operative.
15. Conduct odour surveys	Undertaken by Council	Yes
16. Hold community meeting	Meeting held in 2011	Yes
17. Notify Council of onsite incidents	No notification received	Yes
18. Prepare a Site Exit Plan prior to site closure	N/A	N/A
19. Adhere to Site Exit Plan upon site closure	N/A	N/A
20. Optional review	A review was not required	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

Table 18 Summary of performance for Consent 5892-2 - discharge of drilling solids at Waitara Road, Brixton

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Exercise of consent in accordance with information provided in application	Site inspections	Yes
2. Best practicable option as described by S2 of RMA	Site inspections	Yes
3. Records of source, nature and volume of wastes	Yes	Yes
4. Solid drilling cuttings to be < 5 % hydrocarbon content	No longer processed on this site	N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
5. No contamination of ground or surface water	Samples were not collected during the period under review	N/A
6. Maintenance of stormwater treatment system	Site inspections	Yes
7. Concentration limits on stormwater	Samples were not collected during the period under review	N/A
8. Alterations to processes and operations	Site inspections did not note any changes	Yes
9. Reinstatement of site	N/A	N/A
10. Optional review of consent	A review was not required	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High

Table 19 Summary of performance for Consent 5893-2 - discharge of drilling solids at Pennington Road, Brixton

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Exercise of consent in accordance with information provided in application	Site inspections	Yes
2. Best practicable option as described by S2 of RMA	Site inspections	Yes
3. Records of source, nature and volume of wastes	Yes	N/A
4. Solid drilling cuttings to be < 5 % hydrocarbon content	No longer processed at this site	N/A
5. No contamination of ground or surface water	Site inspections, samples	Yes
6. Maintenance of stormwater treatment system	Site inspections	Yes
7. Concentration limits on stormwater	Sampling	Not assessed
8. Visual impact on surface water after mixing zone	No visual impact observed during site visits	Yes
9. Alterations to processes and operations	Site inspections did not note any changes	Yes
10. Reinstatement of site	N/A	N/A
11. Optional review of consent	No review due this period	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High

Table 20 Summary of performance for Consent 5938-1 - establishment of culvert at Mokau Rd, Uruti

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notification prior to commencement of works	Notification received	Yes
2. Construction in accordance with application	Site inspections	Yes
3. Best practicable option	Site inspections	Yes
4. Minimisation of riverbed disturbance	Site inspections	Yes
5. Reinstatement of site	N/A	N/A
6. Optional review of consent	No review due this period	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High

Table 21 Summary of performance for Consent 6211-1 – stream realignment at Mokau Rd, Uruti

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notification prior to commencement of works	Notification received	Yes
2. Realignment in accordance with application	Site inspections	Yes
3. Best practicable option	Site inspections	Yes
4. Minimisation of discharge	Site inspections	Yes
5. Minimisation of riverbed disturbance	Site inspections	Yes
6. Optional review of consent	No review due this period	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High

Table 22 Summary of performance for Consent 6212-1 - establishment of culvert at Mokau Rd, Uruti

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notification prior to commencement of works	Notification received	Yes
2. Replacement of temporary culvert		N/A
3. Construction in accordance with application	Site inspections	No-culvert outlet above stream
4. Best practicable option	Site inspections	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
5. Minimisation of riverbed disturbance	Site inspections	Yes
6. Provision of fish passage	Site inspections	Yes-fish pass on culvert
7. Reinstatement of site	N/A	N/A
9. Optional review of consent	No review due this period	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

RNZ demonstrated a high level of environmental performance and compliance with the consents associated with its Waitara Road, and Pennington Road sites.

RNZ demonstrated a good level of environmental performance, and a need for improved compliance with consents associated with its Mokau Rd site at Uruti.

Overall RNZ demonstrated a good level of environmental performance and compliance.

3.4 Recommendations from the 2011-2012 Annual Report

In the 2011-2012 Annual Report, it was recommended:

1. THAT the 2012-2013 monitoring programme for the site at Mokau Rd, Uruti remain unchanged from that undertaken in the 2011-2012 period.
2. THAT the 2012-2013 monitoring programme for the Waitara Rd and Pennington Rd sites remain unchanged from that undertaken in the 2011-2012 period.
3. THAT the option for a review of resource consent 5838 in June 2013, as set out in condition 28 of the consent, not be exercised, on the grounds that current conditions are adequate for dealing with any adverse effects arising from the exercise of this consent.
4. THAT the option for a review of resource consent 5839 in June 2013, as set out in condition 20 of the consent, not be exercised, on the grounds that current conditions are adequate for dealing with any adverse effects arising from the exercise of this consent.

These recommendations were implemented in full.

3.5 Alterations to monitoring programmes for 2013-2014

In designing and implementing the monitoring programmes for air and water discharges in the region, the Taranaki Regional Council has taken into account the extent of information made available by previous authorities, its relevance under the Resource Management Act, the obligations of the Act in terms of monitoring

emissions and discharges and effects, and subsequently reporting to the regional community, the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere and discharging to the environment.

It is proposed that the 2013-2014 monitoring programme for the site at Mokau Rd, Uruti remain unchanged from that undertaken in the 2012-2013 period.

It is proposed that the 2013-2014 monitoring programme for the Waitara Rd and Pennington Rd sites remain unchanged from that undertaken in the 2012-2013 period.

Recommendations to this effect are attached to this report.

3.6 Exercise of optional review of consent

3.6.1 Consent 5839

Resource consent 5839 provides for an optional review of the consent in June 2014. Condition 20 allows the Council to review the consent, for the purposes of;

- a) Ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, and in particular to address any more than minor adverse effects relating to odour discharges from the site;
- b) To incorporate into the consent any modification to the operation and maintenance procedures or monitoring that may be necessary to deal with any adverse effects on the environment arising from changes in association with condition 9 of this consent; and
- c) To determine any measures that may be appropriate to comply with condition 1 of this consent, and which are necessary to address any adverse effects of odour from the site.

Based on the results of monitoring in the year under review it is considered that there are no grounds that require a review to be pursued.

A recommendation to this effect is presented in Section 4 of this report.

3.6.2 Consent 5838

Resource consent 5838 provides for an optional review of the consent in June 2014. Condition 28 allows the Council to review the consent, for the purposes of;

- a) Ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, and in particular to address any more than minor adverse effects relating to odour discharges from the site and/or water quality issues;
- b) To incorporate into the consent any modification to the operation and maintenance procedures or monitoring that may be necessary to deal with any adverse effects

on the environment arising from changes in association with condition 9 of consent 5839-2; and

- c) To determine any measures that may be appropriate to comply with condition 1 of this consent, and which are necessary to address any adverse effects relating to the wastewater discharges and/or odour from the site.

Based on the results of monitoring in the year under review it is considered that there are no grounds that require a review to be pursued.

A recommendation to this effect is presented in Section 4 of this report

3.6.3 Consent 5892

Resource consent 5892 provides for an optional review of the consent in June 2014. Condition eleven allows the Council to review the consent, for the purposes of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Based on the results of monitoring in the year under review it is considered that there are no grounds that require a review to be pursued.

4. Recommendations

1. THAT the 2013-2014 monitoring programme for the site at Mokau Rd, Uruti remain unchanged from that undertaken in the 2012-2013 period.
2. THAT the 2013-2014 monitoring programme for the Waitara Rd and Pennington Rd sites remain unchanged from that undertaken in the 2012-2013 period.
3. THAT the option for a review of resource consent 5838 in June 2014, as set out in condition 28 of the consent, not be exercised, on the grounds that current conditions are adequate for dealing with any adverse effects arising from the exercise of this consent.
4. THAT the option for a review of resource consent 5839 in June 2014, as set out in condition 20 of the consent, not be exercised, on the grounds that current conditions are adequate for dealing with any adverse effects arising from the exercise of this consent.
5. THAT the option for a review of resource consent 5892 in June 2014, as set out in condition eleven of the consent, not be exercised, on the grounds that current conditions are adequate for dealing with any adverse effects arising from the exercise of this consent.

Glossary of common terms and abbreviations

The following abbreviations and terms that may have been used within this report:

Al*	aluminium
As*	arsenic
Biomonitoring	assessing the health of the environment using aquatic organisms
BOD	biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate
BODCF	carbonaceous biochemical oxygen demand of a filtered sample. A measure of the presence of dissolved degradable organic matter, excluding the biological conversion of ammonia to nitrate
BODF	biochemical oxygen demand of a filtered sample
BTEX	Benzene, toluene, ethylbenzene and xylene (aromatic solvents found in petroleum products and wastes)
bund	a wall around a tank to contain its contents in the case of a leak
cfu	colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample
COD	chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction
Condy	conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m
Cu*	copper
Cumec	A volumetric measure of flow- 1 cubic metre per second (1 m ³ s ⁻¹)
DO	dissolved oxygen
DAF	dissolved air floatation residues (the residues from an effluent treatment system commonly used in industry)
DRP	dissolved reactive phosphorus
<i>E.coli</i>	<i>escherichia coli</i> , an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample
Ent	enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample
F	fluoride
FC	faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample
fresh	elevated flow in a stream, such as after heavy rainfall
g/m ³	grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures
HC	hydrocarbons
incident	an event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred

intervention	action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring
investigation	action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident
l/s	litres per second
MCI	macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats
mS/m	millisiemens per metre
mixing zone	the zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point
NH ₄	ammonium, normally expressed in terms of the mass of nitrogen (N)
NH ₃	unionised ammonia, normally expressed in terms of the mass of nitrogen (N)
NO ₃	nitrate, normally expressed in terms of the mass of nitrogen (N)
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water
O&G	oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons)
Pb*	lead
pH	a numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5
Physicochemical	measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment
PM ₁₀	relatively fine airborne particles (less than 10 micrometre diameter)
resource consent	refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15)
RMA	Resource Management Act 1991 and including all subsequent amendments
SAR	Sodium Absorption Ratio; a measure of the suitability of water for use in agricultural irrigation, as determined by the concentrations of solids dissolved in the water. It is also a measure of the sodicity of soil, as determined from analysis of water extracted from the soil.
SS	suspended solids
SQMCI	semi quantitative macroinvertebrate community index;
Temp	temperature, measured in °C (degrees Celsius)

Turb	turbidity, expressed in NTU
UI	Unauthorised Incident
UIR	Unauthorised Incident Register – contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan
Zn*	zinc

Bibliography and references

- Taranaki Regional Council 2011: Remediation NZ Monitoring Programme Annual Report 2011-2012. Technical Report 2012-39. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2011: Remediation NZ Monitoring Programme Annual Report 2010-2011. Technical Report 2011-44. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2010: Remediation NZ Monitoring Programme Annual Report 2009-2010. Technical Report 2010-44. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2009: PEL Waste Services/Remediation NZ Monitoring Programme Annual Report 2008-2009. Technical Report 2009-49. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2009: PEL Waste Services Limited (formerly Perry Environmental Limited) Monitoring Programme Annual Report 2007-2008. Technical Report 2008-94. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2007: PEL Waste Services Limited (formerly Perry Environmental Limited) Monitoring Programme Annual Report 2006-2007. Technical Report 2007-112. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2006: Perry Environmental Limited Monitoring Programme Annual Report 2005-2006. Technical Report 2006-26. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2005: Perry Environmental Limited Monitoring Programme Annual Report 2004-2005. Technical Report 2005-12. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2004: Perry Environmental Limited Monitoring Programme Annual Report 2003-2004. Technical Report 2004-26. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2003: Perry Environmental Limited Monitoring Programme Annual Report 2002-2003. Technical Report 2003-37. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2002: Global Vermiculture Limited Monitoring Programme Annual Report 2001-2002. Technical Report 2002-25. Taranaki Regional Council, Stratford.

Appendix I

Resource consents held by Remediation (NZ) Limited



Discharge Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE: 06-765 7127
FAX: 06-765 5097
www.trc.govt.nz

Please quote our file number
on all correspondence

Name of
Consent Holder: Remediation (NZ) Limited
P O Box 8045
NEW PLYMOUTH 4342

Decision Date: 27 May 2010

Commencement
Date: 18 June 2010

Conditions of Consent

Consent Granted: To discharge:
a) waste material to land for composting; and
b) treated stormwater and leachate from composting
operations;
onto and into land in circumstances where contaminants
may enter water in the Haehanga Stream catchment and
directly into an unnamed tributary of the Haehanga Stream
between approximate [NZTM] 1731704E-5685796N,
1733127E-5684809N, 1732277E-5685101N, 1732451E-
5684624N and 1732056E-5684927N

Expiry Date: 1 June 2018

Review Date(s): June 2011, June 2012, June 2013, June 2014, June 2015,
June 2016, June 2017

Site Location: 1450 Mokau Road, Uruti

Legal Description: Sec 34 Pt Sec 4 Blk II Upper Waitara SD

Catchment: Mimi

Tributary: Haehanga

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

Doc# 774164-v1

General condition

- a. The consent holder shall pay to the Taranaki Regional Council [the Council] all the administration, monitoring and supervision costs of this consent, fixed in accordance to section 36 of the Resource Management Act.

