NPDC – Colson Rd Landfill Monitoring Programme Annual Report 2012-2013

Technical Report 2013-51

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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 2012 to June 2013, 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.

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 12 inspections, 10 discharge samples, 35 samples of surface water and groundwater, two biomonitoring surveys of receiving waters, and 8 air quality surveys. NPDC also collected five leachate samples and three under-liner drainage samples for physicochemical analysis.

During the year inspection found that there were some issues in regards to tipface control and refuse coverage. 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 were a number of occasions where the leachate ponds overflowed and discharged into the Puremu Stream causing exceedances in consent limits for ammoniacal nitrogen. The Puremu returned to normal background levels in between the discharges. The Manganaha Stream continued to show no effects from the landfill.

There were four incidents associated with the Colson Rd landfill in the 2012-2013 period. Three incidents were related to the discharge of leachate and one was an odour complaint which could not be substantiated.

Based on performance during the 2012-2013 monitoring period, an improvement in the level of NPDC's environmental performance and compliance with consent conditions is desired. However Council notes that at the time of the publication of this report, significant improvements have been made at the site.

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

This report includes recommendations for the 2013-2014 year.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is the Annual Report for the period July 2012-June 2013 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) 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 13th 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 2013-2014 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 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 discharge source. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the Resource Management Act to assess the effects of the exercise of consents. In accordance with section 35 of the Resource Management Act 1991, the Council undertakes compliance monitoring for consents and rules in regional plans; and maintains an overview of performance of resource users against regional plans and consents. Compliance monitoring, including impact monitoring, also enables the Council to continuously assess its own performance in resource management as well as that of resource users particularly consent holders. It further enables the Council to continually re-evaluate its approach and that of consent holders to resource management, and, ultimately, through the refinement of methods, to move closer to achieving sustainable development of the region's resources.

1.1.4 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 an overall rating. The categories used by the Council, and their interpretation, are as follows:

- a **high** level of environmental performance and compliance indicates that essentially there were no adverse environmental effects to be concerned about, and no, or inconsequential (such as data supplied after a deadline) non-compliance with conditions.

- a **good** level of environmental performance and compliance indicates that adverse environmental effects of activities during the monitoring period were negligible or minor at most, or, the Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices, or, there were perhaps some items noted on inspection notices for attention but these items were not urgent nor critical, and follow-up inspections showed they have been dealt with, and any inconsequential non compliances with conditions were resolved positively, co-operatively, and quickly.

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

- **poor performance (environmental)** or **poor performance (administrative compliance)** indicates generally that the Council was obliged to record a verified unauthorised incident involving significant environmental impacts, or there were material failings to comply with resource consent conditions that required significant intervention by the Council even in the absence of environmental effects. Typically there were grounds for either a prosecution or an infringement notice.

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

1.2 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 earth to a predetermined specification. Leachate from stages one, 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 (HPDE) 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, work began on extending stage three up to the level of the forest line on the eastern side of the landfill.

Photograph 1 Stage three extension works, February 2011

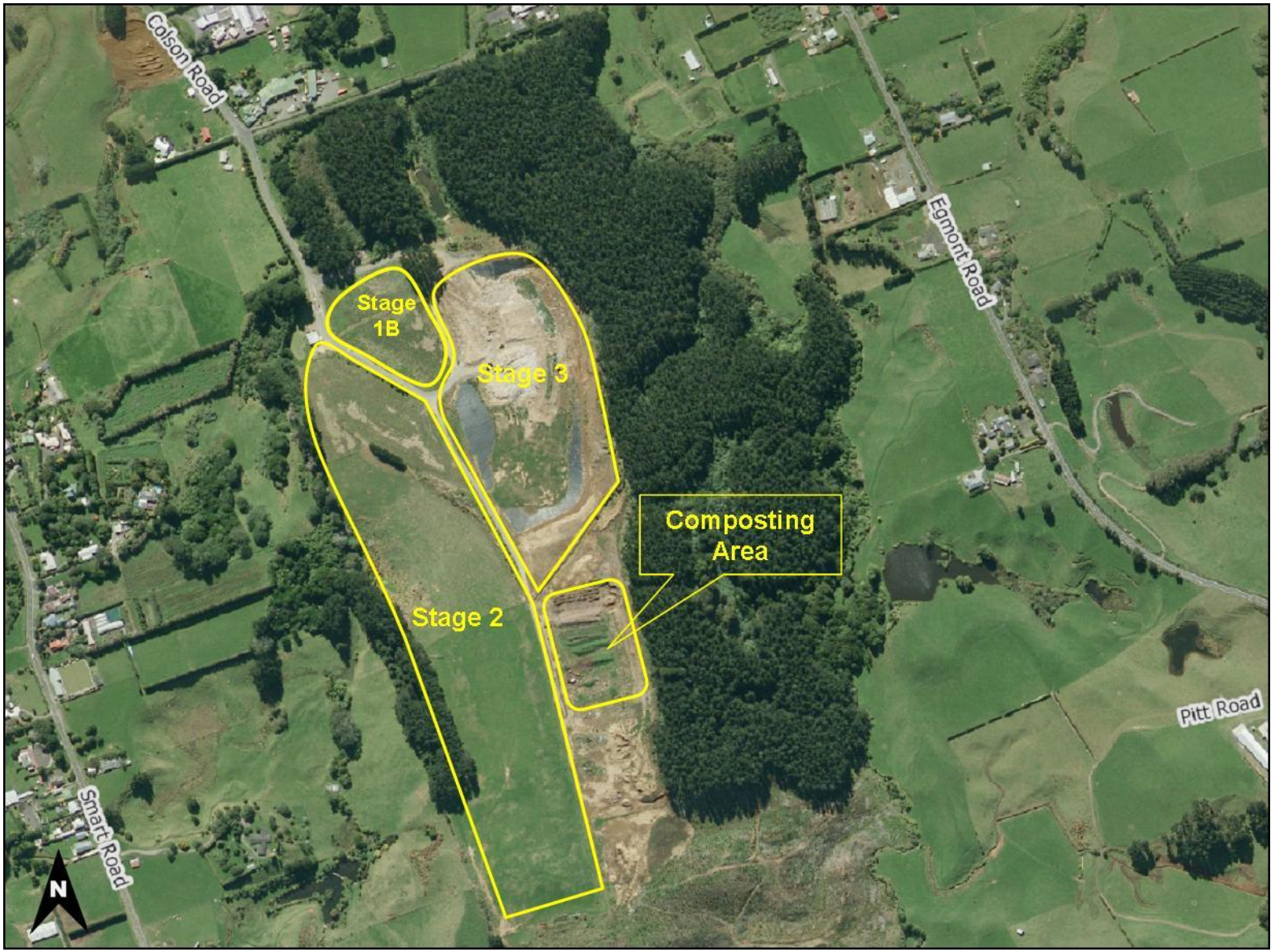

Figure 1 Aerial view of the Colson Road landfill

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 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, 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 2014	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 2012 June 2018	June 2025
4620-1	Discharge uncontaminated stormwater from areas B1, B2, C1 and C2 into the Puremu Stream	June 2012 June 2018	June 2025
4621-1	Discharge solids to land	June 2012 June 2018	June 2025
4622-1	Discharge emissions to air from composting	June 2012 June 2018	June 2025
4779-1	Discharge emissions to air from landfilling	June 2012 June 2018	June 2025
6177-1	Discharge stormwater from earthworks	June 2014	June 2020

1.3.1 Water discharge permits

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

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

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 Resource Management Act. 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 Steam to provide road access to the refuse tip. 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 Resource Management Act.

1.4 Monitoring programme

1.4.1 Introduction

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

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

The monitoring programme for the 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, or new consents, advice on the Council's environmental management strategies and the content of regional plans, and consultation on associated matters.

1.4.3 Site inspections

The Colson Road landfill site was inspected on 12 occasions during the monitoring period. Inspections focused on site processes, the nature and volume of discharges to water, emissions to air and management of the sites processes. 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.

Groundwater in the vicinity of the landfill was sampled on one occasion, and the groundwater sampling sites are shown in Figure 3.

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 conductivity, pH, and 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 2012-2013

Activity	Number
Inspections	12
Discharge samples	10
Receiving water samples	18
Groundwater samples	7
Air deposition samples	12
Methane readings	21
PM10 readings	21
Biomonitoring surveys	2

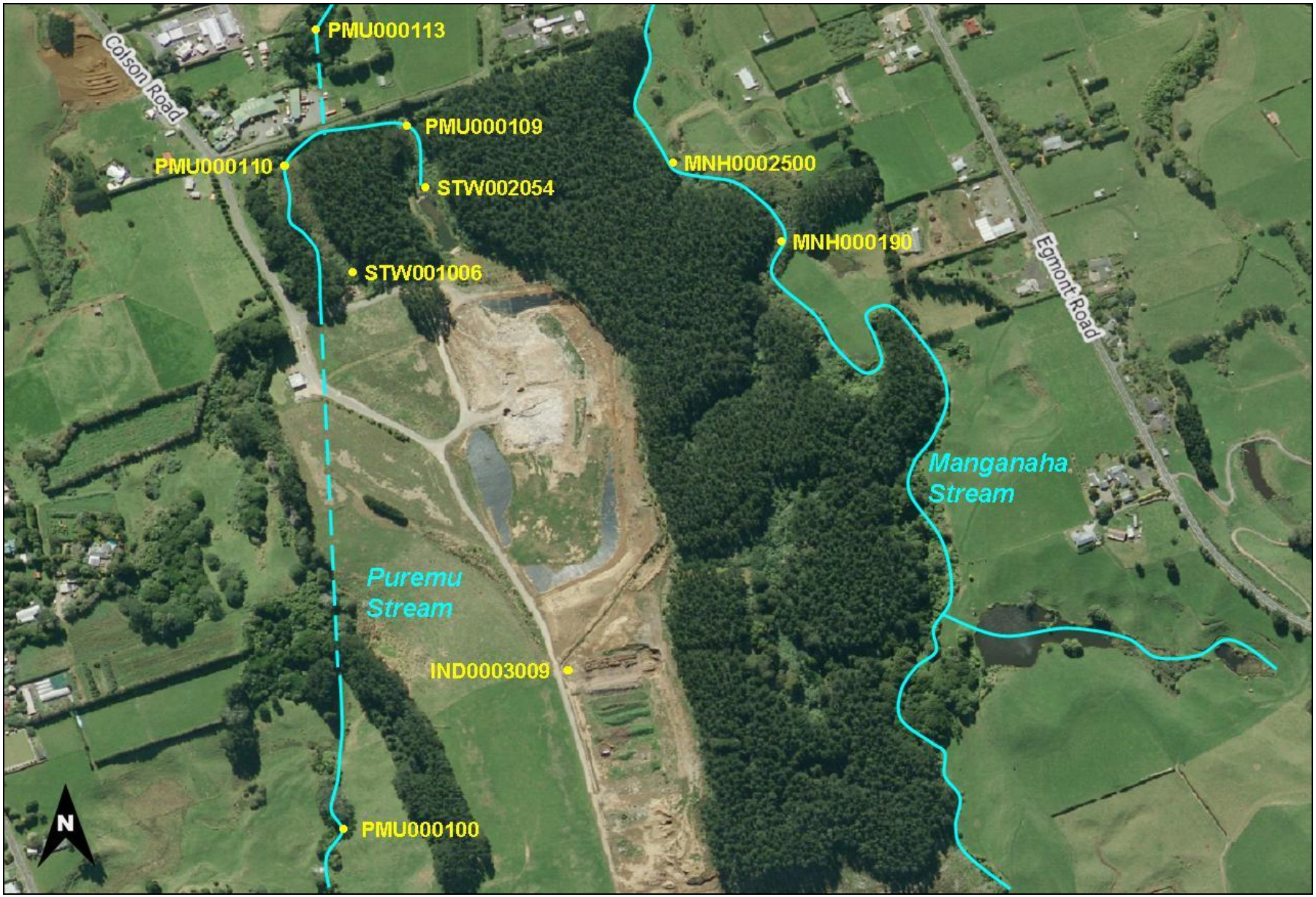

Figure 2 Aerial photo showing the stormwater and receiving water sampling sites at Colson Rd landfill

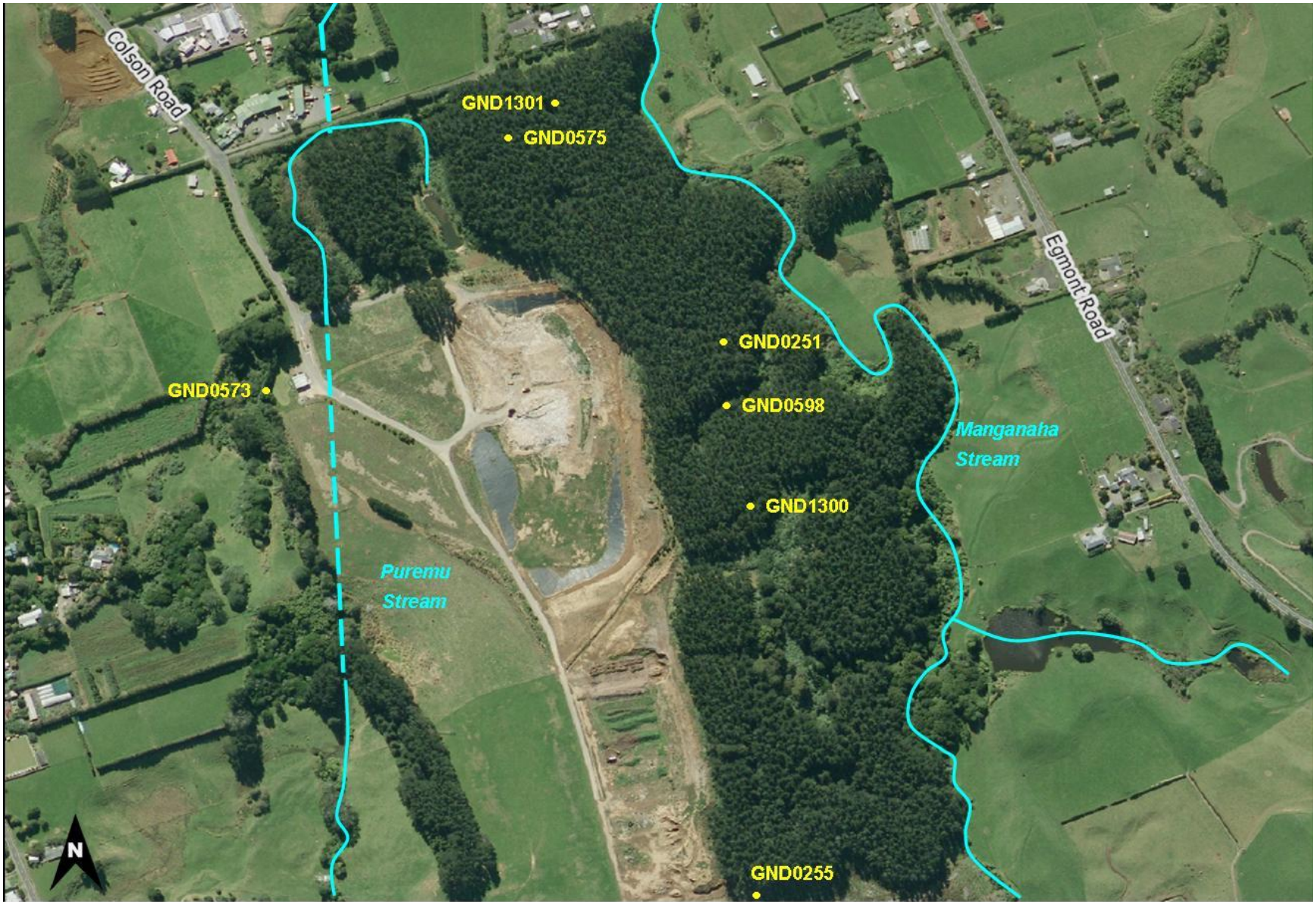

Figure 3 Aerial view of Colson Rd landfill showing the positions of groundwater monitoring bores

