

NPDC – Colson Road Landfill  
Monitoring Programme  
Annual Report  
2013-2014

Technical Report 2014-59

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## Executive summary

The New Plymouth District Council (NPDC) operates a landfill located on Colson Road at New Plymouth, in the Waiwhakaiho catchment. The landfill is currently filling stage three of the site which has a design capacity of approximately 800,000 cubic metres. Stages one and two have been closed and are fully reinstated. This report, for the period July 2013 to June 2014, describes the monitoring programme implemented by the Taranaki Regional Council to assess the consent holder's environmental performance during the period under review, and the results and environmental effects of the consent holder's activities.

**During the monitoring period, NPDC demonstrated an overall high level of both environmental and administrative performance and compliance with the resource consents.**

NPDC holds a total of eight resource consents in relation to the Colson Rd landfill. These consents contain a total of 86 special conditions setting out the requirements that NPDC must satisfy. NPDC holds one consent to discharge uncontaminated stormwater into the Puremu Stream, two consents to discharge leachate and contaminated stormwater into the Puremu Stream, two consents to discharge emissions into the air, one consent to discharge solids onto and into land and one consent to discharge stormwater from earthworks. NPDC also holds one consent to divert water.

The Council's monitoring programme for the year under review included 11 inspections, 3 discharge samples, 18 surface water samples, seven groundwater samples, two biomonitoring surveys of receiving waters, and five air quality surveys. NPDC also collected five leachate samples and three under-liner drainage samples for physicochemical analysis.

During the year inspection found only issues in regards to site management and these were resolved. Groundwater and under liner drainage sampling indicated that there is no significant contamination occurring in the local aquifer as a result of the landfill's presence. Air quality monitoring showed that suspended particulates and dust deposition rates were within guideline levels.

During the monitoring period there was one occasion where ammoniacal nitrogen levels in the Puremu Stream exceeded consent limits, but after investigation it was found to be most likely due to low flows and rural inputs rather the landfill itself. Ammoniacal levels in the Puremu Stream returned to normal background levels after flows returned to normal. The Manganaha Stream continued to show no effects from the landfill.

There were three incidents associated with the Colson Rd landfill in the 2013-2014 period. Two incidents were related ammoniacal nitrogen levels in the Puremu Stream and one was an odour complaint which could not be substantiated.

Based on performance during the 2013-2014 monitoring period, NPDC demonstrated a high level of both environmental and administrative performance and compliance with consent conditions.

For reference, in the 2013-2014 year, 60% 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 29% demonstrated a good level of environmental performance and compliance with their consents

This report includes recommendations for the 2014-2015 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 New Plymouth District Council (NPDC). NPDC operates a landfill situated on Colson Road at New Plymouth, in the Waiwhakaiho catchment.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by NPDC that relate to discharges of water within the Waiwhakaiho catchment, and the two air discharge permits held by NPDC to cover emissions to air from the site.

One of the intents of the *Resource Management Act 1991* (RMA) 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 generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the NPDC's use of water, land, and air. Council produced ten combined NPDC landfills' annual reports that included the Colson Rd landfill during the period from 1990-1999. This is the 14th site specific annual report by the Taranaki Regional Council for the consent holder.

### **1.1.2 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 NPDC in the Waiwhakaiho catchment, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted at the NPDC site.

Section 2 presents the results of monitoring during the period under review, including scientific and technical data.

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

Section 4 presents recommendations to be implemented in the 2014-2015 monitoring year.

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

### 1.1.3 The Resource Management Act (1991) and monitoring

The *Resource Management Act 1991* (RMA) 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 (eg, 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 activity. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

### 1.1.4 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 a rating as to each Company's environmental and administrative performance.

**Environmental performance** is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year.

**Administrative performance** is concerned with the Company's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (i.e. a defence under the provisions of the *RMA* can be established) may be excluded with regard to the performance rating applied. For example loss of data due to a flood destroying deployed field equipment.

The categories used by the Council for this monitoring period, and their interpretation, are as follows:

## Environmental Performance

- **High** No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. 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 in relation to such impacts.
- **Good** Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self reports, or in response to unauthorised incident reports, but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

For example:

- High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
- Strong odour beyond boundary but no residential properties or other recipient nearby.
- **Improvement required** Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.
- **Poor** Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

## Administrative compliance

- **High** The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.
- **Good** Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was

provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

- **Improvement required** Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.
- **Poor** Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

For reference, in the 2013-2014 year, 60% 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 29% demonstrated a good level of environmental performance and compliance with their consents.

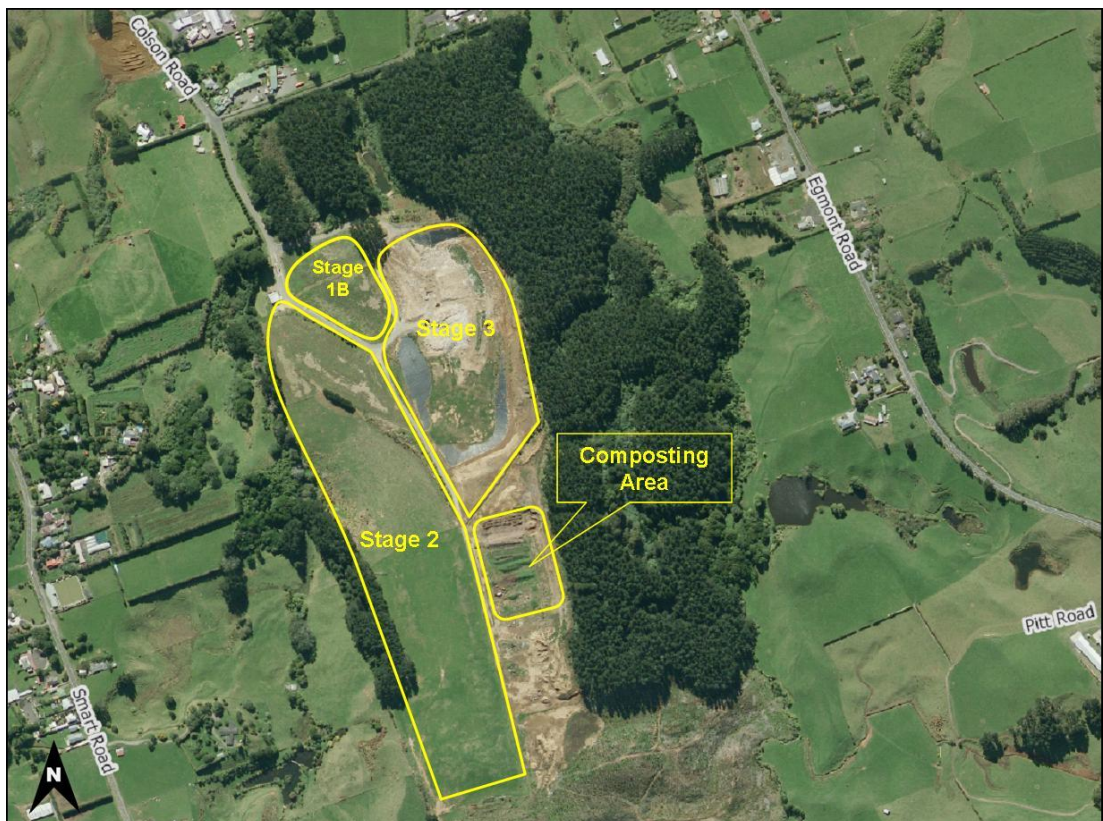
## 1.2 Process description

Wastes originating from municipal refuse kerbside collection, the Colson Road transfer station, other municipal transfer stations and commercial operators are discharged to the landfill. As of December 2007 Colson Rd became the sole operating landfill in the Taranaki region. Once the waste is discharged it is compacted and covered daily with clay. Currently, waste is discharged to stage three of the operation, which is expected to operate until approximately 2018. Once full, the area will be covered with clay and topsoil to a predetermined specification. Leachate from stages two and three is collected and directed to the New Plymouth Municipal Wastewater Treatment Plant. An aerial plan of the site is shown in Figure 1.

The current stage in use (stage three) has a fully engineered liner consisting of high density polyethylene (HDPE) laid over compacted clay. Leachate is collected in porous pipes that have been put down in herring bone configuration over the polyethylene liner. During the period under review, the lining of stage three was completed so that the liner now covers stage three's entire footprint.



**Photograph 1** Stage three extension works, February 2011



**Figure 1** Aerial view of the Colson Road landfill

## 1.3 Resource consents

NPDC holds a total of eight resource consents in relation to the Colson Rd landfill. These consents contain a total of 86 special conditions setting out the requirements that NPDC must satisfy. NPDC holds two consents to discharge uncontaminated stormwater into the Puremu Stream, two consents to discharge leachate and contaminated stormwater into the Puremu Stream, two consents to discharge emissions into the air, and one consent to discharge solids onto and into land. NPDC also holds one consent to divert water.

**Table 1** Summary of the resource consents held by NPDC

Consent No	Purpose	Review	Expire
0226-1	Divert Puremu Stream	-	June 2026
2370-3	Discharge leachate and stormwater from area A to Puremu Stream	-	June 2020
4619-1	Discharge treated stormwater and minor amounts of leachate from areas B1, B2, C1 & C2 to groundwater and the Puremu Stream	June 2018	June 2025
4620-1	Discharge uncontaminated stormwater from areas B1, B2, C1 and C2 into the Puremu Stream	June 2018	June 2025
4621-1	Discharge solids to land	June 2018	June 2025
4622-1	Discharge emissions to air from composting	June 2018	June 2025
4779-1	Discharge emissions to air from landfilling	June 2018	June 2025
6177-1	Discharge stormwater from earthworks	-	June 2020

### 1.3.1 Water discharge permits

Section 15(1) (a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.

NPDC holds water discharge permit **2370-3** to cover the discharge of up to 1000 cubic metres/day of leachate and contaminated stormwater from the closed section, Area A, of Colson Road municipal landfill to groundwater in the vicinity of and into the Puremu Stream. This permit was issued by the Taranaki Regional Council on 19 March 2003 under Section 87(e) of the RMA. This consent was reviewed in June 2006 and is due to expire on 1 June 2026.

Special condition 1 states that the discharge shall not alter certain parameters in the Puremu Stream.

Special condition 2 states that there shall be no significant impact on aquatic life.

Special condition 3 states that monitoring of water at the site shall be to the satisfaction of the Council.

Special condition 4 states that the NPDC shall abide by the District Plan of NPDC.

Special condition 5 states that the NPDC shall maintain and comply with management and contingency plans for the site.

Special condition 6 states that the NPDC shall adopt the best practicable option as defined by the RMA 1991 to minimise discharges and effects upon the environment.

Special conditions 7 and 8 require the consent holder to maintain area A of the landfill to a certain standard.

Special conditions 9 and 10 require the consent holder to maintain water flow and silt control measures on site and prevent vehicle cleaning on site.

Special conditions 11, 12, 13 and 14 state the location of a mixing zone and restrictions of the impact of the discharge in the Puremu Stream.

Special condition 15 states that the discharge should not render water in the Puremu Stream unfit for stock consumption.

Special condition 16 states that systems relating to leachate on the site are maintained.

Special condition 17 deals with changes to the consent and expiry date.

The permit is attached to this report in Appendix I.

The NPDC holds resource consent **4619-1** to discharge up to 675 litres/second of treated stormwater and minor amounts of leachate from areas B1 B2 C1 and C2 of the Colson Road Landfill to groundwater in the vicinity of and into the Puremu stream a tributary of the Mangaone Stream in the Waiwhakaiho Catchment. This permit was issued by the Taranaki Regional Council on 21 March 1999 under Section 87(e) of the RMA. This consent was reviewed in June 2006 and is due to expire on 1 June 2025.

Special condition 1 of this consent states that the water quality of the Manganaha Stream shall not be changed as a result of the discharge.

Special conditions 2 and 3 outlines specific water quality criteria for the Puremu Stream that shall not be exceeded as a result of the discharge.

Special conditions 4 and 5 deal with management plans and monitoring programmes.

Special condition 7 is a review condition.

The permit is attached to this report in Appendix I.

The NPDC holds consent **4620-1** to discharge up to 675 litres/second of uncontaminated stormwater from areas B1, B2, C1 and C2 of the Colson Road Landfill into the Puremu Stream, a tributary of the Mangaone Stream in the Waiwhakaiho Catchment.

This permit was issued by the Taranaki Regional Council on 21 March 1999 under Section 87(e) of the RMA. This consent is due to expire on 1 June 2025.



Special conditions 1, 2 and 8 specify the level of water quality in the Puremu and Manganaha streams that must be maintained.

Special condition 3 proscribes the discharge of any leachate.

Special conditions 4 and 5 require that all constructions, earthworks and stormwater systems be designed and maintained in a manner that minimises erosion and land instability.

Special condition 6 states the consent holder shall repair and rehabilitate any land made unstable and any erosion occurring due to the construction or maintenance of the diversion channels or landfilling operations or composting site associated with the exercise of this consent.

Special condition 7 requires the consent holder to notify Council of any works that may affect the exercise of the consent.

Special condition 9 proscribes activities that may produce contaminated stormwater.

Special conditions 10 and 11 requires adherence to a compliance monitoring programme and the landfill management plan.

Special conditions 12 and 13 deal with rules associated with expiry and review dates of the consent.

The permit is attached to this report in Appendix I.

The NPDC holds resource consent **6177-1** to discharge stormwater [due to earthworks in providing an area for stage 3 of the municipal landfill] onto land and into the Puremu Stream a tributary of the Mangaone Stream in the Waiwhakaiho catchment. This permit was issued by the Taranaki Regional Council on 11 June 2003 under Section 87(e) of the RMA. It is due to expire on 1 June 2020.

Special condition 1 states parameter limits on the discharge to the Puremu Stream.

Special condition 2 states that leachate shall not be discharged by the exercise of the consent.

Special condition 3 deals with stormwater diversion and channels.

Special conditions 4 and 5 states that the activity shall not alter certain characteristics of the water or significantly adversely impact on its aquatic life.

Special condition 6 relates to water monitoring.

Special conditions 7 and 8 deal with the site management plan, contingency plan and erosion control plan.

Special condition 9 outlines that the best practicable option is to be taken in the management of the site.



Special condition 10 relates to repair and rehabilitation of land due to works.

Special condition 11 relates to stormwater movement control on the site.

Special condition 12 relates to water quality in the Puremu Stream.

Special condition 13 relates to expiry and review of the consent.

The permit is attached to this report in Appendix I.

### **1.3.2 Air discharge permit**

Section 15(1)(c) of the RMA 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.

The NPDC holds resource consent **4622-1** to cover the discharge of emissions into the air from composting and ancillary activities at the Colson Road landfill. This permit was issued by the Taranaki Regional Council on 21 March 1999 under Section 87(e) of the RMA. It is due to expire on 1 June 2025.

Special condition 1 requires the consent holder to adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment arising from the emissions from the composting operation.

Special condition 2 states that the discharge of contaminants to air from the landfilling operations shall not result in offensive or objectionable odours or dust or dangerous or noxious ambient concentrations of any airborne contaminants at or beyond the boundary of the site.

Special condition 3 states that the discharge shall not give rise to any significant adverse ecological effects on any ecosystems.

Special condition 4 states that the nature of materials acceptable for composting and the operation of the composting activities shall give effect to the 'Assessment of Discharges to Air', July 1994 and the 'NPDC Colson Road Landfill: Landfill Management Plan', July 1994 and requires that the landfill management plan be updated at least yearly.

Special conditions 5 and 6 state that any composting windrow shall be located at least 300m from any dwelling house and shall comprise no greater than 5% by weight materials other than plant-derived.

Special condition 7 states that the composting operation shall be initially undertaken on a trial basis and that after 6 months and before 9 months the consent holder shall report to the Council noting the results of the operation and effects-based monitoring and any complaints about odour.

Special conditions 8 and 9 outline expiry and review conditions.

The NPDC holds resource consent **4779-1** to cover the discharge of emissions into the air from the existing landfill [Area A] and proposed landfill extension in Areas A, B1, B2, C1 and C2 of the Colson Road municipal landfill site. This permit was issued by the Taranaki Regional Council on 21 March 1999 under Section 87(e) of the RMA. This consent was reviewed in June 2006 and is due to expire on 1 June 2025.

Special condition 1 requires the consent holder to adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment arising from the emissions from the landfilling operation.

Special condition 2 states that the discharge of contaminants to air from the landfilling operations shall not result in offensive or objectionable odours or dust or dangerous or noxious ambient concentrations of any airborne contaminants at or beyond the boundary of the site.

Special condition 3 states that no material is to be burnt at the landfill site.

Special condition 4 states that the discharge shall not give rise to any significant adverse ecological effects on any ecosystems.

Special condition 5 states that no extraction venting of untreated landfill gases be located closer than 200m to any boundary of the landfill property.

Special condition 6 requires that the landfill be operated to give effect to the 'Air Discharge Consent Application Supporting Documentation, July 1995' and in accordance with the 'NPDC Colson Road Landfill: Landfill Management Plan, July 1994' and that the management plan shall be updated at least yearly.

Special condition 7 requires the consent holder to consult with the Council prior to undertaking any alteration to the site or site operations other than specified in the application and supporting documentation lodged with the application.

Special condition 8 requires the consent holder to meet at least once per year with the submitters of the consent and any other interested party to discuss any matter relating to the exercise of the consent and to facilitate ongoing consultation.

Special condition 9 requires the consent holder to provide to the Council a report on the feasibility of collecting, extracting, venting or combusting landfill gas at the landfill, within one year of the commencement of the consent.

Special conditions 10 and 11 outline the review conditions.

The permit is attached to this report in Appendix I.

### 1.3.3 Discharges of wastes to land

Sections 15(1)(b) and (d) of the RMA 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.

The NPDC holds resource consent **4621-1** to cover the discharge of up to 500 tonnes of contaminants onto or into land per day in areas B1, B2, C1 and C2 of the Colson Road landfill. This permit was issued by the Taranaki Regional Council on 21 March 1999 under Section 87(e) of the RMA. This consent is due to expire on 1 June 2025.

Special condition 1 requires the consent holder to install and maintain a further groundwater monitoring piezometer between the bores at sites AH9 and L2 and to maintain groundwater bores at the sites WQA, WQB, WQC, AH1, AH2, AH3, AH5, AH6, AH7, L1, L2, L5, L7, and L8 (as per the AEE).

Special condition 2 requires the consent holder to prevent surface water runoff or contaminants to the Manganaha Stream from areas used for deposition of refuse or earthworks unless the area has been covered and rehabilitated.

Special condition 3 requires the consent holder to demonstrate that the stormwater systems, surface contours and landscaping works have been undertaken to ensure that compliance with special condition 2 will be achieved, prior to commencing any use of Areas B, C1 and C2 for deposition of refuse.

Special condition 4 requires that a registered engineer certify the construction, installation, integrity and performance of groundwater drainage systems, landfill lining systems and leachate interception, collection, holding, recirculation and discharge systems in Areas B1, B2, C1 and C2 prior to any discharge of solids wastes in those areas.

Special condition 5 requires the consent holder to remedy or mitigate and if practicable to prevent any continuation of effects upon the quality of groundwater should the groundwater quality be significantly affected by the landfilling and composting activities.

Special condition 6 outlines monitoring requirements.

Special condition 7 requires the consent holder to operate the landfill in a manner conforming to the relevant requirements of the 'NPDC Colson Road Landfill: Landfill Management Plan 1994' and to update the plan at least yearly.

Special condition 8 outlines the criteria for the acceptance and disposal of waste types at the landfill.

Special condition 9 and 10 outline expiry and review conditions.

The permit is attached to this report in Appendix I.

### **1.3.4 Water right**

The NPDC holds water right **0226-1** to allow the diversion, by culverting, of the Puremu Stream to provide road access to the landfill. The Taranaki Catchment Commission issued this on 2 April 1975, and renewed it on 14 May 1986 under section 21 (3) of the Water and Soil Conservation Act, 1967. It is due to expire on 1 October 2026 as per section 386 (2) of the RMA.

## **1.4 Monitoring programme**

### **1.4.1 Introduction**

Section 35 of the RMA 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 Colson Road landfill site consisted of five primary components.

### **1.4.2 Programme liaison and management**

There is generally a significant investment of time and resources by the Taranaki Regional Council in:

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- in discussion over monitoring requirements;
- preparation for any reviews;
- renewals;
- new consents;
- advice on the Council's environmental management strategies and content of regional plans and;
- consultation on associated matters.

### **1.4.3 Site inspections**

The Colson Road landfill site was inspected on 11 occasions during the monitoring period. With regard to consents for the abstraction of or discharge to 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 surveyed for environmental effects.

#### 1.4.4 Chemical sampling

The Taranaki Regional Council undertook sampling of both the discharges from the site and the water quality upstream and downstream of the discharge points and mixing zones. Water-quality and discharge sampling sites are shown in Figure 2.

The Puremu Stream and the Manganaha Stream was sampled on three occasions. Stormwater and discharge samples were taken on one occasion during the monitoring period. The samples were analysed for a range of parameters including ammoniacal nitrogen, unionised ammonia, suspended solids, conductivity, and metals.

Groundwater in the vicinity of the landfill was sampled on one occasion, and the groundwater sampling sites are shown in Figure 3. These sites were analysed for semi volatile organic compounds (SVOC) and metals.

#### 1.4.5 Air quality

The Taranaki Regional Council undertook sampling of the ambient air quality in the neighbourhood. Six deposition gauges were placed at selected sites in the vicinity of the landfill and at the landfill on two occasions, and the collected samples analysed for solids. Three ambient particulate matter and three methane level surveys were also undertaken. Air monitoring sites are shown in Figure 4.

#### 1.4.6 Biomonitoring surveys

Biological surveys were performed on two occasions in the Puremu Stream (three sites) and Manganaha Stream (two sites) to determine whether or not the discharges from the site have had a detrimental effect upon the communities of the streams.

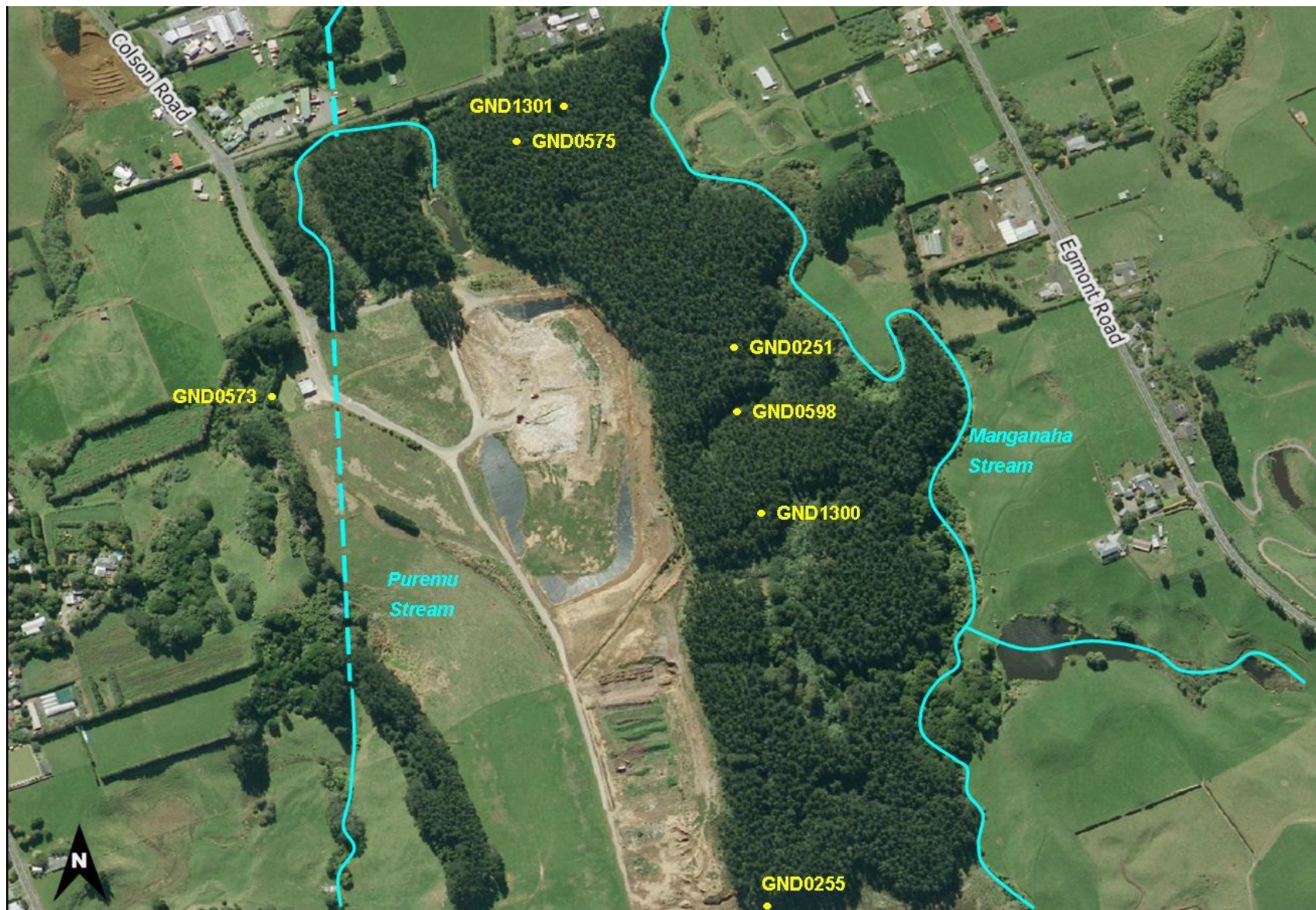
**Table 2** Summary of monitoring activity for 2013-2014

Activity	Number
Inspections	11
Discharge samples	3
Receiving water samples	18
Groundwater samples	17
Air deposition samples	12
Methane readings	21
PM10 readings	21
Biomonitoring surveys	2



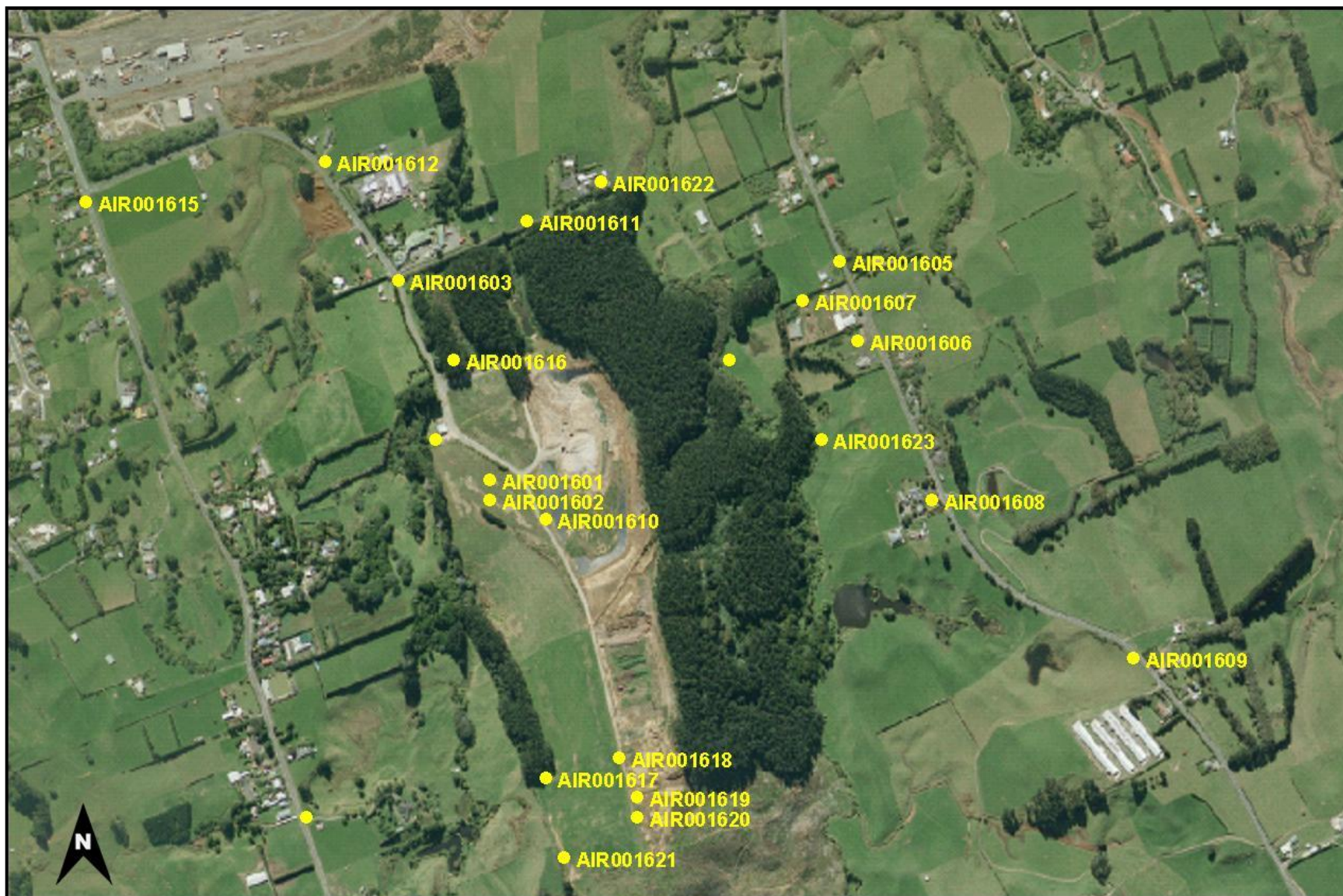
**Figure 2** Aerial photo showing the stormwater and receiving water sampling sites at Colson Rd landfill





**Figure 3** Aerial view of Colson Rd landfill showing the positions of groundwater monitoring bores





**Figure 4** Aerial view of Colson Rd landfill showing the positions of air quality monitoring sites



## **2. Results**

### **2.1 Inspections**

Eleven inspections were carried out over the monitoring period. Below are summaries of the findings of those inspections.