Special conditions

General

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.

Acceptable wastes

2. The raw materials accepted onsite shall be limited to the following:
 - Paunch grass;
 - Animal manure from meat processing plant stock yards and dairy farm oxidation pond solids;
 - Green vegetative wastes;
 - Biosolids wastes including, but not limited to, pellets from wastewater treatment plants;
 - Mechanical pulping pulp and paper residue [excluding any pulping wastes that have been subject to chemical pulping or treated or mixed with any substance or material containing chlorine or chlorinated compounds];
 - Solid drilling cuttings from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0 % total petroleum hydrocarbon within 3 days of being received onsite;
 - Water based and synthetic based drilling fluids from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0 % total petroleum hydrocarbon content within 3 days of being brought onto the site;
 - Produced water from hydrocarbon exploration;
 - Vegetable waste solids [being processing by-products];
 - Grease trap waste [from food service industries];
 - Fish skeletal and muscle residue post filleting [free from offal]; and
 - Poultry industry waste [eggshells, yolks, macerated chicks and chicken mortalities].

The acceptance of any other materials shall only occur if the Chief Executive, Taranaki Regional Council advises in writing that he is satisfied on reasonable grounds that the other materials will have minimal effects beyond those materials listed above.

3. Material produced as a result of a dissolved air flotation process shall not be accepted on site.

Maintenance of measures

4. All sediment ponds and silt traps on site, that are located upstream of the pond treatment system or wetland treatment system, shall be managed so that they are no more than 20% full of solids at any one time.

Note: For the purposes of this condition, the location of the pond treatment system and wetland treatment system are shown on Figure 1, attached as Appendix 1 of this consent.

5. All treatment measures on site shall be implemented and maintained so that:
- clearwater runoff is prevented from entering Pad 1, Pad 2 and the Drill Mud Pad; and
 - all stormwater and/or leachate from Pad 1, Pad 2, the Drill Mud Pad and any other exposed areas within the composting site is directed for treatment through the Pond or Wetland Treatment System.

Note: For the purposes of this condition, the location and extent of Pad 1, Pad 2 and the Drill Mud Pad are shown on Figure 1, attached as Appendix 1 of this consent.

6. Any pond(s) used on site for the purposes of stormwater and leachate treatment shall be constructed and maintained in a manner which avoids the seepage of wastewater through the pond walls entering surface water.

Irrigation

7. The consent holder shall record the following information in association with irrigating wastewater to land:
- a) the date, time and hours of irrigation;
 - b) the approximate volume of wastewater irrigated to land;
 - c) the source of the wastewater [e.g. Pond or Wetland Treatment System]; and
 - d) the location and extent where the wastewater was irrigated.

The above records shall be made available to the Chief Executive, Taranaki Regional Council, on request.

8. There shall be no direct discharge to water as a result of irrigating wastewater to land. This includes, but is not necessarily limited to, ensuring the following:
- No irrigation shall occur closer than 25 m to any surface water body;
 - The discharge does not result in surface ponding;
 - No spray drift enters surface water;
 - The discharge does not occur at a rate at which it cannot be assimilated by the soil/pasture system; and
 - The pasture cover within irrigation areas is maintained at all times.
9. Treated wastewater discharged by irrigation to land shall not have a hydrocarbon content exceeding 5 % total petroleum hydrocarbon.

Consent 5838-2

10. Discharges irrigated to land shall not give rise to any of the following adverse effects in the Haehanga Stream, after a mixing zone extending 30 m from the downstream extent of the irrigation areas, being monitoring sites HHG000100 [at or about grid reference 1732295E-5684964N] and HHG000150 [at or about grid reference 1731673E-5685796N]:
- a) a rise in filtered carbonaceous biochemical oxygen demand of more than 2.00 gm⁻³;
 - b) a level of unionised ammonia greater than 0.025 gm⁻³;
 - c) an increase in total recoverable hydrocarbons;
 - d) an increase in chloride levels;
 - e) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
 - f) any conspicuous change in the colour or visual clarity;
 - g) any emission of objectionable odour;
 - h) the rendering of fresh water unsuitable for consumption by farm animals; and
 - i) any significant adverse effects on aquatic life.

Soil quality

11. Representative soil samples shall be taken from each irrigation area at intervals not exceeding six months for total petroleum hydrocarbons, chloride, sodium, total soluble salts, conductivity and the sodium absorption ratio [SAR].
12. Should the results of soil sampling, undertaken in accordance with condition 11 above, indicate an increasing trend in any of the measured parameters, the consent holder shall prepare a Soil Quality Management Plan which details how any significant adverse effects will be avoided, remedied or mitigated.

The Management Plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within three months of receiving written notice, from the Taranaki Regional Council, of the results and the requirement for a plan.

Note: for the purposes of this condition, an 'increasing trend' will be determined by the Chief Executive, Taranaki Regional Council and is defined as a consistent increase in a parameter level over time whilst taking into account any seasonal variations between results and any extreme weather conditions that may have had any influence on results.

13. Measures outlined in the Soil Quality Management Plan, approved under condition 12 above, shall be implemented within a timeframe specified by the Chief Executive, Taranaki Regional Council.

Groundwater quality

14. The consent holder shall establish at least one groundwater monitoring well at each of the following locations for the purpose of monitoring the effect of the wastewater discharges on groundwater quality:
- a) up gradient of the irrigation areas in an un-impacted area;
 - b) down gradient of the extent of the irrigation area situated upstream of the composting area; and

- c) down gradient of the extent of the irrigation area situated downstream of the composting area.

The design, location and establishment of the monitoring wells shall be to the reasonable approval of the Chief Executive, Taranaki Regional Council, acting in a certification capacity. The monitoring wells shall be fully established and operational within three months of the commencement date of this consent.

- 15. Groundwater shall be monitored at the wells approved under condition 14 at intervals not exceeding six months for total petroleum hydrocarbon, chloride, nitrate, nitrite and ammoniacal nitrogen.
- 16. Should the results of groundwater monitoring, undertaken in accordance with condition 15 above, indicate an increasing trend in one or more of the monitored parameters, the consent holder shall prepare a Groundwater Quality Management Plan which details how any significant adverse effects will be avoided, remedied or mitigated.

The Management Plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within three months of receiving written notice, from the Taranaki Regional Council, of the results and the requirement for a plan.

Note: for the purposes of this condition, an 'increasing trend' will be determined by the Chief Executive, Taranaki Regional Council and is defined as a consistent increase in a parameter level over time whilst taking into account any seasonal variations between results and any extreme weather conditions that may have had any influence on results.

- 17. Measures outlined in the Groundwater Quality Management Plan, approved under condition 16 above, shall be implemented within a timeframe specified by the Chief Executive, Taranaki Regional Council.

Pond Treatment System

- 18. The consent holder shall prepare a Pond Treatment System Management Plan which details management practices undertaken to maximise treatment capabilities of the system. The plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within one month of the commencement date of this consent.

The Management Plan shall address, but not necessarily be limited to, the following matters:

- a) how the build up of sediment and/or sludge will be managed within the entire system, how the level of build-up will be monitored including factors that will trigger management, and the frequency of undertaking the identified measures or procedures;
- b) how overloading of the system will be prevented; and
- c) how any offensive or objectionable odours at or beyond the site boundary will be avoided in accordance with condition 13 of consent 5839-2.

Consent 5838-2

19. Operations on site shall be undertaken in accordance with the Pond Treatment System Management Plan, approved under condition 18 above, except in circumstances when the Proposed Implementation Plan, approved under condition 9 of consent 5839-2, specifies otherwise.

Wetland Treatment System

20. The consent holder shall prepare a Wetland Treatment System Management Plan that details management practices undertaken to maximise treatment capabilities of the system. The plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within one month of the commencement date of this consent.

The Management Plan shall address, but not necessarily be limited to, the following matters:

- a) how the build up of sediment and/or sludge will be managed within the entire system, how the level of build-up will be monitored including factors which will trigger management, and the frequency of undertaking the identified measures or procedures; and
 - b) how plant die-off within the system will be managed, and the frequency and/or timing of undertaking the identified measures or procedures.
21. Operations on site shall be undertaken in accordance with the Wetland Treatment System Management Plan, approved under condition 20 above.
 22. The discharge from the Wetland Treatment System shall meet the following standards [at monitoring site IND003008]:
 - a) the suspended solids concentration shall not exceed 100 g/m³; and
 - b) the pH shall be between 6.0 and 9.0.
 23. Discharges from the Wetland Treatment System shall not give rise to any of the following effects in the unnamed tributary of the Haehanga Stream, after a mixing zone of 40 m, at established monitoring site HHG000103 [at or about grid reference 1732695E-5685050N]:
 - a) a rise in filtered carbonaceous biochemical oxygen demand of more than 2.00 gm⁻³;
 - b) a level of unionised ammonia greater than 0.025 gm⁻³;
 - c) the production of any 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; and
 - g) any significant adverse effects on aquatic life.

Riparian planting

24. The consent holder shall maintain the areas of riparian planting, undertaken in accordance with option 1 of riparian management plan RMP383, by ensuring the ongoing replacement of plants which do not survive, the eradication of weeds until the plants are well established, and the exclusion of stock from the planted areas.

Incident notification

25. The consent holder shall keep a permanent record of any incident related to this consent that results, or could result, in an adverse effect on the environment. The consent holder shall make the incident register available to the Taranaki Regional Council on request.

Details of any incident shall be forwarded to the Taranaki Regional Council immediately. At the grant date of this consent, the Council's phone number is 0800 736 222 [24 hour service].

Site reinstatement

26. The consent holder shall prepare a Site Exit Plan which details how the site is going to be reinstated prior to the consent expiring or being surrendered. The Plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, at least 3 months prior to this consent expiring or being surrendered.

The Site Exit Plan shall address, but not necessarily be limited to, the following matters:

- a) How the site will be reinstated so that no raw materials listed or approved under condition 2 of this consent remain on site;
- b) How the site will be reinstated so that no partially decomposed material remains on site;
- c) How any remaining leachate or sludge, resulting from the operation, will be either removed from the site, buried, treated or otherwise to avoid any adverse effects on groundwater or surface water; and
- d) Timeframes for undertaking the activities identified in association with a) to c) above.

Note: The requirement of this condition shall not apply if the consent holder applies for a new consent to replace this consent when it expires.

27. The consent holder shall reinstate the site in accordance with the plan approved under condition 26 above prior to this consent expiring or being surrendered.

Review

28. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review within one month of approving the plan required under condition 9 of consent 5839-2 and/or during the month of June in any year for any of the following purposes:

Consent 5838-2

- a) Ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, and in particular to address any more than minor adverse effects relating to odour discharges from the site and/or water quality issues;
- b) To incorporate into the consent any modification to the operation and maintenance procedures or monitoring that may be necessary to deal with any adverse effects on the environment arising from changes in association with condition 9 of consent 5839-2; and
- c) To determine any measures that may be appropriate to comply with condition 1 of this consent, and which are necessary to address any adverse effects relating to the wastewater discharges and/or odour from the site.

Signed at Stratford on 27 May 2010

For and on behalf of
Taranaki Regional Council



Director-Resource Management

Appendix 1 of consent 5838-2

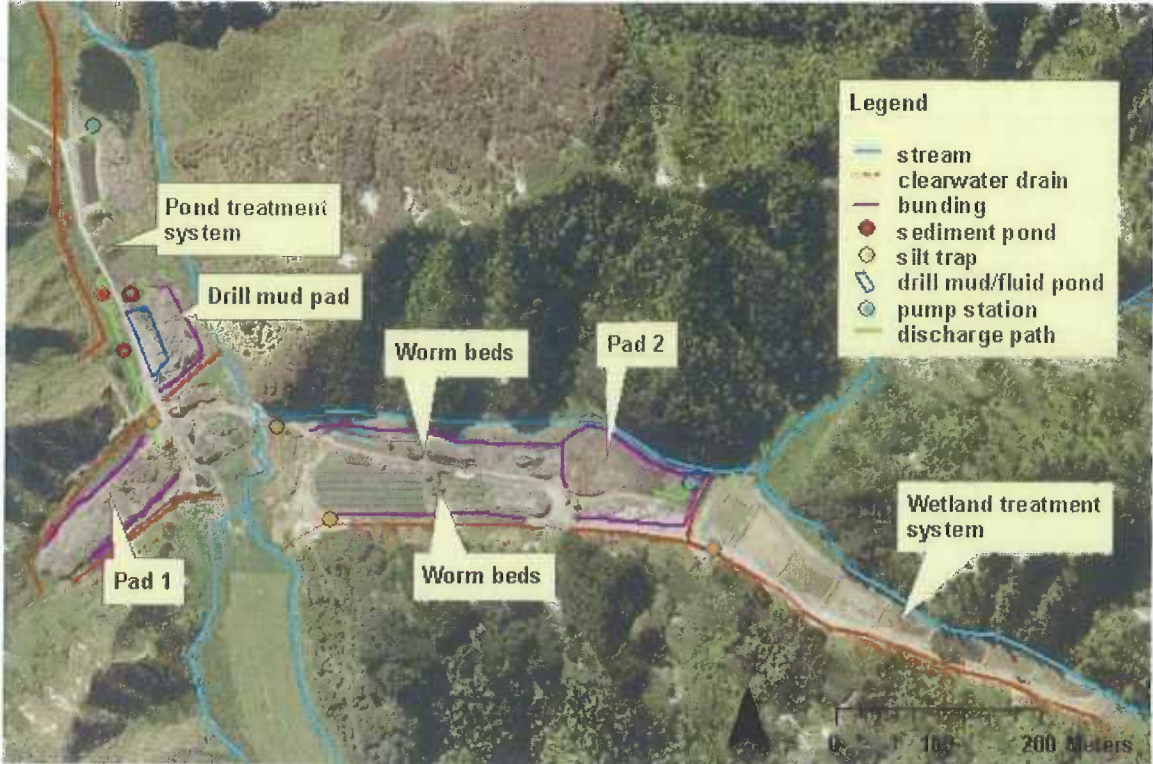


Figure 1 The location and extent of the Pond Treatment System, Wetland Treatment System, Pads 1 and 2, and the Drill Mud Pad.