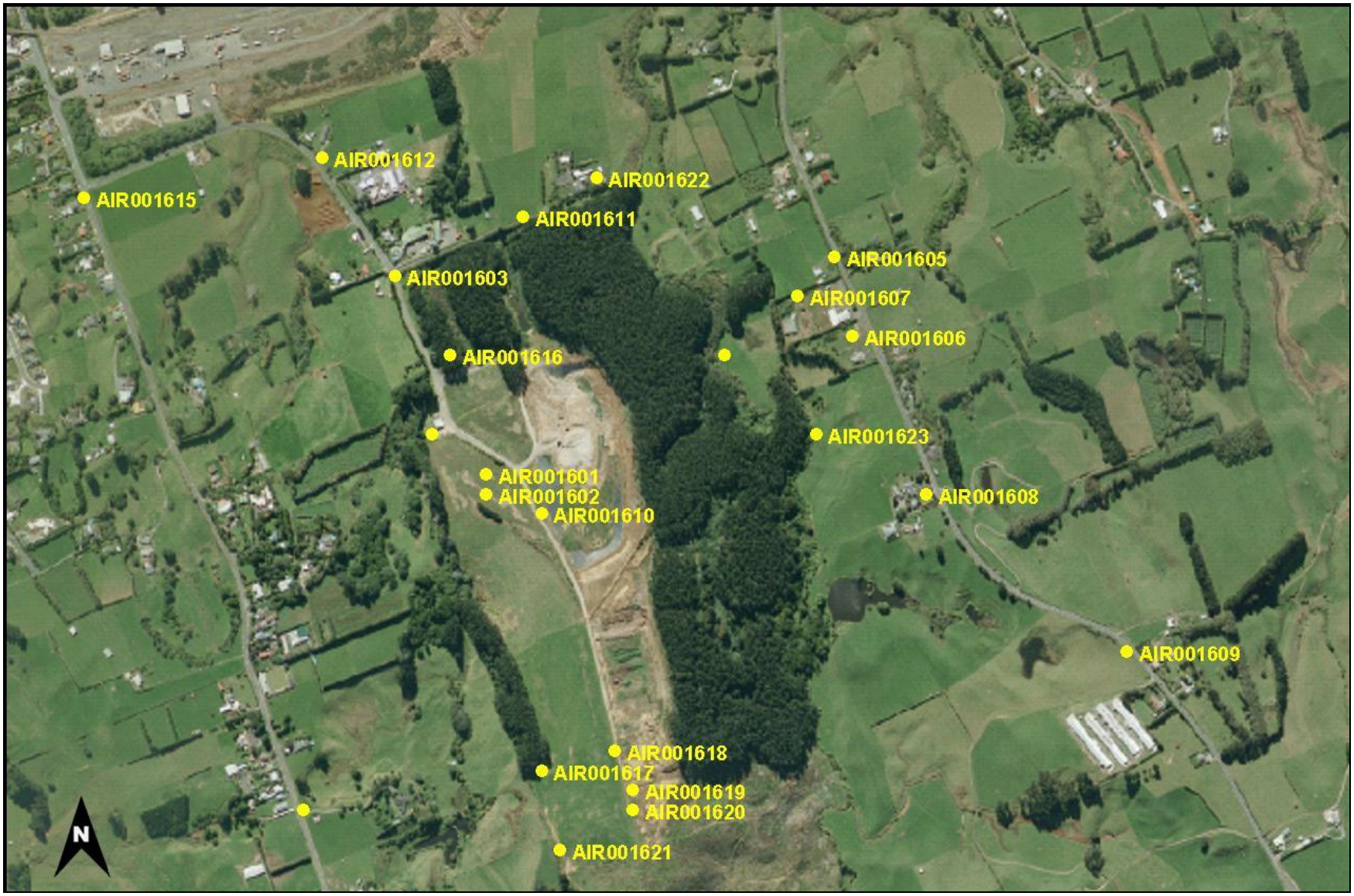

Figure 4 Aerial view of Colson Rd landfill showing the positions of air quality monitoring sites

2. Results

2.1 Inspections

Twelve inspections were carried out over the monitoring period.

2.1.1 28 August 2012

A site visit was made to conduct a compliance monitoring inspection and to take follow up samples for incident 22759. Samples were taken from the discharges into the stormwater pond, STW002054, PMU000109 and PMU000113.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. The treatment ponds had been lined with bentonite matting and appeared to be retaining water. Noise testing was underway for the proposed wood-chipping operation.

Refuse was being tipped and spread at the time of the inspection. The open tipface appeared to be larger than the 900 m^2 limit. There was strong noticeable odour at the tip face but no odours were detected at the downwind site boundary. A digger was working on extending the lined area on the north eastern corner of stage three.

The stormwater pond has pond was inspected and it was noted that the stream below its discharge point had become fouled with litter. This would need to be cleaned out and a litter fence was to be erected across the gully entrance to prevent further contamination. Both grates on the Puremu Stream were free of debris and running freely no significant visual effects on the receiving waters was noted.

The culvert on the unnamed tributary ~20 m upstream of the confluence had been removed, the surrounding soil had gone into the stream, and someone had erected a small treated timber bridge which had subsequently collapsed into the stream.

The following action was to be taken

- Clean litter out of gully below stormwater pond outfall
- Erect a litter fence across the gully entrance
- Remove timber from the unnamed tributary

2.1.2 11 September 2012

A site visit was made to conduct a compliance monitoring inspection.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. The lining on the treatment ponds appeared to be working however it was noted that pond two may have had a slightly lower level than ponds one and three indicating that some seepage may have been occurring.

The open tipface appeared to be larger than the 900 m^2 limit. There was also a significant area of exposed un-spread refuse on the other side of the tip face access road. There was strong noticeable odour at the tip face but no odours were detected at the downwind site boundary.

A surveyor and digger were building a new road next to the compost pads in preparation to move the tip face.

The stormwater pond was inspected and it was noted that it had become fouled with litter. This would need to be cleaned out. There was also a large pile of silt /refuse near the silt pond which should be tidied away. Both grates on the Puremu Stream were free of debris and running freely. No significant visual effects on the receiving waters were noted.

Someone had erected another small treated timber bridge at the damaged crossing on the unnamed tributary. The timber will have to be removed from the stream.

There was concern that the management plan is not being followed in regard to daily and interim cover and tipface management. Especially of note were the large areas of semi-covered refuse at the site not in the vicinity of the working face. The on-going litter issues at the site may have been the result of thinly covered areas and large open tipface areas. NPDC was contacted in regards to this.

The following action was to be taken:

- Ensure the management plan is followed
- Remove timber from the unnamed tributary
- Remove litter from the large silt pond and any litter in the drains

2.1.3 18 October 2012

Refuse was being tipped and spread at the time of the inspection. A new tip face had been opened at the top of stage three and virgin ground in the lower western quadrant was being shaped in preparation for the liner extension. The operating tipface appeared to be within the 900 m^2 limit. There was strong noticeable odour at the tip face but no odours were detected at the downwind site boundary.

Intermediate cover in some areas of stage three still appeared to be very thin and was neither 'covering' nor 'concealing' discharged refuse as specified by the management plan.

The stormwater pond has pond was inspected and it was noted that the stream below its discharge point was fouled with litter. A litter fence had been installed (as requested) across the gully that feeds the stream. It did not appear that any clean up of existing litter in the stream had been undertaken.

Both grates on the Puremu Stream were free of debris and running freely. No significant visual effects on the receiving waters was noted.

No problems with odour and dust were noted at the site.

The following action was to be taken:

- Clean litter out of gully and stream below stormwater pond outfall
- Remove any collected litter around the site and place on tip face
- Clean litter out of large silt pond
- Cover refuse exposed by capital works
- Takes steps to ensure all intermediate cover at the site is compliant with the management plan.

2.1.4 14 November 2012

A site visit was made to conduct a compliance monitoring inspection prior to attending the Landfill Liaison committee meeting. The weather was fine with a south west breeze and 2 mm rain over the previous 48 hours.

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

Refuse was being tipped and spread at the time of the inspection and the tip face appeared to be within the 900 m^2 limit. The western side of the stage had been completely lined and virgin ground in the lower western quadrant was being shaped in preparation for the liner extension. The cap on stages one and two appeared sound and was well vegetated.

There was less litter in the stormwater pond than was observed during last inspection indicating that litter clean up had been occurring. The grates on the Puremu Stream were both largely free of debris and flowing freely.

There were no issues in regards to odour or dust noted during the inspection.

At the liaison committee meeting the site manager outlined that he was in the process of getting more cover material for stage three and was going to have litter removed from the stream below the stormwater pond.

2.1.5 9 January 2013

A site visit was made to conduct a compliance monitoring inspection and to take PM10 and methane readings. The weather was fine with strong north west wind and 2 mm rain over the previous 48 hours.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. A litter fence had been erected along the length of the compost ponds.

Refuse was being tipped and spread at the time of the inspection and the tip face appeared to be within the 900 m^2 limit. The top area of stage three had been recovered and looked much tidier.

The large stormwater pond had been de-silted and appeared clean and tidy. General house keeping work was being undertaken on the roadways and drains at the time of the inspection.

No methane was detected and an average of 57.10 $\mu g/m^3$ PM10 was recorded at the seven sites within the property boundary. For reference, the maximum allowable limit to effects off-site is 50 $\mu g/m^3$ (24 hour average)..

There were no issues in regards to odour at the down wind boundary noted during the inspection.

2.1.6 24 January 2013

A site visit was made to conduct a compliance monitoring inspection and to take water samples. The weather was fine with a northerly wind and no rain over the previous 48 hours.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. The tipface was within the 900 m^2 limit but there were some other areas of exposed refuse present. There were no issues in regards to windblown litter or odour. The grates on the Puremu Stream culverts were clear and running freely.

It was noted that the culvert on the unnamed tributary had yet to be fixed and NPDC were contacted about this.

2.1.7 28 March 2013

A site visit was made to conduct a compliance monitoring inspection and to take water samples and air quality readings. The weather was fine with light SSE breeze and no rain over the previous 72 hours.

The compost area was tidy and organised and no noticeable odours were detected on the compost pad. All of the ponds were empty except for the top pond which had about 30 cm of water in it.

Refuse was being tipped and spread at the time of the inspection and the tip face appeared to be within the 900 m^2 limit. It was noted that the access tracks from the road to the tipface had been heavily watered and this was suppressing dust effectively. Seven sites were surveyed for PM10 downwind of the operational areas and an average of 10 $\mu g/m^3$ was found. No methane was detected.

The Puremu was in low flow and the grates on the culverts were free of debris. The culvert down stream of the large stormwater pond had been repaired.

There were no issues in regards to odour at the down wind boundary noted during the inspection.

2.1.8 12 April 2013

A site visit was made to conduct a compliance monitoring inspection and to undertake an ambient air survey. The weather was fine with a north-northwest wind and no rain over the previous 48 hours.

A site meeting was held between residents, NPDC staff, and the composter in regards to noise issues from the greenwaste shredder. It was decided to trial enclosing the shredder with high bunds of compost to try and block the noise. The compost area was tidy and organised and noticeable odours were detected on the storage pad. No compost odours were detected downwind of the pad.

The tipface was within the 900 m^2 limit but there were some other areas of exposed refuse present. There were no issues in regards to windblown litter or odour at the time of the inspection.

An average PM10 level of 52.71 µg/m^3 was detected across seven sites. For reference, the 24 hour guideline that is the limit applied to effects off-site is 50 µg/m^3.. The highest reading (300 µg/m^3) was at the intersection of the sealed road and the tip face access track during truck movement. Sites outside the boundary were below the guideline. The site manager was informed and he stated that the contractor would be asked to start dust suppression measures.

2.1.9 3 May 2013

A site visit was made to conduct a compliance monitoring inspection and to take water samples. The weather was overcast with 6 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 tip face had moved northward and the recently covered areas looked good. Refuse was being tipped and spread at the time of the inspection and the tip face was quite small and within the 900 m^2 limit.

Earthworks were underway to complete the northern end of stage 3.

The Puremu was in low flow and the grates on the culverts were free of debris.

There were no issues in regards to odour at the down wind boundary noted during the inspection.

2.1.10 29 May 2013

A site visit was made to conduct a compliance monitoring inspection and to take water samples. The weather was overcast with 15 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 tip face was within the 900 m^2 guideline and a large special waste area was being prepared next to the working face.

Earthworks at the northern end of stage three were being undertaken to solve the build up stormwater/leachate on the exposed liner. A surface overflow drain had been cut to direct any overflow to the leachate pumping system.

There were no issues in regards to odour at the down wind boundary noted during the inspection.

2.1.11 10 June 2013

A site visit was made to conduct a compliance monitoring inspection and to take follow up water samples in regards to the leachate breakout that occurred last week (incident 20882). The weather was fine with 1 8mm rain over the previous 72 hours.

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

Refuse was being tipped and spread and the tip face was within the 900 m² guideline. There were strong odours around the tip face but none detected at the downwind boundary. Litter removal was occurring at the time of the inspection.

There was still leachate and stormwater trapped on the liner but the levels had dropped significantly. The level of leachate in the pump pond had also dropped. Samples were taken from the discharge and up and downstream. No odours or discolouration were noted in the receiving waters. Interim lab results showed that the sample taken at the boundary (site PMU000113) was in compliance with consent conditions in regards to ammoniacal nitrogen.

There were no issues in regards to odour at the down wind boundary noted during the inspection.

2.1.12 25 June 2013

A site visit was made to conduct a compliance monitoring inspection and to take groundwater samples. The weather was fine with 0.5 mm rain over the previous 72 hours.

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

Refuse was being tipped and spread and the tip face was quite small and well within the 900 m² guideline. There were strong odours around the tip face but none detected at the downwind boundary. The unused areas of the stage three were noted to have more cover and the site generally looked more tidy and organised.

Excess stormwater and leachate was being pumped from the retention ponds in stage 3 into the leachate lines. The onsite operator stated that it was being done at a rate that the main leachate pump could cope with and no discharge was occurring. Earthworks were underway to cover the exposed liner and divert clean stormwater into the main stormwater pond.

There were no issues in regards to odour at the down wind boundary noted during the inspection.

2.2 NPDC monitoring results

2.2.1 Leachate

The NPDC collected six samples of leachate during the 2012-2013 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	13-Jul-12	01-Aug-12	24-Aug-12	19-Oct-12	02-Nov-12	21-Nov-12
pH	pH	7.7	7.7	7.5	7.7	7.8	7.8
BOD	g/m^3	73	80	110	130	120	140
Suspended solids	g/m^3	26	36	38	30	18	22
Conductivity	mS/	595	597	572	690	758	858
Ammoniacal N	g/m^3	480	480	400	550	640	640
Chromium	g/m^3	0.08	0.09	0.11	0.12	0.15	0.12
Copper	g/m^3	<0.02	0.04	<0.02	0.02	<0.02	<0.02
Iron	g/m^3	12.7	630	13.1	9	5.7	7.4
Lead	g/m^3	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
Manganese	g/m^3	1.7	1.8	2.5	1.7	1.7	1.5
Nickel	g/m^3	<0.03	0.03	<0.03	<0.03		<0.03
Zinc	g/m^3	0.04	0.07	0.07	0.09	<0.04	0.04

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 levels also remain within normal ranges for Taranaki groundwater.