#### **2.1.1 10 July 2013**

A site visit was made to conduct a compliance monitoring inspection. There was a strong cold easterly changeable wind and there had been 22 mm rain over the previous 48 hours.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. The tip face had been covered for the day and no issues were noted. There were strong odours around the tip face but none detected at the downwind boundary. The special waste area at the south end of stage three had been closed to traffic. There were intermittent noticeable odours around the pit.

The leachate pond had very little fluid in it and it was well below the overflow pipe despite the recent rain.

There were no issues in regards to odour at the downwind site boundary noted during the inspection.

#### **2.1.2 28 August 2013**

A site visit was made to conduct a compliance monitoring inspection. There was a northerly breeze and 8.5mm rain had fallen over the previous 48 hours.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad.

The tip face appeared to be over the 900 m<sup>2</sup> size limit, however NPDC staff had advised Council just prior to the inspection that the site manager was under instructions to reduce the size of the working area. Dewatered sludge from the New Plymouth waste water treatment plant (NP WWTP) had been discharged at the site and there was a very strong odour associated with this in and around the special waste pit, however no odours were detected at the downwind boundary of the site. The material was being spread to 50 mm thickness on a level area and then spread with lime. NPDC had supplied a management plan for the handling of the sludge.

The leachate pond only had a small amount of fluid in it and it was well below the outlet. The large silt pond appeared to have been de-silted and was relatively free of litter, and there was also evidence of litter collection activities occurring in several areas around the site.

No visual effects in the Puremu Stream were noted.

### **2.1.3 2 October 2014**

A site visit was made to conduct a compliance monitoring inspection. There was a northerly breeze and had been 33.0 mm rain over the previous 72 hours.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. The compost treatment ponds were full but not discharging. The ponds were free of any litter, as was the drain leading down to the stormwater pond. The caps over stages one and two appeared stable and sound and were well vegetated.

The tip face appeared to be within the 900 m<sup>2</sup> size limit and cover material was been applied at the time of inspections. There were strong odours around the area where dewatered sludge from the NP WWTP had been discharged at the site and there was also a very strong odour associated with this in and around the special waste pit, however no odours were detected at the downwind boundary of the site. Over all the southern end of the stage three and the operational area looked tidy and organised.

There was significant amount of litter in and around the large pond and the leachate pond, and this was probably a result of the strong winds a few days before.

The grate of the Puremu Stream culvert was half blocked with debris and would have to be cleared out. No visual effects in the Puremu Stream were noted.

The site manager was contacted and the litter and culvert grates were discussed and it was arranged to have the issues resolved.

### **2.1.4 1 November 2013**

A site visit was made to conduct a compliance monitoring inspection and take discharge and surface water samples. There was a north westerly breeze and there had been 6.0 mm rain over the previous 24 hours.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. The compost treatment ponds were full and discharging. The ponds were free of any litter, as was the drain leading down to the stormwater pond. The caps over stages one and two appeared stable and sound and were well vegetated.

There was area of exposed refuse below the tipface which was being spread and contoured at the time. Cover material was being stockpiled at the edge of the refuse. The exposed area of refuse was judged to be slightly in excess of the 900 square metre limit, however this was causing no issues at the time.

There were slight landfill odours detected immediately downwind of the tipface but no odours were detected at the boundary. Over all the southern end of the stage three and the operational area looked tidy and organised.

There far less litter in and around the large pond and leachate pond that had been noted in the last inspection. This was evidence of significant litter collection occurring at the site and overall litter control was good and the site looked tidy.

The grate of the Puremu Stream culvert below the weigh bridge had become half blocked with debris again and this would have to be cleared out.

Samples were taken from the usual sites. No visual effects or odours were detected in the Puremu Stream.

The site manager was contacted and the tipface and culvert grates were discussed and it was arranged to have the issues resolved.

### **2.1.5 11 December 2013**

A site visit was made to conduct a compliance monitoring inspection and take discharge and surface water samples and conduct an ambient air survey. It was fine with a 2-3 m/s north westerly breeze.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. The compost treatment ponds were full and discharging. The ponds were free of any litter, as was the drain leading down to the stormwater pond. The caps over stages one and two appeared stable and sound and were well vegetated.

A water cart was spraying water over the access track to suppress dust. A drain running along the tipface area entrance road was full of discoloured water. The water appeared to be runoff coming from the filled area below the southern litter fence and was entering into the stormwater system on the central access road. A sample was taken to ascertain if there was any leachate present in the run-off.

The special waste area, WWTP sludge discharges and general tipface were inspected and no significant issues were noted. There were strong odours noted in and around the tipface but none noted at the downwind site boundary.

There was evidence of significant litter collection occurring at the site and overall litter control was good and the site looked tidy.

Methane and dust meters were deployed and average readings of zero methane and 13 µg/m<sup>3</sup> PM10 which were well inside guideline values. No odours were detected offsite during the survey.

The sample from the drain was found to contain high levels of biochemical oxygen demand and ammonia and the consent holder was directed to redirect the leachate back into the leachate system.

### **2.1.6 9 January 2014**

A site visit was made to conduct a compliance monitoring inspection. There were showers at the time of the inspection with a 2-3 m/s NW breeze.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. The compost treatment ponds were full and discharging. The caps over stages one and two appeared stable and sound and were well vegetated.

As requested the drain running along the tipface area entrance road had been filled and contoured over to redirect the run-off back into the landfill footprint.

The special waste area, WWTP sludge discharge area and general tipface were inspected and no significant issues were noted. There were strong odours noted in and around the tipface but none noted at the downwind site boundary.

There was evidence of significant litter collection occurring at the site and overall litter control was good and the site looked tidy.

#### **2.1.7 10 February 2014**

A site visit was made to conduct a compliance monitoring inspection and conduct an ambient air quality survey. It was fine at the time of the inspection with a 2-3 m/s NW breeze and no rain for the past eight days.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. The compost treatment ponds were full and discharging. The ponds were free of any litter, as was the drain leading down to the stormwater pond. The caps over stages one and two appeared stable and sound and were well vegetated.

The special waste area and general tipface were inspected and no significant issues were noted. There were strong odours noted in and around the tipface but none noted at the downwind site boundary. A water cart had been spraying water over the tipface access roads to suppress dust.

An ambient air survey was conducted over seven sites and showed that there was an average PM10 level of 1.6  $\mu\text{g}/\text{m}^3$  and this confirmed the absence of suspended. No methane was detected.

There was evidence of significant litter collection occurring at the site and overall litter control was good and the site looked tidy.

#### **2.1.8 14 March 2014**

A site visit was made to conduct a compliance monitoring inspection, take water samples and conduct an ambient air quality survey. It was fine at the time of the inspection with a 2-3 m/s SE breeze and no rain for the past eight days.

The special waste area and general tipface were inspected and no significant issues were noted. There were strong odours noted in and around the tipface but none noted at the downwind site boundary. The access track to the operational area and the area itself had been well soaked with water to suppress dust. The tipface appeared to be within the 900 m<sup>2</sup> size limit.

An ambient air survey was conducted over seven sites and showed that there was an average PM10 level of 29  $\mu\text{g}/\text{m}^3$ . No methane was detected.

There was litter noted around the perimeter litter fence and around the access track to the large silt pond, but there was evidence that ongoing collection was occurring.

The Puremu Stream was at a very low flow and was slightly cloudy. Results showed that levels of ammoniacal nitrogen at sites PMU0001132 and PMU000110 exceeded consent limits and an incident was recorded (see section 2.3).

#### **2.1.9 11 April 2014**

A site visit was made to conduct a follow up monitoring inspection, and take follow up water samples. It was fine at the time of the inspection with a NE breeze and 24 mm rain over the 2 days.

The Puremu Stream was at a low-moderate flow and no visual effects from the landfill were noted at the time of sampling. The large silt pond was discharging at the time but the small silt pond was not.

No objectionable odours were noted at the downwind boundary.

#### **2.1.10 7 May 2014**

A site visit was made to conduct a compliance monitoring inspection. It was overcast at the time of the inspection with a WNW breeze and light showers.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. The compost treatment ponds were full and discharging. The ponds were free of any litter, as was the drain leading down to the stormwater pond.

The special waste area and general tipface were inspected and no significant issues were noted. There were strong odours noted in and around the tipface but none noted at the downwind site boundary. The tipface appeared to be within the 900 m<sup>2</sup> size limit.

Overall litter control at the site was good and the area around the large silt pond (and the pond itself) was relatively clear of litter.

The Puremu Stream was at a moderate flow, and no visual effects from the landfill were noted at the time of the inspection.

The cap over stage two was inspected and found to be in free of cracks, erosion or slumping. The cap was well vegetated and appeared to be draining well.

All ground water monitoring bores were visited to check the toby locks for up coming groundwater sampling.

#### **2.1.11 18 June 2014**

A site visit was made to conduct a compliance monitoring inspection and to take groundwater samples. It was overcast with intermittent showers. No objectionable odours were detected on the site or at any time during the inspection.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. The compost treatment ponds were not discharging. Material was

being moved from the NPDC site next to the transfer station up to the gravel pad at the top of the landfill site.

The special waste area and general tipface were inspected and no significant issues were noted. The odour around the tip face was at a very low level (much lower than usual). The tipface was within the 900 m<sup>2</sup> guideline and was being compacted at the time of inspection. Clay was being spread over the HPDE liner on the eastern side of stage three.

Overall litter control at the site was good and the area around the large silt pond (and the pond itself) was relatively clear of litter. Evidence of litter removal was noted at the site.

The Puremu Stream was at a moderate flow, and no visual effects from the landfill were noted at the time of the inspection. There was still the remains of a treated timber bridge (old mountain biker bridge) in the unnamed tributary just upstream of the culvert near the confluence. The landfill staff were contacted and agreed to remove themselves rather than wait for NPDC Parks and Reserves to do it.

The cap of stage two was inspected and was found to be in good condition and well managed in terms of grazing. There was no evidence of slumping, cracking, or erosion.

The following action was to be taken: Remove old wooden bridge from stream.

## 2.2 NPDC monitoring results

### 2.2.1 Leachate

The NPDC collected six samples of leachate during the 2013-2014 monitoring period. Analyses were carried out for a range of parameters. The leachate is pumped to, and treated at the New Plymouth Waste Water Treatment Plant (NPWWTP). Whilst the leachate is not discharged directly to the environment, the results are used by Taranaki Regional Council to compare groundwater and surface water quality. The results are also of interest to the Council because of what the leachate reveals of the landfill processes. The results of the analyses from the samples collected by the NPDC are presented in Table 3.

These results reflect typical leachate quality. The concentration variation within each parameter, for the period under review, possibly reflects a seasonal variation in leachate quality.

**Table 3** Chemical analysis of Colson Rd landfill leachate

Parameter	Unit	09-Aug-13	11-Sep-13	16-Oct-13	07-Nov-13	27-Feb-14	08-May-14
pH	pH	7.9	7.7	7.3	7.7	7.7	7.6
BOD	g/m <sup>3</sup>	74	57	320	200	100	70
Suspended solids	g/m <sup>3</sup>	36	24	74	35	26	46
Conductivity	mS/	604	513	275	741	865	559
Alkalinity	g/m <sup>3</sup>	2444	2040	941	3000	3590	2300
Ammoniacal N	g/m <sup>3</sup>	510	410	150	640	720	520

Parameter	Unit	09-Aug-13	11-Sep-13	16-Oct-13	07-Nov-13	27-Feb-14	08-May-14
Chromium	g/m <sup>3</sup>	<0.1	<0.1	<0.1	<0.1	-	0.111
Copper	g/m <sup>3</sup>	<0.02	<0.02	0.05	<0.02	-	<0.011
Iron	g/m <sup>3</sup>	9.9	11.8	9	7.4	-	14
Lead	g/m <sup>3</sup>	<0.07	<.0021	<0.07	<0.07	-	0.0031
Manganese	g/m <sup>3</sup>	1.3	1.7	2.2	1.9	-	1.56
Nickel	g/m <sup>3</sup>	<0.03	<0.03	<0.03	<0.03	-	0.022
Zinc	g/m <sup>3</sup>	<0.04	<0.04	0.6	0.1	-	0.049

## 2.2.2 Under-liner drainage

NPDC collected three samples of the groundwater that drains from a network of pipes under the liner. The results of the analyses are given in Table 4. The quality of this water is a useful indicator of whether leachate is passing through the liner. This is especially important in view of the slip that occurred in 2005 that ripped the liner in several places on the western side of stage three. The exposed rips were repaired but it was not known if the liner had ripped underneath the slipped refuse.

Ongoing drainage analysis shows that little or no contamination was occurring in the groundwater immediately below the liner and the results from this monitoring period continue to show this. The levels of key indicator species such as zinc and ammoniacal nitrogen remain comparable to background levels and are relatively stable over time. Chloride and iron levels also remain within normal ranges for Taranaki groundwater. An unusual result is the high level of faecal coliforms in the result for 18 March 2014. The underliner drainage has only been analysed for faecal coliforms on five occasions and the highest found prior to this result was 24 per/100 mL. The level of faecal coliforms had dropped back dramatically to 62 per/100 mL in the June sample. After discussions with the consent holder who took the sample it was outlined that the water level in the wet well was very low and it was possible that the sample bottle opening scraped the bottom and become contaminated with settled material. Ongoing monitoring will ascertain if there any potential issues in regards to faecal coliform levels.

**Table 4** Results of analysis of under liner drainage

Parameter	Unit	31 July 2013	18 March 2014	25 June 2014
pH	pH	6.5	6.6	6.6
BODC	g/m <sup>3</sup>	<1	<2	<1
Suspended solids	g/m <sup>3</sup>	7	17	14
Faecal coliforms	per/100 mL	3	3460	62
Conductivity	mS/m	45.6	39.0	37.8
Turbidity	N.T.U.	42.4	52.6	48.0
Alkalinity	g/m <sup>3</sup>	117	106	98
Ammoniacal nitrogen	g/m <sup>3</sup> -N	1.2	1.1	1.3
Cadmium	g/m <sup>3</sup>	<0.002	<0.002	<0.002
Chromium	g/m <sup>3</sup>	<0.1	<0.02	<0.02
Chloride	g/m <sup>3</sup>	61.0	57.0	52.8
Copper	g/m <sup>3</sup>	<0.02	<0.02	<0.02
Iron	g/m <sup>3</sup>	7.6	7.4	15.1

Parameter	Unit	31 July 2013	18 March 2014	25 June 2014
Lead	g/m <sup>3</sup>	<0.03	<0.03	<0.03
Manganese	g/m <sup>3</sup>	1.70	1.30	1.30
Nickel	g/m <sup>3</sup>	<0.008	<0.008	<0.008
Zinc	g/m <sup>3</sup>	<0.04	<0.04	<0.04

## 2.3 Results of low flow receiving environment monitoring

### 2.3.1 Manganaha Stream

The Colson Rd landfill site has two streams associated with it. The Puremu Stream has been culverted to run under the north-western quadrant of the landfill site. It emerges from the culvert near the landfill entrance driveway and then flows approximately 300 metres to a second culvert that takes it under 2 other properties. Just upstream of the second culvert the unnamed tributary which carries discharge from the large settling pond flows in to the main stream stem. The smaller silt pond discharges directly into the main stream stem just upstream of the confluence (see Figure 5).

The Manganaha Stream follows the eastern boundary of the site and 200 metres away from the landfill (at its closest point). There are no direct discharges into the Manganaha Stream from the landfill.

Tables 5-7 give the results of the low flow freshwater sampling undertaken during the period under review. An aerial view of the sampling sites is given in Figure 2.

**Table 5** Chemical analysis of the Manganaha Stream

Parameter	Units	11 December 2013		14 March 2014	
		MNH000190 u/s of landfill	MNH000250 d/s of landfill	MNH000190 u/s of landfill	MNH000250 d/s of landfill
Conductivity	mS/m	13.4	13.2	14.9	15.1
Acid soluble iron	g/m <sup>3</sup>	0.65	0.71	1.62	1.83
Ammonia (unionised)	g/m <sup>3</sup> -N	0.00043	0.00063	0.00018	0.00018
Ammoniacal nitrogen	g/m <sup>3</sup> -N	0.081	0.074	0.047	0.038
pH	pH	7.2	7.4	7.1	7.2
Suspended solids	g/m <sup>3</sup>	4	4	<2	3
Temperature	Deg C	15.4	15.4	13.8	13.9
Dissolved zinc	g/m <sup>3</sup>	<0.005	<0.005	0.009	<0.005

On both sampling occasions the Manganaha Stream showed no adverse effects from the landfilling operation.

The upstream and downstream results on both sampling occasions showed very little difference in water quality. All results were comparable to background levels and similar to those found over the last 5 years. There are no specific consent conditions in regards to the Manganaha Stream other than that discharges from the landfill shall not affect water quality in the stream.

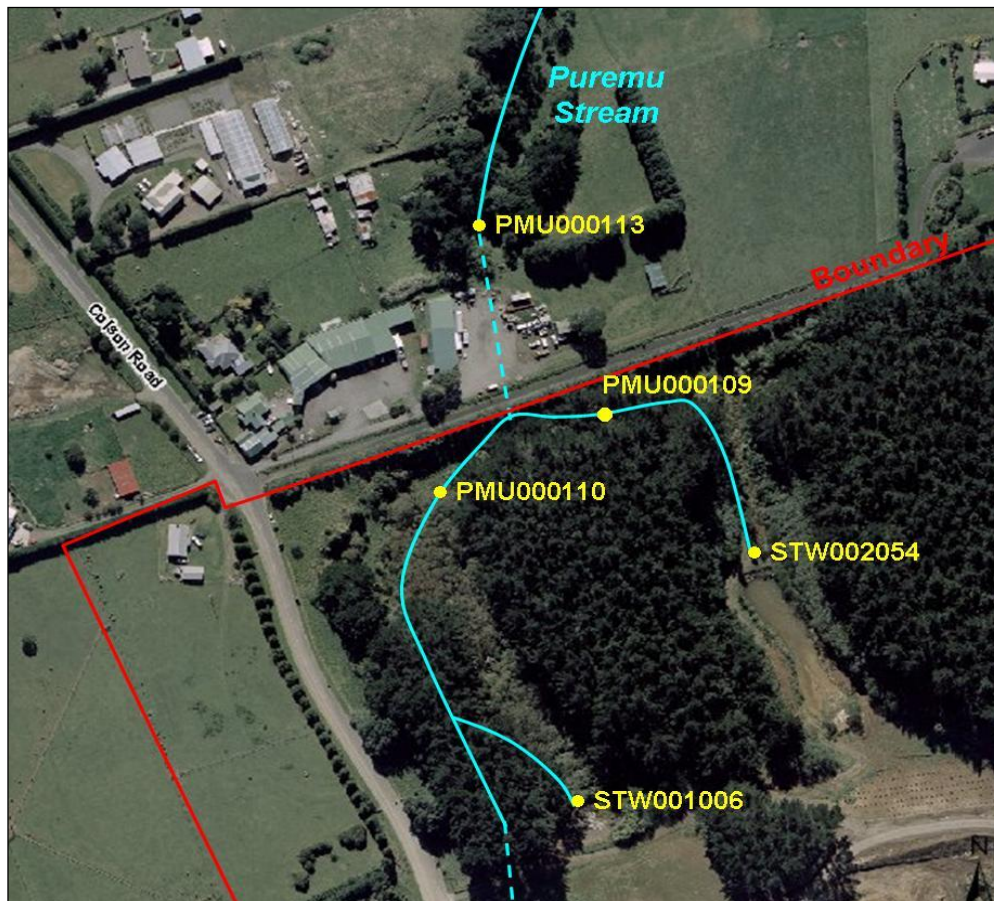


Based on these results and those from past monitoring periods, the landfill's presence is having no measurable effect on water quality in the Manganaha Stream.

### 2.3.2 Puremu Stream

The Puremu Stream was sampled on two occasions under low to moderate flow conditions on 11 December 2013 and 14 March 2014.

A close up diagram of the down stream sampling sites is given in Figure 5 and the results are given in Tables 6 and 7.



**Figure 5** Sampling sites on the Puremu Stream down stream of the landfill

**Table 6** Chemical analysis of the Puremu Stream, sampled on 11 December 2013

Parameter	Unit	PMU000100 500 m u/s of landfill	PMU000109 Trib d/s large silt pond	PMU000110 d/s landfill culvert	PMU000113 d/s SPCA drive culvert	Consent limits at PMU000113* (PMU000110**)
Alkalinity	g/m <sup>3</sup> CaCO <sub>3</sub>	22	78	45	47	NA
BOD	g/m <sup>3</sup>	0.8	2.5	3.4	1.2	NA
Conductivity	mS/m	13.5	29.9	20.1	20.5	NA
Dissolved oxygen	g/m <sup>3</sup>	8.52	6.38	8.69	8.73	>7.52 (5.0)
DRP	g/m <sup>3</sup>	0.008	0.012	0.005	0.012	NA

Parameter	Unit	PMU000100 500 m u/s of landfill	PMU000109 Trib d/s large silt pond	PMU000110 d/s landfill culvert	PMU000113 d/s SPCA drive culvert	Consent limits at PMU000113* (PMU000110**)
Faecal coliforms	per 100ml	470	4800	620	770	>1000
Unionised ammonia	g/m <sup>3</sup> N	0.00008	0.00061	0.00722	0.00828	NA
Ammoniacal N	g/m <sup>3</sup> N	0.03	0.197	1.48	1.32	<sup>2</sup> (2.5)
Nitrate/nitrite N	g/m <sup>3</sup> N	0.37	0.25	1.39	1.35	<sup>10</sup> (100)
Oxygen saturation	%	90.3	66	89	91.3	NA
pH	pH	6.8	6.9	7.1	7.2	>6.5 & <8.5
Sulfates	g/m <sup>3</sup>	5.2	4.7	8.4	8.3	<sup>1000</sup> (500)
Suspended solids	g/m <sup>3</sup>	3	6	<2	2	13
Temperature	Deg C	18.1	17.2	17.2	17.5	(<20.1)

\*Consent limits shown in brackets are for consent 2370-3 at site PMU000110.

\*\* Consent limits with no brackets are for consent 4619 at site PMU000113

Non compliances in bold

**Table 7** Chemical analysis of the Puremu Stream, sampled on 14 March 2014

Parameter	Unit	PMU000100 500 m u/s of landfill	PMU000109 Trib d/s large silt pond	PMU000110 d/s landfill culvert	PMU000113 d/s SPCA drive culvert	Consent limits at PMU000113* (PMU000110**)
Alkalinity	g/m <sup>3</sup> CaCO <sub>3</sub>	41	Flow too low to sample	125	110	NA
BOD	g/m <sup>3</sup>	4.2		1.5	2.4	NA
Conductivity	mS/m	14.7		41.4	37.4	NA
Dissolved oxygen	g/m <sup>3</sup>	6.73		6.84	7.82	>7.52 (5.0)
DRP	g/m <sup>3</sup>	<0.003		<0.003	<0.003	NA
Faecal coliforms	per 100ml	5000		370	1300	>1000
Unionised ammonia	g/m <sup>3</sup> N	0.00025		0.02645	0.01292	NA
Ammoniacal N	g/m <sup>3</sup> N	0.153		<b>5.19</b>	<b>2.48</b>	<sup>2</sup> (2.5)
Nitrate/nitrite N	g/m <sup>3</sup> N	0.17		1.04	0.81	<sup>10</sup> (100)
Oxygen saturation	%	63.2		66.9	76.9	NA
pH	pH	6.7		7.2	7.2	>6.5 & <8.5
Sulfates	g/m <sup>3</sup>	5.4		8.5	8.4	<sup>1000</sup> (500)
Suspended solids	g/m <sup>3</sup>	61		5	6	13
Temperature	Deg C	14.7		14.7	15	(<20.1)

\*Consent limits shown in brackets are for consent 2370-3 at site PMU000110.

\*\* Consent limits with no brackets are for consent 4619 at site PMU000113

\*\*\* Faecal coliforms limit exceeded but much reduced from upstream of landfill

Non compliances in bold

The samples taken on 13 December 2013 were in compliance with all consent conditions. The samples taken on 14 March 2014 had exceedances in regards to the level of ammoniacal nitrogen at sites PMU000110 and PMU000113. The samples were taken at very low flow that may have caused a reduction of the dilution of background inputs from either the landfill or the farmland between site PMU000100 and the top of the culvert. An incident was raised and the matter was investigated (see incidents section 2.8). It should be noted that when the ambient temperature and pH conditions are factored the elevated ammoniacal nitrogen levels resulted in unionised ammonia levels that only slightly exceed the 0.025 g/m<sup>3</sup> guideline for long term aquatic health at site PMU000110.

The sample of 14 March 2014 also returned a result 1300 faecal coliforms/100ml at site PMU000113 and this is technical breach of consent 4619, however, as with previous years, the upstream site PMU000100 was found to have 5000 faecal coliforms/100ml and this likely to be the source of the bacteria rather than the landfill itself.