Discharge Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

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Name of
Consent Holder: Remediation (NZ) Limited
P O Box 8045
NEW PLYMOUTH 4342

Decision Date: 27 May 2010

Commencement
Date: 18 June 2010

Conditions of Consent

Consent Granted: To discharge emissions into the air, namely odour and dust, from composting operations between (NZTM) 1731704E-5685796N, 1733127E-5684809N, 1732277E-5685101N, 1732451E-5684624N and 1732056E-5684927N

Expiry Date: 1 June 2018

Review Date(s): June 2011, June 2012, June 2013, June 2014, June 2015, June 2016, June 2017

Site Location: 1450 Mokau Road, Uruti

Legal Description: Sec 34 Pt Sec 4 Blk II Upper Waitara SD

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

Consent 5839-2

General condition

- a. The consent holder shall pay to the Taranaki Regional Council [the Council] all the administration, monitoring and supervision costs of this consent, fixed in accordance to section 36 of the Resource Management Act.

General

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.
2. The surface areas of Pad 1 and Pad 2 shall not exceed 3,500 m² and 4,000 m², respectively.

Note: For the purposes of this condition, the location and extent of Pad 1 and Pad 2 are shown on Figure 1, attached as Appendix 1 of this consent.

Incoming material

3. The raw materials accepted onsite shall be limited to the following:
 - Paunch grass;
 - Animal manure from meat processing plant stock yards and dairy farm oxidation pond solids;
 - Green vegetative wastes;
 - Biosolids wastes including, but not limited to, pellets from wastewater treatment plants;
 - Mechanical pulping pulp and paper residue [excluding any pulping wastes that have been subject to chemical pulping or treated or mixed with any substance or material containing chlorine or chlorinated compounds];
 - Solid drilling cuttings from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0 % total petroleum hydrocarbon within 3 days of being received onsite;
 - Water based and synthetic based drilling fluids from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0 % total petroleum hydrocarbon content within 3 days of being brought onto the site;
 - Produced water from hydrocarbon exploration;
 - Vegetable waste solids [being processing by-products];
 - Grease trap waste [from food service industries];
 - Fish skeletal and muscle residue post filleting [free from offal]; and
 - Poultry industry waste [eggshells, yolks, macerated chicks and chicken mortalities].

The acceptance of any other materials shall only occur if the Chief Executive, Taranaki Regional Council advises in writing that he is satisfied on reasonable grounds that the other materials will have minimal effects beyond those materials listed above.

4. Material produced as a result of a dissolved air flotation process shall not be accepted on site.

5. The consent holder shall record the following information in association with accepting all incoming material on site:
- a) the date and time that the material is accepted;
 - b) description of the material; and
 - c) the approximate volumes of material.

The above records shall be made available to the Chief Executive, Taranaki Regional Council, on request.

Management practices

6. The consent holder shall prepare a Site Practices Management Plan which details management practices undertaken to ensure that offensive or objectionable odours at or beyond the site boundary will be avoided in accordance with condition 13 of this consent. The plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within one month of the commencement date of this consent.

The Management Plan shall address, but not necessarily be limited to, the following matters:

- a) identification of all activities on site which have the potential to generate odour [e.g. turning compost piles, removing sludge from ponds];
 - b) the conditions and/or time of day when activities identified under a) above should be undertaken [e.g. during favourable weather conditions and the identification of those conditions] and/or measures that shall be implemented to avoid odours arising [e.g. containment measures];
 - c) measures undertaken to minimise odours during receiving and storing material on Pad 1 and Pad 2 and throughout the composting and vermiculture processes [e.g. method[s] used to cover material once received, how anaerobic conditions are maintained];
 - d) measures undertaken to minimise odours arising in the Wetland Treatment System, and identification of the time of year and/or frequency when undertaken;
 - e) measures undertaken to minimise odours arising in the Pond Treatment System and associated treatment measures [e.g. silt traps located upstream], and identification of the time of year and/or frequency when undertaken; and
 - f) details of how a complaint investigation procedure shall operate, including what data shall be collected and what feedback is to be provided to the complaint.
7. Operations on site shall be undertaken in accordance with the Site Practices Management Plan, approved under condition 6 above, except in circumstances when the Proposed Implementation Plan, approved under condition 9 of this consent, specifies otherwise.

Site audit and implementation

8. The consent holder shall engage a suitably qualified and experienced professional to prepare and submit an Odour Assessment Report for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within three months of the commencement date of this consent. The professional that the consent holder engages shall be to the reasonable approval of the Chief Executive, Taranaki Regional Council.

The report shall include, but not necessarily be limited to, the following:

- a) The appropriateness of the management practices and control measures undertaken in avoiding offensive and/or objectionable odours arising beyond the property boundary in association with the composting processes on Pad 1;
- b) Recommendations in association with a) above;
- c) The appropriateness of the design and management of the Pond Treatment System and associated pre-treatment devices (e.g. silt ponds) in effectively managing odours arising from treating leachate derived from Pad 1 and avoiding offensive and/or objectionable odours arising beyond the property boundary; and
- d) Recommendations in association with c) above.

For assisting with the above assessment, the consent holder shall provide a copy of the documents listed below to the engaged and approved professional:

- The Taranaki Regional Council final officers report and hearing decision report for applications 5276 and 5277;
- Consent certificates [including conditions] for consents 5838-2 and 5839-2;
- The Pond Treatment System Management Plan approved under condition 18 of consent 5838-2; and
- The Site Practices Management Plan approved under condition 6 of this consent.

9. The consent holder shall prepare and submit a Proposed Implementation Plan for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within one month of the Odour Assessment Report being approved under condition 8 above.

The Plan shall include, but not necessarily be limited to, the following:

- a) Management practices and/or control measures proposed to be implemented in association with the composting processes on Pad 1, of which are from the recommendations of the Odour Assessment Report, approved in accordance with condition 8;
- b) Management practices and/or control measures proposed to be implemented in association with the Pond Treatment System, of which are from the recommendations of the Odour Assessment Report, approved in accordance with condition 8;
- c) The reasons for the chosen practices and/or measures identified in accordance with a) and b) above
- d) A timeframe by when each of the practices and/or measures identified in accordance with a) and b) above will be implemented

Consent 5839-2

- e) Identification of appropriate management practices to ensure the on-going functionality of any chosen control measures identified in accordance with a) and b) above

10. Operations and activities on site shall be undertaken in accordance with the Proposed Implementation Plan, approved under condition 9 above.

Dust

11. The dust deposition rate beyond the boundary of the consent holder's site arising from the discharge shall be less than 4.0 g/m²/30 days.

Note: For the purposes of this condition, the consent holder's site is defined as Sec 34 Pt Sec 4 Blk II Upper Waitara SD.

12. Any discharge to air from the site shall not give rise to any offensive, objectionable, noxious or toxic levels of dust at or beyond the boundary of the consent holder's site, and in any case, total suspended particulate matter shall not exceed 120 µg/m³ as a 24 hour average [measured under ambient conditions] beyond the boundary of the consent holder's site.

Note: For the purposes of this condition, the consent holder's site is defined as Sec 34 Pt Sec 4 Blk II Upper Waitara SD.

Odour

13. The discharges authorised by this consent shall not give rise to an odour at or beyond the boundary of the consent holder's site that is offensive or objectionable.

Note: For the purposes of this condition:

- The consent holder's site is defined as Sec 34 Pt Sec 4 Blk II Upper Waitara SD; and
- Assessment under this condition shall be in accordance with the *Good Practice Guide for Assessing and Managing Odour in New Zealand, Air Quality Report 36, Ministry for the Environment, 2003.*

Monitoring

14. The consent holder shall install a monitoring device that continuously records wind speed and direction in the area of the composting activity. The device shall be capable of logging collected data for at least six months and shall be installed and be operational within three months of the commencement date of this consent.

The data shall be provided telemetrically to the Taranaki Regional Council. If this method is not technically feasible, the data shall be provided to the Taranaki Regional Council at a frequency and a form advised by the Chief Executive, Taranaki Regional Council until such a time it is technically feasible to telemetric the data.

Odour surveys

15. The consent holder shall undertake an odour survey within six months of the Plan approved under condition 9 of this consent being implemented and thereafter at yearly intervals during periods when metrological conditions are most likely to result in offsite odour. The methodology for the survey shall be consistent with German Standard VDI 3940 "Determination of Odorants in Ambient Air by Field Inspection", or similar. Prior to the survey being carried out, the methodology shall be approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity.

The results of the survey shall be provided to the Chief Executive, Taranaki Regional Council, within three months of the survey being completed.

Community liaison

16. The consent holder and the Director – Resource Management, Taranaki Regional Council, or his delegate, shall meet locally as appropriate, six monthly or at such other frequency as the parties may agree, with submitters to the application of this consent and any other interested party at the discretion of the Chief Executive, Taranaki Regional Council, to discuss any matter relating to the exercise of this consent, in order to facilitate ongoing community consultation.

Incident notification

17. The consent holder shall keep a permanent record of any incident related to this consent that results, or could result, in an adverse effect on the environment. The consent holder shall make the incident register available to the Taranaki Regional Council on request.

Details of any incident shall be forwarded to the Taranaki Regional Council immediately. At the grant date of this consent, the Council's phone number is 0800 736 222 [24 hour service].

Site reinstatement

18. The consent holder shall prepare a Site Exit Plan which details how the site is going to be reinstated prior to the consent expiring or being surrendered. The Plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, at least 3 months prior to this consent expiring or being surrendered.

The Site Exit Plan shall address, but not necessarily be limited to, the following matters:

- a) How the site will be reinstated so that no raw materials listed or approved under condition 3 of this consent remain on site;
- b) How the site will be reinstated so that no partially decomposed material remains on site;
- c) How any remaining leachate or sludge, resulting from the operation, will be either removed from the site, buried, treated or otherwise to avoid any adverse effects on groundwater or surface water; and

Consent 5839-2

- d) Timeframes for undertaking the activities identified in association with a) to c) above.

Note: The requirement of this condition shall not apply if the consent holder applies for a new consent to replace this consent when it expires.

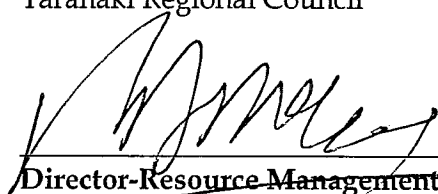
19. The consent holder shall reinstate the site in accordance with the Plan approved under condition 18 above prior to this consent expiring or being surrendered.

Review

20. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review within one month of approving the plan required under condition 9 of this consent and/or during the month of June in any year for any of the following purposes:
- a) Ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, and in particular to address any more than minor adverse effects relating to odour discharges from the site;
 - b) To incorporate into the consent any modification to the operation and maintenance procedures or monitoring that may be necessary to deal with any adverse effects on the environment arising from changes in association with condition 9 of this consent; and
 - c) To determine any measures that may be appropriate to comply with condition 1 of this consent, and which are necessary to address any adverse effects of odour from the site.