Table 4 Results of analysis of under liner drainage

Parameter	Unit	31-Oct-12	12-Mar-13	27-Mar-13
pH	pH	294	1602	*
BODC	g/m^3	6.8	6.5	6.5
Suspended solids	g/m^3	<2	10	6
Fecal coliforms	per/100 mL	7	58	16
Conductivity	mS/m	<1	4	36
Turbidity	N.T.U.	32.7	53.8	54.2
Alkalinity	g/m^3	82	132	136
Ammoniacal Nitrogen	g/m^3-N	0.7	1.5	1.6
Cadmium	g/m^3	<0.002	<0.002	<0.002
Chromium	g/m^3	<0.02	<0.02	<0.02
Chloride	g/m^3	45	79	77

Parameter	Unit	31-Oct-12	12-Mar-13	27-Mar-13
Copper	g/m^3	<0.02	<0.02	<0.02
Iron	g/m^3	2.5	10.5	7.1
Lead	g/m^3	<0.03	<0.03	<0.03
Manganese	g/m^3	0.90	2.06	1.50
Nickel	g/m^3	<0.008	<0.03	<0.008
Zinc	g/m^3	<0.04	0.04	<0.04

Key * = not measured

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	24 Jan 2013		3 May 2013	
		MNH000190 u/s of landfill	MNH000250 d/s of landfill	MNH000190 u/s of landfill	MNH000250 d/s of landfill
Conductivity	mS/m	20.0	15.1	14.6	14.7
pH	pH	6.9	7.3	7.2	7.2
Temperature	Deg C	16.5	17.5	15.9	16.0
Suspended solids	g/m3	<2	3	<2	<2
Ammonia (unionised)	g/m3-N	0.00019	0.00019	0.00011	0.00009
Ammoniacal nitrogen	g/m3-N	0.065	0.024	0.019	0.016
Alkalinity	g/m3 CaCO3	44	35	25	26
Acid soluble iron	g/m3	0.78	1.83	0.82	0.97
Dissolved zinc	g/m3	0.007	<0.005	<0.005	<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 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 24 January 2013 and 28 March 2013.

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.

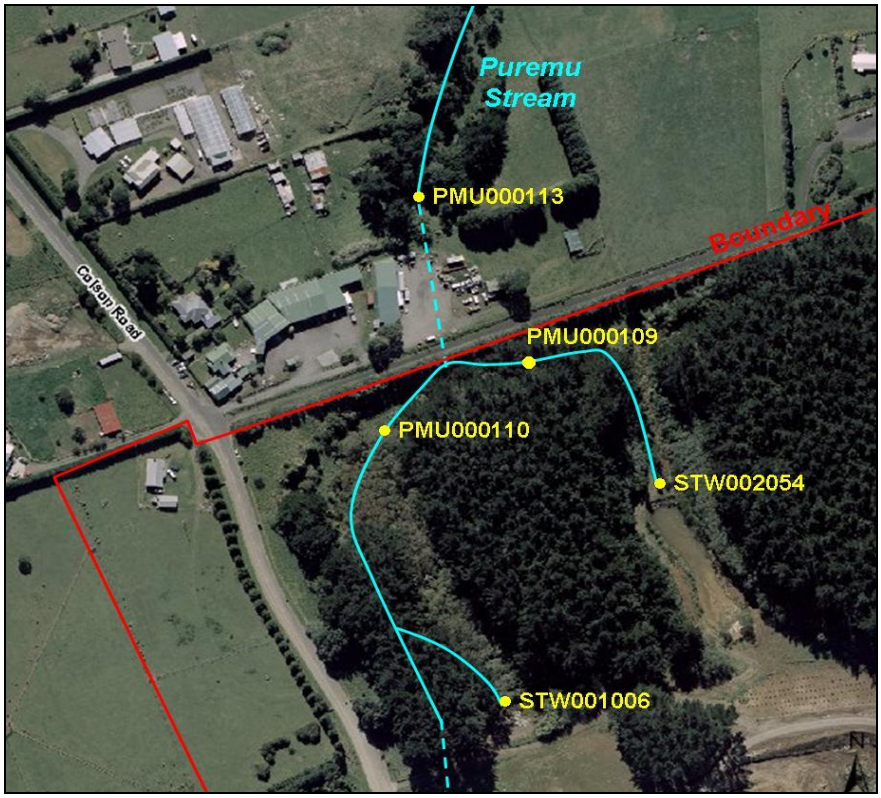

Figure 5 Sampling sites on the Puremu Stream down stream of the landfill

Table 6 Chemical analysis of the Puremu Stream, sampled on 24 January 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**)*
Conductivity	mS/m	14.9	33.7	27.0	28.4	*NA*
pH	pH	7.2	7.3	7.3	7.4	*>6.5 < 8.5*
Alkalinity	g/m^3 $CaCO_3$	32	89	72	74	*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**)*
Temperature	° C	19.9	19.1	18.6	18.3	*(>21.9)*
Suspended solids	g/m^3	11	27	3	3	*21*
BOD	g/m^3	0.5	1.9	2.0	2.1	*NA*
Unionised ammonia	g/m^3 N	0.00064	0.00105	0.01915	0.01755	*NA*
Ammoniacal N	g/m^3 N	0.085	0.118	2.24	1.67	*2.0 (2.5)*
Nitrate/nitrite N	g/m^3 N	0.04	0.31	0.81	0.76	*10 (100)*
DRP	g/m^3	0.003	<0.003	<0.003	<0.003	*NA*
Dissolved oxygen	g/m^3	6.86	3.43	7.85	7.85	*>5.86 (>1.86)*
Oxygen saturation	%	74.7	36.6		82.7	*NA*
Dissolved cadmium	g/m^3	<0.005	<0.005	<0.005	<0.005	*0.0001 (0.01)*
Fecal coliforms	per 100ml	390	120	1700	1200	*1000*
Acid soluble iron	g/m^3	2.30	3.58	2.03	1.82	*10 (5.00)*
Acid soluble manganese	g/m^3	0.78	0.74	1.14	1.07	*NA*
Acid soluble lead	g/m^3	<0.05	<0.05	<0.05	<0.05	*0.002 (0.1)*
Dissolved zinc	g/m^3	<0.005	<0.005	<0.005	<0.005	*0.03 (2.00)*
Sulfates	g/m^3 SO_4	4.4	9.2	6.9	7.3	*1000 (500)*

*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

Table 7 Chemical analysis of the Puremu Stream, sampled on 28 March 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 limit at PMU000113* (PMU000110)***
Conductivity	mS/m	15.8	36.6	36.9	37.1	*NA*
pH	pH	6.7	7.1	7.1	7.3	*>6.5 <8.5*
Alkalinity	g/m^3 $CaCo_3$	41	98	103	105	*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 limit at PMU000113* (PMU000110)***
Temperature	°C	14.8	18.2	**17.9**	17.4	*(16.8)*
Suspended solids	g/m^3	24	13	14	6	*34*
DRP	g/m^3	<0.003	<0.003	<0.003	<0.003	*NA*
Unionised ammonia	g/m^3	0.00042	0.00181	0.00663	0.01784	*NA*
Ammoniacal N	g/m^3 N	0.258	0.345	1.29	**2.28**	*2.0 (2.5)*
Nitrate/nitrite N	g/m^3 N	0.17	0.20	0.26	0.54	*10 (100)*
BOD	g/m^3	1.1	2.7	5.9	1.6	*NA*
Dissolved oxygen	g/m^3	6.12	6.99	6.61	7.34	*>5.12 (>1.12)*
Oxygen saturation	%	59.5	73.0	68.4	75.2	*NA*
Fecal coliforms	per 100ml	410	490	1300	760	*1000*
Dissolved cadmium	g/m^3	<0.005	<0.005	<0.005	<0.005	*0.0001 (0.01)*
Acid soluble iron	g/m^3	13.6	5.71	**5.92**	3.29	*10 (5.00)*
Dissolved lead	g/m^3	<0.05	<0.05	<0.05	<0.05	*0.002 (0.1)*
Acid soluble manganese	g/m^3	1.89	1.25	**1.90**	2.80	*(1.0)*
Dissolved zinc	g/m^3	0.024	0.008	0.010	0.007	*0.03 (2.00)*
Sulfates	g/m^3 SO_4	7.5	11.4	9.4	8.5	*1000 (500)*
Chloride	g/m^3	23.9	*	*	61.4	*NA*

*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

The samples taken on 24 January 2013 were in compliance with all consent conditions. The samples taken on 28 March 2013 have four values that exceeded those set by consent limits. The temperature rose by more than 2 °C between site up and downstream of the landfill (actual rise 3.1 ° C). This is uncharacteristic of the longitudinal temperature profile of the site and its cause on this occasion is unknown. The consent also requires that the activity at the landfill does not cause the levels of iron and manganese and iron to exceed 5.0 g/m^3 and 1.0 g/m^3 respectively at site PMU000110 and these levels were exceeded at this site. However the levels of iron and manganese exceeded the limits set by consent conditions at site PMU000100 upstream of the land fill and therefore it is unlikely the presence of the landfill is the

cause of the exceedance. The level of ammoniacal nitrogen at site PMU000113 exceeded the limit of 2.0 g/m^3 set by consent conditions and when compared to the upstream a 10 fold rise in concentration is noted. However when the ambient temperature and pH conditions are factored in this gives a level of free ammonia of 0.01784 g/m3 which is below the 0.025 g/m^3 guideline for aquatic health.

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 8 Results of rain event monitoring samples taken on 18 October 2012- Puremu Stream

Site	Conductivity	Fecal Coliforms	Unionised ammonia	Ammoniacal nitrogen	pH	Suspended solids	Temp.	Turbidity
	mS/m	/100ml	g/m^3	g/m^3 N	pH	g/m^3	Deg.C	NTU
IND003009	43.1	28000	0.02735	1.49	7.8	180	13.5	150
PMU000100	12.5	5500	*	0.025	7.0	8	No result	6.3
PMU000109	30.0	*	0.00310	0.789	7.1	97	14.3	85
PMU000110	15.6	*	0.00213	0.566	7.1	11	13.7	10
PMU000113	19.3	**14000** (1000)	0.00236	0.634 (2.0)	7.2 (>6.5,<8.5)	29 (8.8)	13.9	26
STW001006	15.1	3300	0.00236	1.62	6.7	75	13.3	71
STW002054	31.4	3900	0.00544	0.874	7.3	130	14.3	110

Key:* = not measured **Bold** = Breach of conditions (#) =consent condition limit

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. At all freshwater sites the levels of ammonia, suspended solids and conductivity were within acceptable ranges and indicate reasonable water quality. The elevation in bacteria may in part be attributed to the landfill, however, the upstream control site had fecal coliform levels five times higher than the downstream consent limit.

The Manganaha Stream was also sampled after a rain event and the results are shown in the table below. 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. The level of turbidity was elevated but this was due to the fact the stream was in a minor fresh at the time of sampling. These results are comparable to those obtained in previous monitoring periods.

Table 9 Results of rain event monitoring samples taken on 24 January 2013- Manganaha Stream

Parameter	Unit	MNH000190	MNH000250
Alkalinity	g/m^3 $CaCO_3$	25	26
Conductivity	mS/m	14.6	14.7
Acid soluble iron	g/m^3	0.78	1.83
Unionised ammonia	g/m^3	0.00011	0.00009
Ammoniacal nitrogen	g/m^3	0.019	0.016
pH	-	7.2	7.2
Suspended solids	g/m^3	<2	<2
Temperature	°C	15.9	16.0
Dissolved zinc	g/m^3	0.007	<0.005

2.5 Biological monitoring

Two macroinvertebrate surveys were conducted during the 2012-2013 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 1 October 2012 Macroinvertebrate survey

The Council's standard 'kick-sampling' technique was used at three established sites (site 2, M4 and M6), the 'sweep-sampling' technique at one established site (site 1) and a combination of both techniques one other established site (PT1), to collect streambed macroinvertebrates from the Puremu and Manganaha Streams on 1 October 2012. Samples were sorted and identified to provide number of taxa (richness), MCI and $SQMCI_S$ scores for each site.

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

This spring 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 and $SQMCI_S$ scores recorded at the upstream control site on the Puremu Stream were higher than their respective median scores, significantly so for the $SQMCI_S$ score. This was largely attributable to the moderate proportion of 'sensitive taxa' present and the numerical dominance of multiple 'moderately sensitive' taxa, especially the amphipod *Paracalliope*. The 'tolerant' *Potamopyrgus* snail was also found to be extremely abundant in this survey. These results were indicative of good preceding water quality and reflected a well-established macrophyte associated community assemblage.

Downstream, site 2 in the Puremu Stream recorded a similar MCI score, although the $SQMCI_S$ score was significantly reduced, when compared with site 1. Site PT1 in the unnamed tributary recorded an MCI score nine to ten units lower than that recorded in the main stem and a $SQMCI_S$ score significantly lower than that recorded in the main stem. However the results for sites 2 and PT1 were well within the range of previous scores for these sites, and reflected well when compared against their respective medians. Differences in habitat quality were considered to be the most likely reason for the results varying from that recorded at site 1.

The numerical dominance of 'tolerant' oligochaete worms and *Polypedilum* midge larvae at site PT1 in the unnamed tributary of the Puremu Stream resulted in a low SQMCIs score (2.0 units). This result was indicative of relatively poor preceding water quality in the tributary, although this result does show recovery from the previous survey, which recorded the lowest SQMCIs score to date. The presence of two mayfly taxa, including one considered 'highly sensitive', suggested that this low SQMCIs score was most likely the result of poor habitat quality than from the discharges to the stream from the landfill. At the time of this survey, there was a low, steady flow of water with significant accumulations of iron oxide, woody debris and other organic material present in the stream bed which was the likely reason for the abundance of oligochaete worms, *Chironomus* bloodworms and *Polypedilum* midge larvae.

The upstream site on the Manganaha Stream recorded a moderately high MCI and $SQMCI_S$ score in this survey which was significantly higher than the historical medians recorded at the site in previous surveys. These results reflected the moderate proportion of 'sensitive' taxa and the numerical dominance of three 'sensitive' taxa, in particular the abundance of two 'moderately sensitive' mayfly taxa and one 'highly sensitive' caddisfly taxon, and was indicative of good preceding water quality.

In the Manganaha Stream downstream of the landfill site, the macroinvertebrate community contained a moderately low proportion of 'tolerant' taxa which resulted in an MCI score of 99 units. This was only an insignificant two units lower than that recorded at the upstream site and indicating little difference in habitat or water quality. In addition to this, the $SQMCI_S$ score recorded at site M6 (downstream) was moderately high (6.4 units) and was similar to that recorded at site M4 (upstream).

No undesirable biological growths were detected at any of these sites during this October 2012 survey.

Overall, the results of this survey were indicative of fair to good preceding water quality at most of the sites monitored, with the exception of site PT1 in the unnamed tributary of the Puremu Stream which was indicative of poor water quality. The poor flow and habitat conditions observed in the tributary at the time of this survey were the most likely reason for this as opposed to the effects of the discharges from the landfill. In summary, these results were not indicative of any 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 2013 Macroinvertebrate survey

The Council's standard 'kick-sampling' technique was used at three established sites (site PT1, M4 and M6) , the 'sweep-sampling' technique at one established site (site 1) and a combination of both techniques at one other established site (2), to collect streambed macroinvertebrates from the Puremu and Manganaha Streams on 12 February 2013. Samples were sorted and identified to provide number of taxa (richness), MCI and $SQMCI_S$ scores for each site.