### 2.3.3 Metals analysis

Consents 2370 and 4619 have limits on the concentration of various metals at sites PMU000113 and PMU000110. As the limits for each are similar and that PMU000110 is only short way upstream a metals screen was undertaken on site PMU000113 with site PMU000100 acting as a control.

The results show that all parameters were in compliance and that there were no increases of note in any of the parameters between the sites upstream and downstream of the landfill.

**Table 8** Results of metal analysis undertaken on 13 December 2013

Parameter	Unit	PMU000100	PMU000113	Consent limit at PMU000113
Dissolved aluminium	g/m <sup>3</sup>	0.005	<0.003	0.105
Total aluminium	g/m <sup>3</sup>	0.072	0.026	5.072
Dissolved arsenic	g/m <sup>3</sup>	<0.0010	<0.0010	0.005
Total arsenic	g/m <sup>3</sup>	<0.0011	<0.0011	0.2
Total beryllium	g/m <sup>3</sup>	<0.00011	<0.00011	0.1
Total boron	g/m <sup>3</sup>	0.017	0.031	5.017
Dissolved cadmium	g/m <sup>3</sup>	<0.00005	<0.00005	0.001
Total cadmium	g/m <sup>3</sup>	<0.000053	<0.000053	0.05
Total cobalt	g/m <sup>3</sup>	0.00043	0.00052	1
Dissolved chromium	g/m <sup>3</sup>	<0.0005	<0.0005	0.02
Total chromium	g/m <sup>3</sup>	<0.00053	<0.00053	1.0
Dissolved copper	g/m <sup>3</sup>	0.0007	0.0009	0.0027
Total copper	g/m <sup>3</sup>	0.00096	0.0011	0.500096
Dissolved iron	g/m <sup>3</sup>	0.21	0.18	0.51
Total iron	g/m <sup>3</sup>	1.16	1.11	11.6
Total manganese	g/m <sup>3</sup>	0.077	0.55	5.033
Dissolved lead	g/m <sup>3</sup>	<0.00010	<0.00010	0.002
Total lead	g/m <sup>3</sup>	<0.00011	<0.00011	0.1
Dissolved selenium	g/m <sup>3</sup>	<0.0010	<0.0010	0.001
Total selenium	g/m <sup>3</sup>	<0.0011	<0.0011	0.05
Total vanadium	g/m <sup>3</sup>	<0.0011	<0.0011	0.1
Dissolved zinc	g/m <sup>3</sup>	0.0025	0.0018	0.0325
Total zinc	g/m <sup>3</sup>	0.0027	0.0021	2.027

## 2.4 Result of stormwater and receiving environment monitoring

Two surveys were conducted during rain events and the results are given in the tables below. Table 9 shows the results for discharges and receiving water from within the landfill catchment (Puremu Stream) whilst table 10 shows the results for the Manganaha Stream which lies adjacent the landfill site.

**Table 9** Results of rain event monitoring samples taken on 1 October 2013

Site	Conductivity	Faecal Coliforms	Unionised ammonia	Ammoniacal nitrogen	pH	Suspended solids	Temp.	Turbidity
	mS/m	/100ml	g/m <sup>3</sup>	g/m <sup>3</sup> N		g/m <sup>3</sup>	Deg.C	NTU
PMU000100	12.8	380	0.00005	0.017	6.9	2	15.5	2.2
PMU000109	32.3	*	0.00073	0.215	7	6	15.5	11
PMU000110	18.9	*	0.00535	1.33	7.1	<2	14.6	3.7
PMU000113	20	<b>1100</b> (1000)	0.00498	1.23	7.1	<2	14.7	3.7
STW001006	48.5	10000	0.0143	13.6	6.5	58	15.1	180
STW002054	38.2	1700	0.00196	0.288	7.3	7	15.5	11
IND003009	105	27000	0.01368	1.71	7.4	44	14.6	46

Key: \* = not measured    **Bold** = Breach of conditions    ( ) = consent condition limit (shown only if in exceedance)

**Table 10** Results of rain event monitoring samples taken on 1 October 2013- Manganaha Stream

Parameter	Unit	MNH000190	MNH000250
Conductivity	mS/m	13.1	12.9
Unionised ammonia	g/m <sup>3</sup>	0.00014	0.00015
Ammoniacal nitrogen	g/m <sup>3</sup>	0.036	0.031
pH	-	7.1	7.2
Suspended solids	g/m <sup>3</sup>	3	3
Temperature	°C	14.0	14.0
Turbidity	NTU	2.4	2.8

The Puremu Stream system receives discharges from two stormwater ponds on the site. STW001006 discharges stormwater and leachate from Stages one and two, and STW002054 discharges stormwater from the eastern forest of the site and the composting pad. STW002054 also receives stage three leachate in the event that the leachate pumping system fails.

The results show that during stormwater discharges the site was complying with consent conditions in regards to water quality in the Puremu Stream with all parameters except faecal coliforms. Consent 4619 requires that the exercise of consent does not cause faecal coliform levels to exceed 1000 cfu/100 mL and in this case that level was exceeded by 10%. However as a level of 380 cfu/1000 mL was found at the control site, it can't be said with all certainty that the exceedance was caused entirely

by the landfill itself. The landfill however, certainly contributed to the overall loading and this is evidenced by the faecal coliform content of the discharges.

At all freshwater sites the levels of ammonia, suspended solids and conductivity were within acceptable ranges and indicate reasonable water quality.

The Manganaha Stream was also sampled after a rain event and the results are shown in Table 10. The Manganaha Stream receives no direct discharges from the landfill catchment but it is a useful indicator for any groundwater contamination or effects from windblown refuse.

The results show that water quality in the stream is quite high and there is negligible difference in water quality when comparing the results from the two sites.. These results are comparable to those obtained in previous monitoring periods.

## **2.5 Biological monitoring**

Two macroinvertebrate surveys were conducted during the 2013-2014 monitoring year. Summaries of the surveys' findings are given below and a full copy of the reports can be found in the appendix.

### **2.5.1 26 November 2013 Macroinvertebrate survey**

The Council's standard 'kick-sampling' technique was used at three sites (site 2, M4 and M6) and the 'sweep-sampling' technique was used at two sites (sites 1 and PT1), to collect streambed macroinvertebrates from the Puremu and Manganaha Streams on 26 November 2013. Samples were sorted and identified to provide number of taxa (richness), MCI and SQMCI<sub>s</sub> 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<sub>s</sub> 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<sub>s</sub> between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

This early summer macroinvertebrate survey indicated that the discharge of treated stormwater and leachate discharged from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Puremu and Manganaha Streams.

In this survey, the MCI score recorded at the upstream control site on the Puremu Stream was the same as the median score for this site, and only slightly less than that recorded in the previous survey. The SQMCI<sub>s</sub> score however was significantly lower than the median and significantly lower than that recorded in the previous survey. This was largely attributable to the reduced abundance within two 'moderately sensitive' taxa, and the increased abundances within four 'tolerant' taxa. These results were indicative of poor preceding water quality, and reflected a macrophyte associated community assemblage, that had been impacted by very low flows.

Site 2 in the Puremu Stream recorded significantly reduced MCI and SQMCI<sub>s</sub> scores, when compared with site 1 (Stark, 1998), and were both well below the historical medians for this site. Differences in habitat quality and sampling method were considered to be the most likely reasons for the variation in results from that recorded at site 1. However, site PT1 in the unnamed tributary recorded MCI and SQMCI<sub>s</sub> scores similar to historical medians. This was an indication of a slight recovery from the instream excavation that had occurred prior to the previous survey. These works resulted in the removal of instream habitat, providing a poor habitat favouring 'tolerant' taxa. The current scores were a reflection of poor water quality and/or habitat quality at this site.

The upstream site on the Manganaha Stream recorded MCI and SQMCI<sub>s</sub> scores above historical medians. These results reflected the moderately high proportion of 'sensitive' taxa and the numerical dominance of three 'sensitive' taxa, in particular the abundance of one 'moderately sensitive' mayfly taxon, and were indicative of moderate preceding water quality.

In the Manganaha Stream downstream of the landfill site, the macroinvertebrate community contained a moderate proportion of 'tolerant' taxa which resulted in an MCI score of 86 units. This MCI score was not significantly lower than that recorded at the upstream site, indicating only a minor difference in biological health. However, the SQMCI<sub>s</sub> score recorded at site M6 of 4.6 units was significantly lower than that recorded at site M4, an indication of the reduced habitat quality at this site.

No undesirable biological growths were detected at any of these sites during this November 2013 survey.

Overall, the results of this survey were indicative of poor (site 1) and very poor (site 2) biological health in the Puremu Stream and poor biological health at site PT1 in the unnamed tributary of the Puremu Stream. The results in the Manganaha Stream were indicative of fair biological health at sites M4 and M6. The poor flow and habitat conditions observed in the Puremu Stream and unnamed tributary of the Puremu Stream at the time of this survey were the most likely reason for this, rather than any effects of the discharges from the landfill. In summary, these results were not indicative of any significant adverse effects on either the Puremu Stream or the Manganaha Stream from the discharges from the Colson Road Landfill at the time of this survey.

### **2.5.2 12 February 2014 Macroinvertebrate survey**

The standard 'sweep-sampling' technique was used at site 1 and site PT1, and the 'kick-sampling' technique was used at site M6 to collect streambed macroinvertebrates from the Puremu and Manganaha Streams on 04 February 2014. A combination of these two techniques was used to collect streambed macroinvertebrates from site 2 and site M4. Samples were sorted and identified to provide number of taxa (richness), MCI and SQMCI<sub>s</sub> 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<sub>s</sub> 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<sub>s</sub> between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

This late summer macroinvertebrate survey indicated that the discharge of treated stormwater and leachate discharged from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Puremu and Manganaha Streams.

In this survey, the MCI score recorded at the upstream control site on the Puremu Stream was slightly higher than the median score for this site, and slightly higher than that recorded in the previous survey. The SQMCI<sub>s</sub> score was only slightly lower than the median but significantly higher than that recorded in the previous survey. These results were indicative of poor preceding water quality, and reflected a macrophyte associated community assemblage, that had been impacted by very low flows.

Site 2 in the Puremu Stream recorded a similar MCI score but significantly reduced SQMCI<sub>s</sub> score, when compared with site 1 (Stark, 1998). The reduced SQMCI<sub>s</sub> score was also well below the historical median for this site. These results were largely indicative of differences in habitat between the upstream site 1 and downstream at sites 2 rather of any effects from the landfill discharges on the macroinvertebrate communities. The Puremu Stream at site 1 was open and the bed was dominated by macrophytes, whereas the stream at site 2 was partially shaded, with the silted bed covered significantly in a mixture of iron oxide accumulations, leaf and wooded debris. Overall, the differences in SQMCI<sub>s</sub> scores between site 2 and site 1 reflect more the improvement at site 1 than a deterioration at site 2.

Site PT1 in the unnamed tributary recorded MCI and SQMCI<sub>s</sub> scores slightly above historical medians, however were still a reflection of poor water quality and/or habitat quality at this site.

The upstream site on the Manganaha Stream recorded MCI and SQMCI<sub>s</sub> scores above historical medians. These results reflected the moderately high proportion of 'sensitive' taxa and the numerical dominance of three 'sensitive' taxa, and were indicative of moderate preceding water quality. In the Manganaha Stream downstream of the landfill site, the macroinvertebrate community also contained a moderately high proportion of 'sensitive' taxa which resulted in an MCI score of 92 units. Both the SQMCI<sub>s</sub> and MCI scores were very similar to that recorded at the upstream site, indicating only a minor difference in biological health.

No undesirable biological growths were detected at any of these sites during this February 2014 survey.

Overall, the results of this survey were indicative of poor biological health in the Puremu Stream and in the unnamed tributary of the Puremu Stream. The results in the Manganaha Stream were indicative of fair biological health at sites M4 and M6. The poor flow and habitat conditions observed in the Puremu Stream and unnamed tributary of the Puremu Stream at the time of this survey were the most likely reason for this, rather than to the effects of the discharges from the landfill. In summary, these results were not indicative of any significant adverse effects on either the





Parameter	Unit	GND0251	GND0255	GND0573	GND1301	GND0575	GND0598	GND1300
Dissolved manganese	g/m <sup>3</sup>	< 0.00010	< 0.00010	< 0.00010	0.00019	< 0.00010	0.00031	0.00013
Dissolved lead	g/m <sup>3</sup>	0.0036	0.0009	0.0032	0.0029	0.001	0.069	0.0024
Dissolved selenium	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved vanadium	g/m <sup>3</sup>	< 0.0010	0.0013	< 0.0010	< 0.0010	0.0105	< 0.0010	0.0083
Dissolved zinc	g/m <sup>3</sup>	0.0034	0.0037	0.0158	0.0033	0.0048	0.0031	0.0027

## 2.7 Air - results of receiving environment monitoring

### 2.7.1 Deposition gauging

Many industries emit dust from various sources during operational periods. In order to assess the effects of the emitted dust, industries have been monitored using deposition gauges.

Deposition gauges are bucket – like containers elevated on a stand to approximately 1.6m. The buckets have an aqueous solution in them to ensure that any dust that settles out of the air is not re-suspended by wind. The solution also inhibits algal growth to prevent the addition of organic mass.

Gauges are placed around the site and within the surrounding community. The gauges were left in place for a period of two weeks to a month, on two separate occasions.

Guideline values used by the Taranaki Regional Council for dust deposition are 4g/m<sup>2</sup>/30 days or 0.13 g/m<sup>2</sup>/day deposited matter. Consideration is given to the location of the industry and the sensitivity of the surrounding community, when assessing results against these values.

Material from the gauges was analysed for solid particulates, the results of which are presented in Table 12 and 13.

**Table 12** Air deposition monitoring results for January 2014

Site	Days deployed	Particulate g/m <sup>2</sup> /day
AIR001604 Adjacent to Manganaha Stream, behind rose nursery	21	0.10
AIR001608 124 Egmont Road, paddock boundary, west of house	21	0.09
AIR001623 Behind 194 Egmont Road	21	0.03
AIR001622 At rear of RSPCA building	21	0.03
AIR001603 Opposite Phillips property	21	0.13
AIR001613 Grass lawn opposite behind work shed	21	0.06

**Key:** Bold = exceeded MfE guideline value of 0.13 g/m<sup>2</sup>/day

**Table 13** Air deposition monitoring results for February 2014

Site	Days deployed	Particulate g/m <sup>2</sup> /day
AIR001604 Adjacent to Manganaha Stream, behind rose nursery	21	<b>0.15</b>
AIR001608 124 Egmont Road, paddock boundary, west of house	21	0.01
AIR001622 At rear of RSPCA building	21	0.03
AIR001603 At entrance to landfill	21	0.10
AIR001613 Grass lawn, behind work shed	21	<b>0.14</b>
AIR001623 Behind 194 Egmont Road	21	0.08

**Key:** Bold = exceeded guideline value of 0.13 g/m<sup>2</sup>/day for residential areas

Over the 2013-2014 period, there were two particulate levels obtained above the Taranaki Regional Council guideline level for dust deposition of 0.13 g/m<sup>2</sup>/day. One was found at AIR001604 during February which is to the east of the landfill, however upon filtering the deposition gauge was found to have a heavy load of insects and algae which artificially inflates the final weight readings. This was also the case with the sample taken at the same site in the February survey.

The other exceedance was found behind the landfill's work shed which is close to an area of high truck movements. This site is well within the landfill's boundary so is unlikely to represent non-compliance offsite. Based on the results it is unlikely that landfill is causing dust deposition levels to exceed the guidelines.

All other sites were below the guideline level and overall the landfill is not causing objectionable levels of dust beyond the boundary and complies with consent conditions.

## 2.7.2 Other ambient monitoring

### Suspended particulate

Suspended particulate dust monitoring was carried out on three occasions over 7 sites under dry weather conditions. The national guideline for air quality (averaged over a 24 hr period) is 50 µg/m<sup>3</sup> PM10. The monitoring showed that this guideline was only being exceeded at the point where the unpaved tipface access track meets the paved central roadway. It was also noted that dust suppression measures were being used more effectively in this monitoring period. The high levels found were however all localised well inside the landfill boundary and other sites both within and outside the boundary were well below guideline levels.

**Table 14** Ambient PM10 and methane survey results 11 December 2013

Site	Methane	Dust µg/m <sup>3</sup>
AIR001609	0	9
AIR001615	0	6
AIR001614	0	8
AIR001612	0	10
AIR001603	0	60

Site	Methane	Dust µg/m <sup>3</sup>
AIR001610	0	9
AIR001618	0	11
Average	0	16

**Table 15** Ambient PM10 and methane survey results 11 December 2014

Site	Methane	Dust µg/m <sup>3</sup>
AIR001620	0	*
AIR001610	0	*
AIR001602	0	*
AIR001613	0	*
AIR001603	0	*
AIR001612	0	*
AIR001614	0	*
Average	0	1.6

\*Individual results not available, however the average result was recorded.

**Table 16** Ambient PM10 and methane survey results 14 March 2013

Site	Methane	Dust µg/m <sup>3</sup>
AIR001620	0	20
AIR001610	0	35
AIR001602	0	47
AIR001613	0	107
AIR001616	0	15
AIR001612	0	16
AIR001615	0	10
Average	0	35

## 2.8 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 causes 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).

In the 2013-2014 period, three incidents were logged in regards to the landfill at Colson Rd.

### **2.8.1 9 July 2013**

A complaint was received concerning odour from the Colson Road landfill. Inspection found no odour at the complainant's property. The landfill was inspected and one area at the site that may have been a cause of odour was identified, and the site manager was contacted and advised to apply extra covering material.

### **2.8.2 14 March 2014**

During analysis of samples taken during routine monitoring it was found that levels of ammoniacal nitrogen in the receiving water at sites PMU000110 and PMU000113 at the Colson Road Landfill exceeded consent conditions. Two incidents were raised as each site is controlled by different consents.

Investigation found that the elevated levels were likely due to low flows occurring in the region at the time and input from other sources such the surrounding semi rural area or potentially the older part of the landfill site (stages one and two). Further sampling was undertaken and results found levels to be within resource consent conditions. The consent holder undertook investigations that showed that the current landfill was not the source of the elevated nitrogen levels.

## **2.9 Management and reporting**

### **2.9.1 Landfill Management and Contingency Plans**

NPDC has a site management and contingency plans in place and undertakes yearly reviews of each document.

### **2.9.2 Colson Road Landfill Liaison Committee**

A liaison committee comprising representatives of NPDC, Taranaki Regional Council, landfill contractor, and neighbours of the landfill was set up in 1999 as required by condition 32 of the land use consent for Colson Road. The purpose of the committee is to facilitate the airing of concerns of the neighbours to the landfill and to ensure that the landfill's neighbours are kept abreast of the development of the landfill site.

During the period under review, the committee met on 3 July 2013, 6 November 2013 and 5 March 2014. This periodicity of meetings was agreed between all parties. The meetings covered site development progress and operations at the landfill, and future activities. Attendees of the meeting agree that they are worthwhile and provide useful feedback to NPDC.

The Colson Road landfill liaison committee has been very successful to date and will continue in its present format for the 2014-2015 monitoring period.

### **2.9.3 Independent Consultant's Reports**

Site inspections were undertaken by WAI Environmental (independent consultants) on 12 July 2013, 13 February 2014 and 5 June 2014.

The report of the 12 July 2013 visit noted that

- Litter control was being undertaken and was being effective
- The tipface was within the 900 square metre guideline
- Refuse coverage was adequate
- The landfill was being operated at high level of compliance

The report of the 13 February inspection noted that:

- Litter control was occurring but some areas need more attention
- In general the landfill continues to be operated at a high standard of compliance.

The report of the 5 June visit noted

- Litter control was being undertaken and was being effective
- The tipface was within the 900 square metre guideline
- The landfill was being operated at high level of compliance

### **2.9.4 Composting**

As a result of concerns raised by residents at a public meeting about composting odours, Council staff conducted a thorough odour survey of the composting site and of the stockpiled input materials. No significant odours were found during the inspection.

Concerns were also raised about whether the material in each windrow had a plant derived matter content of at least 95% as required by consent conditions. These concerns were mostly directed at the acceptance of stock bedding which is a mixture of hay (or wood chips) and manure. To address this the Council clarified plant derived matter as being any plant derived material that has only been exposed to external degradation processes (and has not been partially or wholly ingested by any type of animal). This definition includes greenwaste, shredded greenwaste, humate, untreated woodchip/shavings, the plant derived component of animal litter (such as hay and wood shavings), and old existing compost stored on the site. This definition does not include paunch grass, or animal manure. It is however Council's position, that poultry, goat and horse manure are acceptable constituents of the 5% non-plant derived proportion of the windrows.

NPDC provided weigh-bridge records of all material accepted for composting and Council is satisfied that the 95% plant content requirement for each composting row or pile (as well as can be estimated) is being met.

### **3. Discussion**

#### **3.1 Site performance**

Overall the site was well managed. Litter control had noted to have improved and dust suppression was also noted to be occurring more frequently and more effectively. Tip face control was good and litter control was being undertaken with varying levels of success. Dust control was noted to be improved from previous years.

There was only one complaint about odour and this was not substantiated. Investigations into elevated ammoniacal nitrogen levels in the Puremu Stream were investigated by Council and the consent holder and found to be most likely to be caused by rural inputs or the former landfill and not the current landfill.

The consent holder undertook all administrative requirements required by consent conditions and overall the site had a high level of both environmental and administrative performance.

#### **3.2 Environmental effects of exercise of consents**

In relation to the Puremu Stream, there were elevated ammoniacal nitrogen levels in the receiving water on one occasion. As discussed above these were not likely to be attributable to the current landfill activities and based on ambient pH and temperature conditions it is estimated that the level of unionised ammonia only slightly exceeded the 0.025 g/m<sup>3</sup> guideline for aquatic health on one occasions. The biological survey of the Manganaha and Puremu Streams during the monitoring period under review indicated that the landfill is not likely to be having a significant adverse effect on the macroinvertebrate communities of the streams.

Groundwater quality remains satisfactory and there is no evidence of significant contamination either in the groundwater or in the under-liner drainage system.

With exception of one result all ambient settleable dust levels obtained were below the Taranaki Regional Council guideline level for dust deposition in residential areas of 0.13 g/m<sup>2</sup>/day. Suspended particulate matter readings indicate that the site is complying with national guidelines.

### 3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 17 -24.

**Table 17** Summary of performance for Consent 0226-1 Diversion of Puremu Stream

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Comply with Water Right 226	Site specific monitoring programme - site inspections	Yes
2. Pipe laid in accordance with manufacturer's specifications	Site specific monitoring programmes - site inspection	Yes
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

**Table 18** Summary of performance for Consent 4779-1 Air discharge

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Minimise adverse effects on the environment	Site specific monitoring programme in place	Yes
2. No offensive odours or dust or noxious concentrations	Air monitoring carried out	Yes
3. No burning on site	Site specific monitoring programme - site inspection	Yes
4. No adverse ecological effects on any ecosystem	Site specific monitoring programme - inspection and water sampling	Yes
5. No venting untreated landfill gases within 200 m of any boundary	Site specific monitoring programme - inspection and air sampling	Yes
6. Comply with 'Air Discharge Consent Application Supporting Documentation'	Site specific monitoring programme in place – programme supervision	Yes
7. No site alterations other than those specified in the application	Site specific monitoring programme in place – programme supervision	Yes
8. Meet once a year to discuss any matter relating to the consent	Landfill liaison committee meeting	Yes
9. Provide a report within a year on the collection, extraction, venting and combustion of landfill gas	Report received	Yes
10. Optional review provision re environmental effects	No review option this period	NA
11. Optional review provision re collection, extraction, venting and combustion of landfill gas	No review option this period	NA
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

**Table 19** Summary of performance for Consent 4620-1 Uncontaminated stormwater discharge

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Water quality in the Manganaha Stream shall not be altered	Site specific monitoring programme - water sampling	Yes
2. Discharge to have pH 6.5-8.5, maximum suspended solids 100 g/m <sup>3</sup> , and maximum ammoniacal nitrogen 0.5 g/m <sup>3</sup> as nitrogen	Site specific monitoring programme - water sampling	Not able to assess as discharge is mixed with that of consent 4619
3. No leachate discharge	Sampling and inspection	Yes
4. Channels shall minimise erosion	Site specific monitoring programme - site inspections	Yes
5. Channels shall minimise instability of the surrounding land	Site specific monitoring programme – site inspections	Yes
6. Repair land eroded/made unstable due to construction/maintenance	Site specific monitoring programme – site inspections	Yes
7. Notification of any proposal which may affect areas contributing runoff	Site specific monitoring programme – programme supervision	Yes
8. Discharge shall not alter the Puremu Stream in the way of films, foams or suspended materials, change colour or visibility, objectionable odour, harm aquatic or farm animals, or increase temperature by more than 2.0°C	Site specific monitoring programme - inspection and water sampling	Yes
9. No excavation or landfilling if any runoff water will contain suspended solids	Site specific monitoring programme - inspection and water sampling	Yes
10. Conform with the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan'	Site specific monitoring programme – programme supervision	Yes
11. Maintain and comply with a monitoring programme	Site specific monitoring programme – programme supervision	Yes
12. Consent will lapse after six years if not exercised	N/A	N/A
13. Optional review provision re environmental effects	No review option this period	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable



**Table 20** Summary of performance for Consent 4619-1 Treated stormwater and leachate discharge

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Water quality in the Manganaha Stream shall not be altered	Site specific monitoring programme - inspection and water sampling	Yes
2. Water quality of the Puremu Stream shall not exceed the given criteria	Site specific monitoring programme - water sampling	Ammonia result exceed limits-source not verified
3. Discharge shall not alter the Puremu stream in the way of films, foams or suspended materials, change colour or visibility, objectionable odour, harm aquatic or farm animals, or increase temperature by more than 2.0°C	Site specific monitoring programme - inspection and water sampling	Yes
4. Conform with the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan July	Site specific monitoring programme – programme supervision	Yes
5. Maintain and comply with a monitoring programme	Site specific monitoring programme – programme supervision	Yes
6. Consent will lapse after six years if not exercised	N/A	N/A
7. Optional review provision re environmental effects	No review option this period	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

**Table 21** Summary of performance for Consent 2370-3 Contaminated stormwater and leachate discharge

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practice to be adopted	Site specific monitoring programme - inspection	Yes
2. Consent undertaken in accordance with information supplied in the application	Site specific monitoring programme - programme management	Yes
3. Discharge not alter colour, clarity or pH of Puremu Stream	Site specific monitoring programme - inspection and water sampling	Yes
4. No significant adverse effects on aquatic life	Site specific monitoring programme - biomonitoring	Yes
5. Monitor surface water on/near the site	Site specific monitoring programme - inspection and water sampling	Yes
6. Satisfy all requirements of the District Plan of the New Plymouth District Council	N/A	N/A
7. Management and site contingency	Site specific monitoring programme – programme supervision	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
plan		
8. Maintain a landfill capping barrier and vegetative cover	Inspection (applicable to stage 1 & 2 only)	Yes
9. Area is closed and managed in accordance with the management plan	Site specific monitoring programme – programme supervision, and inspections	Yes
10. Maintain drains, ponds and contours on site to minimise unwanted water movement and ponding on site	Site specific monitoring programme - site inspections	Yes
11. No cleaning or hosing out of refuse vehicles on site	Site specific monitoring programme - site inspections	Yes
12. The mixing zone extends downstream from the culvert outlet to 2 m above the confluence between the Puremu Stream and its tributary	N/A	N/A
13. Discharge shall not alter the Puremu Stream in the way of films, foams or suspended materials, change colour or visibility, objectionable odour, harm aquatic or farm animals, or increase temperature by more than 2.0°C	Site specific monitoring programme - inspection and water sampling	Yes
14. Discharge shall not alter the water quality of the Puremu Stream below the given criteria	Site specific monitoring programme - inspection and water sampling	Ammonia results exceeded limits on one occasion – source not determined
15. Discharge shall not reduce the concentration of dissolved oxygen below 5 mg/litre	Site specific monitoring programme – water sampling	Yes
16. Discharge shall not render the Puremu Stream unfit for stock consumption	Site specific monitoring programme – water sampling	Yes
17. Satisfactorily maintain and manage the leachate collection and treatment systems	Site specific monitoring programme – programme supervision	Yes
18. Optional review provision re environmental effects	Review not required	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