Signed at Stratford on 27 May 2010

For and on behalf of
Taranaki Regional Council



Director-Resource Management

Appendix 1 of consent 5839-2

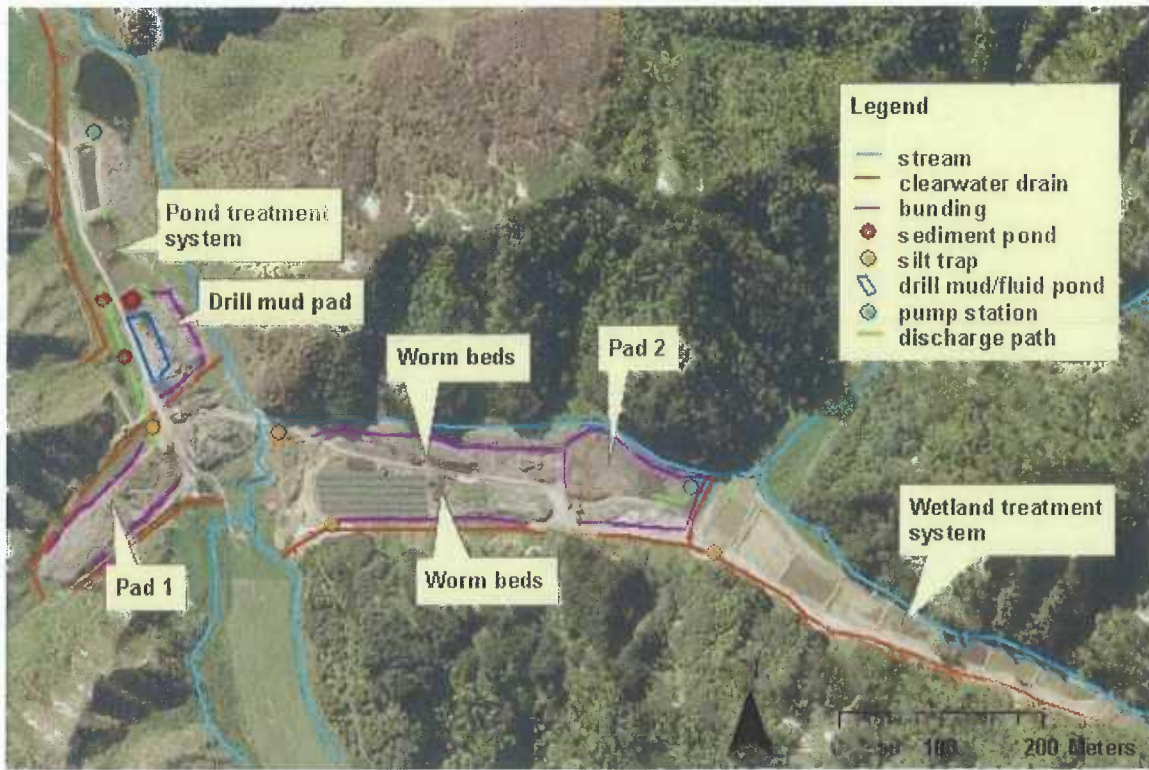


Figure 1 The location and extent of the composting operation including Pads 1 and 2.



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Discharge Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of
Consent Holder: Remediation (NZ) Limited
P O Box 8045
NEW PLYMOUTH 4342

Consent Granted
Date: 7 September 2006

Conditions of Consent

Consent Granted: To discharge stormwater from worm farming operations
onto and into land and into an unnamed tributary of the
Waiongana Stream at or about (NZTM)
1705949E-5679907N

Expiry Date: 1 June 2020

Review Date(s): June 2008, June 2014

Site Location: 96 Waitara Road, Brixton, Waitara

Legal Description: Lot 1 DP 19670 Blk III Paritutu SD

Catchment: Waiongana

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

Consent 5892-2

General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

1. This consent shall be exercised generally in accordance with the information submitted in support of applications 1559 and 4037. In the case of any contradiction between the documentation submitted in support of applications 1559 and 4037 and the conditions of this consent, the conditions of this consent shall prevail.
2. At all times the consent holder shall adopt the best practicable option, as defined in section 2 of the Act, to prevent or minimise any actual or likely adverse effect on the environment associated with worm farming activities and the discharge of stormwater onto and into land.
3. Within three months of granting of this consent the consent holder shall prepare and maintain a stormwater management plan to the satisfaction of the Chief Executive, Taranaki Regional Council. This plan shall be updated as required by any significant changes to plant processes.
4. The consent holder shall keep and make available to the Chief Executive, Taranaki Regional Council, upon request, records of the nature and volume of all wastes received at the site; such records to be kept for at least 12 months.
5. The exercise of this consent shall not result in any contamination of groundwater or surface water, other than as provided for in special condition 6 of this consent.
6. The stormwater treatment system shall be maintained to the satisfaction of the Chief Executive, Taranaki Regional Council.

The following concentrations shall not be exceeded within the discharge effluent:

Component	Concentration
pH (range)	6.5-8.5
suspended solids	100 gm ⁻³


Consent 5892-2

This condition shall apply prior to any stormwater prior to leaving the site into the neighbouring drain, at a designated sampling point approved by the Chief Executive, Taranaki Regional Council.

7. After allowing for reasonable mixing, with a mixing zone extending seven times the width of the receiving waters downstream of the discharge point, the discharge shall not give rise to any of the following effects in the receiving waters of the unnamed tributary:
 - a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
 - b) any conspicuous change in the colour or visual clarity;
 - c) any emission or objectionable odour;
 - d) the rendering of fresh water unsuitable for consumption by farm animals;
 - e) any significant adverse effects on aquatic life.
8. The consent holder shall ensure that except when discharging, windrows shall be covered at all times.
9. Prior to undertaking any alterations to the processes or operations which significantly change the nature or quantity of contaminants emitted from the site, the consent holder shall consult with the Chief Executive, Taranaki Regional Council, and shall obtain any necessary approvals under the Resource Management Act 1991.
10. The Chief Executive, Taranaki Regional Council, shall be advised in writing at least 48 hours prior to the reinstatement of the site and the reinstatement shall be carried out so as to minimise effects on stormwater quality, and to meet the criteria of Tables 4.11, 4.14 & 4.20 of the Ministry for the Environment (1999) document 'Guidelines for Assessing & Managing Petroleum Hydrocarbon Contaminated sites in N.Z.'.
11. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2008 and/or June 2014, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 22 September 2008

For and on behalf of
Taranaki Regional Council



Director Resource Management



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**Discharge Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council**

Name of
Consent Holder: Remediation (NZ) Limited
P O Box 8045
NEW PLYMOUTH 4342

Consent Granted
Date: 12 October 2006

Conditions of Consent

Consent Granted: To discharge solid hydrocarbon exploration drilling wastes onto land for worm farming operations and to discharge stormwater from worm farming operations onto and into land and into an unnamed tributary of the Waitara River at or about (NZTM) 1706208E-5679875N

Expiry Date: 1 June 2021

Review Date(s): June 2009, June 2015

Site Location: 6 Pennington Road, Waitara

Legal Description: Lot 1 DP 18170 Blk V Waitara SD

Catchment: Waitara

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

Consent 5893-2

General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

1. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of applications 1560 and 4038. In the case of any contradiction between the documentation submitted in support of applications 1560 and 4038 and the conditions of this consent, the conditions of this consent shall prevail.
2. At all times the consent holder shall adopt the best practicable option, as defined in section 2 of the Act, to prevent or minimise any actual or likely adverse effect on the environment associated with worm farming activities and the discharge of solid hydrocarbon exploration drilling wastes onto land including effects to surface water and groundwater.
3. The consent holder shall keep and make available to the Chief Executive, Taranaki Regional Council, upon request, records of the nature and volume of all wastes received at the site; such records to be kept for at least 12 months.
4. The solid drilling cuttings from hydrocarbon exploration shall not exceed a maximum hydrocarbon content of 5.0% total petroleum hydrocarbon prior to mixing or incorporation
5. The exercise of this consent shall not result in any contamination of groundwater or surface water, other than as provided for in special conditions 7 and 8 of this consent.
6. The stormwater treatment system shall be maintained to the satisfaction of the Chief Executive, Taranaki Regional Council.
7. The following concentrations shall not be exceeded within the discharge effluent:

Component	Concentration
pH (range)	6.5-8.5
suspended solids	100 gm ⁻³
total recoverable hydrocarbons [infrared spectroscopic technique]	15 gm ⁻³

Consent 5893-2

This condition shall apply prior to the entry of the stormwater into the receiving waters of the unnamed tributary, at a designated sampling point approved by the Chief Executive, Taranaki Regional Council.

8. After allowing for reasonable mixing within a mixing zone extending downstream of the discharge point to the Pennington Road culvert the discharge shall not give rise to any of the following effects in the receiving waters of the unnamed tributary:
 - a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
 - b) any conspicuous change in the colour or visual clarity;
 - c) any emission of objectionable odour;
 - d) the rendering of fresh water unsuitable for consumption by farm animals;
 - e) any significant adverse effects on aquatic life.
9. That prior to undertaking any alterations to the processes or operations which significantly change the nature or quantity of contaminants emitted from the site, the consent holder shall consult with the Chief Executive, Taranaki Regional Council, and shall obtain any necessary approvals under the Resource Management Act 1991.
10. The Chief Executive, Taranaki Regional Council, shall be advised in writing at least 48 hours prior to the reinstatement of the site and the reinstatement shall be carried out so as to minimise effects on stormwater quality, and to meet the criteria of Tables 4.11, 4.14 & 4.20 of the Ministry for the Environment (1999) document 'Guidelines for Assessing & Managing Petroleum Hydrocarbon Contaminated sites in N.Z.'.
11. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 22 September 2008

For and on behalf of
Taranaki Regional Council



Director-Resource Management



**Land Use Consent
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council**

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Name of
Consent Holder: Remediation (NZ) Limited
P O Box 8045
NEW PLYMOUTH 4342

Consent Granted
Date: 5 December 2001

Conditions of Consent

Consent Granted: To erect, place, use and maintain a twin culvert in, on and over the bed of the Haehanga Stream in the Mimi catchment for vehicle access purposes at or about (NZTM) 1731701E-5685876N

Expiry Date: 1 June 2015

Review Date(s): June 2003, June 2009

Site Location: 1460 Mokau Road, Uruti

Legal Description: Pt Sec 4 Blk II Upper Waitara SD

Catchment: Mimi

Tributary: Haehanga

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

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Doc# 515040-v1

Consent 5938-1

General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

1. The consent holder shall notify the Taranaki Regional Council in writing at least 48 hours prior to and upon completion of any subsequent maintenance works which would involve disturbance of or deposition to the riverbed or discharges to water.
2. The structure[s] authorised by this consent shall be constructed generally in accordance with the documentation submitted in support of the application and shall be maintained to ensure the conditions of this consent are met.
3. The consent holder shall adopt the best practicable option to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.
4. The consent holder shall ensure that the area and volume of riverbed disturbance shall, so far as is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.
5. The structure[s] authorised by this consent shall be removed and the area reinstated, if and when the structure[s] are no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to structure[s] removal and reinstatement.

Consent 5938-1

6. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2003 and/or June 2009, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 22 September 2008

For and on behalf of
Taranaki Regional Council



~~Director Resource Management~~



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Land Use Consent
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of
Consent Holder: Remediation (NZ) Limited
P O Box 8045
NEW PLYMOUTH 4342

Consent Granted
Date: 26 September 2003

Conditions of Consent

Consent Granted: To realign and divert the Haehanga Stream in the Mimi catchment for land improvement purposes at or about (NZTM) 1732402E-5684777N

Expiry Date: 1 June 2021

Review Date(s): June 2009, June 2015

Site Location: 1460 Mokau Road, Uruti

Legal Description: Pt Sec 4 Blk II Upper Waitara SD

Catchment: Mimi

Tributary: Haehanga

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

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Doc# 515053-v1

Consent 6211-1

General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

1. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to and upon completion of any subsequent maintenance works that would involve disturbance of or deposition to the riverbed or discharges to water.
2. The realignment authorised by this consent shall be undertaken generally in accordance with the documentation submitted in support of the application and shall be maintained to ensure the conditions of this consent are met.
3. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise erosion and scouring as a result of channel realignment.
4. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.
5. The consent holder shall ensure that the area and volume of riverbed disturbance shall, so far as is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.

Consent 6211-1

6. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 22 September 2008

For and on behalf of
Taranaki Regional Council


Director-Resource Management



Land Use Consent
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE: 06-765 7127
FAX: 06-765 5097
www.trc.govt.nz

Please quote our file number
on all correspondence

Name of
Consent Holder: Remediation (NZ) Limited
P O Box 8045
NEW PLYMOUTH 4342

Consent Granted
Date: 26 September 2003

Conditions of Consent

Consent Granted: To erect, place, use and maintain a culvert and associated structure[s] in the bed of the Haehanga Stream in the Mimi catchment for access purposes at or about (NZTM) 1732402E-5684777N

Expiry Date: 1 June 2021

Review Date(s): June 2009, June 2015

Site Location: 1460 Mokau Road, Uruti

Legal Description: Pt Sec 4 Blk II Upper Waitara SD

Catchment: Mimi

Tributary: Haehanga

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

Consent 6212-1

General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

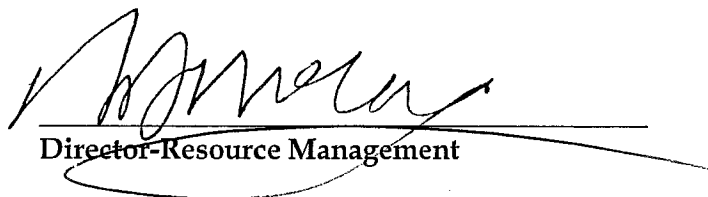
1. The consent holder shall notify the Taranaki Regional Council in writing at least 48 hours prior to the commencement and upon completion of removal of the temporary culvert [being the 800mm diameter culvert] and installation of the permanent culvert and associated structures, and again at least 48 hours prior to and upon completion of any subsequent maintenance works which would involve disturbance of or deposition to the riverbed or discharges to water.
2. The consent holder shall replace the existing temporary culvert with a permanent culvert and associated structure[s] by 1 April 2004. Prior to the installation of the permanent culvert and associated structure[s] the consent holder shall forward designs of the proposed culvert and associated structure[s] for the written approval of the Chief Executive.
3. The structures authorised by this consent shall be constructed generally in accordance with the documentation submitted in support of the application and shall be maintained to ensure the conditions of this consent are met.
4. The consent holder shall adopt the best practicable option to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.
5. The consent holder shall ensure that the area and volume of riverbed disturbance shall, so far as is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.
6. The structures, which are the subject of this consent, shall not obstruct fish passage.
7. The structures authorised by this consent shall be removed and the area reinstated if and when the structures are no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to structures removal and reinstatement.