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

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 and $SQMCI_S$ scores recorded at the upstream control site on the Puremu Stream were similar to their respective median scores, but less than that recorded in the previous survey, significantly so for the $SQMCI_S$ score. This was largely attributable to the reduced abundance of multiple 'moderately sensitive' taxa, especially the amphipod *Paracalliope*. The 'tolerant' *Potamopyrgus* snail was also found to be extremely abundant in this survey. These results were indicative of good preceding water quality, but reflected a macrophyte associated community assemblage, that had been impacted by recent stock access.

Downstream, site 2 in the Puremu Stream recorded similar MCI and $SQMCI_S$ scores, when compared with site 1, and which were well within the range of previous scores for this site, and reflected well when compared against their respective medians. Differences in habitat quality were considered to be the most likely reason for the subtle variation in results from that recorded at site 1. Site PT1 in the unnamed tributary on the other hand recorded MCI and $SQMCI_S$ scores significantly less than those recorded in the main stem and both scores were significantly less than their respective medians for that site.

This is a direct reflection of the instream excavation that had occurred prior to this survey. These works resulted in the removal of instream habitat, leaving behind a habitat of reduced quality, suiting primarily 'tolerant' invertebrates.

The numerical dominance of 'tolerant' oligochaete worms and mosquito larvae at site PT1 in the unnamed tributary of the Puremu Stream resulted in a very low $SQMCI_S$ score (1.2 units), 1.5 units lower than the historical median score for the site, and only 0.2 units higher than the absolute minimum score possible. This $SQMCI_s$ score was also significantly lower than that recorded at sites 1 and 2 (Stark, 1998), and represents very poor water quality and/or habitat quality at this site.

Although the location sampled in this survey differs slightly to that surveyed historically, the previous survey found little difference in macroinvertebrate community composition or health. However, the current survey followed significant disturbance to the stream bed, and as a result, recorded a community of significantly poorer health and condition. This is considered primarily related to the disturbance activities, and as a result it is not possible to conclude either way whether the discharge of stormwater to this stream caused any degradation of the community. It is can be concluded however that the overriding influence was the degree of iron oxide sedimentation, and stream bed disturbance observed at this site.

The upstream site on the Manganaha Stream (m4) recorded a new maximum MCI score, and a $SQMCI_s$ score that was significantly higher than its historical median for this site. These results reflected the moderately high proportion of 'sensitive' taxa and the numerical dominance of three 'sensitive' taxa, in particular the abundance of two 'moderately sensitive' mayfly taxa and one 'highly sensitive' caddisfly taxon, and was indicative of good preceding water quality.

In the Manganaha Stream downstream of the landfill site (m6), the macroinvertebrate community contained a moderately low proportion of 'tolerant' taxa which resulted in an MCI score of 100 units. As with site M4, this was a new maximum MCI score for this site, and was only an insignificant four units lower than that recorded at the upstream site, indicating little difference water quality. However, the $SQMCI_s$ score recorded at site M6 was only moderate (3.6 units) and was significantly lower than that recorded at site M4. This was a result of numerous 'moderately sensitive' taxa reducing in abundance at site M6, a direct reflection of the reduced habitat quality at this site.

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

Overall, the results of this survey were indicative of 'fair' to 'good' preceding water quality at most of the sites monitored, with the exception of site PT1 in the unnamed tributary of the Puremu Stream which was indicative of poor water quality. The poor flow and habitat conditions observed in the tributary at the time of this survey were the most likely reason for this as opposed to the effects of the discharges from the landfill. In summary, these results were not indicative of any 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.

2.6 Groundwater

Groundwater was sampled from seven bores on 25-28 June 2013. The results of the analysis are given in Table 10. As with the subsurface drainage samples, the groundwater results show little evidence of leachate contamination. All parameters measured for all the bores, were well within the ranges expected in Taranaki groundwater and within the ranges of the historical data. Bore GND0598 shows some elevation in alkalinity when compared to the other bores. However this bore is upstream of the landfill in terms of groundwater flow and the results are consistent with those obtained from the bore since 1996. The elevated level of this parameter is therefore unlikely to be a result of leachate contamination. Bores GND1301 and GND0575 also show some elevation in alkalinity and COD, and as these bores are down gradient of the filled areas, this may be attributable to some minor leachate contamination.

The samples were also analysed for SVOC's (semi-volatile organic compounds) and none were found to be above detection levels. A copy of the SVOC results are appended to this report.

In general terms the groundwater quality in the vicinity of the landfill is good and all parameters comparable with typical Taranaki groundwater. The data gathered in this, and other monitoring periods, indicates that the Colson Rd Landfill is not having a significant adverse effect on groundwater quality.

Table 10 Chemical analysis of Colson Rd Landfill groundwater sampled 25-28 June 2013

Parameter	Unit	GND0251	GND0255	GND0573	GND0575	GND0598	GND1300	GND1301
Water level	m	*	9.58	*	7.31	*	11.97	7.65
Alkalinity	g/m^3 $CaCO_3$	38	30	35	61	166	36	92
Conductivity	mS/m	13.4	34.2	23.1	26.7	33.0	16.4	22.0
pH	pH	6.1	5.7	6.0	6.1	7.7	6.1	7.1
Temperature	Deg C	14.7	15.2	14.3	14.9	14.8	15.1	14.9
Chloride	g/m^3	19.9	81.7	48.1	50.8	22.0	23.1	20.6
Sulphate	g/m^3 SO_4^-	6.0	5.2	9.4	3.2	1.1	9.8	4.5
Ammoniacal N	g/m^3	<0.003	0.006	<0.003	0.005	1.25	<0.003	0.005
Nitrate/nitrite N	g/m^3	0.31	4.29	0.55	0.52	0.02	1.81	0.80
Nitrite N	g/m^3	0.001	0.001	0.001	0.001	0.001	0.002	0.002
Filtered COD	g/m^3	<5	<5	<5	<5	8	<5	<5
Dissolved aluminum	g/m^3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Dissolved arsenic	g/m^3	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dissolved boron	g/m^3	0.012	0.025	0.020	0.016	<0.052	0.020	0.023
Dissolved beryllium	g/m^3	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Dissolved cadmium	g/m^3	<0.00005	0.00021	<0.00005	<0.00006	0.00008	<0.00005	0.00005
Dissolved cobalt	g/m^3	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	0.0003	<0.00002

Parameter	Unit	GND0251	GND0255	GND0573	GND0575	GND0598	GND1300	GND1301
Dissolved chromium	g/m³	0.0005	<0.0005	<0.0005	0.0007	<0.0005	<0.0005	0.0015
Dissolved copper	g/m³	0.0005	0.0008	0.0006	0.00005	0.0008	0.0006	<0.0005
Dissolved Iron	g/m³	<0.02	<0.02	<0.02	<0.02	<0.07	<0.02	<0.02
Dissolved manganese	g/m³	0.0009	0.0087	0.0090	0.0061	0.045	0.0041	<0.0005
Dissolved lead	g/m³	<0.00010	<0.00010	0.00028	0.00010	0.00013	<0.00010	<0.00010
Dissolved selenium	g/m³	<0.0010	<0.00010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dissolved vanadium	g/m³	<0.0010	<0.0010	<0.0010	0.0056	0.0013	<0.0010	0.0084
Dissolved zinc	g/m³	0.0014	0.029	0.0133	0.0165	0.0048	0.0028	<0.0091

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/m²/30 days or 0.13 g/m²/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 11 and 12.

Table 11 Air deposition monitoring results for January/February 2013

Site	Days deployed	Particulate g/m²/day	Volume litres
AIR001603 At entrance to landfill	26	0.09	6.1
AIR001604 Adjacent to Manganaha Stream, behind rose nursery	26	0.07	2.4
AIR001608 124 Egmont Road, paddock boundary, west of house	26	0.08	1.3
AIR001613 Grass lawn opposite behind work shed	26	**0.2**	2.4
AIR001622 At rear of RSPCA building	26	0.05	1.5
AIR001623 Behind 194 Egmont Road	26	0.07	1.2

Key: Bold = exceeded MfE guideline value of 0.13 g/m²/day

Table 12 Air deposition monitoring results for February/March 2013

Site	Days deployed	Particulate g/m²/day	Volume litres
AIR001603 At entrance to landfill	24	**0.16**	0.6
AIR001604 Adjacent to Manganaha Stream, behind rose nursery	24	0.11	0.4
AIR001608 124 Egmont Road, paddock boundary, west of house	24	0.04	0.5
AIR001613 Grass lawn, behind work shed	24	0.07	0.6
AIR001622 At rear of RSPCA building	24	0.05	0.4
AIR001623 Behind 194 Egmont Road	24	0.03	0.2

Key: Bold = exceeded MfE guideline value of 0.13 g/m^2/day for residential areas

Over the 2012-2013 period, there were two particulate levels obtained above the Taranaki Regional Council guideline level for dust deposition of 0.13 g/m^2/day. These were found at the landfill entrance and behind the work shed. The site at the entrance often has elevated levels as trucks stop and start there to get through the security barrier. The site behind the work shed is also close to the security barrier and the weighing kiosk where all trucks stop for weighing.

All other sites were below the guideline level and overall the landfill 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^3 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. On two occasions the guideline was exceed when a truck passed by. Dust was noted as an issue during inspections over the drought period and it was also noted that dust suppression measures were being used. After recording the results for the April survey the landfill manger was contacted to have dust suppression measures instigated. The high levels found were however all localised well inside the landfill boundary and other sites within and outside the boundary were well below guidelines levels.

Table 13 Ambient PM10 and methane survey results 9 January 2013

Site	Methane	Dust µg/m3
AIR001609	0	18
AIR001615	0	22
AIR001614	0	15
AIR001612	0	18
AIR001603	0	18
AIR001610	0	240*
AIR001618	0	38
Average	0	52.71

*Truck from tipface passed directly by detector

Table 14 Ambient PM10 and methane survey results 28 March 2013

Site	Methane	Dust µg/m3
AIR001620	0	10
AIR001610	0	14
AIR001602	0	16
AIR001613	0	8
AIR001603	0	7
AIR001612	0	8
AIR001614	0	7
Average	0	10.00

Table 15 Ambient PM10 and methane survey results 14 April 2013

Site	Methane	Dust µg/m3
AIR001620	0	6
AIR001610	0	6
AIR001602	0	300*
AIR001613	0	16
AIR001616	0	14
AIR001612	0	5
AIR001615	0	5
Average	0	50.29

*Truck from tipface passed directly by detector

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 2012-2013 period, four incidents were logged in regards to the landfill at Colson Rd.

2.8.1 17 August 2012

Self notification was received of a leachate discharge from the Colson Road Landfill into an unnamed tributary of the Puremu Stream. Investigation found that leachate had discharged via the stormwater pond to an unnamed tributary of the Puremu Stream. The tributary was discoloured for approximately 100 metres to the confluence with the Puremu Stream. Sample results showed that on 17 August 2012 the level of ammoniacal nitrogen at site PMU000113 was 1. 73 g/m^3 (consent limit is 2.0 g/m^3. Further sampling on 21 August 2013 showed that the level of ammoniacal nitrogen at site PMU000113 was 2.15 g/m^3.

A letter of explanation was received stating a small slippage of refuse had caused the contaminated and uncontaminated water to mix and enter the stormwater system. and that works were being undertaken to prevent reoccurrence. This explanation was accepted by Council.

2.8.2 13 August 2012

A complaint was received regarding an objectionable odour discharging beyond the boundary of the Colson Road landfill. An odour survey conducted at the complainant's property found no objectionable odours and no odours attributable to the Colson Road landfill.

2.8.3 7 June 2013

Self notification from New Plymouth District Council was received regarding a leachate discharge from the Colson Road landfill. The consent holder's response to the contaminated stormwater discharge of last August 2012 was to finish lining stage three and direct all run-off from the liner to the WWTP. Heavy rain inundated the pumping system and the leachate pond started to overflow and contaminated stormwater/leachate had discharged into the Puremu Stream. Two sucker trucks were in operation removing water from the pond as well the pumps working at 17 litres per second outflow. Samples were taken upstream and downstream of the discharge (at compliance point PMU000113). Sampling found that the level of ammoniacal nitrogen at site PMU000113 breached consent conditions but that levels dropped away quickly as the consent holder responded to the incident.

An incident report was received from NPDC explaining what occurred and what steps were taken to mitigate effects and what preventive measures had been undertaken to prevent future occurrences. This explanation was accepted.

2.8.4 20 June 2013

Self notification was received regarding an emergency discharge of contaminated stormwater into the Puremu Stream from the Colson Road Landfill, New Plymouth. An inspection of the landfill found that due to heavy rainfall and a large exposed catchment area the leachate collection system could not cope with the volume of water and so had to be directed to a collection pond where it flowed into the Puremu Stream. Samples and photographs were taken.

The following day the discharge was again occurring even though sucker trucks were being used to lower the level of the pond. Sampling found that the level of ammoniacal nitrogen at site PMU000113 breached consent conditions but that levels dropped away quickly as the consent holder responded to the incident.

NPDC submitted an incident report and this was reviewed and accepted by Council on the proviso that the diversion of uncontaminated liner-stormwater away from the leachate system be investigated.

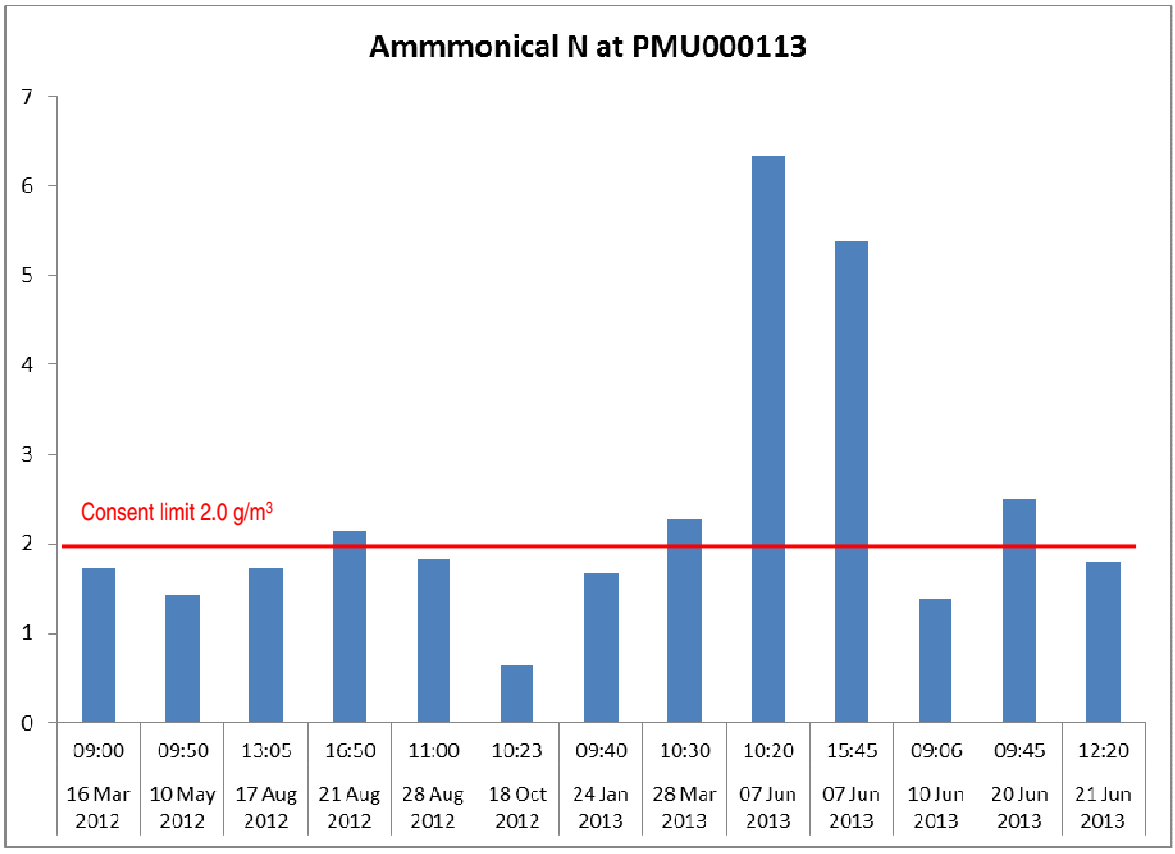

Figure 6 Graph showing non-compliances during incidents in August 2012 and June 2013 (compliant results from routine monitoring also shown)

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 11 July 2012, 14 November 2012 and 6 March 2013. 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 2013-2014 monitoring period.