**Table 22** Summary of performance for Consent 4622-1 Air discharge due to composting

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Minimise adverse effects on the environment	Site specific monitoring programme	Yes
2. No offensive odours	Site specific monitoring programme – air monitoring	Yes
3. No adverse ecological effects on any ecosystem	Site specific monitoring programme	Yes
4. Materials accepted for composting comply with the 'Assessment of Discharges to Air' July 1994 and the New Plymouth District Council Colson Road Landfill Management Plan July 1994	Site specific monitoring programme	Yes
5. All composting to occur 300 m from any dwelling existing as of 21 March 1999	Site specific monitoring programme - site inspections	Yes
6. Composting piles must consist of no less than 95% plant-derived material	Site specific monitoring programme - site inspections and visual assessment	Yes – as could be best estimated
7. Composting to occur on a trial basis until the consent is approved or reviewed on receipt of a full report	N/A	N/A
8. Consent will lapse after six years if not exercised	N/A	N/A
9. Optional review provision re environmental effects	N/A	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

**Table 23** Summary of performance for Consent 4621-1 Discharge of contaminants onto land

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Install and maintain groundwater monitoring piezometers	Site specific monitoring programme – programme supervision	Yes
2. Prevent surface runoff into the Manganaha Stream from any area used or previously used for the deposition of refuse	Site specific monitoring programme – programme supervision	Yes
3. Prior to use all drainage channels, bunds and contouring is complete	Site specific monitoring programme – site inspection	Yes
4. Civil works relating to construction of stage 3 be certified by a registered engineer prior to use	Site specific monitoring programme – programme supervision	Yes
5. Mitigate or prevent any adverse effects on groundwater	Site specific monitoring programme – water sampling	Yes
6. Maintain and comply with a monitoring programme	Site specific monitoring programme – programme supervision	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
7. Disposal of waste to be carried out in accordance with the New Plymouth District Council Colson Road Landfill: Landfill Management Plan	Site specific monitoring programme – site inspection	Yes
8. Disposal of waste shall comply with the 'criteria for calculating landfill potentials' and the 'Draft Health and Environment Guidelines for selected Timber Treatment Chemicals'	Site specific monitoring programme – programme supervision and site inspection	Yes
9. Consent will lapse after six years if not exercised	N/A	N/A
10. Optional review provision re environmental effects	Review not required	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

**Table 24** Summary of performance for Consent 6177-1 Discharge of stormwater

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Discharge quality within specified parameters	Site specific monitoring programme – programme supervision	Yes
2. No leachate discharged	Site specific monitoring programme – programme supervision	Yes
3. Maintenance of drains to prevent erosion and sedimentation	Site specific monitoring programme – site inspection	Yes
4. No conspicuous effect on clarity or colour of receiving waters	Site specific monitoring programme – programme supervision	Yes
5. No significant effect on aquatic life	Site specific monitoring programme – water sampling	Yes
6. Maintain and comply with a monitoring programme	Site specific monitoring programme – programme supervision	Yes
7. Preparation and adherence to a management plan	Site specific monitoring programme – programme supervision and site inspection	Yes
8. Sediment and erosion management plan	Site specific monitoring programme – programme supervision and site inspection	Yes
9. Adopt best practice	Site specific monitoring programme – programme supervision and site inspection	Yes
10. Rehabilitation of disturbed areas	Site specific monitoring programme – site inspection	Yes
11. Maintain stormwater system to prevent ponding and overland flow.	Site specific monitoring programme – site inspection	Yes
12. Receiving waters not adversely affected	Site specific monitoring programme – water sampling	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
13. A review condition	A review was not required	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

\* N/A = Not applicable

During the year, NPDC demonstrated a high level of both environmental performance and administrative compliance with the resource consents. During the year under review there were some minor operational issues raised by the independent consultant but these were all resolved by the consent holder.

### **3.4 Recommendations from the 2012-2013 Annual Report**

The 2012-2013 Annual Report recommended:

1. THAT for 2013-2014 the monitoring of discharges at the Colson Rd landfill remain unchanged from that of the 2012-2013 monitoring period.
2. That the option to review consents 2370 and 6771 in June 2014 not be exercised on the grounds that current conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent.

This recommendation was implemented in full.

### **3.5 Alterations to monitoring programmes for 2014-2015**

In designing and implementing the monitoring programmes for air/ 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/ 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/ discharging to the environment.

It is proposed that for 2014-2015, that the monitoring programme remain unchanged from that of the 2013-2014 monitoring period.

## **4. Recommendation**

1. THAT for 2014-2015 the monitoring of discharges at the Colson Rd landfill remain unchanged from that of the 2013-2014 monitoring period.

## 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
BODF	biochemical oxygen demand of a filtered sample
bund	a wall around a tank to contain its contents in the case of a leak
CBOD	carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate
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
DO	dissolved oxygen
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 <sup>3</sup>	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
HDPE	High Density Polyethylene
l/s	litres per second
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

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
Moxie	A large earthmoving truck
NH <sub>4</sub>	ammonium, normally expressed in terms of the mass of nitrogen (N)
NH <sub>3</sub>	unionised ammonia, normally expressed in terms of the mass of nitrogen (N)
NO <sub>3</sub>	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 <sub>10</sub>	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 subsequent amendments
SS	suspended solids
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

\*an abbreviation for a metal or other analyte may be followed by the letters 'As', to denote the amount of metal recoverable in acidic conditions. This is taken as indicating the total amount of metal that might be solubilised under extreme environmental conditions. The abbreviation may alternatively be followed by the letter 'D', denoting the amount of the metal present in dissolved form rather than in particulate or solid form.

For further information on analytical methods, contact the Council's laboratory.



## Bibliography and references

- Beca Carter Hollings and Ferner 1994. Groundwater and Geotechnical Investigations; Colson Road Landfill Consents (unpublished report prepared for New Plymouth District Council).
- Taranaki Regional Council (1990): 'New Plymouth District Council Waitara and New Plymouth Landfill. Annual Report 1989/90'. Technical Report 90-31.
- Taranaki Regional Council (1991): 'New Plymouth District Council Waitara and New Plymouth Landfill. Annual Report 1990/91'. Technical Report 91-12.
- Taranaki Regional Council (1992): 'New Plymouth District Council Landfills, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara Annual Report 1991-92'. Technical Report 92-23.
- Taranaki Regional Council (1993): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara. Annual Report 1992-93'. Technical Report 93-65.
- Taranaki Regional Council (1994): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara. Annual Report 1993-94'. Technical Report 94-22.
- Taranaki Regional Council (1995): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 1994-95'. Technical Report 95-51.
- Taranaki Regional Council (1996): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 1995-96'. Technical Report 96-45.
- Taranaki Regional Council (1997): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 1996-97'. Technical Report 97-56.
- Taranaki Regional Council (1998): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 1997-98'. Technical Report 98-51.
- Taranaki Regional Council (1999): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 1998-99'. Technical Report 99-44.
- Taranaki Regional Council (2000): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 1999-00'. Technical Report 00-38.

- Taranaki Regional Council (2001): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2000-01'. Technical Report 2001-61.
- Taranaki Regional Council (2002): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2001-02'. Technical Report 2002-81.
- Taranaki Regional Council (2003): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2002-03'. Technical Report 2003-83.
- Taranaki Regional Council (2004): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2003-04'. Technical Report 2004-112.
- Taranaki Regional Council (2005): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2004-05'. Technical Report 2005-65.
- Taranaki Regional Council (2006): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2005-06'. Technical Report 2006-63.
- Taranaki Regional Council (2007): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2006-07'. Technical Report 2007-48.
- Taranaki Regional Council (2008): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2007-08'. Technical Report 2008-56.
- Taranaki Regional Council (2009): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2008-09'. Technical Report 2009-60.
- Taranaki Regional Council (2010): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2009-10'. Technical Report 2010-66.
- Taranaki Regional Council (2011): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2010-11'. Technical Report 2011-46.
- New Plymouth District Council (2012): 'Colson Road Regional Landfill Management Plan'. January 2012.
- Taranaki Regional Council (2012): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2011-12'. Technical Report 2012-38.

Taranaki Regional Council (2013): 'New Plymouth District Council, New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 2012-13'. Technical Report 2013-51.



## **Appendix I**

### **Resource consents held by NPDC for Colson Road landfill**





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

Please quote our file number  
on all correspondence

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

Name of  
Consent Holder: New Plymouth District Council  
Private Bag 2025  
NEW PLYMOUTH 4342



Change To  
Conditions Date:

19 January 2010 [Granted: 21 March 1999]

**Conditions of Consent**



Consent Granted:

To discharge up to 500 tonnes/day of contaminants onto  
and into land in areas B1, C1 and C2 at the Colson Road  
landfill at or about (NZTM) 1697313E-5675450N

Expiry Date: 1 June 2025

Review Date(s): June 2012, June 2018

Site Location: Colson Road Landfill, Colson Road, New Plymouth

Legal Description: Sec 223 Hua Dist Blk VI Paritutu SD

Catchment: Waiwhakaiho

Tributary: Puremu

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

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Doc# 710136-v1

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## Consent 4621-1

### General conditions

- a) That 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) That 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) That 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. THAT the consent holder shall install and maintain to the satisfaction of the Chief Executive, Taranaki Regional Council, a further groundwater monitoring piezometer approximately equidistant between the bores designated as AH9 and L2, and shall maintain to the satisfaction of the Chief Executive, Taranaki Regional Council, groundwater monitoring piezometers and bores at the sites designated as WQA, WQB and WQC, as AH1, AH2, AH3, AH5, AH6, AH7, and as L1, L2, L5, L7 and L8. [Bore designations are those in Appendix A2, Figure 1, in the Assessment of Effects on the Environment prepared by Woodward-Clyde for New Plymouth District Council, July 1994].
2. THAT the consent holder shall prevent surface runoff of water or contaminants to the Manganaha Stream from any surface area being used or previously used for the deposition of refuse, or for extraction of soil, clay, or other cover material, or prepared for the deposition of refuse, unless such surface area has been covered and rehabilitated to the satisfaction of the Chief Executive, Taranaki Regional Council.
3. THAT prior to commencing any use of any part of Area B, C1 or C2 for the deposition of refuse or for composting activities, the consent holder shall demonstrate to the satisfaction of the Chief Executive, Taranaki Regional Council, that drainage channels, bunds, surface contouring, or other engineering and landscaping works associated with an Area or part of an Area have been undertaken and completed to the extent that compliance with condition 2 above will be achieved.



4. THAT the construction, installation, placement, integrity and performance of groundwater drainage systems, landfill lining systems, and leachate interception, collection, holding, recirculation, and discharge systems in any part of Areas B1, B2, C1 and C2 of the Colson Road Landfill as described in the 'Colson Road Landfill Assessment of Effects on the Environment' July 1994 and the 'New Plymouth District Council Colson Road Landfill Management Plan' July 1994 be certified by a registered engineer prior to any discharge of solid wastes in such part of those areas.
5. THAT should groundwater quality be significantly affected by activities or processes associated with the landfill or composting, then the consent holder shall implement such measures as are necessary to remedy or mitigate and if practicable to prevent the continuation of any effect upon quality of the groundwater. 'Significantly affected' for the purposes of this condition is defined as a change greater than the maximum natural variation in any parameter for water in any piezometer, bore, or spring, and the criteria for this shall be set out in the monitoring programme under condition 6.
6. THAT the consent holder shall provide, maintain and comply with a monitoring programme, to the satisfaction of the Chief Executive, Taranaki Regional Council, setting out details of monitoring to be carried out and containing guidelines for the determination of whether contamination is occurring, the initial plan to be provided at least three months prior to the exercise of this consent.
7. THAT the disposal of wastes shall be carried out in a manner conforming with the relevant requirements of the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan July 1994', or any subsequent version of that document which does not lessen environmental protection standards. The Management Plan shall be updated at not greater than yearly intervals, to the satisfaction of the Chief Executive, Taranaki Regional Council.
8. THAT the acceptance and disposal of waste types at the landfill for disposal shall conform to Section 2.5, Section 5.6 and Appendix E [or their equivalent] of the Landfill Management Plan referred to in condition 7 above, and in particular shall conform to the following:

Table 11.2 'Criteria for calculating landfill potentials' Hazardous Waste Management Handbook, Ministry for the Environment, 1994;

and

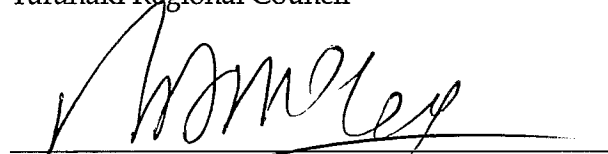
Chapter 5 of the 'Draft Health and Environmental Guidelines for Selected Timber Treatment Chemicals', Ministry for the Environment / Ministry of Health, September 1993, in compliance with the requirement for a Class 2 landfill.
9. THAT this consent shall lapse on the expiry of six years after the date of commencement of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(b) of the Resource Management Act 1991.

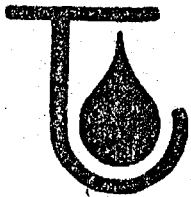
Consent 4621-1

10. THAT pursuant to section 128(1) of the Resource Management Act 1991, the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2006, June 2102, June 2018 and/or within six months of the first exercise of this consent, to deal with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

Signed at Stratford on 19 January 2010

For and on behalf of  
Taranaki Regional Council

  
\_\_\_\_\_  
Director-Resource Management



TARANAKI CATCHMENT COMMISSION  
AND  
REGIONAL WATER BOARD

COPY

PO BOX - 159  
TELEPHONE - 7127

MANAGER  
MUNICIPAL CHAMBERS  
BROADWAY  
STRATFORD  
NEW ZEALAND

RIGHT IN RESPECT OF NATURAL WATER

NO: 226.VF V2

Pursuant to Section 21 (3) of the Water and Soil Conservation Act 1967, a right is hereby granted by the Taranaki Catchment Commission as the Regional Water Board for the area to:

Name: NEW PLYMOUTH CITY COUNCIL

of: PRIVATE BAG NEW PLYMOUTH

occupation: LOCAL AUTHORITY

for a period to: ~~PLEASURE OF THE COMMISSION~~ 1 OCTOBER 2026 (as per section 386(2) of the Resource Management Act 1991

from: 14 MAY 1986

DETAILS OF RIGHT

Purpose for which right is granted: TO DIVERT THE PUREMU STREAM BY  
CULVERTING STREAM TO PROVIDE ROAD ACCESS TO REFUSE TIP

Location of: COLSON ROAD, NEW PLYMOUTH

Grid reference: N109 694 919 Catchment: WAIWAKAIHO

Legal description of land at site: NEW PLYMOUTH CITY COUNCIL REFUSE  
DISPOSAL SITE

Rate: WHOLE FLOW

Local Authority: NEW PLYMOUTH CITY COUNCIL

CONDITIONS OF RIGHT

- (a) The Grantee shall provide to the Manager, Taranaki Catchment Commission, on request plans, specifications and maintenance programmes of works associated with the exercise of this right, showing that the conditions of this right are able to be met.
- (b) The standards, techniques and frequency of monitoring of this right shall be to the specific approval of the Manager, Taranaki Catchment Commission.

- (c) The actual and reasonable cost of administration supervision and monitoring of this right, deemed necessary by the Manager, Taranaki Catchment Commission, shall be met by the Grantee.
- (d) This right may be cancelled in writing to the grantee by the Commission if the right is not exercised within twelve months of the date of grant or such longer time as the Manager, Taranaki Catchment Commission, may approve.
- (e) This right may be terminated by the Commission upon not less than six months notice in writing to the grantee if, in the opinion of the Commission, the public interest so requires, but without prejudice to the grantee to apply for a further right in respect of the same matter.

Special Conditions

1. The terms and conditions pertaining to Water Right 226 shall apply.
2. ~~The existing 900 mm pipe shall be sealed in such a manner so as to prevent leachate from entering the pipe~~ (deleted as per variation of 08 October 1986) *ALB*
3. The new 900 mm pipe shall be laid in accordance with the manufacturers specifications.

Signed at STRATFORD this *14<sup>th</sup>* day of *May* 1986

For and on behalf of  
THE TARANAKI CATCHMENT COMMISSION  
AND REGIONAL WATER BOARD

*ALB*  
Secretary



**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 CLOTON ROAD  
STRATFORD  
NEW ZEALAND  
PHONE 06-765 7127  
FAX 06-765 5097

Please quote our file number  
on all correspondence

Name of  
Consent Holder: New Plymouth District Council  
Private Bag 2025  
NEW PLYMOUTH

Review Completed 20 July 2004 [Granted: 19 March 2003]  
Date:

**Conditions of Consent**

Consent Granted: To discharge up to 1000 cubic metres/day [5 litres/second]  
of leachate and contaminated stormwater from the closed  
section, Area A, of Colson Road municipal landfill to  
groundwater in the vicinity of and into the Puremu Stream  
a tributary of the Mangaone Stream in the Waiwhakaiho  
catchment at or about GR: P19:074-372

Expiry Date: 1 June 2026

Review Date(s): June 2004, June 2006, June 2008, June 2014, June 2020

Site Location: Colson Road Landfill, Colson Road, New Plymouth

Legal Description: Sec 223 Hua Dist Blk VI Paritutu SD

Catchment: Waiwhakaiho

Tributary: Mangaone  
Puremu

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





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**Working with people • Caring for our environment**

### 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

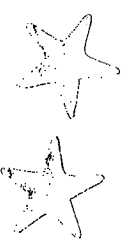
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- 
- 1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.
  - 2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of applications 87/228, 92/205 and 1664. In the case of any contradiction between the documentation submitted in support of applications 87/228, 92/205 and 1664 and the conditions of this consent, the conditions of this consent shall prevail.
  - 3. Any discharge shall not alter to a conspicuous extent the natural colour, clarity or pH of the receiving water, nor shall it contain visible oil or grease, nor shall it emit objectionable odours, nor shall it increase the temperature of the Puremu Stream by more than 2.0°C.
  - 4. There shall be no significant adverse impact upon natural aquatic life downstream of the landfill as a result of the exercise of this consent.
  - 5. Monitoring of surface waters and groundwater on or in the vicinity of the site shall be undertaken to the satisfaction of the Chief Executive, Taranaki Regional Council.
  - 6. The consent holder shall satisfy all relevant requirements, obligations and duties of the Proposed District Plan of the New Plymouth District Council.
  -  7. The consent holder shall prepare, maintain and comply with a site management plan to the approval of the Chief Executive, Taranaki Regional Council.
  - 8. The consent holder shall maintain an adequate landfill capping barrier and vegetative cover on the site to the satisfaction of the Chief Executive, Taranaki Regional Council.
  -  9. The consent holder shall ensure that the area to which this consent is attributed is closed and subsequently managed in accordance with the Colson Road Regional Landfill Management Plan provided June 2004 or as subsequently amended provided that subsequent amendments do not reduce the level of environmental protection set out in the June 2004 plan.

10. The consent holder shall maintain stormwater drains, sediment detention ponds, and/or ground contours at the site, in order to minimise stormwater movement across, or ponding on the site.
11. The consent holder shall ensure that there shall be no cleaning or hosing out of refuse-containing vehicles at the site.
12. The mixing zone in each condition of this consent shall extend for a distance downstream of the point of the culvert outlet of the Puremu Stream to 2 metres above the confluence of the unnamed tributary of the Puremu Stream and the Puremu Stream at the site's legal boundary.
13. After allowing for reasonable mixing the consent holder shall ensure that the discharge shall not give rise to any of the following effects in the receiving waters of the Puremu Stream:
- The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended material;
  - any conspicuous change in colour or visual clarity;
  - any emission of objectionable odour;
  - the rendering of fresh water unsuitable for consumption by farm animals;
  - any significant adverse effects on aquatic life.
  - an increase in the temperature of the Puremu Stream by more than 2.0° Celsius
14. The discharge shall not be shown to reduce the quality of the Puremu Stream at or beyond the mixing zone below the following criteria:

constituent	maximum concentration or level
aluminium	5.0 mg/l
arsenic	0.1 mg/l
beryllium	0.1 mg/l
boron	0.5 mg/l
cadmium	0.01 mg/l
chromium	0.1 mg/l
cobalt	0.05 mg/l
copper	0.2 mg/l
fluoride	1.0 mg/l
iron	5.0 mg/l
lead	0.1 mg/l
manganese	1.0 mg/l
nitrate + nitrite (NO <sub>3</sub> -N + NO <sub>2</sub> -N)	100 mg/l
nitrite -N	5.0 mg/l
selenium	0.02 mg/l
vanadium	0.1 mg/l
zinc	2.0 mg/l
ammoniacal nitrogen	2.5 mg/l
pH	6.5 - 8.5
sulphate	500 mg/l

Note: levels of trace metals expressed as total recoverable metals

Consent 2370-3

- 
15. The discharge shall not be shown to reduce the concentration of dissolved oxygen in the Puremu Stream below 5 mg/litre, beyond the mixing zone specified in special condition 12 above.
  16. The discharge shall not, in the opinion of the Chief Executive, Taranaki Regional Council, contain substances or constituents other than those listed in condition 14, nor pathogenic organisms, which would render the water of the Puremu Stream, beyond the mixing zone specified in condition 12 above, unpalatable or unfit for stock consumption purposes.
  17. The maintenance, management and operation of the leachate and collection and treatment systems shall be to the satisfaction of the Chief Executive, Taranaki Regional Council, to ensure that the conditions attached to this consent can be met.
  18. 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 2004 and/or June 2006 and/or June 2008 and/or June 2014 and/or June 2020, 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.

Signed at Stratford on 20 July 2004

For and on behalf of  
Taranaki Regional Council



---

~~Director~~ Resource Management



TRK994619



PRIVATE BAG 713  
47 CLOTON ROAD  
STRATFORD  
NEW ZEALAND  
PHONE 0-6-765 7127  
FAX 0-6-765 5097

## DISCHARGE PERMIT

**Pursuant to the RESOURCE MANAGEMENT ACT 1991  
a resource consent is hereby granted by the  
Taranaki Regional Council**

Name of  
Consent Holder: NEW PLYMOUTH DISTRICT COUNCIL  
PRIVATE BAG 2025 NEW PLYMOUTH

Consent  
Granted Date: 21 March 1999

## CONDITIONS OF CONSENT

Consent Granted: TO DISCHARGE UP TO A MAXIMUM OF 675 LITRES/SECOND OF TREATED STORMWATER AND MINOR AMOUNTS OF LEACHATE FROM AREAS B1, B2, C1 AND C2 OF THE COLSON ROAD LANDFILL TO GROUNDWATER IN THE VICINITY OF AND INTO THE PUREMU STREAM A TRIBUTARY OF THE MANGAONE STREAM IN THE WAIWHAKAIHO CATCHMENT AT OR ABOUT GR: P19:074-372

Expiry Date: 1 June 2025

Review Date[s]: June 2006, June 2012, June 2018 and/or within six months of the first exercise of this consent

Site Location: COLSON ROAD LANDFILL, COLSON ROAD, NEW PLYMOUTH

Legal Description: SEC 223 HUA DIST BLK VI PARITUTU SD

Catchment: WAIWHAKAIHO 392.000

Tributary: MANGAONE 392.010  
PUREMU 392.012

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

TRK994619

### General conditions

- a) That on receipt of a requirement from the General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) That 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) That 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. THAT the water quality in the Manganaha Stream above its confluence with the Mangaone Stream shall not be changed as a result of this discharge.
2. THAT the exercise of this consent shall not cause the water quality of the Puremu Stream at the northern boundary of the site to exceed the following criteria:

Component	Criteria
pH	range within 6.5-8.5
Dissolved oxygen	maximum reduction of $1.0 \text{ gm}^{-3}$ in the upstream dissolved oxygen concentration
Ammoniacal nitrogen	$2.0 \text{ gm}^{-3}$ for pH below 7.75 $1.3 \text{ gm}^{-3}$ for pH between 7.75-8.00 $1.0 \text{ gm}^{-3}$ for pH between 8.00-8.50
Nitrate	$10 \text{ gm}^{-3}$ as nitrogen
Nitrite	$0.06 \text{ gm}^{-3}$ as nitrogen
Faecal coliforms	1000/100 mL
Sulphate	$1000 \text{ gm}^{-3}$
Oil and grease	$10 \text{ gm}^{-3}$
Suspended solids maximum permitted increase in instream concentration	
[dry weather conditions]	$10 \text{ gm}^{-3}$
[wet weather conditions]	10%
of upstream concentration	

	Maximum instream concentration Total Recoverable Metals gm <sup>-3</sup>	Maximum permitted increase in concentration Filtered Metals gm <sup>-3</sup>
Aluminium	5.0	0.1
Arsenic	0.2	0.05
Beryllium	0.1	n/a
Boron	5.0	n/a
Cadmium	0.05	0.001
Chromium	1.0	0.02
Cobalt	1.0	n/a
Copper	0.5	0.002
Iron	10.0	0.3
Lead	0.1	0.002
Manganese	5.0	n/a
Selenium	0.05	0.001
Vanadium	0.1	n/a
Zinc	2.4	0.03


3. THAT the discharge authorised by this consent, in conjunction with the exercise of any other consent associated with the landfill property, shall not give rise to any of the following effects in the Puremu Stream at the northern boundary of the site:
  - a) the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials [other than storm debris and suspended solids as permitted under condition 2 above];
  - 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.
4. THAT this consent shall be exercised in a manner conforming with the relevant requirements of the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan 1994', or any subsequent version of that document which does not lessen environmental protection standards. The Management Plan shall be updated at not greater than yearly intervals, to the satisfaction of the General Manager, Taranaki Regional Council.
5. THAT the consent holder shall provide, maintain and comply with a monitoring programme, to the satisfaction of the General Manager, Taranaki Regional Council, setting out details of monitoring to be carried out and containing guidelines for the determination of whether contamination is occurring, the initial plan to be provided at least three months prior to the exercise of this consent.
6. THAT this consent shall lapse on the expiry of six years after the date of commencement of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(b) of the Resource Management Act 1991.