Consent 6212-1

8. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 22 September 2008

For and on behalf of
Taranaki Regional Council



Director-Resource Management

Appendix II
Biomonitoring report

To Scott Cowperthwaite, Job Manager
From Bart Jansma, Scientific Officer
File 03-02-005-13/01; 5838
Report No BJ175
Document No 1101310
Date 27 September 2012

Biomonitoring of the Haehanga Stream in relation to discharges from the Remediation (NZ) Limited composting site at Uruti, May 2012

Introduction

Remediation (NZ) Ltd operates a composting facility in the Haehanga Valley, Uruti (previously owned by Perry Environmental Ltd who was preceded by Global Vermiculture Ltd). Raw materials are trucked to the site for composting, on a purpose built composting pad for a period of 35-40 days. Synthetic hydrocarbon contaminated drilling muds and cuttings are also received on site. They are piled up and the liquids are allowed to drain, then blended with green waste and other organic matter. Composted material is transported off site by trucks to Remediation (NZ) Ltd's worm farming operations at Waitara Road and Pennington Road.

This survey was the only survey undertaken in the 2011-2012 period. At the time of this survey, there were two composting pads. The south-west pad (referred to as composting pad 1 in this report) has been established and operating for some years, and is where the synthetic muds are blended with green waste and other organic matter. A second pad north-east of the original composting pad, which became operational in the summer of 2005 is referred to as composting pad 2.

Both composting pads are bunded, with all surface stormwater and leachate contained and directed to treatment ponds. Water from the settling pond is recycled back to the composting material if and when required to maintain a moist composting environment. The runoff from composting pad 1 is treated in the series of ponds. Between each pond there is a baffle that skims off any floating hydrocarbons as the leachate passes through. The treated liquid in the final pond, located just upstream of site 5 (HHG000115), is then irrigated to pasture. This irrigation system was installed prior to the November 2005 biological survey.

Prior to February 2008, no discharges of stormwater or leachate directly entered the Haehanga Stream or its tributaries. However, after that date, the site has since been permitted to discharge treated stormwater and compost leachate to the unnamed tributary of the Haehanga Stream. This comes from composting pad 2, where leachate is pumped up to the top of a seven tier wetland, which was constructed in late 2007. Under dry conditions the wetland water from the bottom pond of the wetland is reticulated back to the upper tier of the wetland. Under high flow conditions the wetland discharges to a tributary of the Haehanga Stream.

In addition to this discharge from the wetland, there is some potential for seepage from the composting pads and irrigation area to enter groundwater, and for stormwater runoff to escape the collection system, and thus gravitate toward the surface watercourses at the site.

A baseline survey of five sites was conducted in October 2002 in relation to the composting operation (Dunning, 2003). At the time of this earlier survey, only composting pad 1 was operational, and sites were established for both the existing and proposed composting pads. Unnamed tributaries of the Haehanga Stream flow adjacent to (and down gradient of) both composting pads and flow into the Haehanga Stream downstream of the composting areas (Figure 1). Since this baseline survey, significant changes have occurred on site, leading to sampling sites being moved, or sampling at some sites to be discontinued. Any changes to sampling sites made prior to the current survey have been discussed in previous reports, referenced below.

The current biological survey was conducted to monitor the effects of discharges from the composting site to the Haehanga Stream and tributaries in relation to composting areas (pads 1 & 2), the irrigation of treated liquid to land, and the discharge of treated stormwater and leachate to the unnamed tributary. The only change to the sampling sites was the inclusion of an additional site (HHG000150), at the downstream extent of the irrigation area as recommended in the previous macroinvertebrate monitoring report (BJ149). This site is now referred to as site 6, with HHG000112 now referred to as site 5. This constitutes a change, as HHG000112 was previously referred to as site 6.

Methods

The vegetation 'sweep-sampling' and 'kick-net' sampling techniques (or a combination of the two) were used to collect macroinvertebrates from the aquatic plants growing in the stream, or from the stream bed from seven sampling sites in the Haehanga Stream catchment (Table 1, Figure 1), on 12 April 2011. The 'kick-net' sampling technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative), and the 'sweep-sampling' technique is very similar to Protocol C2 (soft-bottomed, semi-quantitative), of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

Two of the sites surveyed were previously established in the baseline survey (sites 1 and 2) (Dunning, 2003). Site T2 and T3 were sampled for the fourth time during the current survey, while site 5 has been sampled since January 2005 and site 7 since February 2007. Site 6 was sampled for the first time in the current survey.

Table 1 Biomonitoring sites in the Haehanga Stream catchment

Site	Site Code	Location
1	HHG000093	Upstream of extended irrigation area
2	HHG000100	Downstream of extended irrigation area
T2	HHG000098	Upstream of wetland discharge point
T3	HHG000103	Downstream of wetland discharge point
5	HHG000115	25 m downstream of last pond and swale collection area
6	HHG000150	30 m downstream of lower irrigation area
7	HHG000190	50 metres upstream of State Highway 3 bridge

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001).







Macroinvertebrate taxa found in each sample were recorded as:

R (rare)	= less than 5 individuals;
C (common)	= 5-19 individuals;
A (abundant)	= estimated 20-99 individuals;
VA (very abundant)	= estimated 100-499 individuals;
XA (extremely abundant)	= estimated 500 individuals or more.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams (MCI). Recently, a similar scoring system has been developed for macroinvertebrate taxa found in soft bottomed streams (Stark and Maxted, 2004, 2007) (SBMCI). The SBMCI has been used in a number of biomonitoring reports since its inception, and results to date suggest that it is not as effective at assessing the impacts of organic pollution as the MCI. For example, results from the February 2008 Mangati survey found a relatively unchanged SBMCI score at a site which had thick growths of sewage fungus (Jansma, 2008c). Therefore this index is considered less appropriate for the assessment of macroinvertebrate communities possibly affected by industrial discharges. Any subsequent reference to MCI refers to the MCI.

Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1 and 0.1 in hard bottomed and soft bottomed streams respectively. The sensitivity scores for certain taxa found in hard bottomed streams have been modified in accordance with Taranaki experience. By averaging the scores obtained from a list of taxa taken from one site and multiplying by a scaling factor of 20, a Macroinvertebrate Community Index (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. More 'sensitive' communities inhabit less polluted waterways.

A gradation of biological water quality conditions based upon MCI ranges has been adapted for Taranaki streams and rivers from Stark's classification (Stark, 1985 and Boothroyd & Stark, 2000). This is as follows:

Grading	MCI	Code
Excellent	>140	
Very Good	120-140	
Good	100-119	
Fair	80-99	
Poor	60-79	
Very Poor	<60	

A semi-quantitative MCI value (SQMCI_s) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCI_s is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower.

HHG000190 ~1900m DS
HHG000150 ~ 675m DS

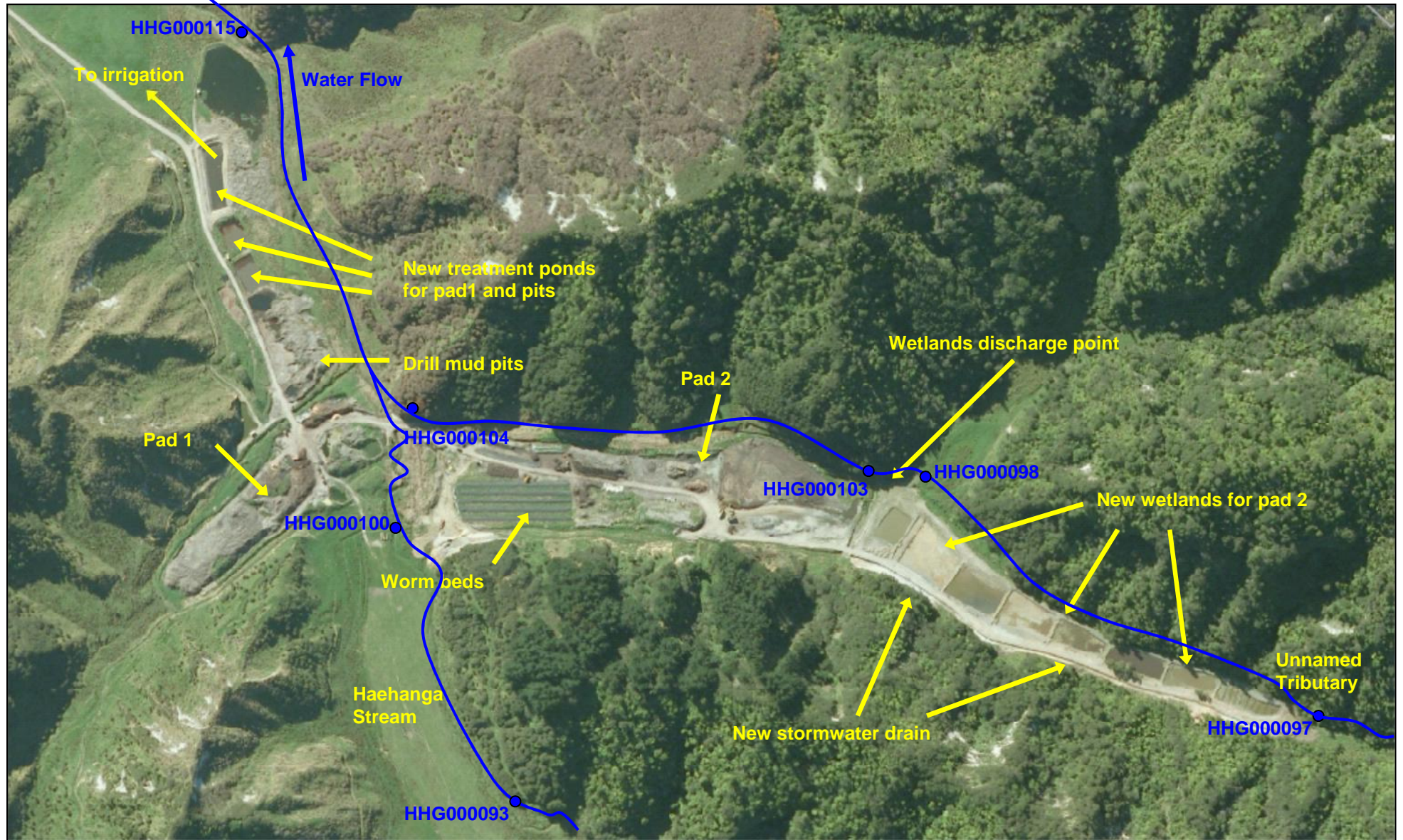


Figure 1 Location of biomonitoring sites in the Haehanga Stream catchment

Sub-samples of algal and detrital material taken from the macroinvertebrate samples, were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa (“undesirable biological growths”) at a microscopic level. The presence of masses of these organisms is an indicator of organic enrichment within a stream.

Results and Discussion

During the present survey, water temperatures in the Haehanga Stream catchment ranged from 9.9°C to 11.7°C. Flows in the catchment were moderate, with this clear and uncoloured at sites 1, 2 and T2. The remaining sites had a brown and cloudy flow, with this discolouration being caused by the wetland discharge. Water speeds ranged from slow to steady, reflecting the very shallow gradient of this catchment. Sites 1, 2, 7, T2 and T3 were dominated by silty substrate. Site 5 and 6 were dominated by gravels, although silt was still a significant component of the substrate.

All sites supported aquatic vegetation, with this growth being throughout the stream at sites 1, 2 and 6 but only on the edges of the stream at sites T2, T3, 5 and 7. This vegetation habitat was targeted for sampling at site 1 using the ‘sweep-net’ technique. At sites 2, 7, T2 and T3, a combination of substrate and vegetation was sampled i.e. both ‘kick’ and ‘sweep-net’ sampling, while only substrate was sampled at the remaining sites. Although flows were high enough to not hinder sampling in the main stem, sampling in the tributary was difficult due to it being so small. Filamentous algal growth was patchy at sites 2 and 6, while a slippery film was present at the remaining sites (and site 6), with no algae noted at site 1.

No undesirable heterotrophic growths were recorded at any of the five sites in this survey.