2.9.3 Independent Consultant's Reports

Site inspections were undertaken by WAI Environmental (independent consultants) on 11 October 2012 and 7 February 2013.

The report of the 11 October 2012 concluded that there were a number of matters that needed to be addressed in order to ensure compliance. These matters were:

- General litter control was not adequate
- The tipface exceeded the 900 m^2 guideline

The report of the 7 February 2013 inspection noted that:

- Large volumes of dewatered WWTP sludge were uncovered
- Litter collection was underway at the time and that silts ponds looked tidy
- The tipface appeared to exceed the 900 m^2 guideline
- Some bags containing asbestos had split
- The site was not being maintained at a 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

There were some issues in regards to the size of the tip face and litter control during the period under review. There was one complaint in regards to odour, but this was not substantiated. The level of daily and interim cover was also raised as there seemed to be large areas of semi exposed refuse.

The key issue during this period was the discharge of leachate contaminated stormwater from Stage three. Consent 4619 allows for the discharge of minor amounts of leachate on a contingency basis if the leachate pumps are unable to pump away all the liquid discharging from stage three. The consent however also specifies that ammoniacal nitrogen levels shall not exceed 2.0 g/m^3 at site PMU000113 and this occurred on a number of occasions during these incidents and on one occasion during routine operations.

The independent consultant reports also raised numerous operational and compliance issues and in conjunction with the incidents discussed above, an improvement in site performance is desired. Council notes, however, that at the time of the publication of this report, significant improvements have been made at the site.

3.2 Environmental effects of exercise of consents

In relation to the Puremu Stream, there were non compliances with the consent conditions relating to the receiving water quality. These were in regard to the level of ammoniacal nitrogen recorded at the boundary. Based on ambient pH and temperature conditions it is estimated that the level of unionised ammonia exceeded the 0.025 g/m^3 guideline for aquatic health on two 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. Degradation of the stream habitat due to logging and unauthorised culvert works in the unnamed tributary below the main silt pond are more likely the cause in the lower MCI values found there this period.

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 of 0.13 $g/m^2/day$. 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 16 -23.

Table 16 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 consent compliance and environmental performance in respect of this consent		**High**

Table 17 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	One non compliance in PM10 readings
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 gasses 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 consent compliance and environmental performance in respect of this consent		**High**

Table 18 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^3, and maximum ammoniacal nitrogen 0.5 g/m^3 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	No- as stormwater from this consent was mixed with contaminated stormwater and leachate
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	No- contaminated and uncontaminated stormwater are mixed
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 consent compliance and environmental performance in respect of this consent		**Improvement desired**

N/A = not applicable

Table 19 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	Six exceedances in ammoniacal nitrogen
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	No-contaminated and uncontaminated stormwater were mixed
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 consent compliance and environmental performance in respect of this consent		**Improvement desired**

N/A = not applicable

Table 20 Summary of performance for Consent 2370-3 Contaminated stormwater and leachate discharge

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Discharge shall not conspicuously alter the Puremu Stream's natural odour or clarity	Site specific monitoring programme - inspection and water sampling	Yes
2. No adverse impact on aquatic life	Site specific monitoring programme - inspection and water sampling	Yes
3. Monitor surface water on/near the site	Site specific monitoring programme - inspection and water sampling	Yes
4. Satisfy all requirements of the District Plan of the New Plymouth District Council	N/A	N/A
5. Management and site contingency plan	Site specific monitoring programme – programme supervision	Yes
6. Prevent or minimise any likely adverse effects on the environment	Site specific monitoring programme - inspection and water sampling	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
7. Maintain a landfill capping barrier and vegetative cover	Inspection (applicable to stage 1 & 2 only)	Yes
8. Area is closed and managed in accordance with the amended management plan November 2001	Site specific monitoring programme – programme supervision, and inspections	Yes
9. Maintain drains, ponds and contours on site to minimise unwanted water movement and ponding on site	Site specific monitoring programme - site inspections	Yes
10. No cleaning or hosing out of refuse vehicles on site	Site specific monitoring programme - site inspections	Yes
11. 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
12. 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
13. Discharge shall not alter the water quality of the Puremu Stream below the given criteria	Site specific monitoring programme - inspection and water sampling	Yes
14. Discharge shall not reduce the concentration of dissolved oxygen below 5 mg/litre	Site specific monitoring programme – water sampling	Yes
15. Discharge shall not render the Puremu Stream unfit for stock consumption	Site specific monitoring programme – water sampling	Yes
16. Satisfactorily maintain and manage the leachate collection and treatment systems	Site specific monitoring programme – programme supervision	Yes
17. Optional review provision re environmental effects	Review not required	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**High**

N/A = not applicable

Table 21 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

Condition requirement	Means of monitoring during period under review	Compliance achieved?
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 consent compliance and environmental performance in respect of this consent		**High**

N/A = not applicable

Table 22 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
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	No –cover or refuse found to be not as specified in management plan
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

Condition requirement	Means of monitoring during period under review	Compliance achieved?
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 consent compliance and environmental performance in respect of this consent		**Improvement Desired**

N/A = not applicable

Table 23 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	No
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
13. A review condition	A review was not required	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		**Good**

* N/A = Not applicable

Based on the record of environment performance and compliance during the year, an improvement in NPDC's level of environmental performance and compliance with the resource consents was desired. During the year under review it was found that there were issues in regards to the cover of refuse and there were several non-compliances in regards to water quality in the Puremu Stream as a result of leachate discharges.

3.4 Recommendations from the 2011-2012 Annual Report

The 2011-2012 Annual Report recommended:

THAT for 2012-2013 the monitoring of discharges at the Colson Rd landfill remain unchanged from that of the 2011-2012 monitoring period.

This recommendation was implemented in full.

3.5 Alterations to monitoring programmes for 2013-2014

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 2013-2014, that the monitoring programme remain unchanged from that of the 2012-2013 monitoring period.

A recommendation to this effect is attached to this report.

3.6 Exercise of optional review of consent

Resource consents 6177 and 2370 provide for an optional review of the consent in June 2014. Conditions allows the Council to review the consent 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.

Based on the results of monitoring in the year under review, and in previous years as set out in earlier annual compliance monitoring reports, it is considered that there are no grounds that require a review to be pursued.

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

4. Recommendation

1. THAT for 2013-2014 the monitoring of discharges at the Colosn 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,.

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
E.coli	*escherichia coli*, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample
Ent	enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample
F	fluoride
FC	faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample
fresh	elevated flow in a stream, such as after heavy rainfall
g/m^3	grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures
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_4	ammonium, normally expressed in terms of the mass of nitrogen (N)
NH_3	unionised ammonia, normally expressed in terms of the mass of nitrogen (N)
NO_3	nitrate, normally expressed in terms of the mass of nitrogen (N)
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water
O&G	oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons)
Pb*	lead
pH	a numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5
Physicochemical	measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment
PM_{10}	relatively fine airborne particles (less than 10 micrometre diameter)
resource consent	refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15)
RMA	Resource Management Act 1991 and 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.

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Appendix I

Resource consents held by NPDC for Colson Road landfill

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.~~VI~~ 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 of 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 futher 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) A L Bray

3. The new 900 mm pipe shall be laid in accordance with the manufacturers specifications.

Signed at STRATFORD this 14th day of May 1986

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

A L Bray

Secretary

Consent 2370-3

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

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

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

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

   i) the administration, monitoring and supervision of this consent; and
   ii) charges authorised by regulations.

Special conditions

1. The consent holder shall 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:

    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° 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_3-N + NO_2-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

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

TARANAKI REGIONAL COUNCIL

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

	Maximum instream concentration Total Recoverable Metals gm^{-3}	Maximum permitted increase in concentration Filtered Metals gm^{-3}
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.

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

TARANAKI REGIONAL COUNCIL

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 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^{-3}
ammoniacal nitrogen	maximum concentration of 0.5 gm^{-3} 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.

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

Consent 4621-1

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
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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

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.

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

TRK994622

TARANAKI REGIONAL COUNCIL

PRIVATE BAG 713
47 CLOTON ROAD
STRATFORD
NEW ZEALAND
PHONE 0-6-765 7127
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DISCHARGE PERMIT

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

Name of Consent Holder:	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.

TRK994622

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

TARANAKI REGIONAL COUNCIL

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DISCHARGE PERMIT

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

Name of Consent Holder:	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.

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

Consent 6177-1

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
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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
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

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 $100gm^{-3}$
ammoniacal nitrogen	maximum concentration of $0.5\ gm^{-3}$ 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.

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.

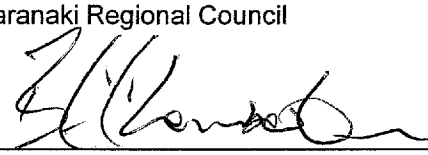
12. After allowing for reasonable mixing the consent holder shall ensure that the discharge shall not give rise to any of the following effects in the receiving waters of the Puremu Stream:

    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



Chief Executive

Appendix II

Biomonitoring reports for Colson Road landfill

To Job Manager, Scott Cowperthwaite
From Scientific Officers Bart Jansma and Katrina Smith
Report No BJ206
Document No 1246651
Date 5 September 2013

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

As with other landfill, 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 12 February 2013 at two previously established sampling sites in the Puremu Stream catchment and at two established sites in the Manganaha Stream (Figure 1, 2, 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 second survey undertaken at this new site and further disturbance was noted, with a digger removing instream material, and clearing bankside vegetation.

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. 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 PT1 in an unnamed tributary of 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).

A combination of both sampling techniques was used at site 2 in the Puremu 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	Vegetation sweep
	2	PMU000110	400 metres downstream landfill	Kick/sweep
Unnamed tributary of Puremu Stream	PT1	PMU000108	60 metres upstream of the confluence with Puremu Stream	Kick
Manganaha Stream	M4	MNH000190	10 metres downstream of an unnamed tributary of the Manganaha Stream	Kick
	M6	MNH000260	500 downstream of site M4	Kick

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.

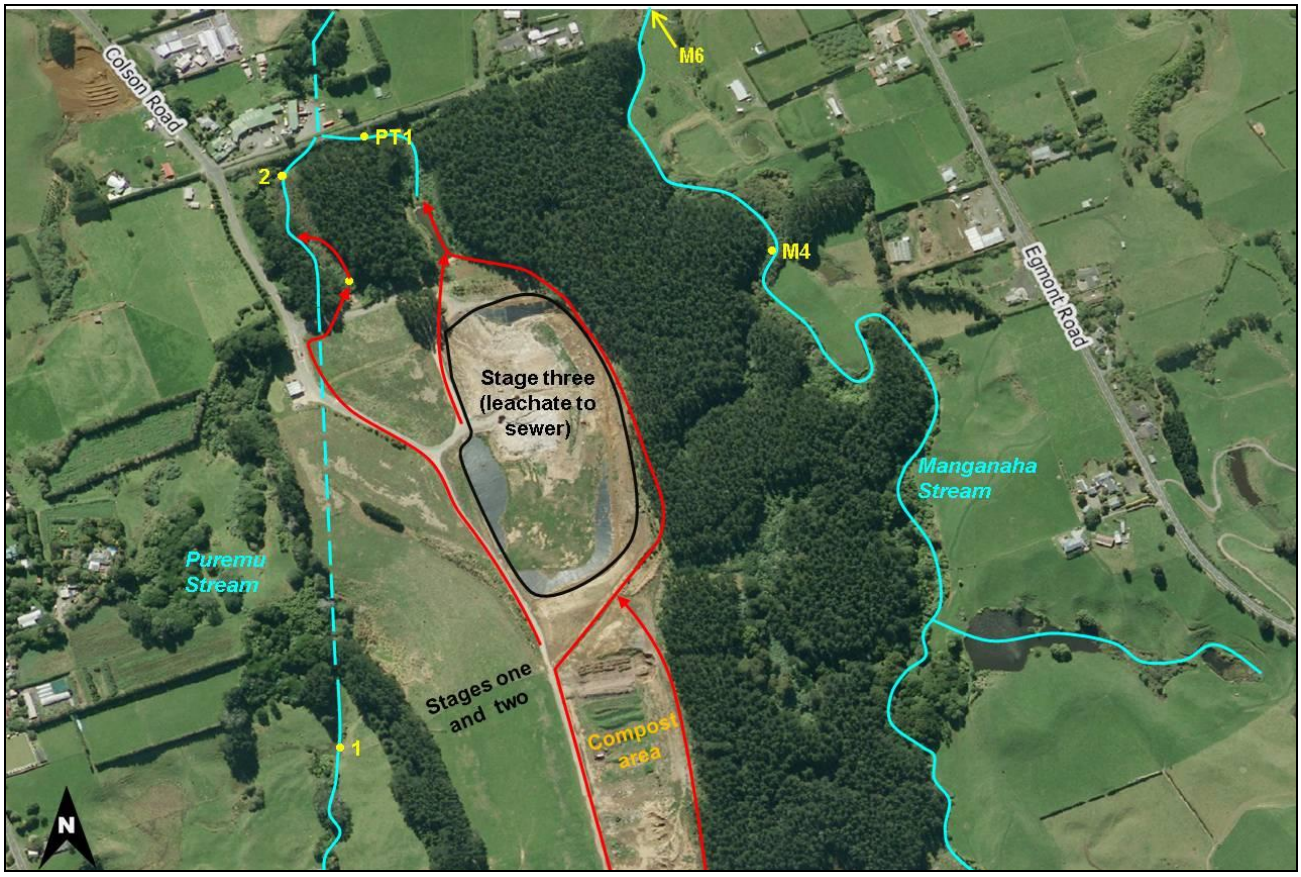


Figure 1 Biomonitoring sites related to the Colson Road landfill, New Plymouth. The red lines on the aerial photograph indicate the direction of stormwater runoff from the land fill site.

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	
Very Good	120-140	
Good	100-119	
Fair	80-99	
Poor	60-79	
Very Poor	<60	

A semi-quantitative MCI value ($SQMCI_s$) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling

these products, and dividing by the sum of the loading factors (Stark 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the $SQMCI_s$ is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower.

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 2013 biomonitoring survey, the water temperatures in the Puremu Stream and tributary ranged from 15.9 °C to 16.7°C. Site 1 in the Puremu Stream had an uncoloured, clear and steady flow, closely resembling a swamp. At site 2 the stream had an uncoloured cloudy and low flow. The unnamed tributary of the Puremu Stream had a low and slow flow of uncoloured, clear water. Iron oxide accumulations were significant at site PT1 and to a lesser extent at site 2, while site 1 was affected by silt. It was noted during the survey that stock had once again accessed the stream at site 1, resulting in this sedimentation.