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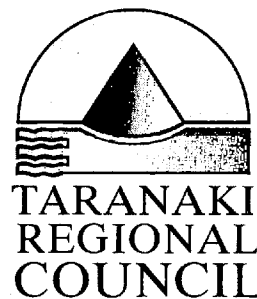
7. THAT pursuant to section 128(1)(a) of the Resource Management Act 1991, the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2006, June 2012, June 2018 and/or within six months of the first exercise of this consent, to deal with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

Signed at Stratford on 21 March 1999

For and on behalf of  
TARANAKI REGIONAL COUNCIL

  
\_\_\_\_\_  
GENERAL MANAGER

TRK994620



## DISCHARGE PERMIT

**Pursuant to the RESOURCE MANAGEMENT ACT 1991  
a resource consent is hereby granted by the  
Taranaki Regional Council**

PRIVATE BAG 713  
47 CLOTON ROAD  
STRATFORD  
NEW ZEALAND  
PHONE 0-6-765 7127  
FAX 0-6-765 5097

Name of  
Consent Holder: **NEW PLYMOUTH DISTRICT COUNCIL  
PRIVATE BAG 2025 NEW PLYMOUTH**

Consent  
Granted Date: **21 March 1999**

## CONDITIONS OF CONSENT

Consent Granted: **TO DISCHARGE UP TO 675 LITRES/SECOND OF  
UNCONTAMINATED STORMWATER FROM AREAS B1 B2 C1  
AND C2 OF THE COLSON ROAD LANDFILL INTO THE  
PUREMU STREAM A TRIBUTARY OF THE MANGAONE  
STREAM IN THE WAIWHAKAIHO CATCHMENT AT OR ABOUT  
GR: P19:074-372**

Expiry Date: **1 June 2025**

Review Date[s]: **June 2006, June 2012, June 2018 and/or within six months of the  
first exercise of this consent**

Site Location: **COLSON ROAD LANDFILL, COLSON ROAD, NEW PLYMOUTH**

Legal Description: **SEC 223 HUA DIST BLK VI PARITUTU SD**

Catchment: **WAIWHAKAIHO 392.000**

Tributary: **MANGAONE 392.010  
PUREMU 392.012**

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

TRK994620

**General conditions**

- a) That on receipt of a requirement from the General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) That 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) That 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. THAT the water quality in the Manganaha Stream above its confluence with the Mangaone Stream shall not be changed as a result of this discharge.
- 2. THAT the water quality of uncontaminated stormwater discharged to the Puremu Stream shall meet the following criteria:

pH	6.5-8.5
suspended solids	maximum concentration of 100 gm <sup>-3</sup>
ammoniacal nitrogen	maximum concentration of 0.5 gm <sup>-3</sup> as nitrogen
- 3. THAT no leachate discharge shall be permitted by the exercise of this consent.
- 4. THAT all stormwater diversion and containment channels shall be designed, constructed and maintained so as to prevent or minimise erosion of the channel in all circumstances.
- 5. THAT the earthworks and construction associated with the landfill and the composting site and the stormwater diversion and containment channels shall be designed, constructed and maintained so as to minimise instability of the surrounding land.
- 6. THAT the consent holder shall repair and rehabilitate any land made unstable and any erosion occurring due to the construction or maintenance of the diversion channels or landfilling operations or composting site associated with the exercise of this consent.
- 7. THAT the consent holder shall notify the General Manager, Taranaki Regional Council, of any proposal which may alter or affect the areas contributing runoff insofar as may affect the exercise of this consent, other than as advised to the Taranaki Regional Council in the application for this consent, at least two months prior to commencing any such works. The consent holder shall obtain any necessary approvals under the Resource Management Act 1991 prior to commencing any such works.

TRK994620

8. THAT the discharge authorised by this consent, in conjunction with the exercise of any other consent associated with the landfill property, shall not give rise to any of the following effects in the Puremu Stream at the northern boundary of the site:
- a) the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials [other than storm debris and suspended solids as permitted under condition 2 above];
  - 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, including but not limited to, freshwater fish, eels and watercress.
9. THAT there shall be no excavation or earthworks or other landfilling-related activities or composting activities in any area if any runoff of water containing suspended solids or any other contaminant arising from such activities might by reason of land topography or engineered works enter the Manganaha Stream, and in the event of any runoff water entering the Manganaha Stream contrary to this consent the consent holder shall immediately undertake such works as may be necessary to cease the discharge and to prevent a recurrence.
10. THAT this consent shall be exercised in a manner conforming with the relevant requirements of the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan July 1994', or any subsequent version of that document which does not lessen environmental protection standards. The Management Plan shall be updated at not greater than yearly intervals, to the satisfaction of the General Manager, Taranaki Regional Council.
11. THAT the consent holder shall provide, maintain and comply with a monitoring programme, to the satisfaction of the General Manager, Taranaki Regional Council, setting out details of monitoring to be carried out and containing guidelines for the determination of whether contamination is occurring, the initial plan to be provided at least three months prior to the exercise of this consent.
12. THAT this consent shall lapse on the expiry of six years after the date of commencement of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(b) of the Resource Management Act 1991.
13. THAT pursuant to section 128(1)(a) of the Resource Management Act 1991, the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2006, June 2012, June 2018 and/or within six months of the first exercise of this consent, for the purpose of reviewing the best practicable option or options available to reduce or remove any adverse effects on the environment, or to deal with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

Signed at Stratford on 21 March 1999

For and on behalf of  
TARANAKI REGIONAL COUNCIL

  
\_\_\_\_\_  
GENERAL MANAGER

TRK994622



## **DISCHARGE PERMIT**

**Pursuant to the RESOURCE MANAGEMENT ACT 1991  
a resource consent is hereby granted by the  
Taranaki Regional Council**

PRIVATE BAG 713  
47 CLOTON ROAD  
STRATFORD  
NEW ZEALAND  
PHONE 0-6-765 7127  
FAX 0-6-765 5097

Name of  
Consent Holder: **NEW PLYMOUTH DISTRICT COUNCIL  
PRIVATE BAG 2025 NEW PLYMOUTH**

Consent  
Granted Date: **21 March 1999**

## **CONDITIONS OF CONSENT**

Consent Granted: **TO DISCHARGE EMISSIONS INTO THE AIR FROM  
COMPOSTING AND ANCILLARY ACTIVITIES AT THE  
COLSON ROAD LANDFILL AT OR ABOUT GR: P19:074-372**

Expiry Date: **1 June 2025**

Review Date[s]: **June 2006, June 2012 and June 2018**

Site Location: **COLSON ROAD LANDFILL, COLSON ROAD, NEW PLYMOUTH**

Legal Description: **SEC 223 HUA DIST BLK VI PARITUTU SD**

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



TRK994622

### General conditions

- a) That on receipt of a requirement from the General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) That 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) That 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. THAT the consent holder shall at all times adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment arising from emissions from the composting operation. 'Best practicable option' [as defined in section 2 of the Act] shall be determined by the Taranaki Regional Council, following review of the conditions of this consent as set out under condition 9 of this consent.
2. THAT the discharge of contaminants into the air from the composting operation shall not result in offensive or objectionable odours or dust or dangerous or noxious ambient concentrations of any airborne contaminant in the opinion of an enforcement officer of the Taranaki Regional Council, at or beyond the boundary of the site.
3. THAT the discharges authorised by this consent shall not give rise to any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna.
4. THAT the nature of materials accepted for composting and the operation of the composting activities shall give effect to the 'Assessment of Discharges to Air' July 1994, prepared for the New Plymouth District Council by Woodward-Clyde [in particular, but not exclusively, section 2.2.2] and the New Plymouth District Council Colson Road Landfill Management Plan July 1994 [in particular, but not exclusively, section 5.9.6 and Figure 1 of Appendix A] or any subsequent version of that document which does not lessen environmental protection standards. The Management Plan shall be updated at not greater than yearly intervals, to the satisfaction of the General Manager, Taranaki Regional Council.
5. THAT any composting pile or windrow shall be located at least 300 metres from any dwellinghouse existing as of 21 March 1999.
6. THAT the maximum proportion of a composting windrow or pile comprising other than plant-derived material shall not exceed 5% by weight.
7. THAT the composting operation shall initially be undertaken on a trial basis. After at least six, but not more than nine, months of operation, the consent holder shall report to the Taranaki Regional Council on trial, noting particularly the results of operation and effects-based monitoring, and recording any complaints received about odour from composting. Upon receipt of that report, the Taranaki Regional Council may either approve the continuation of composting, or require a review of this consent pursuant to section 128(1)(a) of the Resource Management Act 1991.

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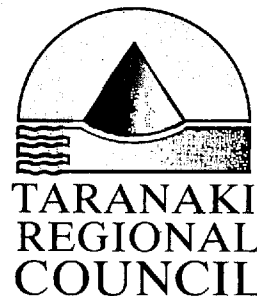
8. THAT this consent shall lapse on the expiry of six years after the date of commencement of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(b) of the Resource Management Act 1991.
9. THAT pursuant to section 128(1)(a) of the Resource Management Act 1991, the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2006, June 2012, June 2018, for the purpose of reviewing the best practicable option or options available to reduce or remove any adverse effects on the environment, or to deal with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.

Signed at Stratford on 21 March 1999

For and on behalf of  
TARANAKI REGIONAL COUNCIL

  
\_\_\_\_\_  
GENERAL MANAGER

TRK994779



## **DISCHARGE PERMIT**

**Pursuant to the RESOURCE MANAGEMENT ACT 1991  
a resource consent is hereby granted by the  
Taranaki Regional Council**

PRIVATE BAG 713  
47 CLOTON ROAD  
STRATFORD  
NEW ZEALAND  
PHONE 0-6-765 7127  
FAX 0-6-765 5097

Name of  
Consent Holder: **NEW PLYMOUTH DISTRICT COUNCIL  
PRIVATE BAG 2025 NEW PLYMOUTH**

Consent  
Granted Date: **21 March 1999**

## **CONDITIONS OF CONSENT**

Consent Granted: **TO DISCHARGE CONTAMINANTS INTO THE AIR FROM THE  
EXISTING LANDFILL [AREA A] AND PROPOSED LANDFILL  
EXTENSION IN AREAS A, B1, B2, C1 AND C2 OF THE  
COLSON ROAD MUNICIPAL LANDFILL SITE, NEW  
PLYMOUTH AT OR ABOUT GR: P19:074-372**

Expiry Date: **1 June 2025**

Review Date[s]: **June 2001, June 2003, June 2006, June 2012, June 2018 and/or  
within six months of the first exercise of this consent**

Site Location: **COLSON ROAD LANDFILL EXTENSION, COLSON ROAD,  
NEW PLYMOUTH**

Legal Description: **SEC 223 HUA DIST BLK VI PARITUTU SD**

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

TRK994779

**General conditions**

- a) That on receipt of a requirement from the General Manager, Taranaki Regional Council (hereinafter the General Manager), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) That 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) That 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**

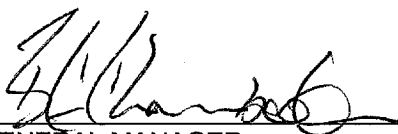
- 1. THAT the consent holder shall at all times adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment arising from emissions from the landfill operation. 'Best practicable option' [as defined in section 2 of the Act] shall be determined by the Taranaki Regional Council, following review of the conditions of this consent as set out under conditions 10 and 11 of this consent and having regard to the requirements of condition 6 of this consent.
- 2. THAT the discharge of contaminants into the air from the landfill operation shall not result in any of the following – offensive or objectionable odours; offensive or objectionable dust; or dangerous or noxious ambient concentrations of any airborne contaminant -- as determined by at least one enforcement officer of the Taranaki Regional Council, at or beyond the boundary of the site.
- 3. THAT no material is to be burnt at the landfill site.
- 4. THAT the discharges authorised by this consent shall not give rise to any significant adverse ecological effects on any ecosystem, including but not limited to, habitats, plants, animals, microflora and microfauna.
- 5. THAT no extraction venting of untreated landfill gases be located closer than 200 metres to any boundary of the landfill property site.
- 6. THAT the operation of the landfill shall give effect to the 'Air Discharge Consent Application Supporting Documentation' July 1995, prepared for the New Plymouth District Council by Woodward Clyde, and the New Plymouth District Council Colson Road Landfill Management Plan July 1994 or any subsequent version of that document which does not lessen the standard of environmental protection afforded by that document. The management plan shall be updated at not greater than yearly intervals, to the satisfaction of the General Manager, Taranaki Regional Council.
- 7. THAT prior to undertaking any alteration to the site or site operations other than as specified and discussed in the application and supporting documentation lodged with the Taranaki Regional Council for this consent, which may significantly alter the nature or quantities of contaminants discharged from the site into the air, the consent holder shall consult with the General Manager, Taranaki Regional Council, and shall obtain any necessary approvals under the Resource Management Act 1991.

TRK994779

8. THAT the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with the submitters to the consent, and any other interested party at the discretion of the General Manager, Taranaki Regional Council, to discuss any matter relating to the exercise of this consent, and in order to facilitate ongoing consultation.
9. THAT the consent holder shall, within one year of the commencement of this consent, provide a report on the feasibility of collecting, extracting, venting, or combusting of landfill gas at the Colson Road landfill, to the satisfaction of the General Manager, Taranaki Regional Council.
10. THAT pursuant to section 128(1)(a) of the Resource Management Act 1991, the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2006, June 2012, June 2018 and/or within six months of the first exercise of this consent, for the purpose of reviewing the best practicable option or options available to reduce or remove any adverse effects on the environment, or to deal with any significant adverse ecological effects on any ecosystems, including but not limited to, habitats, plants, animals, microflora and microfauna, arising from discharges licensed by this consent.
11. THAT in addition to the review provisions of condition 10 above, pursuant to section 128(1)(a) of the Resource Management Act 1991 the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review within six months of receipt of the report required by condition 9, and/or during June 2001, June 2003, June 2006, June 2012 and/or June 2018, for the purpose of considering the options of collecting, extracting, venting or combusting landfill gas.

Signed at Stratford on 21 March 1999

For and on behalf of  
TARANAKI REGIONAL COUNCIL

  
\_\_\_\_\_  
GENERAL MANAGER





**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

Please quote our file number  
on all correspondence

Name of  
Consent Holder: New Plymouth District Council  
Private Bag 2025  
NEW PLYMOUTH

Consent Granted  
Date: 11 June 2003

**Conditions of Consent**

Consent Granted: To discharge stormwater [due to earthworks in providing an area for Stage 3 of the municipal landfill] onto land and into the Puremu Stream a tributary of the Mangaone Stream in the Waiwhakaiho catchment at or about GR: P19:074-372

Expiry Date: 1 June 2020

Review Date(s): June 2004, June 2006, June 2008, June 2014

Site Location: Colson Road Landfill, Colson Road, New Plymouth

Legal Description: Sec 223 Hua Dist Blk VI Paritutu SD

Catchment: Waiwhakaiho

Tributary: Mangaone  
Puremu

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

[www.trc.govt.nz](http://www.trc.govt.nz)

## Consent 6177-1

### General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), 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 water quality of uncontaminated stormwater discharge to the Puremu Stream shall meet the following criteria:

pH	6.5-8.5
suspended solids	maximum concentration of 100gm <sup>-3</sup>
ammoniacal nitrogen	maximum concentration of 0.5 gm <sup>-3</sup> as nitrogen
2. No leachate discharge shall be permitted by the exercise of this consent.
3. All stormwater diversion and channels shall be designed, constructed and maintained so as to prevent or minimise erosion of the channel in all circumstances.
4. Any discharge shall not alter to a conspicuous extent the natural colour or clarity of the receiving water in the Puremu Stream.
5. There shall be no significant adverse impact upon natural aquatic life downstream of the landfill as a result of the exercise of this permit.
6. Monitoring of surface waters on or in the vicinity of the site shall be undertaken to the satisfaction of the Chief Executive, Taranaki Regional Council.
7. The consent holder shall prepare and maintain a management plan and site contingency plan for the site and associated activities on the site, to the satisfaction of the Chief Executive, Taranaki Regional Council.
8. The consent holder shall prepare and maintain a site erosion and sediment control management plan for the site and associated activities on the site, to the satisfaction of the Chief Executive, Taranaki Regional Council.
9. The consent holder shall at all times adopt the best practicable option, as defined in the Resource Management Act 1991, to prevent or minimise any or likely adverse effects on the environment associated with the discharges of stormwater from the site, including but not limited to the collection, containment and removal from the site of any discharge of contaminated stormwater.
10. The consent holder shall repair and rehabilitate any land made unstable and any erosion occurring due to the construction or maintenance of the diversion channels.

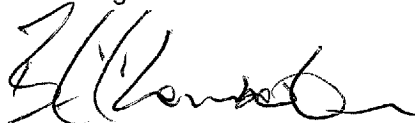


Consent 6177-1

11. The consent holder shall maintain stormwater drains, sediment detention ponds, and ground contours at the site, in order to minimise stormwater movement across, or ponding on the site, to the satisfaction of the Chief Executive, Taranaki Regional Council.
12. After allowing for reasonable mixing the consent holder shall ensure that the discharge shall not give rise to any of the following effects in the receiving waters of the Puremu Stream:
  - a) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended material;
  - b) any conspicuous change in 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.
  - f) an increase in the temperature of the Puremu Stream by more than 2.0 degrees Celsius.
13. 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 2004 and/or June 2006 and/or 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.

Signed at Stratford on 11 June 2003

For and on behalf of  
Taranaki Regional Council



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Chief Executive



## **Appendix II**

### **Biomonitoring reports for Colson Road landfill**



To Job Manager, Scott Cowperthwaite  
From Scientific Officer, Brooke Thomas  
Report No BT025  
Document No 1392586  
Date 27 August 2014

## **Biomonitoring of the Puremu and Manganaha Streams in relation to the New Plymouth District Council Colson Road landfill, November 2013**

### **Introduction**

New Plymouth District Council hold resource consents to authorise discharges to land and to water in relation to the operations of the Colson Road Landfill, in New Plymouth. The resource consents most relevant to this biological survey are summarised in Table 1 below.

**Table 1** Summary of discharge consents held by NPDC which are of most relevance to this biological survey.

Consent	Purpose
2370	To discharge leachate to groundwater and into the Puremu Stream
4619	To discharge stormwater and leachate to land and into the Puremu Stream
4620	To discharge stormwater into Puremu Stream
4621	To discharge contaminants into land

The Colson Road land fill site has been opened up, filled and capped off progressively in stages since it was established (Figure 1). Stages 1 and 2 of the landfill site have been completed and, at present the landfill is operating in the stage 3 area of the site. A section of the site is also dedicated to the management of composting waste.

Leachate from stages two and three is collected and directed to the New Plymouth Municipal Wastewater Treatment Plant. Leachate from stage one and stormwater from these areas including the access road are directed towards the Puremu Stream which flows through the landfill site. Stormwater from the compost area and from clean areas surrounding the stage 3 area of the site is directed to a large 'stormwater pond' which then discharges into an unnamed tributary of the Puremu Stream. There may also be some stormwater runoff and groundwater seepage from the landfill towards the Manganaha Stream which runs along the north-eastern boundary of the land fill.

Biological surveys have been undertaken on the Puremu Stream since 1986, to assess potential adverse effects of leachate from the landfill on the macroinvertebrate communities of the stream. Further to this, biological monitoring has been undertaken on the Manganaha Stream since 1994 to assess the effects of seepage from the landfill site on the macroinvertebrate communities in the stream.

Results of freshwater biological surveys performed in relation to the Colson Road landfill since the 2000-2001 monitoring year are discussed in numerous biomonitoring reports listed in the references.

## Methods

This survey was undertaken on 26 November 2013 at two previously established sampling sites in the Puremu Stream catchment and at two established sites in the Manganaha Stream (Figure 1 and Table 2). A third site located in an unnamed tributary of the Puremu Stream (PT1), which was routinely monitored in previous surveys, had been significantly modified by instream activities prior to the spring 2012 survey, and as a result, a new site was established 50m upstream. This is the third survey undertaken at this site.

Site 1 is a 'control' site on the Puremu Stream located upstream of the landfill site and site 2 is also located on this stream, but downstream of stage one and two areas. PT1 is located downstream of the large 'stormwater pond' discussed above. Site M4 is located on the Manganaha Stream downstream of an unnamed tributary which drains from the eastern side of the landfill site and site M6 is situated approximately 500 metres downstream of M4.

The standard '400 ml sweep-sampling' technique was used to collect streambed macroinvertebrates from site 1 in the Puremu stream and from PT1 in an unnamed tributary of the Puremu Stream. This 'sweep-sampling' technique is very similar to Protocol C2 (semi-quantitative methods for soft-bottomed streams) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

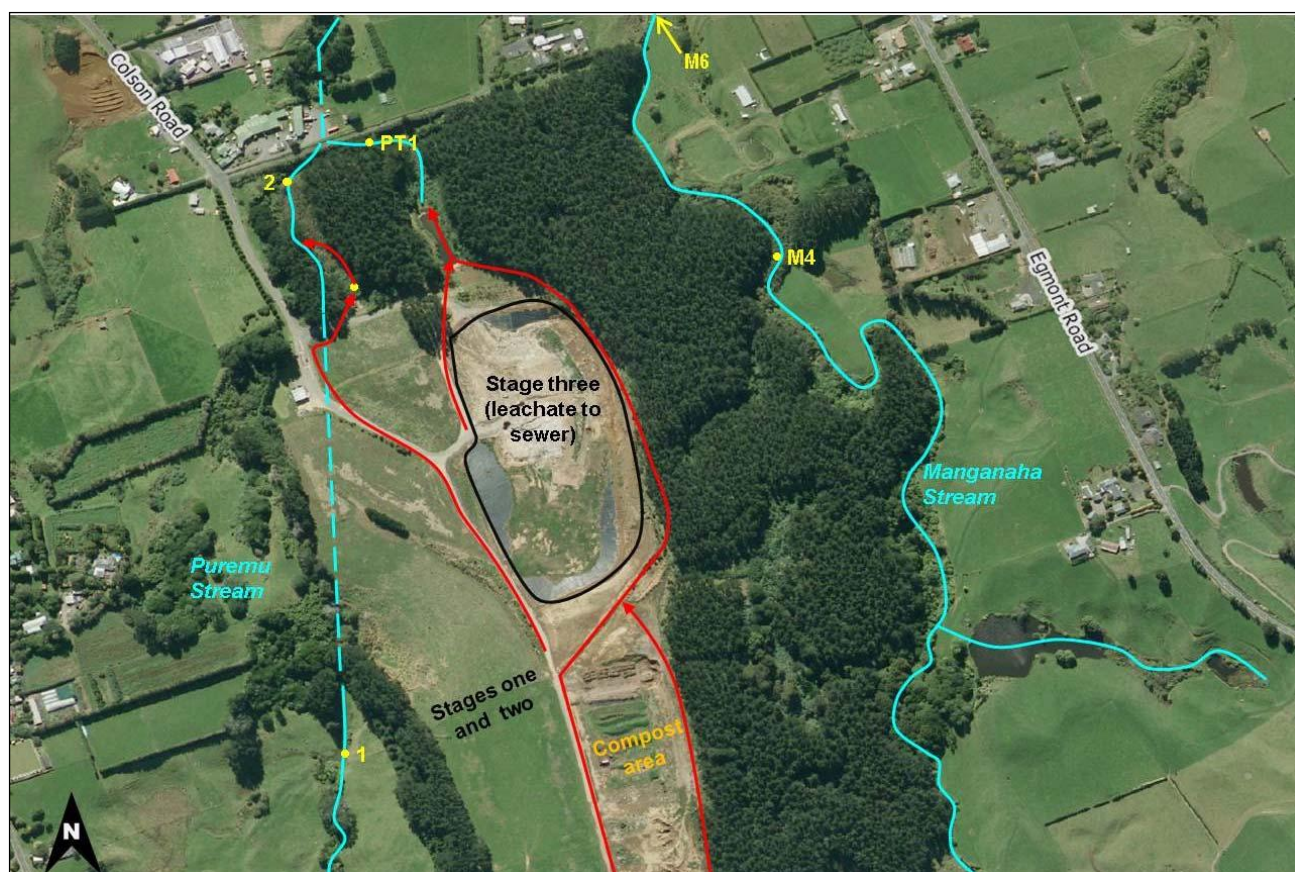
The standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from site 2 in the Puremu Stream and sites M4 and M6 in the Manganaha stream. This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

**Table 2** Biomonitoring sites in the Puremu and Manganaha Streams related to the Colson Road Landfill

Stream	Site No.	Site Code	Location	Sampling method
Puremu stream	1	PMU000104	Upstream of the landfill	Sweep-sampling
	2	PMU000110	400 metres downstream landfill	Kick-sampling
Unnamed tributary of Puremu Stream	PT1	PMU000108	60 metres upstream of the confluence with Puremu Stream	Sweep-sampling
Manganaha Stream	M4	MNH000190	10 metres downstream of an unnamed tributary of the Manganaha Stream	Kick-sampling
	M6	MNH000260	500 downstream of site M4	Kick-sampling

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.



**Figure 1** Biomonitoring sites related to the Colson Road landfill, New Plymouth. The red lines on the aerial photograph indicate the direction of stormwater runoff from the land fill site.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. Averaging the scores from a list of taxa taken from one site and multiplying by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value.

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	<span style="background-color: #00FFFF; display: inline-block; width: 20px; height: 10px;"></span>
Very Good	120-140	<span style="background-color: #00FF00; display: inline-block; width: 20px; height: 10px;"></span>
Good	100-119	<span style="background-color: #FFFF00; display: inline-block; width: 20px; height: 10px;"></span>
Fair	80-99	<span style="background-color: #FFFF00; display: inline-block; width: 20px; height: 10px;"></span>
Poor	60-79	<span style="background-color: #FFA500; display: inline-block; width: 20px; height: 10px;"></span>
Very Poor	<60	<span style="background-color: #FF0000; display: inline-block; width: 20px; height: 10px;"></span>

A semi-quantitative MCI value (SQMCI<sub>s</sub>) 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<sub>s</sub> is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower.

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 these organisms is an indicator of organic enrichment within a stream.

## **Results and discussion**

At the time of this November 2013 biomonitoring survey, the water temperatures in the Puremu Stream and tributary ranged from 18.0 °C to 21.2°C. Site 1 in the Puremu Stream had an uncoloured, clear and very slow flow, closely resembling a swamp. At site 2 the stream had a brown, clear and low flow. The unnamed tributary of the Puremu Stream at PT1 had a low and slow flow of brown, clear water. Iron oxide accumulations were significant at site 2 and to a lesser extent at site PT1, while site 1 was affected by silt.

At site 1 the substrate consisted predominantly of wood and root with silt, while the substrate at site PT1 was predominantly silt, with some sand and fine and coarse gravels. The substrate sampled at site 2 was predominantly comprised of silt with some sand, fine and coarse gravels and cobbles. Partial shading of the bed was recorded at site 2 and site PT1, with site 1 being completely unshaded.

No periphyton was recorded at any sites in the Puremu Stream. Previous surveys typically recorded significant amounts of pine needles at PT1, but with the more recent location of this site this is no longer the case. Macrophytes dominated the bed of the stream at site 1 and site PT1 at the time of this survey. No macrophytes were recorded at site 2. No unusual bacterial, fungal or protozoan growths were found by microscopic examination of the samples for 'heterotrophic growths' at any of the Puremu Stream sites in this November 2013 survey.

The Manganaha Stream had a steady, uncoloured and cloudy flow at site M4 and a grey and cloudy flow at site M6. The water temperature at site M4 was 17.1°C and at site M6, 17.2°C. Site M4 was completely shaded, while site M6 was partially shaded. The substrate at site M4 consisted principally of willow roots with some silt, while site M6 primarily consisted of silt and coarse gravels with some sand, fine gravel and cobbles. Neither site M4 or M6 supported any algal growth. No unusual bacterial, fungal or protozoan growths were found in the Manganaha Stream by the microscopic examination of the samples for 'heterotrophic growths'.

## **Macroinvertebrate communities**

A summary of the results of previous macroinvertebrate surveys performed at the sites used in the current survey is presented in Table 3 together with current results.