Macroinvertebrate communities

Only a small number of macroinvertebrate surveys have been conducted at these sites. Monitoring has been conducted in other small lowland hill country streams in Taranaki surveyed at similar altitudes (TRC, 1999 (statistics updated 2011)) and these have been compared with the current results in Table 2. Table 2 gives summary statistics for the sites, while Table 3 provides a complete taxa list for the current survey.

Table 2 Number of taxa, MCI and SQMCI_s values recorded in the Haehanga Stream catchment together with a summary of results from control sites in other small lowland hill country streams (LOWL) in Taranaki (TRC, 1999)

Site	Number of previous surveys	Numbers of taxa			MCI values			SQMCI _s values		
		Median	Range	Current	Median	Range	Current	Median	Range	Current
LOWL	36	20	14-27	-	72	68-109	-	4.1*	2.7-6.1	-
1	6	22	21-25	19	71	68-78	72	3.6	2.7-4.2	3.9
2	14	19	17-23	21	69	62-85	82	3.8	2.7-4.4	4.3
T2	3	22	20-27	22	84	79-92	79	5.0	4.6-5.5	4.6
T3	3	27	26-30	26	87	79-93	83	4.6	3.5-5.4	4.4
5	13	19	6-26	19	72	53-82	82	2.6	1.1-3.6	2.8
6	-	-	-	22	-	-	70	-	-	3.0
7	9	19	12-25	22	69	62-82	75	2.9	1.3-4.1	4.1

*SQMCI_s median and range based on only 18 surveys

Site 1 – Upstream of expanded irrigation area

This site, sampled intermittently since 2002, was re-introduced to the monitoring programme in 2010, prior to the irrigation of wastewater onto land between sites 1 and 2. Irrigation on this land has since occurred, and as such site 1 becomes the upstream control site, and site 2 becomes an impact site.

A moderate taxa richness was recorded at this site (19), which although being lower than any richness recorded in the previous six surveys, is only three taxa less than the median and that recorded in the previous survey. The community comprised a relatively high proportion of tolerant taxa (68%) which resulted in a 'poor' MCI score of 72 units. This is four units higher than the minimum score recorded previously at this site, and considered a reflection of the slow flows and vegetation habitat sampled. This score is not dissimilar to the median MCI score for other similar lowland streams, indicating that although this score is low, it is relatively typical for streams of this nature.

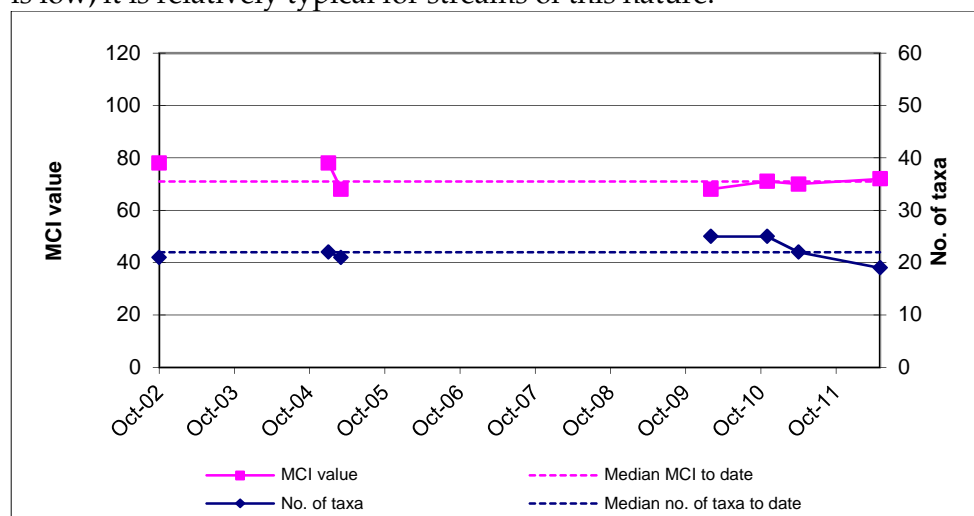


Figure 2 Taxa numbers and MCI recorded to date at site 1

The community was dominated by one 'moderately sensitive' taxon (*Paracalliope* amphipods), and five 'tolerant' taxa (snails (*Physa* and *Potamopyrgus*), ostracod seed shrimps, damselfly larvae (*Xanthocnemis*) and axehead caddisfly larvae (*Oxyethira*)) were abundant. This dominance of slightly less 'tolerant' taxa resulted in a moderately low SQMCI_s score of 3.9 units, higher than the median of previous surveys, and similar to the median for other sites in similar small lowland streams.

Overall, this indicates that the water quality of the Haehanga Stream prior to it flowing into the Remediation NZ composting site was of average quality, primarily reflecting the slow flow and shallow gradient of this stream.

Site 2 – Downstream of extended irrigation area

At site 2 in the Haehanga Stream, upstream of all composting areas, 21 macroinvertebrate taxa were recorded. This was similar to that recorded in the previous survey and the median (Table 2). The community was dominated by 'tolerant' oligochaete worms, *Potamopyrgus* snails, *Xanthocnemis* damselfly larvae and *Austrosimulium* sandfly larvae. 'Moderately sensitive' *Paracalliope* amphipods and *Austroclima* mayflies were also abundant (Table 3). Most of these taxa are usually abundant at this site and their abundance is a reflection of the particularly slow water speed at this site.

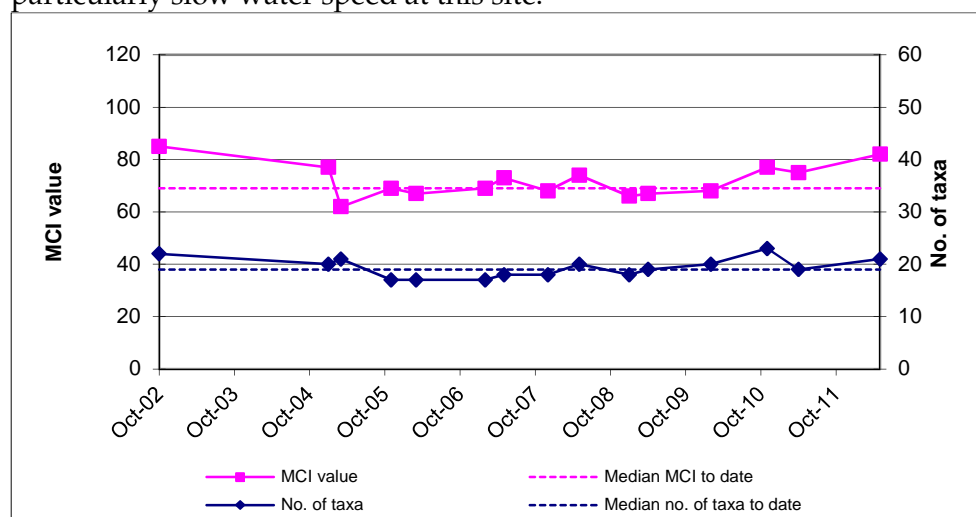


Figure 3 Taxa numbers and MCI recorded to date at site 2

The MCI value of 82 reflected a moderate proportion of sensitive taxa in the community at this site (48%). However, this result is better than typical for this site, being a statistically significant 13 units above the median for this site (Stark, 1998), and ten units higher than the median of other lowland streams sampled at a similar altitude (Table 2, Figure 3). The SQMCI_s value at this site (4.3) was slightly higher than the median value (from fourteen previous surveys), and reflected the fact that *Potamopyrgus* snails and *Paracalliope* amphipods were extremely abundant (Table 2, Table 3).

Although the results from this survey indicate a 'fair' community, they are an improvement on the most of the previous surveys, which commonly recorded 'poor' communities. This is not surprising when the available habitat is considered. Habitat was considered poor during the current survey, as there was little flow, and significant bank collapse impinging on the channel. However, there was some improvement in the amount of macrophyte habitat available, and this may help explain the slight increase in the number of 'sensitive' taxa. This is a slightly improved result to that recorded in the previous survey and overall, supportive of the conclusion of reasonable preceding water quality with no discernible impacts from the irrigation of wastewater to land between sites 1 and 2.

Table 3 Macroinvertebrate fauna of the Haehanga Stream catchment, sampled in relation to Remediation (NZ) Ltd on 2 May 2012

Taxa List	Site Number	MCI score	1	2	T2	T3	5	6	7
	Site Code		HHG000093	HHG000100	HHG000098	HHG000103	HHG000115	HHG000150	HHG000190
	Sample No.		FWB12236	FWB12237	FWB12238	FWB12239	FWB12240	FWB12241	FWB12242
PLATYHELMINTHES	<i>Cura</i>	3	C	-	-	-	-	C	C
NEMERTEA	Nemertea	3	-	R	C	-	-	R	R
ANNELIDA	Oligochaeta	1	R	A	C	A	XA	XA	VA
	Lumbricidae	5	-	-	-	-	R	-	-
HIRUDINEA	Hirudinea	3	R	C	-	-	C	-	-
MOLLUSCA	<i>Gyraulus</i>	3	-	-	-	-	-	-	R
	Lymnaeidae	3	-	-	C	C	-	-	-
	<i>Physa</i>	3	A	-	A	C	R	R	A
	<i>Potamopyrgus</i>	4	XA	XA	VA	XA	VA	XA	XA
	Sphaeriidae	3	-	-	R	-	-	R	-
CRUSTACEA	Ostracoda	1	A	R	R	A	R	A	A
	<i>Paracalliope</i>	5	A	XA	VA	XA	VA	R	XA
	<i>Paranephrops</i>	5	-	R	-	R	-	-	-
EPEMEROPTERA	<i>Austroclima</i>	7	R	A	-	-	R	-	-
	<i>Deleatidium</i>	8	-	C	C	R	VA	VA	C
	<i>Zephlebia group</i>	7	-	-	A	A	-	-	-
PLECOPTERA	<i>Acroperla</i>	5	-	-	R	-	C	R	R
ODONATA	<i>Austrolestes</i>	4	R	-	-	C	-	-	R
	<i>Aeshna</i>	5	C	-	-	-	-	-	-
	<i>Xanthocnemis</i>	4	VA	A	C	A	-	R	A
	<i>Procordulia</i>	5	R	-	-	-	-	-	-
HEMIPTERA	<i>Anisops</i>	5	-	-	-	R	-	-	-
	<i>Microvelia</i>	3	-	-	R	R	-	-	-
	<i>Sigara</i>	3	-	-	-	R	-	-	-
COLEOPTERA	Dytiscidae	5	-	-	-	R	-	-	C
	Hydrophilidae	5	R	-	-	-	-	-	-
TRICHOPTERA	<i>Hydrobiosis</i>	5	-	R	-	-	C	A	R
	<i>Polypsectropus</i>	6	-	-	A	A	R	-	-
	<i>Psilochorema</i>	6	-	R	C	C	-	C	-
	<i>Oxyethira</i>	2	A	R	R	-	R	A	C
	<i>Paroxyethira</i>	2	R	R	-	-	-	-	-
	<i>Triplectides</i>	5	R	R	R	R	R	R	A
DIPTERA	Eriopterini	5	-	-	-	-	-	-	R
	Hexatomini	5	-	R	-	-	-	-	-
	<i>Paralimnophila</i>	6	-	R	R	R	R	-	R
	<i>Zelandotipula</i>	6	-	R	-	-	-	-	-
	<i>Chironomus</i>	1	-	-	-	-	-	R	-
	Orthoclaadiinae	2	R	R	R	R	R	C	C
	<i>Polypedilum</i>	3	-	-	-	R	R	R	R
	Tanypodinae	5	-	-	-	R	-	-	-
	Culicidae	3	-	-	-	A	-	-	-
	<i>Paradixa</i>	4	R	-	R	C	-	-	-
	Empididae	3	R	R	R	-	-	R	R
	Ephydriidae	4	-	-	-	R	-	-	-
	Muscidae	3	-	-	-	-	-	R	-
	<i>Austrosimulium</i>	3	-	VA	C	C	R	A	A
	Tanyderidae	4	-	-	-	-	R	R	-
No of taxa			19	21	22	26	19	22	22
MCI			72	82	79	83	82	7	75
SQMCI			3.9	4.3	4.6	4.4	2.8	3.0	4.1
EPT (taxa)			2	5	6	5	6	5	4
%EPT (taxa)			11	24	27	19	32	23	18
'Tolerant' taxa		'Moderately sensitive' taxa			'Highly sensitive' taxa				

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

Site T2 – upstream of the wetland discharge

This is the fourth time that this site has been sampled for macroinvertebrates. Twenty-two macroinvertebrate taxa were recorded at site T2 in an unnamed tributary of the Haehanga Stream, upstream of the wetland discharge point. This is two higher than the median for control sites in similar streams (Table 2, Figure 4), but five lower than that recorded in the previous survey. Good water quality had preceded this survey, as indicated by the presence of a number of ‘moderately sensitive’ taxa in the community and even a ‘highly sensitive’ mayfly (*Deleatidium*).