At site 1 the substrate consisted of silt and sand, while the substrate at site PT1 was predominantly silt, with some hard clay, wood and roots and sand also present. The substrate sampled at Site 2 was predominantly willow roots, with some silt and sand included. Complete shading of the bed was recorded at site 2, with sites 1 and PT1 being completely unshaded.

No periphyton was recorded at any sites in the Puremu Stream, although sites 2 and PT1 did have some leaves and wood which may have provided some habitat. Previous surveys typically recorded significant amounts of pine needles at PT1, but with the change in site location this is no longer the case. Macrophytes dominated the bed of the stream at site 1 during this survey. No unusual bacterial, fungal or protozoan growths were found by microscopic examination for 'heterotrophic growths' at any of the Puremu Stream sites in this October 2012 survey.

The Manganaha Stream had a low, swift, uncoloured flow at sites M4 and M6. This flow was clear at site M4, but cloudy at site M6. The water temperature at site M4 was 15.9°C and 15.58°C at M6. Site M4 was partially shaded, with site M6 being completely shaded. The substrate at site M4 consisted principally of willow roots, while site M6 primarily consisted of hard clay, with some fine substrate also present. Site M4 did not support any algal growth, while site M6 had patchy growths of algal filaments. No unusual bacterial, fungal or protozoan growths were found in the Manganaha Stream by the microscopic examination 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$_s$ values			
	No. samples	Range	Median	Current survey	Range	Median	Current Survey	No. of samples	Range	Median	Current survey
1	40	8-27	18	16	60-90	74	79	26	1.4-5.0	3.8	3.8
2	52	7-24	17	24	51-87	73	78	26	1.5-3.9	3.1	3.7
PT1*	25	11-22	16	13	55-79	71	60	24	1.3-3.7	2.7	1.2
M4	35	11-25	19	20	76-102	87	104	26	2.3-6.9	4.7	6.3
M6	29	12-27	19	19	58-99	83	100	26	2.8-6.8	4.1	3.6

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

Puremu Stream

Site 1 (PMU000104)

A total taxa richness of 16 taxa was recorded at site 1 in this late summer survey (Table 3 and Figure 2). This result was two taxa less than the historical median but was still within the range recorded at this site previously.

The community at this site was characterised by two 'moderately sensitive' taxa (amphipod (*Paracalliope*) and mayfly (*Zephlebia*)) and four 'tolerant' taxa (*Cura* flatworms, oligochaete worms, *Potamopyrgus* snail and ostracod seed shrimps). This community assemblage reflected the prevalence of macrophyte habitat recorded at this site and was indicative of moderate preceding water quality (Table 4).

In this survey, just less than half (44%) of the community consisted of 'sensitive taxa', which resulted in an MCI score of 79 units, five units higher than the median score recorded at this site previously (Table 3 and Figure 2). The numerical dominance of the 'tolerant' snail *Potamopyrgus* resulted in a SQMCI$_s$ score of 3.8 units (Table 4). This score was equal to the median score recorded for the site (Table 3).

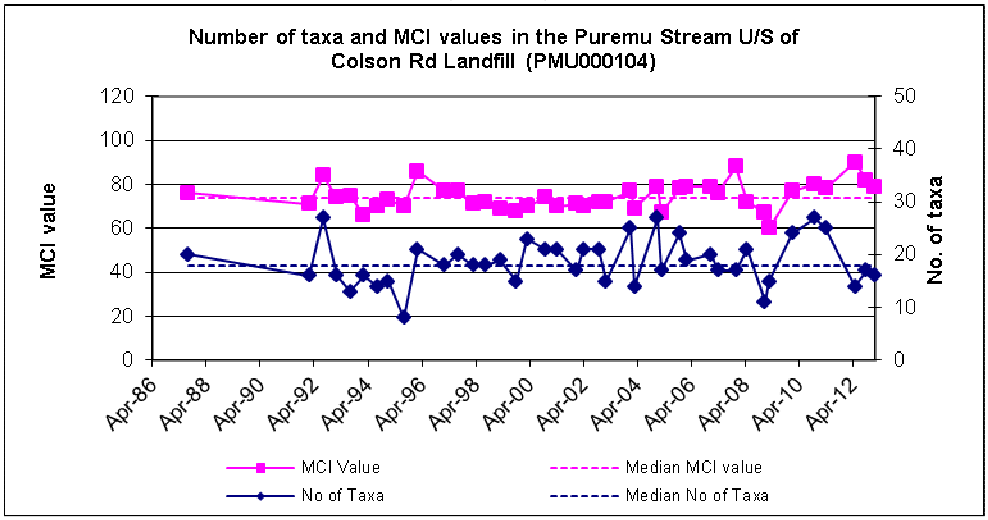


Figure 2 Number of macroinvertebrate taxa and MCI values recorded at site 1 in the Puremu Stream, upstream of Colson Road Landfill since April 1987

In comparison to historical results from this site, these results were indicative of relatively typical health, despite the fact that recent stock access had damaged the instream habitat. This resulted in a slight decrease in the abundance of some macrophyte associated taxa (such as the 'moderately sensitive' amphipod *Paracalliope* and the mayfly *Zephlebia*) from that recorded in the previous survey. There was also a reduction in the number of 'sensitive taxa present at the site, suggesting recent reductions in water quality, most likely due to stock access.

Table 4 Macroinvertebrate fauna of the Puremu Stream (sites 1 & 2) and tributary (site PT1) in relation to the Colson Road landfill sampled on 12 February 2013

Taxa List	Site Number	MCI score	1	2	PT1
	Site Code		PMU000104	PMU000110	PMU000108
	Sample Number		FWB13046	FWB13047	FWB13048
COELENTERATA	Coelenterata	3	R	R	-
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	A	R	C
NEMERTEA	Nemertea	3	C	C	-
NEMATODA	Nematoda	3	-	R	-
ANNELIDA (WORMS)	Oligochaeta	1	VA	A	XA
HIRUDINEA (LEECHES)	Hirudinea	3	-	-	C
MOLLUSCA	Lymnaeidae	3	-	R	R
	Potamopyrgus	4	XA	XA	-
	Sphaeriidae	3	-	R	-
CRUSTACEA	Copepoda	5	-	R	-
	Ostracoda	1	VA	A	C
	Isopoda	5	-	R	-
	Paracalliope	5	VA	R	-
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	-	R	-
	Zephlebia group	7	VA	-	-
ODONATA (DRAGONFLIES)	*Antipodochlora*	5	R	-	-
	Xanthocnemis	4	R	-	-
HEMIPTERA (BUGS)	*Microvelia*	3	-	R	-
TRICHOPTERA (CADDISFLIES)	*Polyplectropus*	6	C	C	-
	Psilochorema	6	R	-	-
	Oeconesidae	5	-	R	-
	Triplectides	5	R	C	-
DIPTERA (TRUE FLIES)	*Paralimnophila*	6	-	R	R
	Zelandotipula	6	-	R	-
	Orthocladiinae	2	R	-	R
	Polypedilum	3	-	VA	C
	Tanypodinae	5	C	R	C
	Culicidae	3	-	R	A
	Empididae	3	-	C	R
	Psychodidae	1	-	-	R
	Sciomyzidae	3	-	C	-
	Austrosimulium	3	C	-	-
ACARINA (MITES)	Acarina	5	-	-	C
		No of taxa	16	24	13
		MCI	79	78	60
		SQMCIs	3.8	3.7	1.2
		EPT (taxa)	4	4	0
		%EPT (taxa)	25	17	0

'Tolerant' taxa | 'Moderately sensitive' taxa | 'Highly sensitive' taxa

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

Site 2 (PMU000110)

A relatively high number of taxa was recorded at this site (24), seven taxa more than the median of previous surveys at this site, twice that recorded in the previous survey and equal to the previous maximum richness recorded at this site to date (Table 3 and Figure 3). It was noted during this survey that this site was more shaded by bankside ferns, although the iron oxide observed previously was still present. It is unclear what has resulted in this improved taxa richness, although the improved shading and the use of two sampling methods will have contributed.

No 'moderately sensitive' taxa were abundant in this community at site 2, which was characterised by four 'tolerant' taxa (oligochaete worms, *Potamopyrgus* snails, ostracod seed shrimps and *Polypedilum* midge larvae) and these taxa are commonly associated with leafy and woody habitat with slow flow (Table 4). At the time of this survey, leaf material and wood was noted on the stream bed, and the primary substrate sampled comprised willow roots.

The reduced proportion of 'sensitive' taxa (38%) recorded at this site (when compared with the previous survey (50%) resulted in a reduced MCI score of 78 units, although this was five units higher than the historical median for the site and similar to the MCI score recorded at site 1 (Table 3 and Figure 3).

The numerical dominance of the two 'tolerant taxa' in particular *Potamopyrgus* snails resulted in a moderately low SQMCI score of 3.7 units. This score was marginally higher than the historical median for the site but similar to the score recorded upstream at site 1 (Table 3).

These results suggest that the health of the macroinvertebrate community at site 2 is similar to that recorded at site 1, despite differences in habitat and sampling technique between the sites. The health of the community at site 2 has not changed from that recorded in the previous survey, despite the significant increase in taxa richness. However, when the overall macroinvertebrate assemblage downstream at site 2 is compared with the historical results for this site, there is no clear 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 during this survey.

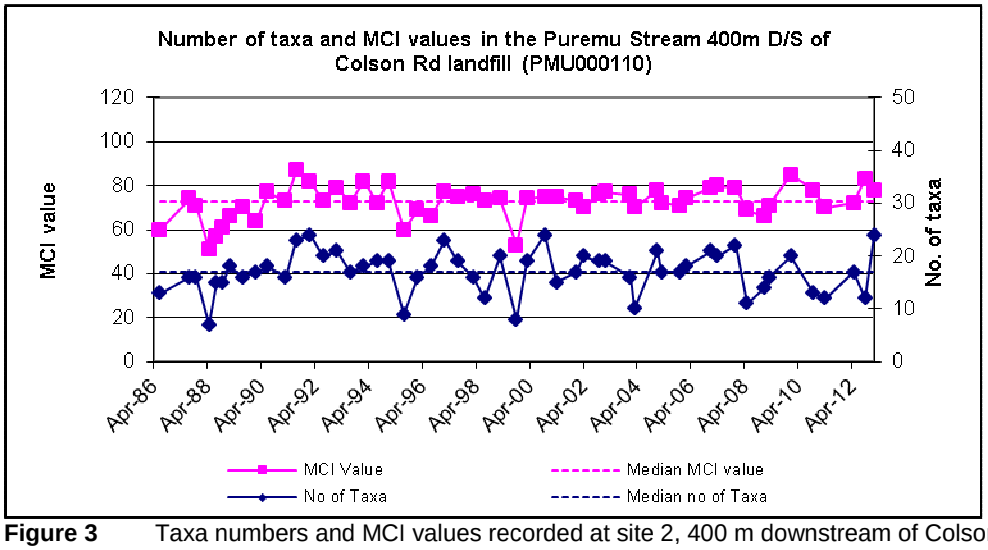


Figure 3 Taxa numbers and MCI values recorded at site 2, 400 m downstream of Colson Rd Landfill

Site PT1 (PMU000109)

Thirteen taxa were recorded at site PT1 in the unnamed tributary of the Puremu Stream, three less than the historical median for the site and less than that recorded at sites 1 and 2 in the Puremu Stream (Table 3 and Figure 4). This result may in part be explained by the presence of significant accumulations of iron oxide at this site compared to sites 1 and 2 and also the disturbance observed such as the removal of streambed material by digger.

The community at site PT1 was characterised by only two 'tolerant' taxa (oligochaete worms, and mosquito larvae) (Table 4). The high proportion of 'tolerant' taxa (77%) recorded in the community at this site was indicative of poor preceding water quality, most likely due to the presence of significant iron oxide accumulations, the removal of instream habitat and the low flow of water. This was reflected in the MCI score of 60 units, which borders on 'very poor' water quality, and was significantly less (Stark, 1998) than the median MCI score for the site (Table 3 and Figure 4). This MCI score was also significantly lower than both sites in the Puremu Stream (Stark, 1998).

Two low scoring 'tolerant' taxa numerically dominated the community at this site in the current survey which resulted in extremely low $SQMCI_s$ score of 1.2 units, 1.5 units lower than the historical median score for the site, and only 0.2 units higher than the absolute minimum score possible. This $SQMCI_s$ score was also significantly lower than that recorded at sites 1 and 2 (Stark, 1998), and represents very poor water quality and/or habitat quality at this site.

Although the location sampled in this survey differs slightly to that surveyed historically, the previous survey found little difference in macroinvertebrate community composition or health. However, the current survey followed significant disturbance to the stream bed, and as a result, recorded a community of significantly poorer health and condition. This is considered primarily related to the disturbance activities, and as a result it is not possible to conclude either way whether the discharge of stormwater to this stream caused any degradation of the community. It is can be concluded however that the overriding influence was the degree of iron oxide sedimentation, and stream bed disturbance observed at this site.

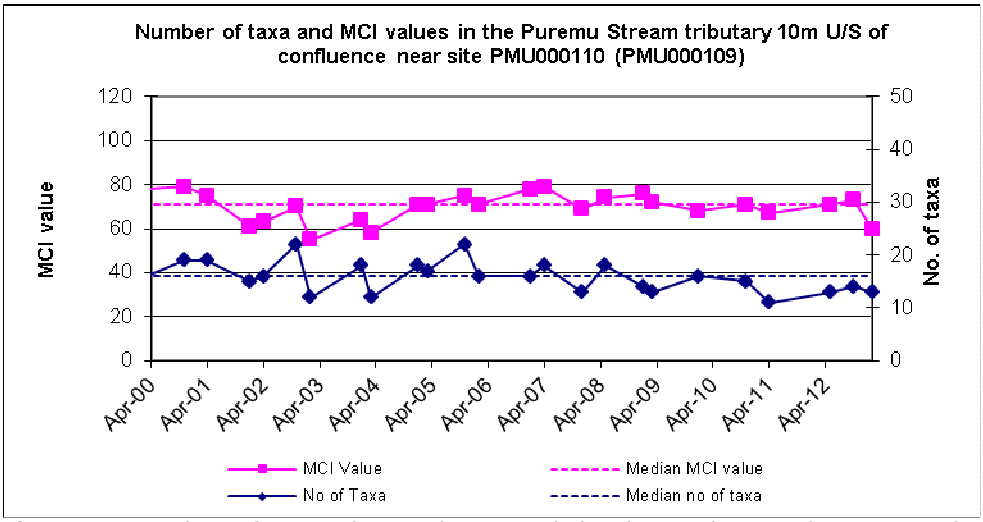


Figure 4 Numbers of taxa and MCI values recorded to date at site PT1, downstream of Colson Rd Landfill

Manganaha Stream

Site M4 (MNH000190)

A total of twenty taxa were recorded at site M4 in this survey, three taxa more than the historical median for the site (Table 3 and Figure 5). The community at this site was characterised by one 'highly sensitive' taxon (caddisfly (*Orthopsyche*)), three 'moderately sensitive' taxa (*Paracalliope* amphipods and mayflies (*Austroclima* and *Coloburiscus*)) and two 'tolerant' taxa (*Potamopyrgus* snails and sandfly larvae (*Austrosimulium*)) (Table 5), which was indicative of good preceding water quality.

The moderately high proportion of 'sensitive' taxa (70% of total taxa) in the community resulted in an MCI score of 104 units, which is the highest MCI score recorded at this site to date, and was significantly (Stark, 1998) higher than the historical median score recorded for the site (Table 3 and Figure 5). This is the third consecutive survey to record a MCI score significantly higher than the median.