**Table 3** Numbers of taxa and MCI values recorded in previous surveys performed at sites in the Puremu and Manganaha Streams and a tributary of the Puremu Stream in relation to the Colson Road landfill since July 1986, together with current results.

Site No.	Number of taxa				MCI values			SQMCI <sub>s</sub> values			
	No. samples	Range	Median	Current survey	Range	Median	Current Survey	No. of samples	Range	Median	Current survey
1	41	8-27	18	19	60-90	74	74	27	1.4-5.0	3.8	2.4
2	53	7-24	17	10	51-87	73	52	27	1.5-3.9	3.1	1.7
PT1*	26	11-22	16	20	55-79	71	79	25	1.2-3.7	2.7	2.2
M4	36	11-25	19	21	76-104	88	96	27	2.3-6.9	4.7	6.0
M6	30	12-27	19	24	58-100	84	86	27	2.8-6.8	4.1	4.6

\* Summary statistics given for PT1 combine data for sites PMU000108 and PMU000109.

## Puremu Stream

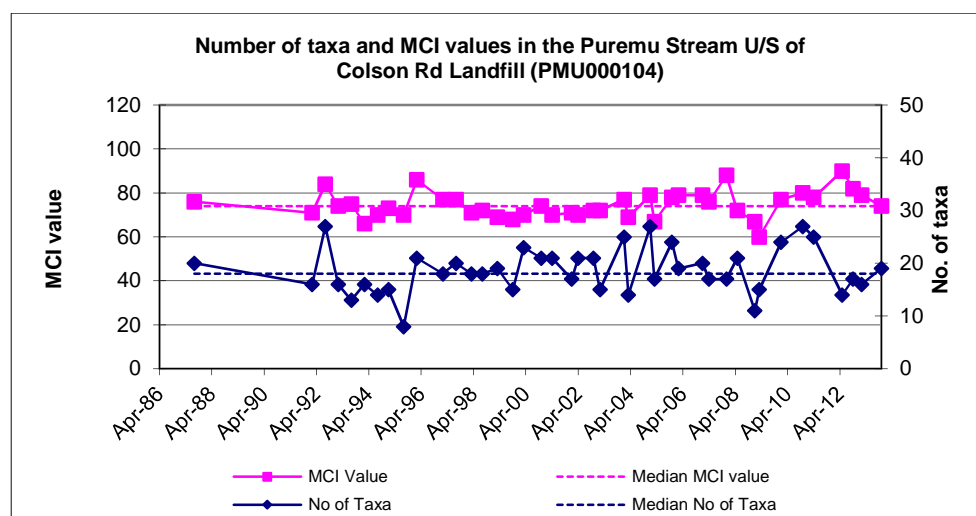
The current results for the Puremu Stream and the unnamed tributary of the Puremu Stream are presented in Table 4 below.

**Table 4** Macroinvertebrate fauna of the Puremu Stream (sites 1 & 2) and tributary (site PT1) in relation to the Colson Road landfill sampled on 26 November 2013

Taxa List	Site Number	MCI score	Site 1	Site 2	Site PT1
	Site Code		PMU000104	PMU000110	PMU000108
	Sample Number		FWB13368	FWB13369	FWB13370
COELENTERATA	Coelenterata	3	C	C	-
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	C	-	-
NEMERTEA	Nemertea	3	R	R	R
NEMATODA	Nematoda	3	C	-	-
ANNELIDA (WORMS)	Oligochaeta	1	VA	VA	A
HIRUDINEA (LEECHES)	Hirudinea	3	-	-	R
MOLLUSCA	<i>Physa</i>	3	C	-	-
	<i>Potamopyrgus</i>	4	VA	A	-
	Sphaeriidae	3	R	R	-
CRUSTACEA	Ostracoda	1	VA	R	VA
	<i>Paracalliope</i>	5	A	-	A
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	C	-	-
	<i>Zephlebia group</i>	7	R	-	-
ODONATA (DRAGONFLIES)	<i>Xanthocnemis</i>	4	R	-	-
HEMIPTERA (BUGS)	<i>Sigara</i>	3	-	-	R
COLEOPTERA (BEETLES)	Dytiscidae	5	-	-	R
	Scirtidae	8	-	-	R
TRICHOPTERA (CADDISFLIES)	<i>Hydrobiosis</i>	5	C	-	-
	<i>Polypsectropus</i>	6	-	-	R
	<i>Triplectides</i>	5	C	-	R
DIPTERA (TRUE FLIES)	<i>Paralimnophila</i>	6	-	-	R
	<i>Zelandotipula</i>	6	-	-	R
	<i>Chironomus</i>	1	-	-	R
	Orthocladiinae	2	A	A	C
	<i>Polypedilum</i>	3	-	C	-
	Tanypodinae	5	R	-	A
	Tanytarsini	3	A	-	-
	Ceratopogonidae	3	-	-	R
	Empididae	3	-	R	R
	Muscidae	3	-	-	R
	<i>Austrosimulium</i>	3	C	R	-
	Stratiomyidae	5	-	-	R
ACARINA (MITES)	Acarina	5	-	-	R
No of taxa			19	10	20
MCI			74	52	79
SQMCIs			2.4	1.7	2.2
EPT (taxa)			4	0	2
%EPT (taxa)			21	0	10
'Tolerant' taxa		'Moderately sensitive' taxa	'Highly sensitive' taxa		
R = Rare      C = Common      A = Abundant      VA = Very Abundant      XA = Extremely Abundant					

### Site 1 (PMU000104)

A total taxa richness of 19 taxa was recorded at site 1 in this early summer survey (Table 3 and Figure 2). This result was one taxon more than the historical median.



**Figure 2** Number of macroinvertebrate taxa and MCI values recorded at site 1 in the Puremu Stream, upstream of Colson Road Landfill since April 1987

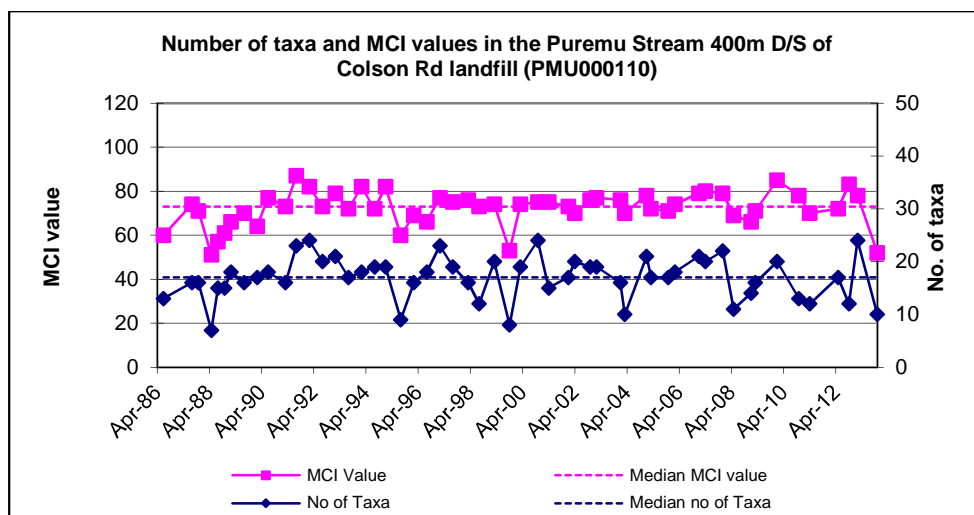
The community at this site was characterised by one 'moderately sensitive' taxon (amphipod (*Paracalliope*) and five 'tolerant' taxa (oligochaete worms, *Potamopyrgus* snails, orthoclad midges, ostracod seed shrimps and chironomid midge larvae (*Tanytarsini*)). This community assemblage reflected the prevalence of macrophyte habitat recorded at this site and the very low flow that was recorded at the time of this survey (Table 4).

In this survey only (32%) of the community consisted of 'sensitive' taxa, which resulted in the MCI score of 74 units, the same as the median score recorded at this site previously and five units less than that recorded in the previous survey (Table 3 and Figure 2). The numerical dominance by three 'tolerant' taxa resulted in a SQMCI<sub>s</sub> score of 2.4 units (Table 4). This score was a significant 1.4 units below that recorded in the previous survey and also the median score recorded for the site (Stark, 1998) (Table 3).

The significant reduction in SQMCI<sub>s</sub> score recorded from the previous survey was due to several significant changes in the abundance of taxa. In particular, the reduction in SQMCI<sub>s</sub> score can be attributed to the significant decrease in abundances within two 'sensitive' taxa and significant increase in abundances within four 'tolerant' taxa. Characteristic taxa were otherwise relatively similar between the current and previous surveys, with four of the seven dominant taxa found during both surveys. These results reflected a macrophyte associated community assemblage that had been impacted by very low flows.

### Site 2 (PMU000110)

A low number of taxa (10) was recorded at this site, seven taxa less than the median of previous surveys at this site, and 14 taxa less than the richness recorded in the previous survey and only three taxa more than the minimum richness recorded at this site to date (Table 3 and Figure 3).



**Figure 3** Taxa numbers and MCI values recorded at site 2, 400 m downstream of Colson Rd Landfill

No 'sensitive' taxa were present in this community, which was characterised by three 'tolerant' taxa (oligochaete worms, *Potamopyrgus* snails, and orthoclad midges) (Table 4).

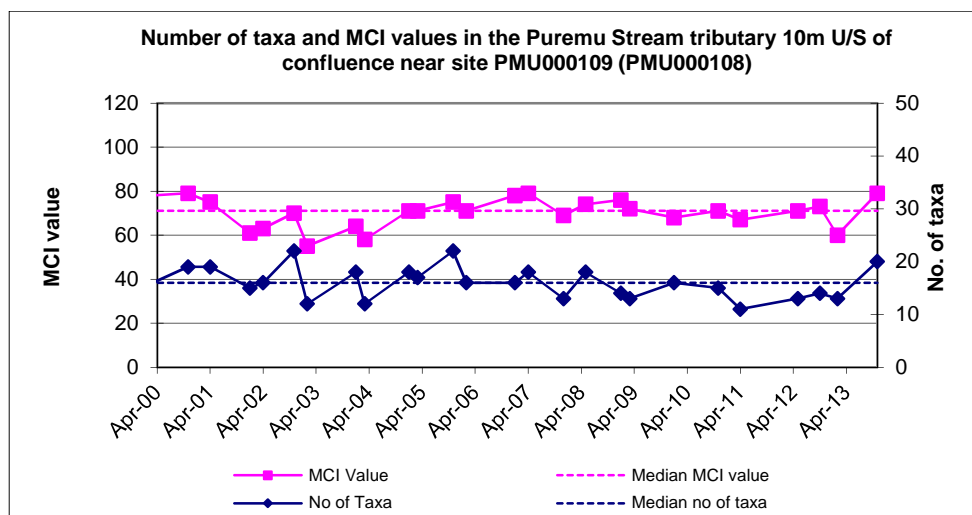
The lack of 'sensitive' taxa recorded at this site (when compared with the previous survey (38%)) resulted in a reduced MCI score of 52 units, which was a very significant 21 units fewer than the historical median for the site and a very significant 22 units lower than the MCI score recorded at site 1 (Stark, 1998) (Table 3 and Figure 3).

The numerical dominance by 'tolerant taxa' only, resulted in a very low SQMCI score of 1.7 units. This score was significantly lower (by 1.4 units) than the historical median for the site and significantly lower than that recorded upstream at site 1 (Stark, 1998) (Table 3).

These results suggest that the health of the macroinvertebrate community at site 2 was much poorer than that recorded at site 1, possibly due to differences in habitat and sampling technique between the sites. The health of the community at site 2 had changed significantly from that recorded by the previous survey, which again may have been due to variability in the habitat sampled, the main difference being the substrate (predominantly silt rather than willow root) sampled at the time of the current survey. However, when the overall macroinvertebrate assemblage downstream at site 2 is compared with the historical results for this site, there is limited indication of a degradation caused by any discharge and/or seepage from the landfill between these two sites, and it is likely that the changes recorded reflect the limited habitat available at this site at the time of this survey.

#### Site PT1 (PMU000108)

Twenty taxa were recorded at site PT1 in the unnamed tributary of the Puremu Stream, four taxa more than the historical median for the site and a higher richness than recorded at sites 1 and 2 in the Puremu Stream (Table 3 and Figure 4).



**Figure 4** Numbers of taxa and MCI values recorded to date at site PT1, downstream of Colson Road Landfill

The community at site PT1 was characterised by two 'tolerant' taxa (oligochaete worms, and ostracod seed shrimps) and two 'moderately sensitive' taxa (amphipods (*Paracalliope*) and Tanypod midges) (Table 4). The equal proportions of 'tolerant' and 'moderate' taxa and absence of 'highly sensitive' taxa were reflected in the MCI score of 79 units, which indicated 'poor' biological health, and was similar to the median MCI score for the site (Table 3 and Figure 4). This MCI score was also significantly higher than site 2 in the Puremu Stream but similar to site 1 (Stark, 1998).

One low scoring 'tolerant' taxon numerically dominated the community at this site in the current survey which resulted in the low SQMCI<sub>s</sub> score of 2.2 units, an insignificant 0.5 units lower than the historical median score for the site, but 1.0 unit higher than the minimum score previously recorded. This SQMCI<sub>s</sub> score was not significantly different to that recorded at sites 1 and 2 (Stark, 1998), and indicated poor physicochemical water quality and/or habitat quality at this site.

## Manganaha Stream

The results for the current survey of the Manganaha Stream are presented in Table 5 below.

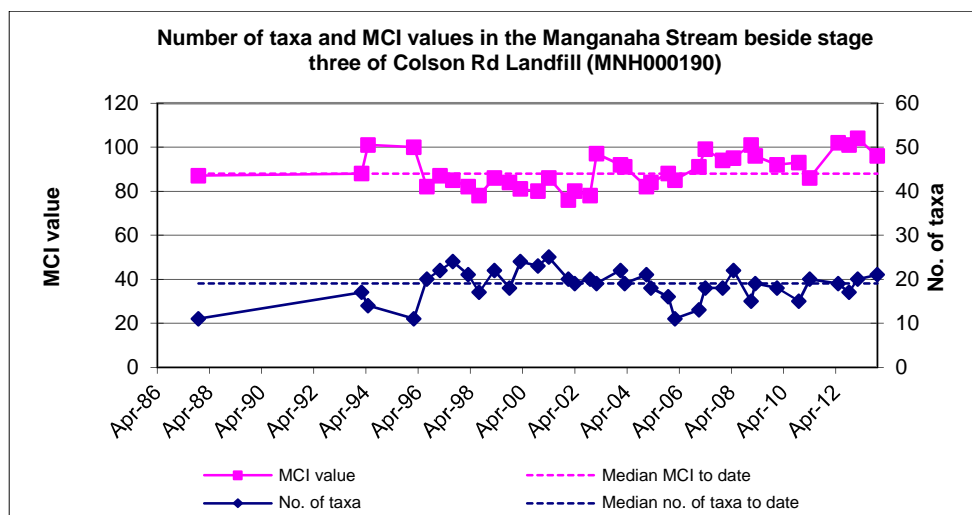
**Table 5** Macroinvertebrate fauna of the Manganaha Stream in relation to the Colson Road landfill sampled on 26 November 2013

Taxa List	Site Number	MCI score	Site M4	Site M6
	Site Code		MNH000190	MNH000260
	Sample Number		FWB13371	FWB13372
COELENTERATA	Coelenterata	3	R	R
NEMERTEA	Nemertea	3	R	-
NEMATODA	Nematoda	3	R	-
ANNELIDA (WORMS)	Oligochaeta	1	C	A
	Lumbricidae	5	R	R
MOLLUSCA	<i>Physa</i>	3	-	R
	<i>Potamopyrgus</i>	4	A	R
	Sphaeriidae	3	-	R
CRUSTACEA	Ostracoda	1	-	C
	Isopoda	5	R	R
	<i>Paracalliope</i>	5	A	A
	Talitridae	5	R	-
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	VA	C
	<i>Coloburiscus</i>	7	A	A
	<i>Zephlebia group</i>	7	-	R
PLECOPTERA (STONEFLIES)	<i>Acroperla</i>	5	R	-
COLEOPTERA (BEETLES)	Ptilodactylidae	8	R	-
MEGALOPTERA (DOBSONFLIES)	<i>Archichauliodes</i>	7	R	-
TRICHOPTERA (CADDISFLIES)	Ecnomidae/Psychomyiidae	6	R	C
	<i>Hydrobiosis</i>	5	C	C
	<i>Orthopsyche</i>	9	C	A
	<i>Tripletides</i>	5	C	C
DIPTERA (TRUE FLIES)	<i>Aphrophila</i>	5	-	R
	Hexatomini	5	-	R
	<i>Chironomus</i>	1	-	C
	Orthocladiinae	2	C	A
	<i>Polypedium</i>	3	R	R
	Tanypodinae	5	-	R
	Empididae	3	-	R
	<i>Austrosimulium</i>	3	C	R
No of taxa			21	24
MCI			96	86
SQMCIs			6.0	4.6
EPT (taxa)			7	7
%EPT (taxa)			33	29
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa

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

### Site M4 (MNH000190)

Twenty-one taxa were recorded at site M4 in this survey which was two taxa more than the historical median for the site (Table 3 and Figure 5). The community at this site was characterised by three 'moderately sensitive' taxa (amphipods (*Paracalliope*) and mayflies (*Austroclima* and *Coloburiscus*)) and one 'tolerant' taxon (snail (*Potamopyrgus*)) (Table 5), which was indicative of moderate preceding water quality.



**Figure 5** Taxa numbers and MCI values recorded at site M4, in the Manganaha Stream adjacent to Colson Road landfill

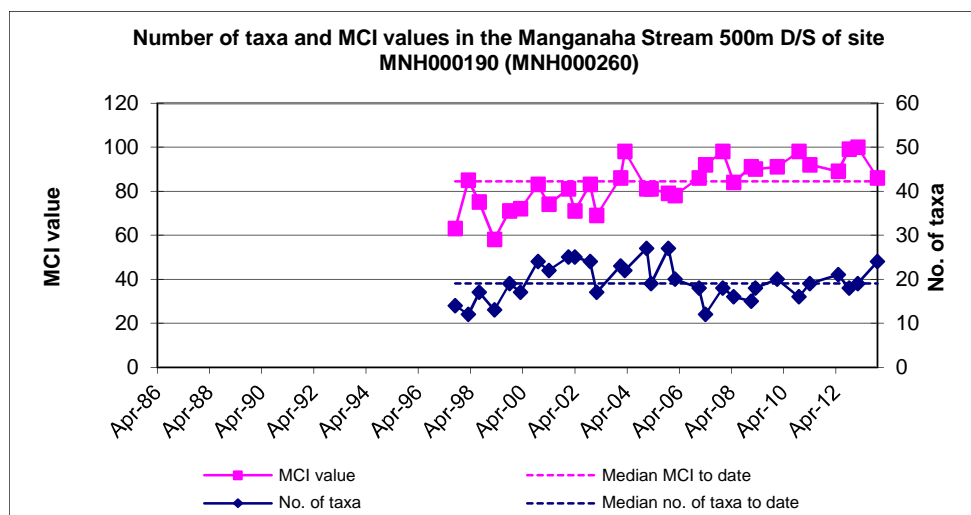
The moderate proportion of ‘sensitive’ taxa (62% of total taxa) in the community resulted in the MCI score of 96 units, which was an insignificant (Stark, 1998) eight units higher than the historical median and an insignificant eight units lower than the previous survey results for this site (Table 3 and Figure 5).

The numerical dominance of the ‘moderately sensitive’ mayfly *Austroclima*, resulted in a relatively high SQMCI<sub>S</sub> value of 6.0 units, which was significantly (Stark, 1998) higher than the median score recorded at this site.

### Site M6 (MNH000260)

Twenty-four taxa were recorded at site M6, five taxa more than the median for the site and three taxa more than that recorded at the upstream site M4 (Table 3 and Figure 6 ).

In this survey, the dominant taxa at this site included one ‘highly sensitive’ taxon (net-building caddisfly (*Orthopsyche*)), two ‘moderately sensitive’ taxa (mayfly (*Coloburiscus*) and amphipod (*Paracalliope*)), and two ‘tolerant’ taxa (oligochaete worms and orthoclad midges). The community structure was similar to that found at site M4, with four significant differences in taxon abundance between the two sites (Table 5). This may be attributed to changes in habitat, primarily the change from willow roots to silt and gravel sampled by this survey.



**Figure 6** Taxa numbers and MCI values recorded at site M6, in the Manganaha Stream downstream of Colson Road landfill

The moderate proportion of 'tolerant' taxa (46%) in the community resulted in an MCI score of 86 units, 10 units lower than the MCI score recorded at site M4. This score was two units higher than the historical median recorded for the site and a significant (Stark, 1998) 14 units lower than that recorded by the previous survey at this site (Table 3 and Figure 6).

The SQMCI<sub>s</sub> score dropped to 4.6 units, which was 0.5 unit greater than the median for this site, but significantly (Stark, 1998) lower than that recorded upstream in the current survey (Table 3). It was slightly higher than that recorded by the previous survey (0.5 units).

It is apparent from the current survey that there was no significant difference in biological health or community composition between sites M4 and M6. Other than the significant reduction in SQMCI<sub>s</sub> score at site M6 and a number of significant differences in individual taxon abundances, which were attributable to the change in habitat, the results from the two sites on Manganaha Stream in this survey were indicative of good preceding water quality and there was no indication of effects from any discharge from the landfill on the macroinvertebrate community of the stream.

In general, the results of this survey were indicative of poor to fair biological health and differences in habitat between sites were the most likely cause of any significant differences recorded in the macroinvertebrate communities between sites in the Puremu Stream and in the Manganaha Stream as opposed to effects from discharges from the landfill.

## Summary and conclusions

The Council's standard 'kick-sampling' technique was used at three sites (site 2, M4 and M6) and the 'sweep-sampling' technique was used at two sites (sites 1 and PT1), to collect streambed macroinvertebrates from the Puremu and Manganaha Streams on 26 November 2013. Samples were sorted and identified to provide number of taxa (richness), MCI and SQMCI<sub>s</sub> 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<sub>s</sub> 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<sub>s</sub> between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

This early summer macroinvertebrate survey indicated that the discharge of treated stormwater and leachate discharged from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Puremu and Manganaha Streams.

In this survey, the MCI score recorded at the upstream control site on the Puremu Stream was the same as the median score for this site, and only slightly less than that recorded in the previous survey. The SQMCI<sub>s</sub> score however was significantly lower than the median and significantly lower than that recorded in the previous survey. This was largely attributable to the reduced abundance within two 'moderately sensitive' taxa, and the increased abundances within four 'tolerant' taxa. These results were indicative of poor preceding water quality, and reflected a macrophyte associated community assemblage, that had been impacted by very low flows.

Site 2 in the Puremu Stream recorded significantly reduced MCI and SQMCI<sub>s</sub> scores, when compared with site 1 (Stark, 1998), and were both well below the historical medians for this site. Differences in habitat quality and sampling method were considered to be the most likely reasons for the variation in results from that recorded at site 1. However, site PT1 in the unnamed tributary recorded MCI and SQMCI<sub>s</sub> scores similar to historical medians. This was an indication of a slight recovery from the instream excavation that had occurred prior to the previous survey. These works resulted in the removal of instream habitat, providing a poor habitat favouring 'tolerant' taxa. The current scores were a reflection of poor water quality and/or habitat quality at this site.

The upstream site on the Manganaha Stream recorded MCI and SQMCI<sub>s</sub> scores above historical medians. These results reflected the moderately high proportion of 'sensitive' taxa and the numerical dominance of three 'sensitive' taxa, in particular the abundance of one 'moderately sensitive' mayfly taxon, and were indicative of moderate preceding water quality.

In the Manganaha Stream downstream of the landfill site, the macroinvertebrate community contained a moderate proportion of 'tolerant' taxa which resulted in an MCI score of 86 units. This MCI score was not significantly lower than that recorded at the upstream site, indicating only a minor difference in biological health. However, the SQMCI<sub>s</sub> score recorded at site M6 of 4.6 units was significantly lower than that recorded at site M4, an indication of the reduced habitat quality at this site.

No undesirable biological growths were detected at any of these sites during this November 2013 survey.

Overall, the results of this survey were indicative of poor (site 1) and very poor (site 2) biological health in the Puremu Stream and poor biological health at site PT1 in the unnamed tributary of the Puremu Stream. The results in the Manganaha Stream were indicative of fair biological health at sites M4 and M6. The poor flow and habitat conditions observed in the Puremu Stream and unnamed tributary of the Puremu Stream at the time of this survey were the most likely reason for this, rather than to the effects of the discharges from the landfill. In summary, these results were not indicative of any significant adverse effects on either the



Puremu Stream or the Manganaha Stream from the discharges from the Colson Road Landfill at the time of this survey.

## References

- Australian & New Zealand Environment & Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand, 2000: Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Volumes 1 and 2. Environment Australia.
- Dunning KJ, 2002a: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, January 2002. TRC report KD94.
- Dunning KJ, 2002b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, April 2002. TRC report KD125.
- Hope KJ, 2005: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, March 2005. TRC report KD033.
- Hope KJ, 2005: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, November 2005. TRC Report KH076.
- Fowles CR and Hope KJ, 2005: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, January 2005. TRC report CF383.
- Fowles CR and Moore SC, 2004: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, March 2004. TRC report CF333.
- Jansma B, 2006: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, February 2006. TRC report BJ008.
- Jansma B, 2007a: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, January 2007. TRC report BJ022.
- Jansma B, 2007b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, April 2007. TRC report BJ023.
- Jansma B, 2008a: Biomonitoring of the Mangati Stream, in relation to the Bell Block industrial area, February 2008. TRC report BJ043.

- Jansma B, 2008b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, December 2007. TRC report BJ044.
- Jansma B, 2008c: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, May 2008. TRC report BJ045.
- Jansma B, 2009a: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, January 2009. TRC report BJ074.
- Jansma B, 2009b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, March 2009. TRC report BJ075.
- Jansma B, 2010: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, January 2010. TRC report BJ126.
- Jansma B, 2011: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, November 2010. TRC report BJ163.
- Jansma B, 2011: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, April 2011. TRC report BJ164.
- Jansma B and Smith K, 2013: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, October 2012. TRC report BJ205.
- Jansma B and Smith K, 2013: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, February 2013. TRC report BJ206.
- McWilliam H, 2000b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, March 2000. TRC report HM211.
- McWilliam H, 2001a: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, November 2000. TRC report HM241.
- McWilliam H, 2001b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, April 2001. TRC report HM252.
- Moore S, 2003a: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, November 2002. TRC report SM573.
- Moore S, 2003b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, 17 February 2003. TRC report SM580.
- Moore S and Colgan BG, 2004: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, 6 January 2004. TRC report SM586.
- Smith K, 2012: Biomonitoring of the Puremu and Manganaha Streams in relation to the New Plymouth District Council Colson Road landfill, May 2012. TRC report KS009.
- Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. *Water and Soil Miscellaneous Publication No. 87*.
- 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 Taranaki Regional Council'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.
- Taranaki Regional Council, 2000: New Plymouth District Council New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 1999-2000. Technical Report 2000-38.



To Job Manager, Scott Cowperthwaite  
From Scientific Officer, Brooke Thomas  
Report No BT026  
Document No 1393398  
Date 29 August 2014

## **Biomonitoring of the Puremu and Manganaha Streams in relation to the New Plymouth District Council Colson Road landfill, February 2014**

### **Introduction**

New Plymouth District Council hold resource consents to authorise discharges to land and to water in relation to the operations of the Colson Road Landfill, in New Plymouth. The resource consents most relevant to this biological survey are summarised in Table 1 below.