The taxa which dominated this community differed slightly to that at site 2. Two of the taxa that were abundant at site 2 were abundant at T2 (*Potamopyrgus* snails and *Paracalliope* amphipods). Two additional ‘moderately sensitive’ taxa were also abundant at site T2 (*Zephlebia* mayfly and *Polyplectropus* caddisfly larvae), as was one additional ‘tolerant’ taxon (*Physa* snails) (Table 3).

This community had a moderate MCI score (79) compared to sites 1 and 2, reflecting the similar proportion of sensitive taxa present (36%). This is also similar to the median MCI score for control sites in similar streams, but significantly less than that recorded in the previous survey (Stark, 1998). The SQMCI_s value of 4.6 was moderate for this type of stream, and slightly higher than the median for control sites in other lowland streams at a similar altitude (TRC, 1999). It is also the highest SQMCI_s value recorded in this survey.

This stream typically has better MCI and SQMCI_s scores than the Haehanga Stream sites, and it is considered that this is a direct reflection of the difference in headwater character. Site T2 is located near to the source of this stream, which rises from a swampy spring, and flows through a short channel which is well shaded. In contrast, sites 1 and 2 in the Haehanga Stream are located in excess of 1.5 km downstream of the source of this stream, below which the stream is relatively unshaded and unprotected.

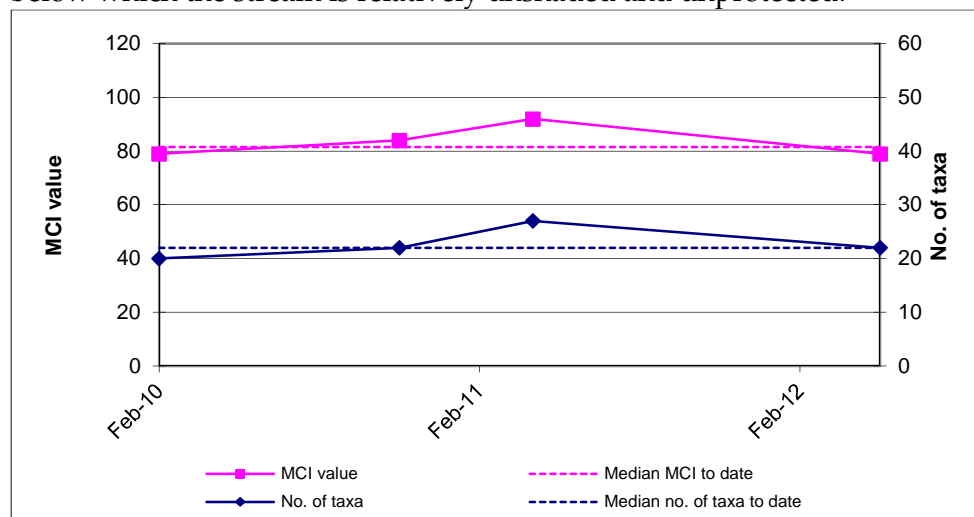


Figure 4 Taxa numbers and MCI recorded to date at site T2

Site T3 – downstream of the wetland discharge point

This is the fourth time that macroinvertebrates have been sampled at this site, located approximately 20 metres downstream of the wetland discharge. Twenty-six taxa were recorded at this site. This is the highest richness recorded in this survey (Table 2), and four taxa more than that recorded upstream at site T2 (Table 2, Figure 5). The community was characterised by three moderately sensitive taxa (*Paracalliope* amphipods, *Zephlebia* mayfly larvae and *Polyplectropus* caddisfly larvae) and five ‘tolerant’ taxa (oligochaete worms,

Potamopyrgus snails, ostracod seed shrimps, *Xanthocnemis* damselfly larvae, and mosquito larvae (Culicidae) (Table 3)). This site had a similar proportion of sensitive taxa (42%) as site T2 upstream, resulting in a similar MCI score (83), suggesting little impact from the wetland discharge. This is the highest MCI score recorded in the current survey. As there was little change in the taxa that dominated the community from site T2, there was little change in SQMCI_s score (4.4).

There were only four significant changes in abundance from site T2 to site T3, none of which were necessarily indicative of impacts caused by the discharge from the wetland. Previous surveys have frequently recorded oligochaete worms, ostracod seed shrimps and *Chironomus* blood worms increasing significantly in abundance downstream of the discharge. These taxa are often associated with organically enriched discharges. In the current survey oligochaete worms and ostracod seed shrimps increased in abundance, but *Chironomus* blood worms were absent at both sites. In addition, the number of 'sensitive' taxa increased from 8 to 11. Overall, these observations indicate that the discharge has not had an impact on the communities. This is especially encouraging, as the discharge was noted as entering the stream at the time of the survey, and had been recorded as continuously entering the tributary from 11 February to 30 March 2012.

Some previous water quality results indicate that unionised ammonia concentrations in the unnamed tributary have at times been toxic enough to reduce the abundance of, or eliminate entirely, some of the sensitive species usually found in this stream. Results of sampling undertaken in the year prior to this survey show that all six samples taken contained concentrations of unionised ammonia below the toxicity threshold of 0.025 g/m³. This shows an improvement in unionised ammonia concentrations in the effluent being discharged. However, should unionised ammonia concentrations return to high levels in the winter period, an additional macroinvertebrate survey at this time may be warranted. At the very least, the water quality monitoring will need to continue so as to assist with the interpretation of macroinvertebrate results.

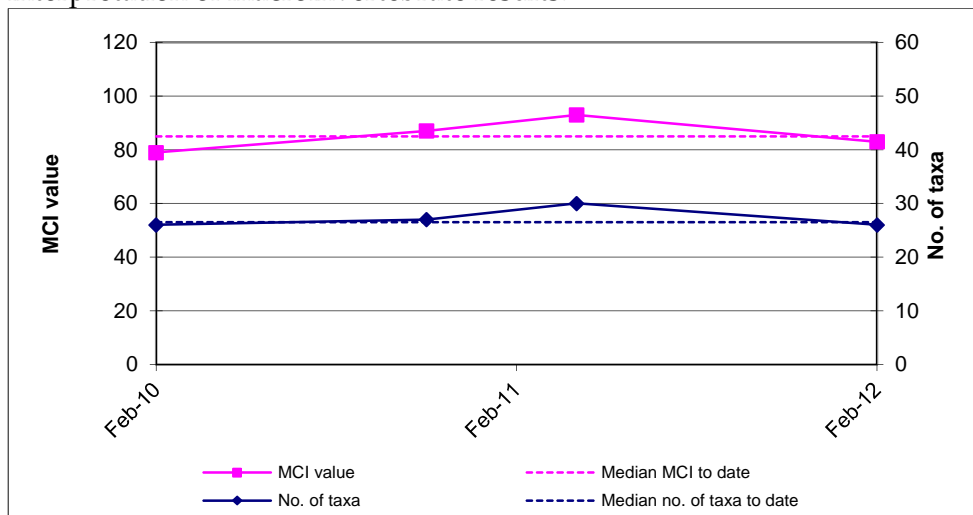


Figure 5 Taxa numbers and MCI recorded to date at site T3

Site 5 – downstream of all pond discharges

At site 5 in the Haehanga Stream, 25 m downstream of all wastewater ponds, a moderate taxa richness was recorded (19), equal to the median of the thirteen previous surveys (Table 2, Figure 6). Previous poor taxa numbers have been related to a combination of nutrient enrichment, the silty substrate at this site, and 'kick-sampling' technique used to gather

macroinvertebrates, as a lack of aquatic vegetation meant that the 'sweep-net' sampling technique could not be used.

Two 'tolerant' taxa dominated the community at this downstream site (oligochaete worms and *Potamopyrgus* snails), one 'moderately sensitive' taxon (*Paracalliope* amphipods) and one 'highly sensitive' mayfly (*Deleatidium*) (Table 3). The numerical dominance of oligochaete worms and *Potamopyrgus* snails resulted in a SQMCI_S score of 2.8, which was 0.2 units higher than the median for this site, but significantly less than that recorded at site 2 (Stark, 1998). The MCI score (82), was ten units higher than the median score for this site and equal to the previous maximum score recorded at this site (Figure 6), and equal to that recorded at site 2 upstream in the current survey. This is a reflection of the improved proportion of 'sensitive' taxa in the community (47%).

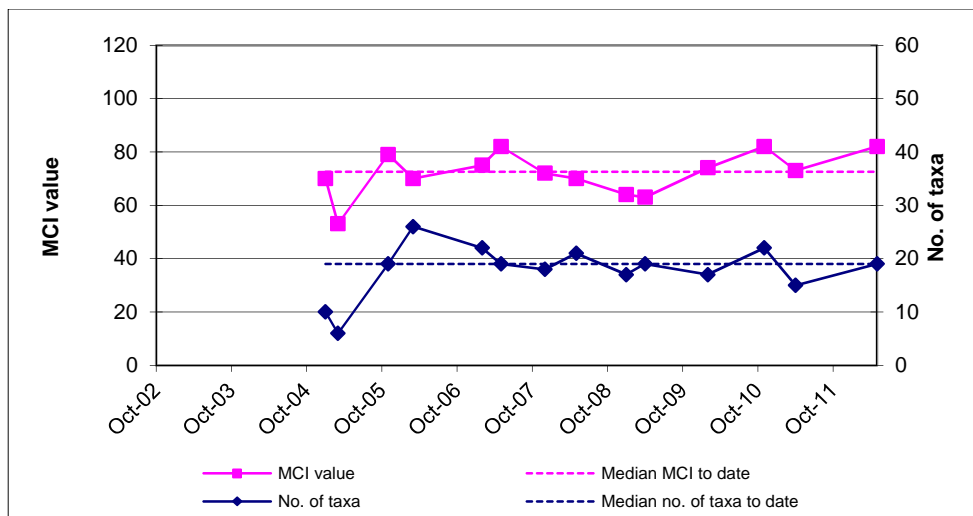


Figure 6 Number of taxa and MCI scores recorded to date at Site 5

Some previous surveys have recorded changes in abundance of individual taxa, which can be interpreted as being an indication of organic enrichment of the stream. Such changes included *Chironomus* blood worms becoming abundant at this site. The results from the current survey indicate that *Chironomus* blood worms were absent. Although there was a significant increase in abundance of 'tolerant' oligochaete worms, this was coupled with a significant increase of one 'highly sensitive' taxon. Overall, this may indicate the presence of a very subtle impact, reflecting organic enrichment of this reach of the stream. However, if there was organic enrichment of the stream, it was minor and not causing a significant adverse impact on the macroinvertebrate community.

Site 6 – Downstream of effluent irrigation area

Twenty-two taxa were recorded in the first sample collected from this site, located downstream of the effluent irrigation area. This is a moderate taxa richness, and within the range recorded from other sites in the current survey. The community was dominated by similar taxa to that recorded upstream at site 5, with abundant taxa including six 'tolerant' taxa (oligochaete worms, *Potamopyrgus* snails, ostracod seed shrimp, *Oxyethira* axehead caddisfly and *Austrosimulium* sandfly larvae), one 'moderately sensitive' caddisfly (*Hydrobiosis*) and one 'highly sensitive' mayfly (*Deleatidium*). There was a slight increase in the number of 'tolerant' taxa (16) from that recorded at site 5 (10), resulting in an eight unit drop in MCI score. This score (70) was the lowest recorded in the current survey, and was significantly lower than that recorded at site 5 upstream. It was however only two units less

than the median for control sites in other lowland streams at a similar altitude (TRC, 1999), and also not significantly different to the median score for the other Haehanga Stream sites (Table 2).

The SQMCI_s score was primarily influenced by the extremely abundant oligochaete worms and *Potamopyrgus* snails (both 'tolerant') and the 'highly sensitive', very abundant *Deleatidium* mayfly. This resulted in a SQMCI_s score of 3.0 units, similar to that recorded at site 5, but significantly less than that recorded at sites 1 and 2.

The habitat sampled at this site differed to the other Haehanga Stream sites, as it was a true riffle, in that it was shallow flow tumbling over coarse and fine gravel, as opposed to deeper flow moving over macrophyte or submerged wood. This difference in habitat can create some difficulty in interpreting differences in the respective macroinvertebrate communities. Overall the differences in the macroinvertebrate communities can be attributed to this change in habitat, with the appearance of muscid crane fly and increased axehead caddisfly abundance attributable to increased periphyton growth and reduced *Paracalliope* abundance related to increased water speeds. However, the appearance of *Chironomus* blood worms at this site may suggest a deterioration of water quality. Overall, unless physicochemical sampling indicates a reduction in water quality at this site, it appears that the irrigation of wastewater upstream of this site has not lead to a reduction in invertebrate health at this site.

Site 7 – Downstream of all site activities

This site exhibited a moderately high taxa richness (22), being 3 taxa higher than the median of the previous surveys undertaken at this site. It is important to note that this site was surveyed using a combination of the sweep and kick sample techniques.