The numerical dominance of the 'moderately sensitive' mayfly *Austroclima*, resulted in a relatively high $SQMCI_S$ value of 6.3 units, significantly (Stark, 1998) higher than the median score recorded at this site.

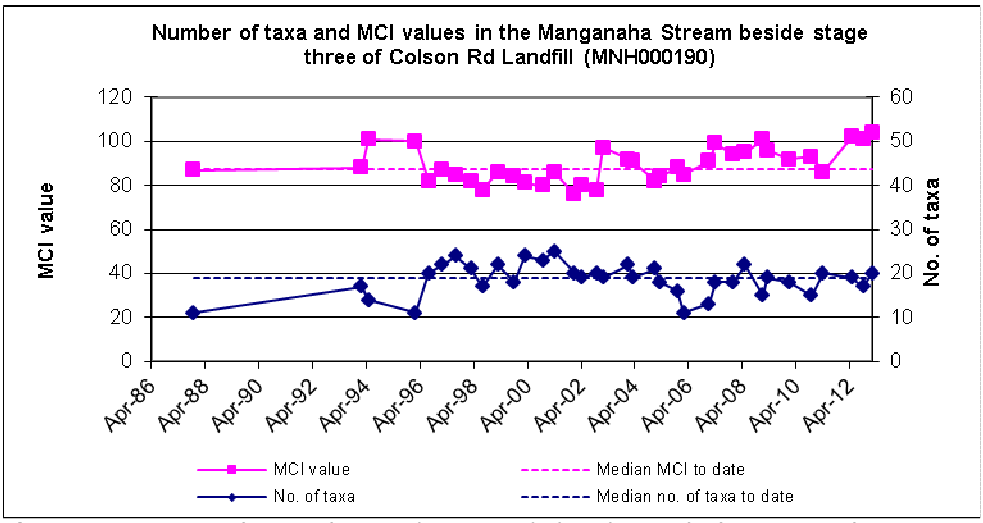


Figure 5 Taxa numbers and MCI values recorded at site M4, in the Manganaha Stream adjacent to Colson Road landfill

Site M6 (MNH000260)

Nineteen taxa were recorded at site M6, equal to the median for the site and similar to that recorded at the upstream site M4 (Table 3 and Figure 6). In this survey, the dominant taxa at this site included two 'moderately sensitive' taxa (mayfly (*Austroclima*)), and one 'tolerant' taxon (oligochaete worms). This community structure differed somewhat to that found at site M4, with eight significant changes in taxon abundance between the two sites (Table 5). This can be attributed to changes in habitat, primarily the change from willow roots to hard clay being sampled, and resulted in large reductions in the abundance of 'moderately sensitive' taxa.

The moderately low proportion of 'tolerant' taxa (32%) in the community resulted in an MCI score of 100 units, similar to the MCI score recorded at site M4. This score was seventeen units higher than the historical median recorded for the site, a statistically significant result (Stark,

1998), and was the highest score recorded at this site to date. This is the second consecutive survey to record a new maximum MCI score at this site (Table 3 and Figure 6).

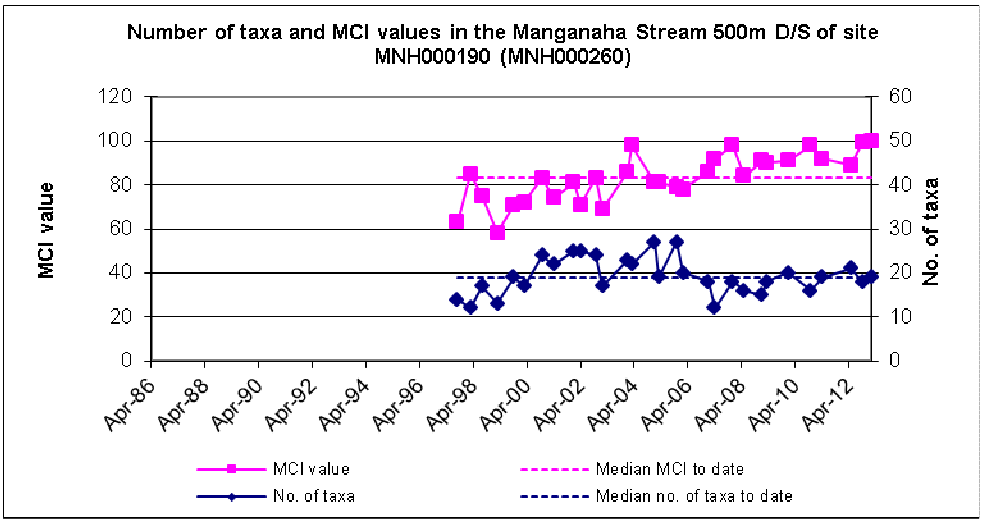


Figure 6 Taxa numbers and MCI values recorded at site M6, in the Manganaha Stream downstream of Colson Road landfill

Due to the variation in habitat resulting in the significant reduction in the abundance of a number of sensitive taxa, the SQMCIs score dropped to 3.6 units. This is 0.5 unit less than the median for this site, and significantly less than that recorded upstream in the current survey. It also constitutes a significant reduction from that recorded in the previous survey (6.3 units) was significantly higher than the median and is the second highest score recorded to date at this site (Table 3).

It is apparent that in the current survey there is little difference in community health or composition between sites M4 and M6. Other than the significant reduction in $SQMCI_s$ score at site M6 and numerous significant differences in abundance, which is attributable to the change in habitat, influence of 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 good water quality and differences in habitat between sites was 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. The worst site, PT1 in the Puremu Stream tributary, reflected impacts from manual removal of bed material from the stream.

Table 5 Macroinvertebrate fauna of the Manganaha Stream in relation to the Colson Road landfill sampled on 12 February 2013

Taxa List	Site Number	MCI score	M4	M6
	Site Code		MNH000190	MNH000260
	Sample Number		FWB13049	FWB13050
COELENTERATA	Coelenterata	3	R	-
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	R	-
ANNELIDA (WORMS)	Oligochaeta	1	C	VA
	Lumbricidae	5	-	R
MOLLUSCA	*Potamopyrgus*	4	VA	C
CRUSTACEA	Isopoda	5	C	-
	Paracalliope	5	VA	VA
	Paraleptamphopidae	5	C	-
	Talitridae	5	R	-
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	XA	A
	Coloburiscus	7	VA	R
	Zephlebia group	7	R	-
COLEOPTERA (BEETLES)	Ptilodactylidae	8	R	-
MEGALOPTERA (DOBSONFLIES)	*Archichauliodes*	7	-	R
TRICHOPTERA (CADDISFLIES)	*Costachorema*	7	R	R
	Ecnomidae/Psychomyiidae	6	R	C
	Hydrobiosis	5	C	C
	Orthopsyche	9	A	C
	Psilochorema	6	R	-
	Oxyethira	2	-	R
	Triplectides	5	C	C
DIPTERA (TRUE FLIES)	*Aphrophila*	5	-	R
	Limonia	6	-	R
	Paralimnophila	6	-	R
	Orthocladiinae	2	-	C
	Polypedilum	3	R	R
	Austrosimulium	3	A	R
		No of taxa	20	19
		MCI	104	100
		SQMCIs	6.3	3.6
		EPT (taxa)	9	7
		%EPT (taxa)	45	37

'Tolerant' taxa | 'Moderately sensitive' taxa | 'Highly sensitive' taxa

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

Summary and conclusions

The Council's standard 'kick-sampling' technique was used at three established sites (site PT1, M4 and M6) , the 'sweep-sampling' technique at one established site (site 1) and a combination of both techniques one other established site (2), to collect streambed macroinvertebrates from the Puremu and Manganaha Streams on 12 February 2013. Samples were sorted and identified to provide number of taxa (richness), MCI and $SQMCI_S$ scores for each site.

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

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 and $SQMCI_s$ scores recorded at the upstream control site on the Puremu Stream were similar to their respective median scores, but less than that recorded in the previous survey, significantly so for the $SQMCI_S$ score. This was largely attributable to the reduced abundance of multiple 'moderately sensitive' taxa, especially the amphipod *Paracalliope*. The 'tolerant' *Potamopyrgus* snail was also found to be extremely abundant in this survey. These results were indicative of good preceding water quality, but reflected a macrophyte associated community assemblage, that had been impacted by recent stock access.

Downstream, site 2 in the Puremu Stream recorded similar MCI and $SQMCI_s$ scores, when compared with site 1, and were well within the range of previous scores for this site, and reflected well when compared against their respective medians. Differences in habitat quality were considered to be the most likely reason for the subtle variation in results from that recorded at site 1. Site PT1 in the unnamed tributary on the other hand recorded MCI and $SQMCI_s$ scores significantly less than that recorded in the main stem and both scores were significantly less than their respective medians for that site. This is a direct reflection of the instream excavation that had occurred prior to this survey. These works resulted in the removal of instream habitat, leaving behind a habitat of reduced quality, suiting primarily 'tolerant' invertebrates.

The numerical dominance of 'tolerant' oligochaete worms and mosquito larvae at site PT1 in the unnamed tributary of the Puremu resulted in a very low $SQMCI_s$ score (1.2 units), 1.5 units lower than the historical median score for the site, and only 0.2 units higher than the absolute minimum score possible. This SQMCIs score was also significantly lower than that recorded at sites 1 and 2 (Stark, 1998), and represents very poor water quality and/or habitat quality at this site.

Although the location sampled in this survey differs slightly to that surveyed historically, the previous survey found little difference in macroinvertebrate community composition or health. However, the current survey followed significant disturbance to the stream bed, and as a result, recorded a community of significantly poorer health and condition. This is considered primarily related to the disturbance activities, and as a result it is not possible to conclude either way whether the discharge of stormwater to this stream caused any degradation of the community. It is can be concluded however that the overriding influence was the degree of iron oxide sedimentation, and stream bed disturbance observed at this site.

The upstream site on the Manganaha Stream recorded a new maximum MCI score, and a $SQMCI_s$ score that was significantly higher than its historical median for this site. These results reflected the moderately high proportion of 'sensitive' taxa and the numerical dominance of three 'sensitive' taxa, in particular the abundance of two 'moderately sensitive' mayfly taxa and one 'highly sensitive' caddisfly taxon, and was indicative of good preceding water quality.

In the Manganaha Stream downstream of the landfill site, the macroinvertebrate community contained a moderately low proportion of 'tolerant' taxa which resulted in an MCI score of 100 units. As with site M4, this was a new maximum MCI score for this site, and was only an insignificant four units lower than that recorded at the upstream site, indicating little difference water quality. However, the $SQMCI_s$ score recorded at site M6 was only moderate (3.6 units) and was significantly lower than that recorded at site M4. This was a result of

numerous 'moderately sensitive' taxa reducing in abundance at site M6, a direct reflection of the reduced habitat quality at this site.

No undesirable biological growths were detected at any of these sites during this February 2012 survey.

Overall, the results of this survey were indicative of fair to good preceding water quality at most of the sites monitored, with the exception of site PT1 in the unnamed tributary of the Puremu Stream which was indicative of poor water quality. The poor flow and habitat conditions observed in the tributary at the time of this survey were the most likely reason for this as opposed to the effects of the discharges from the landfill. In summary, these results were not indicative of any 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.

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To Job Manager, Scott Cowperthwaite
From Scientific Officers Bart Jansma and Katrina Smith
Report No BJ205
Document No 1243071
Date 29 August 2013

Biomonitoring of the Puremu and Manganaha Streams in relation to the New Plymouth District Council Colson Road landfill, October 2012

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

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

A combination of both sampling techniques was used at site PT1 in an unnamed tributary of the Puremu 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	Vegetation sweep
	2	PMU000110	400 metres downstream landfill	Kick
Unnamed tributary of Puremu Stream	PT1	PMU000108	60 metres upstream of the confluence with Puremu Stream	Kick/sweep
Manganaha Stream	M4	MNH000190	10 metres downstream of an unnamed tributary of the Manganaha Stream	Kick
	M6	MNH000260	500 downstream of site M4	Kick

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.

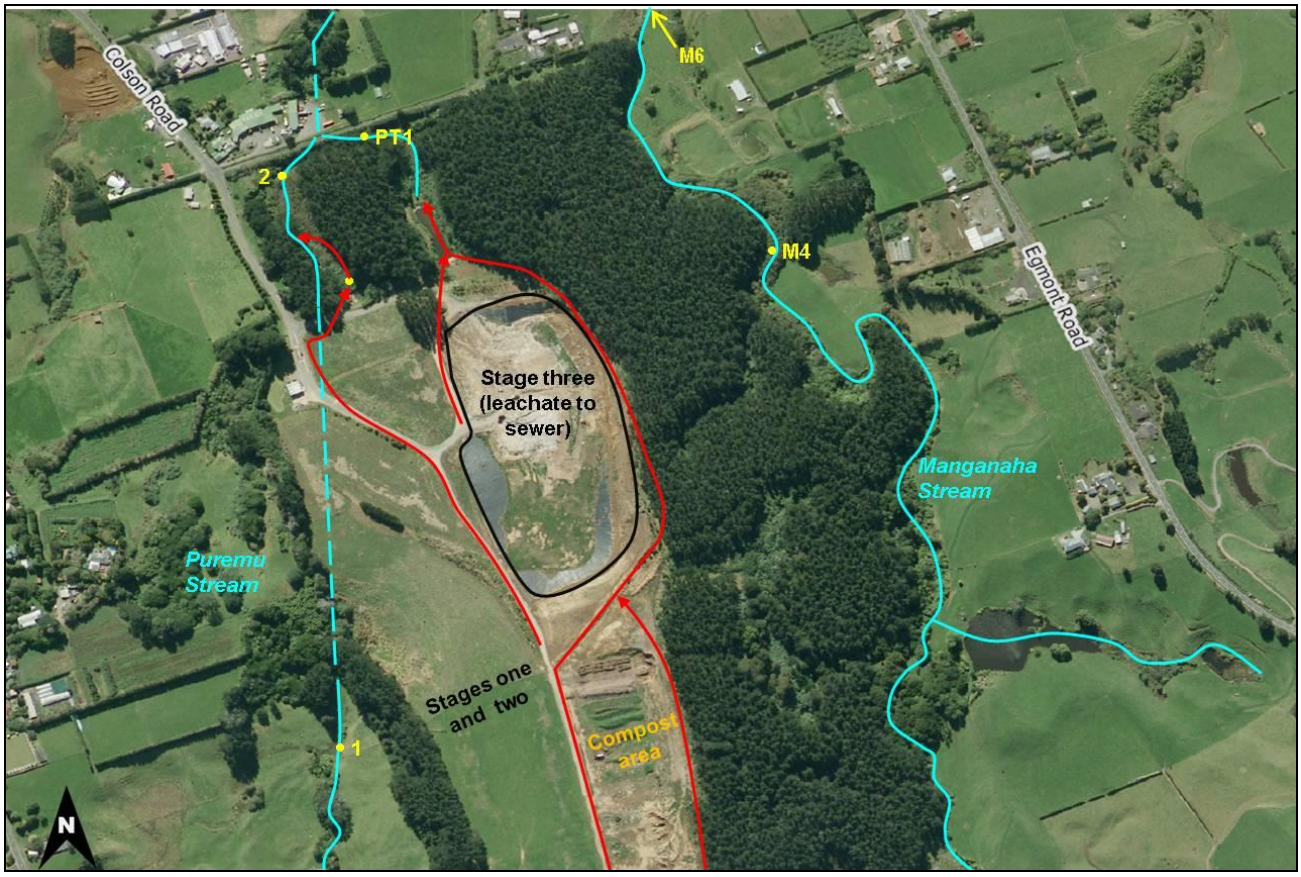

Figure 1 Biomonitoring sites related to the Colson Road landfill, New Plymouth. The red lines on the aerial photograph indicate the direction of stormwater runoff from the land fill site.