**Table 1** Summary of discharge consents held by NPDC which are of most relevance to this biological survey.

Consent	Purpose
2370	To discharge leachate to groundwater and into the Puremu Stream
4619	To discharge stormwater and leachate to land and into the Puremu Stream
4620	To discharge stormwater into Puremu Stream
4621	To discharge contaminants into land

The Colson Road land fill site has been opened up, filled and capped off progressively in stages since it was established (Figure 1). Stages 1 and 2 of the landfill site have been completed and, at present the landfill is operating in the stage 3 area of the site. A section of the site is also dedicated to the management of composting waste.

Leachate from stages two and three is collected and directed to the New Plymouth Municipal Wastewater Treatment Plant. Leachate from stage one and stormwater from these areas including the access road are directed towards the Puremu Stream which flows through the landfill site. Stormwater from the compost area and from clean areas surrounding the stage 3 area of the site is directed to a large 'stormwater pond' which then discharges into an unnamed tributary of the Puremu Stream. There may also be some stormwater runoff and groundwater seepage from the landfill towards the Manganaha Stream which runs along the north-eastern boundary of the land fill.

Biological surveys have been undertaken on the Puremu Stream since 1986, to assess potential adverse effects of leachate from the landfill on the macroinvertebrate communities of the stream. Further to this, biological monitoring has been undertaken on the Manganaha Stream since 1994 to assess the effects of seepage from the landfill site on the macroinvertebrate communities in the stream.

Results of freshwater biological surveys performed in relation to the Colson Road landfill since the 2000-2001 monitoring year are discussed in numerous biomonitoring reports listed in the references.

## Methods

This survey was undertaken on 04 February 2014 at two previously established sampling sites in the Puremu Stream catchment and at two established sites in the Manganaha Stream (Figure 1 and Table 2). A third site located in an unnamed tributary of the Puremu Stream (PT1), which was routinely monitored in previous surveys, had been significantly modified by instream activities prior to the spring 2012 survey, and as a result, a new site was established 50m upstream. This is the fourth survey undertaken at this site.

Site 1 is a 'control' site on the Puremu Stream located upstream of the landfill site and site 2 is also located on this stream, but downstream of stage one and two areas. PT1 is located downstream of the large 'stormwater pond' discussed above. Site M4 is located on the Manganaha Stream downstream of an unnamed tributary which drains from the eastern side of the landfill site and site M6 is situated approximately 500 metres downstream of M4.

The standard '400 ml sweep-sampling' technique was used to collect streambed macroinvertebrates from site 1 in the Puremu stream and from PT1 in an unnamed tributary of the Puremu Stream. This 'sweep-sampling' technique is very similar to Protocol C2 (semi-quantitative methods for soft-bottomed streams) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

The standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from site M6 in the Manganaha stream. This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

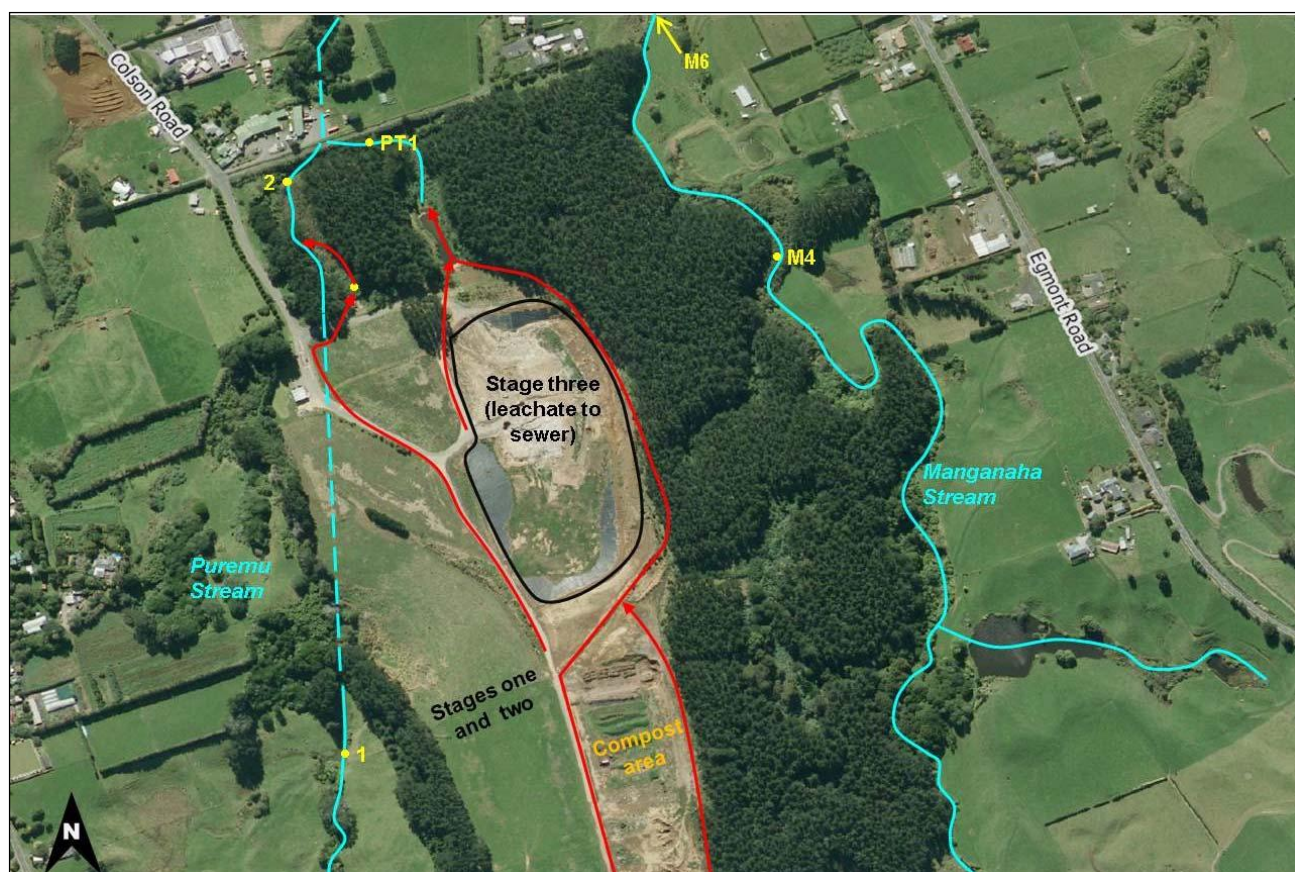
A combination of the 'sweep-sampling' and 'kick-sampling' techniques was used to collect streambed macroinvertebrates from site 2 in the Puremu Stream and site M4 from the Manganaha Stream.

**Table 2** Biomonitoring sites in the Puremu and Manganaha Streams related to the Colson Road Landfill

Stream	Site No.	Site Code	Location	Sampling method
Puremu stream	1	PMU000104	Upstream of the landfill	Sweep-sampling
	2	PMU000110	400 metres downstream landfill	Sweep-kick sampling
Unnamed tributary of Puremu Stream	PT1	PMU000108	60 metres upstream of the confluence with Puremu Stream	Sweep-sampling
Manganaha Stream	M4	MNH000190	10 metres downstream of an unnamed tributary of the Manganaha Stream	Sweep-kick sampling
	M6	MNH000260	500 downstream of site M4	Kick-sampling

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.



**Figure 1** Biomonitoring sites related to the Colson Road landfill, New Plymouth. The red lines on the aerial photograph indicate the direction of stormwater runoff from the land fill site.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. Averaging the scores from a list of taxa taken from one site and multiplying by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value.

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	<span style="background-color: #00FFFF; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span>
Very Good	120-140	<span style="background-color: #00FF00; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span>
Good	100-119	<span style="background-color: #FFFF00; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span>
Fair	80-99	<span style="background-color: #FFFF00; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span>
Poor	60-79	<span style="background-color: #FFA500; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span>
Very Poor	<60	<span style="background-color: #FF0000; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span>

A semi-quantitative MCI value (SQMCI<sub>s</sub>) 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<sub>s</sub> is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower.

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 these organisms is an indicator of organic enrichment within a stream.

## Results and discussion

At the time of this February 2014 biomonitoring survey, the water temperatures in the Puremu Stream and tributary ranged from 15.7 °C to 17.8°C. Site 1 in the Puremu Stream had an uncoloured, clear and very slow flow, closely resembling a swamp. At site 2 the stream had a brown, dirty and very low flow. The unnamed tributary of the Puremu Stream at PT1 had a very low and very slow flow of brown, clear water. Iron oxide accumulations were significant at site 2 and to a lesser extent at site PT1, while site 1 was affected by silt.

The substrate at site 1 and site PT1 was comprised of silt, while the substrate at site 2 was predominantly silt, with some sand and fine and coarse gravels. The substrate sampled at site 2 was predominantly comprised of silt with some sand, wood and root and fine and coarse gravels. Partial shading of the streambed was recorded at sites 2 and PT1, with site 1 being completely unshaded.

No periphyton was recorded at any sites in the Puremu Stream. Macrophytes dominated the bed of the stream at site 1 and site PT1 at the time of this survey. No macrophytes were recorded at site 2. No unusual bacterial, fungal or protozoan growths were found by microscopic examination of the samples for 'heterotrophic growths' at any of the Puremu Stream sites in this February 2014 survey.

The Manganaha Stream had a slow, low, grey and cloudy flow at site M4 and a grey, cloudy very low and slow flow at M6. The water temperature at site M4 was 15.9°C and at site M6, 16.0°C. Site M4 was partially shaded, while site M6 was not shaded. The substrate at site M4 consisted principally of willow roots and silt, while site M6 primarily consisted of silt. Site M4 did not support any algal growth while site M6 supported patchy filaments. No unusual bacterial, fungal or protozoan growths were found in the Manganaha Stream by the microscopic examination of the samples for 'heterotrophic growths'.



## Macroinvertebrate communities

A summary of the results of previous macroinvertebrate surveys performed at the sites used in the current survey is presented in Table 3, together with current results.

**Table 3** Numbers of taxa and MCI values recorded in previous surveys performed at sites in the Puremu and Manganaha Streams and a tributary of the Puremu Stream in relation to the Colson Road landfill since July 1986, together with current results.

Site No.	Number of taxa				MCI values			SQMCI <sub>s</sub> values			
	No. samples	Range	Median	Current survey	Range	Median	Current Survey	No. of samples	Range	Median	Current survey
1	42	8-27	18	23	60-90	74	77	28	1.4-5.0	3.8	3.3
2	54	7-24	17	12	51-87	73	73	28	1.5-3.9	3.1	1.2
PT1*	27	11-22	16	20	55-79	71	73	26	1.2-3.7	2.7	3.0
M4	37	11-25	19	18	76-104	88	91	28	2.3-6.9	4.8	5.8
M6	31	12-27	19	22	58-100	84	92	28	2.8-6.8	4.1	5.5

\* Summary statistics given for PT1 combine data for sites PMU000108 and PMU000109.

## Puremu Stream

The current results for the Puremu Stream and the unnamed tributary of the Puremu Stream are presented in Table 4 below.

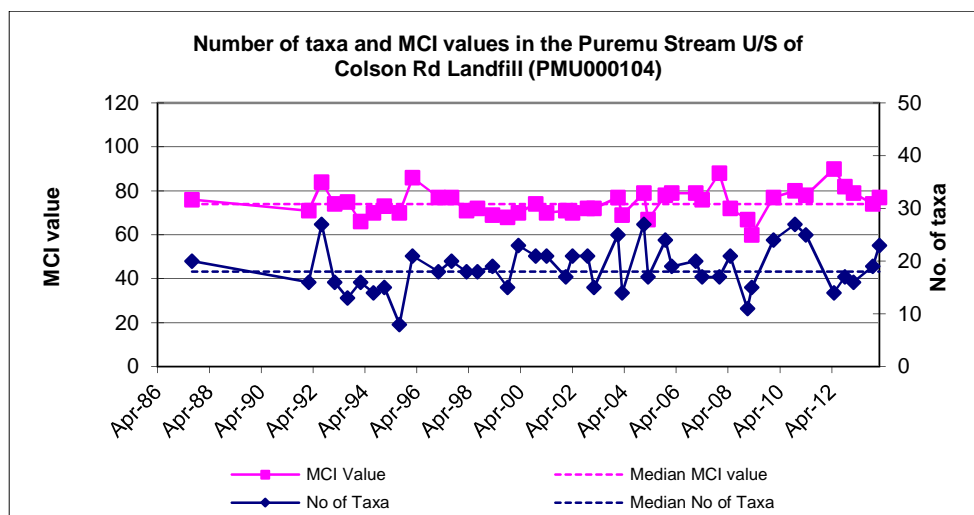
**Table 4** Macroinvertebrate fauna of the Puremu Stream (sites 1 & 2) and tributary (site PT1) in relation to the Colson Road landfill sampled on 04 February 2014

Taxa List	Site Number	MCI score	Site 1	Site 2	Site PT1
	Site Code		PMU000104	PMU000110	PMU000108
	Sample Number		FWB14048	FWB14051	FWB14052
COELENTERATA	Coelenterata	3	R	-	-
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	C	-	C
NEMERTEA	Nemertea	3	R	-	A
NEMATODA	Nematoda	3	-	-	C
ANNELIDA (WORMS)	Oligochaeta	1	A	XA	A
MOLLUSCA	Lymnaeidae	3	R	-	R
	<i>Physa</i>	3	R	-	R
	<i>Potamopyrgus</i>	4	XA	A	-
	Sphaeriidae	3	C	C	-
CRUSTACEA	Ostracoda	1	XA	VA	XA
	Isopoda	5	-	-	R
	<i>Paracalliope</i>	5	XA	R	XA
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	R	-	-
	<i>Zephlebia group</i>	7	C	-	-
ODONATA (DRAGONFLIES)	<i>Xanthocnemis</i>	4	C	R	C
HEMIPTERA (BUGS)	<i>Sigara</i>	3	-	-	C
COLEOPTERA (BEETLES)	Dytiscidae	5	R	-	-
TRICHOPTERA (CADDISFLIES)	<i>Hydrobiosis</i>	5	R	-	-
	<i>Polypsectropus</i>	6	R	C	-
	<i>Triplectides</i>	5	A	C	-
DIPTERA (TRUE FLIES)	<i>Paralimnophila</i>	6	-	R	R
	<i>Zelandotipula</i>	6	R	-	R
	<i>Chironomus</i>	1	-	C	-
	Orthoclaudiinae	2	R	-	R
	<i>Polypedilum</i>	3	-	C	-
	Tanypodinae	5	-	-	C
	Tanytarsini	3	C	-	-
	Ceratopogonidae	3	R	-	R
	<i>Paradixa</i>	4	C	-	-
	Empididae	3	-	-	R
	Ephydriidae	4	-	-	R
	<i>Austrosimulium</i>	3	C	-	-
	Stratiomyidae	5	-	-	R
ACARINA (MITES)	Acarina	5	-	C	A
No of taxa			23	12	20
MCI			77	73	73
SQMCIs			3.3	1.2	3.0
EPT (taxa)			5	2	0
%EPT (taxa)			22	17	0
'Tolerant' taxa		'Moderately sensitive' taxa	'Highly sensitive' taxa		

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

### Site 1 (PMU000104)

A total taxa richness of 23 taxa was recorded at site 1 in this late summer survey (Table 3 and Figure 2). This result was five taxa more than the historical median.



**Figure 2** Number of macroinvertebrate taxa and MCI values recorded at site 1 in the Puremu Stream, upstream of Colson Road Landfill since April 1987

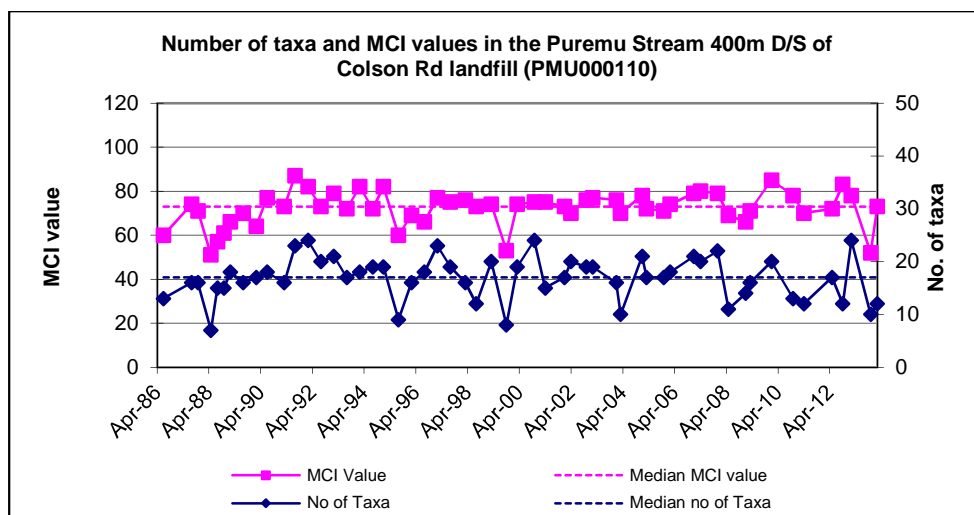
The community at this site was characterised by two ‘moderately sensitive’ taxa (amphipod (*Paracalliope*) and stick caddis (*Triplectides*)) and three ‘tolerant’ taxa (oligochaete worms, (*Potamopyrgus*) snail, and ostracod seed shrimps). This community assemblage reflected the prevalence of macrophyte habitat recorded at this site and the very low flow that was recorded at the time of this survey (Table 4).

In this survey (35%) of the community consisted of ‘sensitive’ taxa, which resulted in the MCI score of 77 units, three units more than the median score recorded at this site previously and three units more than that recorded in the previous survey (Table 3 and Figure 2). The numerical dominance by two ‘tolerant’ taxa was tempered by the numerical dominance of one ‘sensitive’ taxon, resulting the SQMCI<sub>s</sub> score of 3.3 units (Table 4). This score was a significant 0.9 unit more than that recorded in the previous survey and similar to the median score recorded for the site (Stark, 1998) (Table 3).

These results reflect poor preceding biological quality at this site, the result of the very low and slow flows recorded at the time of this survey.

### Site 2 (PMU000110)

A low number of taxa (12) was recorded at this site, five taxa less than the median of previous surveys at this site, and two taxa more than the richness recorded in the previous survey (Table 3 and Figure 3).



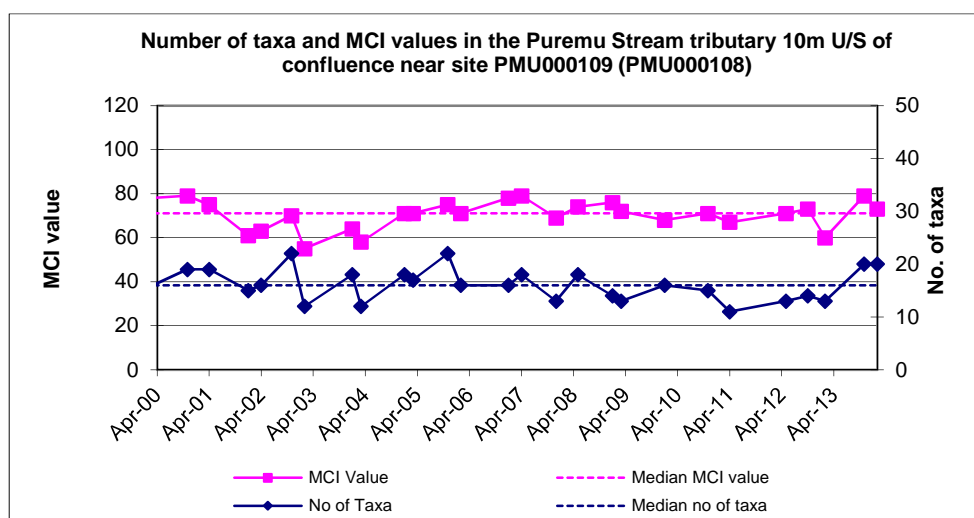
**Figure 3** Taxa numbers and MCI values recorded at site 2, 400 m downstream of Colson Rd Landfill

The community at this site was characterised by three 'tolerant' taxa (oligochaete worms, (*Potamopyrgus*) snails and ostracod seed shrimps) (Table 4). This community assemblage reflected the very low and slow flows recorded and the thick iron oxide sediment that was abundant at the time of this survey.

In this survey a moderately low proportion (58%) of the community consisted of 'sensitive' taxa, which resulted in the MCI score of 73 units, the same as the median score recorded at this site previously and a very significant (Stark, 1998) 21 units more than that recorded in the previous survey (Table 3 and Figure 2). The numerical dominance by 'tolerant' taxa resulted in the SQMCI<sub>s</sub> score of 1.2 units (Table 4). This score was an insignificant 0.5 unit less than that recorded by the previous survey but a significant (1.9 units) less than the median score recorded for the site and a significant 2.1 units less than that recorded upstream at site 1 (Stark, 1998) (Table 3).

#### Site PT1 (PMU000108)

Twenty taxa were recorded at site PT1 in the unnamed tributary of the Puremu Stream, four taxa more than the historical median for the site and a higher richness than recorded at site 2 in the Puremu Stream (Table 3 and Figure 4).



**Figure 4** Numbers of taxa and MCI values recorded to date at site PT1, downstream of Colson Road Landfill

The community at site PT1 was characterised by three 'tolerant' taxa (oligochaete worms, proboscis worms (Nemertea) and ostracod seed shrimps) and two 'moderately sensitive' taxa (amphipods (*Paracalliope*) and Acarina mites) (Table 4). The moderately high proportion of 'tolerant' taxa and absence of 'highly sensitive' taxa were reflected in the MCI score of 73 units, which indicated 'poor' biological health, and was similar to the median MCI score for the site (Table 3 and Figure 4). This MCI score was also similar to site 1 and to site 2 in the Puremu Stream.

One low scoring 'tolerant' taxon and one 'moderately sensitive' taxon numerically dominated the community at this site in the current survey which resulted in the SQMCI<sub>s</sub> score of 3.0 units, an insignificant 0.3 units higher than the historical median score for the site, but 1.8 units higher than the minimum score previously recorded. This SQMCI<sub>s</sub> score was significantly different to that recorded at sites 2 but not site 1 (Stark, 1998).

## Manganaha Stream

The results for the current survey of the Manganaha Stream are presented in Table 5 below.

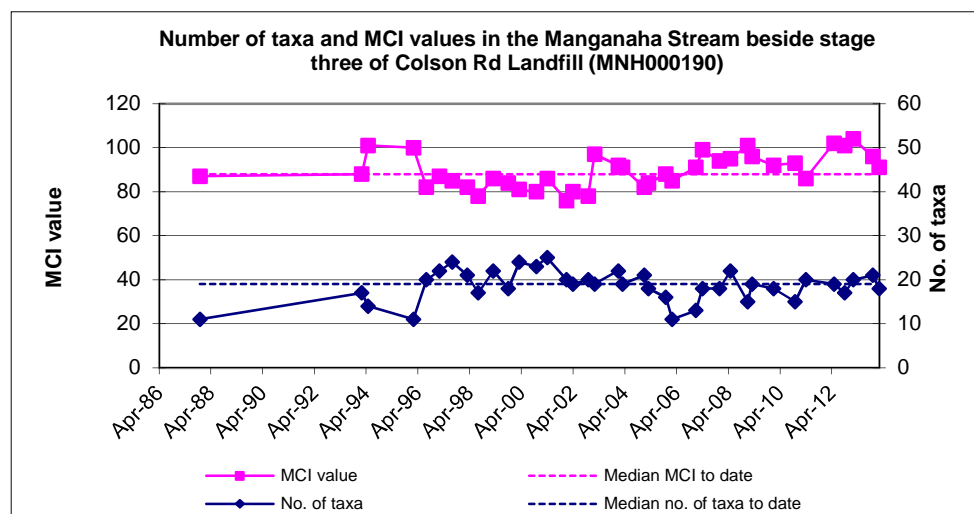
**Table 5** Macroinvertebrate fauna of the Manganaha Stream in relation to the Colson Road landfill sampled on 04 February 2014

Taxa List	Site Number	MCI score	Site M4	Site M6
	Site Code		MNH000190	MNH000260
	Sample Number		FWB14049	FWB14050
COELENTERATA	Coelenterata	3	R	-
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	R	R
NEMERTEA	Nemertea	3	R	R
NEMATODA	Nematoda	3	R	R
ANNELIDA (WORMS)	Oligochaeta	1	A	A
MOLLUSCA	<i>Potamopyrgus</i>	4	A	R
CRUSTACEA	<i>Paracalliope</i>	5	VA	VA
	Paraleptamphopidae	5	R	-
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	VA	VA
	<i>Coloburiscus</i>	7	VA	A
	<i>Zephlebia group</i>	7	R	C
PLECOPTERA (STONEFLIES)	<i>Acroperla</i>	5	-	R
ODONATA (DRAGONFLIES)	<i>Antipodochlora</i>	5	R	-
MEGALOPTERA (DOBSOFLIES)	<i>Archichauliodes</i>	7	-	R
TRICHOPTERA (CADDISFLIES)	Ecnomidae/Psychomyiidae	6	-	R
	<i>Hydrobiosis</i>	5	C	C
	<i>Orthopsyche</i>	9	C	C
	<i>Psilochorema</i>	6	-	R
	<i>Oxyethira</i>	2	-	R
	<i>Tripletides</i>	5	C	C
DIPTERA (TRUE FLIES)	<i>Aphrophila</i>	5	-	C
	Hexatomini	5	R	-
	Orthoclaadiinae	2	R	C
	<i>Polypedilum</i>	3	-	C
	Empididae	3	-	R
	<i>Austrosimulium</i>	3	C	R
No of taxa			18	22
MCI			91	92
SQMCI <sub>s</sub>			5.8	5.5
EPT (taxa)			6	9
%EPT (taxa)			33	41
'Tolerant' taxa		'Moderately sensitive' taxa	'Highly sensitive' taxa	

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

### Site M4 (MNH000190)

Eighteen taxa were recorded at site M4 in this survey which was one taxon less than the historical median for the site (Table 3 and Figure 5). The community at this site was characterised by three 'moderately sensitive' taxa (amphipods (*Paracalliope*) and mayflies (*Austroclima* and *Coloburiscus*)) and two 'tolerant' taxa (snail (*Potamopyrgus*) and oligochaete worms) (Table 5), which was indicative of moderate preceding water quality.



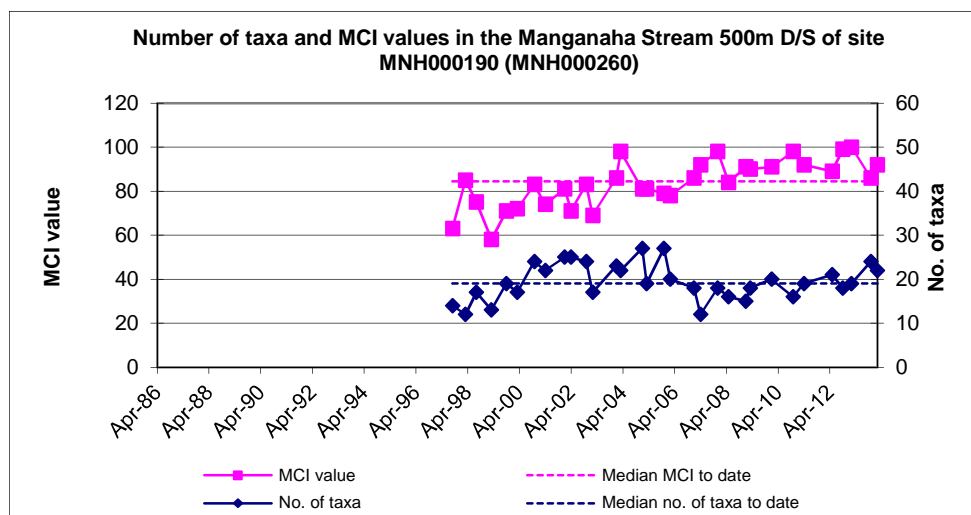
**Figure 5** Taxa numbers and MCI values recorded at site M4, in the Manganaha Stream adjacent to Colson Road landfill

The moderate proportion of 'sensitive' taxa (56% of total taxa) in the community resulted in the MCI score of 91 units, which was an insignificant (Stark, 1998) three units higher than the historical median and an insignificant five units lower than the previous survey results for this site (Table 3 and Figure 5).