The 'poor' MCI score of 75 was due to the community comprising 64% 'tolerant' taxa, of which six were abundant (oligochaete worms, *Physa* and *Potamopyrgus* snails, ostracod seed shrimp, damselfly larvae *Xanthocnemis* and *Austrosimulium* sandfly larvae). 'Moderately sensitive' *Paracalliope* amphipods and *Triplectides* caddisfly were also abundant at this site in the current survey. This MCI score is insignificantly (4 units) higher than that recorded in the previous survey (Stark, 1998) (Table 2, Figure 7), and six units higher than the median score for this site. The extreme abundance of 'tolerant' *Potamopyrgus* snails and 'moderately sensitive' *Paracalliope* amphipods resulted in a SQMCI_s of 4.1, significantly (1.2 units) above the median for this site, and 0.4 units higher than the previous survey's score. This is the seventh consecutive survey where above median SQMCI_s scores have been recorded at this site.

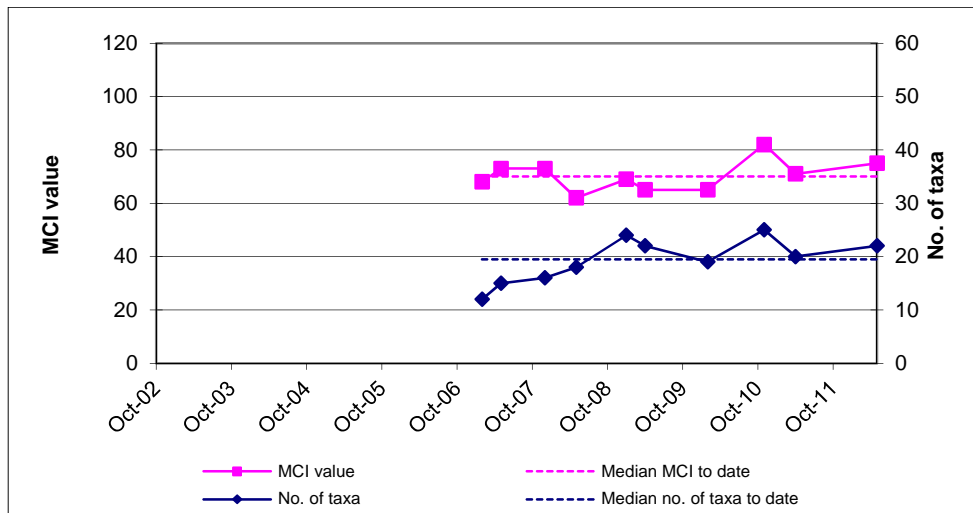


Figure 7 Number of taxa and MCI scores recorded to date at Site 7

When compared with site 6 upstream, the MCI score was similar, but the SQMCI_s score was significantly higher (Stark, 1998). The significantly higher SQMCI_s score is principally due to the significant increase in amphipod abundance, which reflects the fact that the primary habitat sampled at site 7 was macrophytes, as opposed to coarse gravels at site 6.

During some previous surveys, concern was raised regarding an extreme abundance of *Chironomus* blood worm larvae at this site. Such abundance usually only occurs where there is a significant organic discharge, which the *Chironomus* blood worm larvae feed upon. It was noted that should this result be repeated in subsequent surveys, further investigation will be required. Dissolved oxygen readings were subsequently taken in the stream, and this found that there may be periods of low dissolved oxygen, especially when weed beds are well established, such as in summer. This is natural, and related to the shallow gradient of the stream, and can be exacerbated during low flows. It is likely that the sporadic abundance of *Chironomus* is related to the low dissolved oxygen concentrations within the stream, rather than the discharge of organic wastes upstream. *Chironomus* was recorded as rare at this site in the current survey, which noted moderate but slow flows in the stream.

Conclusions

The Council's standard 'sweep net' and 'kick-sampling' techniques were used at seven established sites to collect streambed macroinvertebrates from the Haehanga Stream catchment in order to assess whether the Remediation (NZ) Ltd composting areas have had any adverse effects on the macroinvertebrate communities of these streams. Samples were processed to provide number of taxa (richness), MCI, and SQMCI_s scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

Following up on a recommendation made in the previous monitoring period, a seventh site was added to the survey. This site was located at the downstream extent of the irrigation area, and is intended to monitor for potential impacts caused by wastewater irrigation to land.

The macroinvertebrate survey conducted on 2 May 2012 found water flows in the Haehanga catchment to be moderate but slow to steady, with community richness similar to the median for each site. Overall, this survey found that macroinvertebrate communities at all sites were near to or above average health.

The two sites in the unnamed tributary were sampled for the fourth time in the current survey, and exhibited a community typical of this kind of habitat. Site T2 and site T3 had similar MCI and SQMCI_s scores, which was reflective of good preceding water quality conditions. There were only four significant changes in abundance from site T2 to site T3, none of which were necessarily indicative of impacts caused by the discharge from the wetland. Previous surveys have frequently recorded oligochaete worms, ostracod seed shrimps and *Chironomus* blood worms increasing significantly in abundance downstream of the discharge. These taxa are often associated with organically enriched discharges. In the current survey oligochaete worms and ostracod seed shrimps increased in abundance, but *Chironomus* blood worms were absent at both sites. In addition, the number of 'sensitive' taxa increased from 8 to 11. Overall, these observations indicate that the discharge has not had an impact on the communities. This is especially encouraging, as the discharge was noted as entering the stream at the time of the survey, and had been recorded as continuously entering the tributary from 11 February to 30 March 2012.

Some previous water quality results indicate that unionised ammonia concentrations in the unnamed tributary have at times been toxic enough to reduce the abundance of, or eliminate entirely, some of the sensitive species usually found in this stream. Results of sampling undertaken in the year prior to this survey show that all six samples taken contained concentrations of unionised ammonia below the toxicity threshold of 0.025 g/m³. This shows an improvement in unionised ammonia concentrations in the effluent being discharged. However, should unionised ammonia concentrations return to high levels in the winter period, an additional macroinvertebrate survey at this time may be warranted. At the very least, the water quality monitoring will need to continue so as to assist with the interpretation of macroinvertebrate results.

In general the communities in the Haehanga Stream sites had low proportions of sensitive taxa. This is expected in small, silty bottomed streams such as the Haehanga Stream and the numbers of taxa were generally similar to other lowland hill country streams surveyed at similar altitude. MCI values recorded in the Haehanga Stream indicated that the macroinvertebrate communities were in similar or better health when compared with other small lowland hill country streams in the region. Three elvers were also recorded during this survey, two at site 6, and one at site 2.

Site 5 has exhibited poorer macroinvertebrate communities in the past compared to other sites upstream. This has suggested some level of impact from the composting operation, although the extent of adverse effects has been difficult to determine due to poor natural habitat quality. During the current survey, the MCI score for site 5 was somewhat higher than the median score for this site, and equal to that recorded at the next upstream Haehanga Stream site. The SQMCI_s score on the other hand may suggest deterioration, with a significant 1.5 unit drop, primarily due to a significant increase in abundance of 'tolerant'

oligochaete worms. However, this was coupled with a significant increase of one 'highly sensitive' taxon (*Deleatidium* mayfly). Overall, this may indicate the presence of a very subtle impact, reflecting organic enrichment of this reach of the stream. However, if there was organic enrichment of the stream, it was minor and not causing a significant adverse impact on the macroinvertebrate community.

Site 6, which consisted of a riffle with coarse and fine gravels, recorded an MCI score that was not significantly different to the medians for the other Haehanga Stream sites, although it was significantly lower than that recorded at site 5 in the current survey. The SQMCI_s score however did not indicate much difference between these sites. Overall the differences in the macroinvertebrate communities can be attributed to a change in habitat, with the appearance of muscid cranefly and increased axehead caddisfly abundance attributable to increased periphyton growth and reduced *Paracalliope* abundance related to increased water speeds. However, the appearance of *Chironomus* blood worms at this site may suggest a deterioration of water quality. Overall, unless physicochemical sampling indicates a reduction in water quality at this site, it appears that the irrigation of wastewater upstream of this site has not lead to a reduction in invertebrate health at this site.

The lowest site (site 7) was sampled for the tenth time in this survey. There were eight significant changes in abundance between sites 6 and 7, although the MCI score shows little change at this site, while the SQMCI_s score showing a significant improvement. When compared with historical data the community at site 7 was in above-average health, and indicative of an improvement in water quality from previous surveys.

Of some concern during certain previous surveys was the abundance of *Chironomus* blood worms at various sites. Abundance of this taxon is usually an indication of an organic discharge, although low dissolved oxygen in the stream can also allow this taxon to dominate the community, especially when this is associated with low flows. It may be then that the sporadic appearance of *Chironomus* in abundance is at least in part related to the dissolved oxygen concentrations. Dissolved oxygen concentrations in the Haehanga have been found to be depressed at times, and during the warmer months, when there is more aquatic weed growth, dissolved oxygen may be significantly depleted at night. This is a natural occurrence in some streams that are slow flowing and weedy. Any macroinvertebrate surveys undertaken when such conditions exist could potentially record a community with fewer sensitive species, and a more abundant population of *Chironomus*. During the current survey *Chironomus* was only present at site 6, and only as a rarity. This indicates that water quality in the Haehanga catchment may have improved, possibly contributed to by on-going works to the leachate and stormwater treatment system, and improved management of the riparian margin. These works likely to lead to an improvement in freshwater macroinvertebrate communities below the discharges, and should continue to be encouraged.

References

Dunning KJ, 2003: Biomonitoring of the Haehanga Stream in relation to discharges from the Global Vermiculture site at Uruti. TRC report no. KD136.

- Hope KJ, 2005a: Biomonitoring of the Haehanga Stream in relation to discharges from the Perry Environmental Limited composting site at Uruti. TRC report no. KH12.
- Hope KJ, 2005b: Biomonitoring of the Haehanga Stream in relation to discharges from the Perry Environmental Limited composting site at Uruti, March 2005. TRC report no. KH025.
- Hope KJ, 2006: Biomonitoring of the Haehanga Stream in relation to discharges from the Perry Environmental Limited composting site at Uruti, November 2005. TRC report no. KH073.
- Hope KJ, 2006: Biomonitoring of the Haehanga Stream in relation to discharges from the Perry Environmental Limited composting site at Uruti, March 2006. TRC report no. KH078.
- Jansma, B, 2007: Biomonitoring of the Haehanga Stream in relation to discharges from the Perry Environmental Limited composting site at Uruti, February 2007. TRC report no. BJ020.
- Jansma, B, 2007: Biomonitoring of the Haehanga Stream in relation to discharges from the Perry Environmental Limited composting site at Uruti, May 2007. TRC report no. BJ030.
- Jansma, B, 2008a: Biomonitoring of the Haehanga Stream in relation to discharges from the Perry Environmental Limited composting site at Uruti, December 2007. TRC report no. BJ050.
- Jansma, B, 2008b: Biomonitoring of the Haehanga Stream in relation to discharges from the Perry Environmental Limited composting site at Uruti, May 2008. TRC report no. BJ051.
- Jansma B, 2008c: Biomonitoring of the Mangati Stream, in relation to the Bell Block industrial area, February 2008. TRC report BJ043.
- Jansma, B, 2009a: Biomonitoring of the Haehanga Stream in relation to discharges from the Remediation (NZ) Limited composting site at Uruti, January 2009. TRC report no. BJ055.
- Jansma, B, 2009b: Biomonitoring of the Haehanga Stream in relation to discharges from the Remediation (NZ) Limited composting site at Uruti, April 2009. TRC report no. BJ056.
- Jansma, B, 2011a: Biomonitoring of the Haehanga Stream in relation to discharges from the Remediation (NZ) Limited composting site at Uruti, November 2010. TRC report no. BJ148.
- Jansma, B, 2011b: Biomonitoring of the Haehanga Stream in relation to discharges from the Remediation (NZ) Limited composting site at Uruti, April 2011. TRC report no. BJ149.
- Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams.

- Stark JD, 1998: SQMCI: a biotic index for freshwater macroinvertebrate coded abundance data. *New Zealand Journal of Marine and Freshwater Research* 32(1): 55-66.
- Stark JD, 1999: An evaluation of TRC's SQMCI biomonitoring index. Cawthron Institute, Nelson. Cawthron Report No. 472.
- Stark JD, Boothroyd IKG, Harding JS, Maxted JR, Scarsbrook MR, 2001: Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for the Ministry for the Environment. Sustainable Management Fund Project No. 5103. 57p.
- Stark JD and Maxted JR, 2004. Macroinvertebrate community indices for Auckland's soft-bottomed streams and applications to SOE reporting. Prepared for Auckland Regional Council. Cawthron Report No. 970. Cawthron Institute, Nelson. ARC Technical Publication 303. 59p.
- Stark JD and Maxted JR, 2007. A biotic index for New Zealand's soft bottomed streams. *New Zealand Journal of Marine and Freshwater Research* 41(1).
- Stark JD and Maxted JR, 2007a. A user guide for the macroinvertebrate community index. Cawthron Institute, Nelson. Cawthron Report No. 1166.
- TRC, 1999: Some statistics from the Taranaki Regional Council database (FWB) of freshwater macroinvertebrate surveys performed during the period from January 1980 to 31 December 1998. State of the Environment Monitoring Reference Report. Technical Report 99-17.