The numerical dominance by three 'moderately sensitive' taxa, resulted in a relatively high SQMCI<sub>s</sub> value of 5.8 units, which was significantly (Stark, 1998) higher than the median score recorded at this site.

### Site M6 (MNH000260)

Twenty-two taxa were recorded at site M6, three taxa more than the median for the site and four taxa more than that recorded at the upstream site M4 (Table 3 and Figure 6). In this survey, the dominant taxa at this site included the same three 'moderately sensitive' taxa recorded at site M4, with the addition of one 'tolerant' taxon (oligochaete worms). The community structure was similar to that found at site M4, with only three significant differences in taxon abundance between the two sites (Table 5). This may be attributed to changes in habitat, primarily the change from mainly willow roots to silt sampled by this survey, but also to the change in sampling technique used at this site.



**Figure 6** Taxa numbers and MCI values recorded at site M6, in the Manganaha Stream downstream of Colson Road landfill

The moderate proportion of 'tolerant' taxa (45%) in the community resulted in an MCI score of 92 units, 1 unit higher than the MCI score recorded at site M4. This score was eight units higher than the historical median recorded for the site and an insignificant (Stark, 1998) six units higher than that recorded by the previous survey at this site (Table 3 and Figure 6).

The SQMCI<sub>s</sub> score dropped to 5.5 units, which was a significant 1.4 units greater than the median for this site, and an insignificant 0.3 unit lower than that recorded upstream in the current survey (Table 3). It was however significantly higher (by 0.9 unit) than that recorded by the previous survey (Stark, 1998).

It is apparent from the current survey that there was no significant difference in biological health or community composition between sites M4 and M6. The results from the two sites on Manganaha Stream in this survey were indicative of moderate preceding water quality and there was no indication of effects from any discharge from the landfill on the macroinvertebrate community of the stream.

## Summary and conclusions

The standard 'sweep-sampling' technique was used at site 1 and site PT1, and the 'kick-sampling' technique was used at site M6 to collect streambed macroinvertebrates from the Puremu and Manganaha Streams on 04 February 2014. A combination of these two techniques was used to collect streambed macroinvertebrates from site 2 and site M4. Samples were sorted and identified to provide number of taxa (richness), MCI and SQMCI<sub>s</sub> 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<sub>s</sub> 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<sub>s</sub> between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

This late summer macroinvertebrate survey indicated that the discharge of treated stormwater and leachate discharged from the Colson Road landfill site had not had any detrimental effect on the macroinvertebrate communities of the Puremu and Manganaha Streams.

In this survey, the MCI score recorded at the upstream control site on the Puremu Stream was the slightly higher than the median score for this site, and slightly higher than that recorded in the previous survey. The SQMCI<sub>s</sub> score was only slightly lower than the median but significantly higher than that recorded in the previous survey. These results were indicative of poor preceding water quality, and reflected a macrophyte associated community assemblage, that had been impacted by very low flows.

Site 2 in the Puremu Stream recorded a similar MCI score but significantly reduced SQMCI<sub>s</sub> score, when compared with site 1 (Stark, 1998). The reduced SQMCI<sub>s</sub> score was also well below the historical median for this site. These results were largely indicative of differences in habitat between the upstream site 1 and downstream at sites 2 rather of any effects from the landfill discharges on the macroinvertebrate communities. The Puremu Stream at site 1 was open and the bed was dominated by macrophytes, whereas the stream at site 2 was partially shaded, with the silted bed covered significantly in a mixture of iron oxide accumulations, leaf and wooded debris. Overall, the differences in SQMCI<sub>s</sub> scores between site 2 and site 1 reflect more the improvement at site 1 than a deterioration at site 2.

Site PT1 in the unnamed tributary recorded MCI and SQMCI<sub>s</sub> scores slightly above historical medians, however were still a reflection of poor water quality and/or habitat quality at this site.

The upstream site on the Manganaha Stream recorded MCI and SQMCI<sub>s</sub> scores above historical medians. These results reflected the moderately high proportion of 'sensitive' taxa and the numerical dominance of three 'sensitive' taxa, and were indicative of moderate preceding water quality. In the Manganaha Stream downstream of the landfill site, the macroinvertebrate community also contained a moderately high proportion of 'sensitive' taxa which resulted in an MCI score of 92 units. Both the SQMCI<sub>s</sub> and MCI scores were very similar to that recorded at the upstream site, indicating only a minor difference in biological health.

No undesirable biological growths were detected at any of these sites during this February 2014 survey.

Overall, the results of this survey were indicative of poor biological health in the Puremu Stream and in the unnamed tributary of the Puremu Stream. The results in the Manganaha Stream were indicative of fair biological health at sites M4 and M6. The poor flow and habitat conditions observed in the Puremu Stream and unnamed tributary of the Puremu Stream at the time of this survey were the most likely reason for this, rather than to the effects of the discharges from the landfill. In summary, these results were not indicative of any significant adverse effects on either the Puremu Stream or the Manganaha Stream from the discharges from the Colson Road Landfill at the time of this survey.



## References

- Australian & New Zealand Environment & Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand, 2000: Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Volumes 1 and 2. Environment Australia.
- Dunning KJ, 2002a: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, January 2002. TRC report KD94.
- Dunning KJ, 2002b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, April 2002. TRC report KD125.
- Hope KJ, 2005: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, March 2005. TRC report KD033.
- Hope KJ, 2005: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, November 2005. TRC Report KH076.
- Fowles CR and Hope KJ, 2005: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, January 2005. TRC report CF383.
- Fowles CR and Moore SC, 2004: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, March 2004. TRC report CF333.
- Jansma B, 2006: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, February 2006. TRC report BJ008.
- Jansma B, 2007a: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, January 2007. TRC report BJ022.
- Jansma B, 2007b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, April 2007. TRC report BJ023.
- Jansma B, 2008a: Biomonitoring of the Mangati Stream, in relation to the Bell Block industrial area, February 2008. TRC report BJ043.

- Jansma B, 2008b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, December 2007. TRC report BJ044.
- Jansma B, 2008c: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, May 2008. TRC report BJ045.
- Jansma B, 2009a: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, January 2009. TRC report BJ074.
- Jansma B, 2009b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, March 2009. TRC report BJ075.
- Jansma B, 2010: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, January 2010. TRC report BJ126.
- Jansma B, 2011: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, November 2010. TRC report BJ163.
- Jansma B, 2011: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, April 2011. TRC report BJ164.
- Jansma B and Smith K, 2013: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, October 2012. TRC report BJ205.
- Jansma B and Smith K, 2013: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, February 2013. TRC report BJ206.
- McWilliam H, 2000b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, March 2000. TRC report HM211.
- McWilliam H, 2001a: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, November 2000. TRC report HM241.
- McWilliam H, 2001b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, April 2001. TRC report HM252.
- Moore S, 2003a: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, November 2002. TRC report SM573.
- Moore S, 2003b: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, 17 February 2003. TRC report SM580.
- Moore S and Colgan BG, 2004: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, 6 January 2004. TRC report SM586.
- Smith K, 2012: Biomonitoring of the Puremu and Manganaha Streams in relation to the New Plymouth District Council Colson Road landfill, May 2012. TRC report KS009.
- Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. *Water and Soil Miscellaneous Publication No. 87*.
- 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 Taranaki Regional Council'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.
- Taranaki Regional Council, 2000: New Plymouth District Council New Plymouth (Colson Road) Landfill Monitoring Programme Annual Report 1999-2000. Technical Report 2000-38.
- Thomas B, 2014: Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, November 2014. TRC report BT025.



**Appendix III**

**Groundwater Results**





## ANALYSIS REPORT

Page 1 of 6

<b>Client:</b>	Taranaki Regional Council	<b>Lab No:</b>	1280746	SPV2
<b>Contact:</b>	Scott Cowperthwaite C/- Taranaki Regional Council Private Bag 713 STRATFORD 4352	<b>Date Registered:</b>	28-May-2014	
		<b>Date Reported:</b>	10-Jun-2014	
		<b>Quote No:</b>	36283	
		<b>Order No:</b>	44723	
		<b>Client Reference:</b>	Groundwater	
		<b>Submitted By:</b>	Scott Cowperthwaite	

## Amended Report

This report replaces an earlier report issued on the 06 Jun 2014 at 4:50 pm  
The Sample Names of 1280746.4 and 5 have been amended as requested by the client.

Sample Type: Aqueous						
Sample Name:	GND0573 27-May-2014 8:45 am	GND1301 27-May-2014 11:15 am	GND0575 27-May-2014 11:10 am	GND0598 27-May-2014 11:45 am	GND0251 27-May-2014 11:35 am	
Lab Number:	1280746.1	1280746.2	1280746.3	1280746.4	1280746.5	
Individual Tests						
pH	pH Units	-	-	-	8.0	6.7
Electrical Conductivity (EC)	mS/m	-	-	-	37.3	16.4
Dissolved Aluminium	g/m <sup>3</sup>	< 0.003	< 0.003	0.015	0.006	0.014
Dissolved Arsenic	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved Beryllium	g/m <sup>3</sup>	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Boron	g/m <sup>3</sup>	0.021	0.019	0.018	0.050	0.012
Dissolved Cadmium	g/m <sup>3</sup>	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Chromium	g/m <sup>3</sup>	< 0.0005	0.0009	0.0008	< 0.0005	0.0008
Dissolved Cobalt	g/m <sup>3</sup>	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Dissolved Copper	g/m <sup>3</sup>	< 0.0005	< 0.0005	0.0006	0.0006	0.0006
Dissolved Iron	g/m <sup>3</sup>	< 0.02	< 0.02	< 0.02	0.36	< 0.02
Dissolved Lead	g/m <sup>3</sup>	0.00019	0.00013	< 0.00010	0.00031	< 0.00010
Dissolved Manganese	g/m <sup>3</sup>	0.0029	0.0024	0.0010	0.069	0.0009
Dissolved Selenium	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved Vanadium	g/m <sup>3</sup>	< 0.0010	0.0083	0.0105	< 0.0010	0.0013
Dissolved Zinc	g/m <sup>3</sup>	0.0033	0.0027	0.0048	0.0031	0.0037
Haloethers Trace in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Bis(2-chloroethyl)ether	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Bis(2-chloroisopropyl)ether	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
4-Bromophenyl phenyl ether	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
4-Chlorophenyl phenyl ether	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
3,3'-Dichlorobenzidine	g/m <sup>3</sup>	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
2,4-Dinitrotoluene	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,6-Dinitrotoluene	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrobenzene	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
N-Nitrosodi-n-propylamine	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
N-Nitrosodiphenylamine	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Aldrin	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
alpha-BHC	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
beta-BHC	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
delta-BHC	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005



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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked \*, which are not accredited.

Sample Type: Aqueous						
Sample Name:		GND0573 27-May-2014 8:45 am	GND1301 27-May-2014 11:15 am	GND0575 27-May-2014 11:10 am	GND0598 27-May-2014 11:45 am	GND0251 27-May-2014 11:35 am
Lab Number:		1280746.1	1280746.2	1280746.3	1280746.4	1280746.5
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
gamma-BHC (Lindane)	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
4,4'-DDD	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
4,4'-DDE	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
4,4'-DDT	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dieldrin	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Endosulfan I	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan II	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endosulfan sulfate	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Endrin ketone	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Heptachlor	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Heptachlor epoxide	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Hexachlorobenzene	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m <sup>3</sup>	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Acenaphthylene	g/m <sup>3</sup>	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Anthracene	g/m <sup>3</sup>	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Benzo[a]anthracene	g/m <sup>3</sup>	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Benzo[a]pyrene (BAP)	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Benzo[g,h,i]perylene	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Benzo[k]fluoranthene	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2-Chloronaphthalene	g/m <sup>3</sup>	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Chrysene	g/m <sup>3</sup>	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Dibenzo[a,h]anthracene	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Fluoranthene	g/m <sup>3</sup>	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Fluorene	g/m <sup>3</sup>	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Indeno(1,2,3-c,d)pyrene	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2-Methylnaphthalene	g/m <sup>3</sup>	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Naphthalene	g/m <sup>3</sup>	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Phenanthrene	g/m <sup>3</sup>	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Pyrene	g/m <sup>3</sup>	< 0.0003	< 0.0003	< 0.0003	< 0.0003	< 0.0003
Phenols Trace (drinkingwater) in SVOC Water Samples by GC-MS						
2-Chlorophenol	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2,4-Dichlorophenol	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2,4,6-Trichlorophenol	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4-Dimethylphenol	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
3 & 4-Methylphenol (m- + p-cresol)	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2-Methylphenol (o-Cresol)	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
2-Nitrophenol	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Pentachlorophenol (PCP)	g/m <sup>3</sup>	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Phenol	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
2,4,5-Trichlorophenol	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Diethylphthalate	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dimethylphthalate	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Di-n-butylphthalate	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Di-n-octylphthalate	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Plasticisers Trace (drinkingwater) in SVOC Water Samples by GCMS						
Bis(2-ethylhexyl)phthalate	g/m <sup>3</sup>	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003



Sample Type: Aqueous						
<b>Sample Name:</b>	GND0573 27-May-2014 8:45 am	GND1301 27-May-2014 11:15 am	GND0575 27-May-2014 11:10 am	GND0598 27-May-2014 11:45 am	GND0251 27-May-2014 11:35 am	
<b>Lab Number:</b>	1280746.1	1280746.2	1280746.3	1280746.4	1280746.5	
Plasticisers Trace (drinkingwater) in SVOC Water Samples by GCMS						
Di(2-ethylhexyl)adipate	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,2-Dichlorobenzene	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
1,3-Dichlorobenzene	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
1,4-Dichlorobenzene	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Hexachloroethane	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
1,2,4-Trichlorobenzene	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Other SVOC Trace in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m <sup>3</sup>	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Carbazole	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dibenzofuran	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Isophorone	g/m <sup>3</sup>	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
<b>Sample Name:</b>	GND1300 27-May-2014 9:30 am	GND0255 27-May-2014 9:15 am				
<b>Lab Number:</b>	1280746.6	1280746.7				
Individual Tests						
Dissolved Aluminium	g/m <sup>3</sup>	0.018	0.003	-	-	-
Dissolved Arsenic	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Dissolved Beryllium	g/m <sup>3</sup>	< 0.00010	< 0.00010	-	-	-
Dissolved Boron	g/m <sup>3</sup>	0.018	0.021	-	-	-
Dissolved Cadmium	g/m <sup>3</sup>	< 0.00005	0.00010	-	-	-
Dissolved Chromium	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Dissolved Cobalt	g/m <sup>3</sup>	< 0.0002	< 0.0002	-	-	-
Dissolved Copper	g/m <sup>3</sup>	0.0008	0.0009	-	-	-
Dissolved Iron	g/m <sup>3</sup>	< 0.02	< 0.02	-	-	-
Dissolved Lead	g/m <sup>3</sup>	< 0.00010	< 0.00010	-	-	-
Dissolved Manganese	g/m <sup>3</sup>	0.0036	0.0032	-	-	-
Dissolved Selenium	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Dissolved Vanadium	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Dissolved Zinc	g/m <sup>3</sup>	0.0034	0.0158	-	-	-
Haloethers Trace in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Bis(2-chloroethyl)ether	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Bis(2-chloroisopropyl)ether	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
4-Bromophenyl phenyl ether	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
4-Chlorophenyl phenyl ether	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
3,3'-Dichlorobenzidine	g/m <sup>3</sup>	< 0.003	< 0.003	-	-	-
2,4-Dinitrotoluene	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
2,6-Dinitrotoluene	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Nitrobenzene	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
N-Nitrosodi-n-propylamine	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
N-Nitrosodiphenylamine	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Aldrin	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
alpha-BHC	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
beta-BHC	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
delta-BHC	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
gamma-BHC (Lindane)	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
4,4'-DDD	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
4,4'-DDE	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-

Sample Type: Aqueous						
<b>Sample Name:</b>		GND1300 27-May-2014 9:30 am	GND0255 27-May-2014 9:15 am			
<b>Lab Number:</b>		1280746.6	1280746.7			
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
4,4'-DDT	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Dieldrin	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Endosulfan I	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Endosulfan II	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Endosulfan sulfate	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Endrin	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Endrin ketone	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Heptachlor	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Heptachlor epoxide	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Hexachlorobenzene	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m <sup>3</sup>	< 0.0003	< 0.0003	-	-	-
Acenaphthylene	g/m <sup>3</sup>	< 0.0003	< 0.0003	-	-	-
Anthracene	g/m <sup>3</sup>	< 0.0003	< 0.0003	-	-	-
Benzo[a]anthracene	g/m <sup>3</sup>	< 0.0003	< 0.0003	-	-	-
Benzo[a]pyrene (BAP)	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Benzo[g,h,i]perylene	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Benzo[k]fluoranthene	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
2-Chloronaphthalene	g/m <sup>3</sup>	< 0.0003	< 0.0003	-	-	-
Chrysene	g/m <sup>3</sup>	< 0.0003	< 0.0003	-	-	-
Dibenzo[a,h]anthracene	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Fluoranthene	g/m <sup>3</sup>	< 0.0003	< 0.0003	-	-	-
Fluorene	g/m <sup>3</sup>	< 0.0003	< 0.0003	-	-	-
Indeno(1,2,3-c,d)pyrene	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
2-Methylnaphthalene	g/m <sup>3</sup>	< 0.0003	< 0.0003	-	-	-
Naphthalene	g/m <sup>3</sup>	< 0.0003	< 0.0003	-	-	-
Phenanthrene	g/m <sup>3</sup>	< 0.0003	< 0.0003	-	-	-
Pyrene	g/m <sup>3</sup>	< 0.0003	< 0.0003	-	-	-
Phenols Trace (drinkingwater) in SVOC Water Samples by GC-MS						
2-Chlorophenol	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
2,4-Dichlorophenol	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
2,4,6-Trichlorophenol	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
2,4-Dimethylphenol	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
2-Methylphenol (o-Cresol)	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
2-Nitrophenol	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Pentachlorophenol (PCP)	g/m <sup>3</sup>	< 0.010	< 0.010	-	-	-
Phenol	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
2,4,5-Trichlorophenol	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Diethylphthalate	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Dimethylphthalate	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Di-n-butylphthalate	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Di-n-octylphthalate	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Plasticisers Trace (drinkingwater) in SVOC Water Samples by GCMS						
Bis(2-ethylhexyl)phthalate	g/m <sup>3</sup>	< 0.003	< 0.003	-	-	-
Di(2-ethylhexyl)adipate	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,2-Dichlorobenzene	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-

Sample Type: Aqueous						
<b>Sample Name:</b>		GND1300 27-May-2014 9:30 am	GND0255 27-May-2014 9:15 am			
<b>Lab Number:</b>		1280746.6	1280746.7			
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,3-Dichlorobenzene	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
1,4-Dichlorobenzene	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Hexachloroethane	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
1,2,4-Trichlorobenzene	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Other SVOC Trace in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m <sup>3</sup>	< 0.005	< 0.005	-	-	-
Carbazole	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Dibenzofuran	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Isophorone	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-

### Analyst's Comments

#### Samples 1-7 Comment:

It has been noted that the method performance for Hexachlorocyclopentadiene for SVOC analysis is not acceptable therefore we are unable to report this compound at this present time.

## SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Semivolatile Organic Compounds Trace in Water by GC-MS	Liquid/Liquid extraction, GPC cleanup (if required), GC-MS FS analysis	0.0003 - 0.010 g/m <sup>3</sup>	1-7
pH	pH meter. APHA 4500-H <sup>+</sup> B 22 <sup>nd</sup> ed. 2012.	0.1 pH Units	4-5
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22 <sup>nd</sup> ed. 2012.	0.1 mS/m	4-5
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.003 g/m <sup>3</sup>	1-7
Dissolved Arsenic	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0010 g/m <sup>3</sup>	1-7
Dissolved Beryllium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.00010 g/m <sup>3</sup>	1-7
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.005 g/m <sup>3</sup>	1-7
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.00005 g/m <sup>3</sup>	1-7
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0005 g/m <sup>3</sup>	1-7
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0002 g/m <sup>3</sup>	1-7
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0005 g/m <sup>3</sup>	1-7
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.02 g/m <sup>3</sup>	1-7
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.00010 g/m <sup>3</sup>	1-7
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0005 g/m <sup>3</sup>	1-7
Dissolved Selenium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0010 g/m <sup>3</sup>	1-7
Dissolved Vanadium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0010 g/m <sup>3</sup>	1-7
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0010 g/m <sup>3</sup>	1-7

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, reading "Carole Rodgers-Carroll". The signature is fluid and cursive, with the first name "Carole" being more prominent.

Carole Rodgers-Carroll BA, NZCS  
Client Services Manager - Environmental Division



## ANALYSIS REPORT

Page 1 of 3

<b>Client:</b>	Taranaki Regional Council	<b>Lab No:</b>	1248601	SPV1
<b>Contact:</b>	Scott Cowperthwaite	<b>Date Registered:</b>	15-Mar-2014	
	C/- Taranaki Regional Council	<b>Date Reported:</b>	27-Mar-2014	
	Private Bag 713	<b>Quote No:</b>	52567	
	STRATFORD 4352	<b>Order No:</b>	43704	
		<b>Client Reference:</b>	Groundwater	
		<b>Submitted By:</b>	Scott Cowperthwaite	

Sample Type: Aqueous						
Sample Name:		PMU100	PMU113			
Lab Number:		1248601.1	1248601.2			
Dissolved Aluminium	g/m <sup>3</sup>	< 0.003	< 0.003	-	-	-
Total Aluminium	g/m <sup>3</sup>	0.194	0.0134	-	-	-
Dissolved Arsenic	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Total Arsenic	g/m <sup>3</sup>	< 0.0011	< 0.0011	-	-	-
Dissolved Beryllium	g/m <sup>3</sup>	< 0.00010	< 0.00010	-	-	-
Total Beryllium	g/m <sup>3</sup>	< 0.00011	< 0.00011	-	-	-
Dissolved Boron	g/m <sup>3</sup>	0.017 #1	0.038	-	-	-
Total Boron	g/m <sup>3</sup>	0.0162 #1	0.038	-	-	-
Dissolved Cadmium	g/m <sup>3</sup>	< 0.00005	< 0.00005	-	-	-
Total Cadmium	g/m <sup>3</sup>	0.000055	< 0.000053	-	-	-
Dissolved Chromium	g/m <sup>3</sup>	< 0.0005	< 0.0005	-	-	-
Total Chromium	g/m <sup>3</sup>	< 0.00053	< 0.00053	-	-	-
Dissolved Cobalt	g/m <sup>3</sup>	0.0012	0.0008	-	-	-
Total Cobalt	g/m <sup>3</sup>	0.0044	0.00095	-	-	-
Dissolved Copper	g/m <sup>3</sup>	0.0006	0.0012	-	-	-
Total Copper	g/m <sup>3</sup>	0.00163	0.00138	-	-	-
Dissolved Iron	g/m <sup>3</sup>	< 0.02	< 0.02	-	-	-
Total Iron	g/m <sup>3</sup>	4.5	2.3	-	-	-
Dissolved Lead	g/m <sup>3</sup>	< 0.00010	< 0.00010	-	-	-
Total Lead	g/m <sup>3</sup>	0.00012	< 0.00011	-	-	-
Dissolved Manganese	g/m <sup>3</sup>	1.08	1.70	-	-	-
Total Manganese	g/m <sup>3</sup>	1.79	1.83	-	-	-
Dissolved Selenium	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Total Selenium	g/m <sup>3</sup>	< 0.0011	< 0.0011	-	-	-
Dissolved Vanadium	g/m <sup>3</sup>	< 0.0010	< 0.0010	-	-	-
Total Vanadium	g/m <sup>3</sup>	< 0.0011	< 0.0011	-	-	-
Dissolved Zinc	g/m <sup>3</sup>	0.0055	0.0030	-	-	-
Total Zinc	g/m <sup>3</sup>	0.0119	0.0043	-	-	-

### Analyst's Comments

#1 It has been noted that the result for the dissolved fraction was greater than that for the total fraction, but within analytical variation of the methods.

## SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Total Digestion	Boiling nitric acid digestion. APHA 3030 E 22 <sup>d</sup> ed. 2012 (modified).	-	1-2



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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked \*, which are not accredited.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 <sup>nd</sup> ed. 2012.	-	1-2
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.003 g/m <sup>3</sup>	1-2
Total Aluminium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012 / US EPA 200.8.	0.0032 g/m <sup>3</sup>	1-2
Dissolved Arsenic	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0010 g/m <sup>3</sup>	1-2
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012 / US EPA 200.8.	0.0011 g/m <sup>3</sup>	1-2
Dissolved Beryllium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.00010 g/m <sup>3</sup>	1-2
Total Beryllium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012 / US EPA 200.8.	0.00011 g/m <sup>3</sup>	1-2
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.005 g/m <sup>3</sup>	1-2
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0053 g/m <sup>3</sup>	1-2
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.00005 g/m <sup>3</sup>	1-2
Total Cadmium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012 / US EPA 200.8.	0.000053 g/m <sup>3</sup>	1-2
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0005 g/m <sup>3</sup>	1-2
Total Chromium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012 / US EPA 200.8.	0.00053 g/m <sup>3</sup>	1-2
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0002 g/m <sup>3</sup>	1-2
Total Cobalt	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012 / US EPA 200.8.	0.00021 g/m <sup>3</sup>	1-2
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0005 g/m <sup>3</sup>	1-2
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012 / US EPA 200.8.	0.00053 g/m <sup>3</sup>	1-2
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.02 g/m <sup>3</sup>	1-2
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.021 g/m <sup>3</sup>	1-2
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.00010 g/m <sup>3</sup>	1-2
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012 / US EPA 200.8.	0.00011 g/m <sup>3</sup>	1-2
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0005 g/m <sup>3</sup>	1-2
Total Manganese	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012 / US EPA 200.8.	0.00053 g/m <sup>3</sup>	1-2
Dissolved Selenium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0010 g/m <sup>3</sup>	1-2
Total Selenium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012 / US EPA 200.8.	0.0011 g/m <sup>3</sup>	1-2
Dissolved Vanadium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0010 g/m <sup>3</sup>	1-2
Total Vanadium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012 / US EPA 200.8.	0.0011 g/m <sup>3</sup>	1-2
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0010 g/m <sup>3</sup>	1-2
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012 / US EPA 200.8.	0.0011 g/m <sup>3</sup>	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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A handwritten signature in blue ink, appearing to be 'Ara Heron', written over a light blue rectangular background.

Ara Heron BSc (Tech)  
Client Services Manager - Environmental Division