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	
Very Good	120-140	
Good	100-119	
Fair	80-99	
Poor	60-79	
Very Poor	<60	

A semi-quantitative MCI value ($SQMCI_s$) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling

these products, and dividing by the sum of the loading factors (Stark 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the $SQMCI_s$ is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower.

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 October 2012 biomonitoring survey, the water temperatures in the Puremu Stream and tributary ranged from 14.0 °C to 14.9°C. Site 1 in the Puremu Stream had an uncoloured, clear and slow flow, closely resembling a swamp. At site 2 the stream had an uncoloured clear moderate flow. The unnamed tributary of the Puremu Stream had a low steady flow of uncoloured, clear water. Iron oxide accumulations were significant at site PT1 and to a lesser extent at site 2.

At site 1 the substrate consisted of silt and sand, as did the substrate at site PT1. Site 2 also had a significant proportion of silt within the substrate, but hard clay and willow root were also present. Partial shading of the bed was recorded at site 2, with complete shading at site PT1, whereas site 1 was open.

No periphyton was recorded at sites 1 and PT1 in this survey, although site 2 had some patches of filamentous algae. Previous surveys typically recorded significant amounts of pine needles at PT1, but with the change in site location this is no longer the case. Macrophytes dominated the bed of the stream at site 1 during this survey. No unusual bacterial, fungal or protozoan growths were found by microscopic examination for 'heterotrophic growths' at any of the Puremu Stream sites in this October 2012 survey.

The Manganaha Stream had a moderate, swift, cloudy and uncoloured flow at sites M4 and M6. The water temperature at site M4 was 13.7°C and 13.8°C at M6. Both sites were partially shaded. The substrate at both sites (M4 and M6) primarily consisted of roots and silt, with a moderate proportion of hard clay also found at site M6. Site M4 did not support any algal growth, while site M6 had patchy growths of algal mats and filaments. No unusual bacterial, fungal or protozoan growths were found in the Manganaha Stream by the microscopic examination 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$_s$ values			
	No. samples	Range	Median	Current survey	Range	Median	Current Survey	No. of samples	Range	Median	Current survey
1	39	8-27	18	17	60-90	73	82	25	1.4-5.0	3.7	4.8
2	51	7-24	17	12	51-87	73	83	25	1.5-3.9	3.0	3.8
PT1*	24	11-22	16	14	55-79	71	73	23	1.3-3.7	2.7	2.0
M4	34	11-25	19	17	76-102	87	101	25	2.3-6.9	4.6	6.4
M6	28	12-27	19	18	58-98	83	99	25	2.8-6.8	4.1	6.3

* summary statistics given for PT1 are for sampling site PMU000109.

Puremu Stream

Site 1 (PMU000104)

A total taxa richness of 17 taxa was recorded at site 1 in this late summer survey (Table 3 and Figure 2). This result was one taxon less than the historical median but was still within the range recorded at this site previously.

The community at this site was characterised by four 'moderately sensitive' taxa (amphipod (*Paracalliope*), two mayfly species (*Austroclima* and *Zephlebia*) and stick cased caddisfly (*Trichoptera*)) and three 'tolerant' taxa (*Potamopyrgus* snail, ostracod seed shrimps and *Austrosimulium* sandfly larvae). This community assemblage reflected the prevalence of macrophyte habitat recorded at this site and was indicative of good preceding water quality (Table 4).

In this survey, almost half (47%) of the community consisted of 'sensitive taxa' which resulted in an MCI score of 82 units, nine units higher than the median score recorded at this site previously (Table 3 and Figure 2). The numerical dominance of the 'moderately sensitive' taxa, especially amphipod *Paracalliope* resulted in a SQMCI$_s$ score of 4.8 units (Table 4). This score was significantly (Stark, 1998) higher than the median score recorded for the site (Table 3).

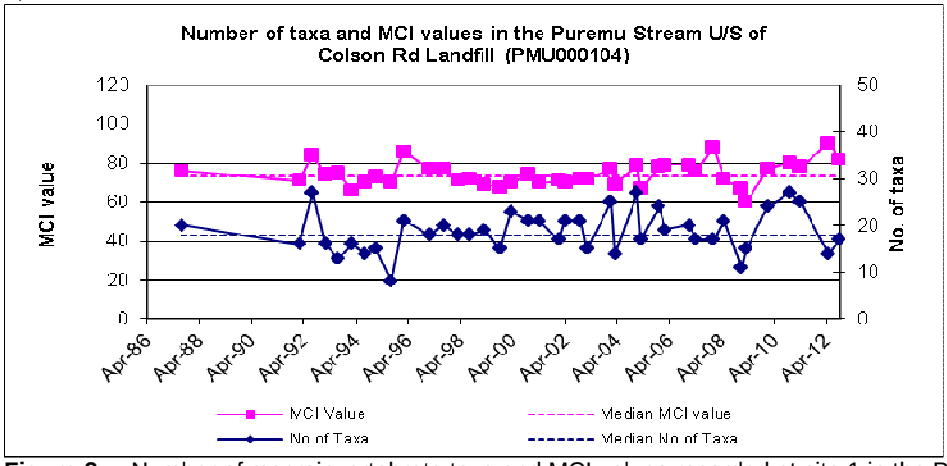

Figure 2 Number of macroinvertebrate taxa and MCI values recorded at site 1 in the Puremu Stream, upstream of Colson Road Landfill since April 1987

In comparison to historical results from this site, these results were indicative of a much healthier more well-established macrophyte habitat which allowed 'sensitive' taxa (such as the amphipod *Paracalliope* and the mayfly *Zephlebia*) to increase in abundance. There was also a reduction in the number of 'tolerant' taxa present at the site, suggesting recent improvements in water quality, possibly due to improvements around stock access for example.

Table 4 Macroinvertebrate fauna of the Puremu Stream (sites 1 & 2) and tributary (site PT1) in relation to the Colson Road landfill sampled on 1 October 2012

Taxa List	Site Number	MCI score	1	2	PT1
	Site Code		PMU000104	PMU000110	PMU000108
	Sample Number		FWB12324	FWB12325	FWB12326
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	R	-	-
NEMATODA	Nematoda	3	-	R	-
ANNELIDA (WORMS)	Oligochaeta	1	C	R	XA
HIRUDINEA (LEECHES)	Hirudinea	3	-	-	C
MOLLUSCA	*Potamopyrgus*	4	XA	XA	-
	Sphaeriidae	3	R	-	-
CRUSTACEA	Ostracoda	1	A	C	R
	Isopoda	5	-	-	R
	Paracalliope	5	XA	-	-
	Talitridae	5	-	-	R
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	VA	R	C
	Deleatidium	8	-	-	R
	Zephlebia group	7	VA	R	-
PLECOPTERA (STONEFLIES)	*Acroperla*	5	C	R	-
ODONATA (DRAGONFLIES)	*Xanthocnemis*	4	R	-	-
COLEOPTERA (BEETLES)	Hydrophilidae	5	-	-	R
TRICHOPTERA (CADDISFLIES)	*Aoteapsyche*	4	-	-	R
	Hydrobiosis	5	R	R	-
	Polyplectropus	6	R	-	-
	Triplectides	5	A	-	-
DIPTERA (TRUE FLIES)	*Chironomus*	1	-	-	A
	Harrisius	6	-	R	-
	Orthocladiinae	2	-	-	C
	Polypedilum	3	R	VA	XA
	Tanypodinae	5	R	R	-
	Tanytarsini	3	C	-	-
	Empididae	3	-	R	-
	Muscidae	3	-	-	R
	Austrosimulium	3	A	-	R
		No of taxa	17	12	14
		MCI	82	83	73
		SQMCIs	4.8	3.8	2.0
		EPT (taxa)	6	4	3
		%EPT (taxa)	35	33	21

'Tolerant' taxa	'Moderately sensitive' taxa	'Highly sensitive' taxa

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

Site 2 (PMU000110)

A moderately low number of taxa was recorded at this site (12), five taxa less than the median of previous surveys at this site, and a slight decrease from the upstream site 1 (Table 3 and Figure 3). It was noted during this survey that this site seemed to have more iron oxide than normal, with the smothering impact of this iron oxide possibly explaining the reduced taxa richness.
Only two 'tolerant' taxa characterised the community at site 2 (*Potamopyrgus* snails and *Polypedilum* midge larvae) and these taxa are commonly associated with leafy and woody habitat (Table 4). At the time of this survey, a considerable amount of leaf material and willow roots were observed at this site.

The moderate proportion of 'sensitive' taxa (50%) recorded at this site resulted in a MCI score of 83 units which was ten units higher than the historical median for the site and similar to the MCI score recorded at site 1 (Table 3 and Figure 3).

The numerical dominance of the two 'tolerant' taxa in particular *Potamopyrgus* snails resulted in a moderately low SQMCI score of 3.8 units. This score was marginally higher than the historical median for the site but significantly (Stark, 1998) lower than the score for the upstream site 1 (Table 3).

These results suggest that the health of the macroinvertebrate community at site 2 is similar to that recorded at site 1, despite differences in habitat and sampling technique between the sites. The health of the community at site 2 has improved slightly from that recorded in the previous survey. However, when the overall macroinvertebrate assemblage downstream at site 2 is compared with the historical results for this site, there is no clear 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 during this survey.

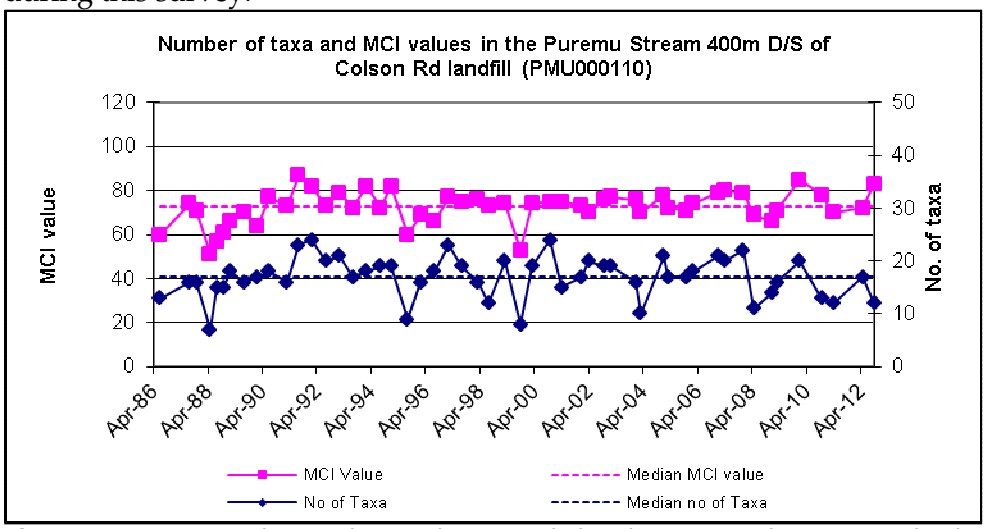

Figure 3 Taxa numbers and MCI values recorded at site 2, 400 m downstream of Colson Rd Landfill

Site PT1 (PMU000109)

Fourteen taxa were recorded at site PT1 in the unnamed tributary of the Puremu Stream, two less than the historical median for the site but within the range recorded at sites 1 and 2 in the Puremu Stream (Table 3 and Figure 4). This result may in part be explained by the presence of significant accumulations of iron oxide at this site compared to sites 1 and 2.

The community at site PT1 was characterised by three 'tolerant' taxa (oligochaete worms, *Chironomus* blood worms and *Polypedilum* midge larvae) (Table 4). The high proportion of 'tolerant' taxa (64%) recorded in the community at this site was indicative of relatively poor preceding water quality, most likely due to the presence of significant iron oxide accumulations combined with a low flow of water. This was reflected in the MCI score of 73 units, similar to the median MCI score for the site (Table 3 and Figure 4). This MCI score was lower than both sites in the Puremu Stream, but not significantly (Stark, 1998).

Two low scoring 'tolerant' taxa numerically dominated the community at this site in the current survey which resulted in a very low $SQMCI_s$ score of 2.0 units, 0.7 units lower than the historical median score for the site, but 0.7 units higher than that recorded in the previous survey. This $SQMCI_s$ score was significantly lower than that recorded at sites 1 and 2.

Although the location sampled in this survey differs slightly to that surveyed historically, there is little difference in macroinvertebrate community composition or health. There has been no notable degradation in community health since the previous survey, and neither does it depart significantly from the median. As a result it is possible to conclude that the discharge of stormwater to this stream is causing no degradation in community, and the overriding influence is the degree of iron oxide sedimentation and leaf fall present at this site.

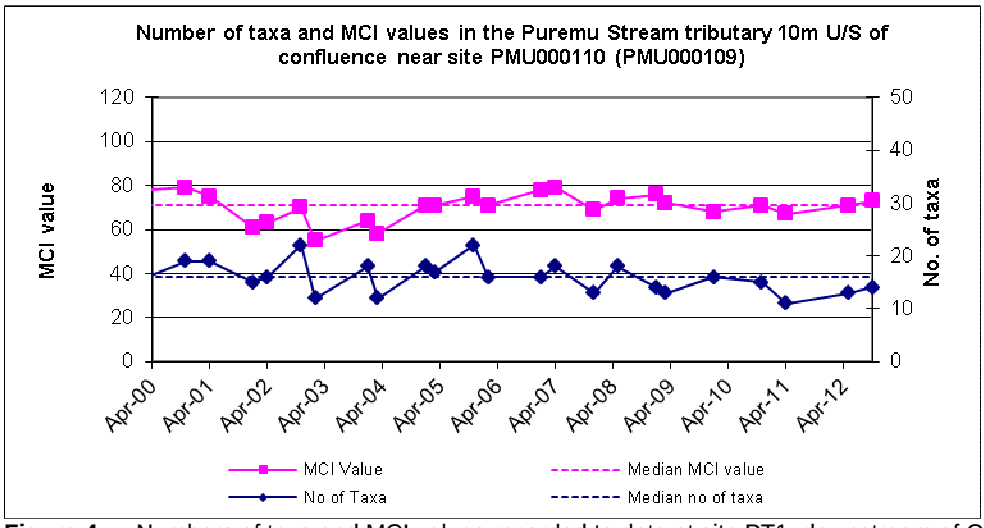

Figure 4 Numbers of taxa and MCI values recorded to date at site PT1, downstream of Colson Rd Landfill

Manganaha Stream

Site M4 (MNH000190)

A total of seventeen taxa were recorded at site M4 in this survey, which was similar to the historical median for the site (Table 3 and Figure 5). The community at this site was characterised by one 'highly sensitive' taxon (caddisfly (*Orthopsyche*)), two 'moderately sensitive' taxa (mayflies (*Austroclima* and *Coloburiscus*)) and one 'tolerant' taxon (oligochaete worms) (Table 5), which was indicative of good preceding water quality.

The moderately high proportion of 'sensitive' taxa (71% of total taxa) in the community resulted in an MCI score of 101 units, which is the second highest MCI score recorded at this site to date, and was significantly (Stark, 1998) higher than the historical median score recorded for the site (Table 3 and Figure 5).

The numerical dominance of the 'highly sensitive' caddisfly (*Orthopsyche*) and the 'moderately sensitive' mayfly *Austroclima* resulted in a relatively high $SQMCI_S$ value of 6.4 units, significantly (Stark, 1998) higher than the median score recorded at this site.

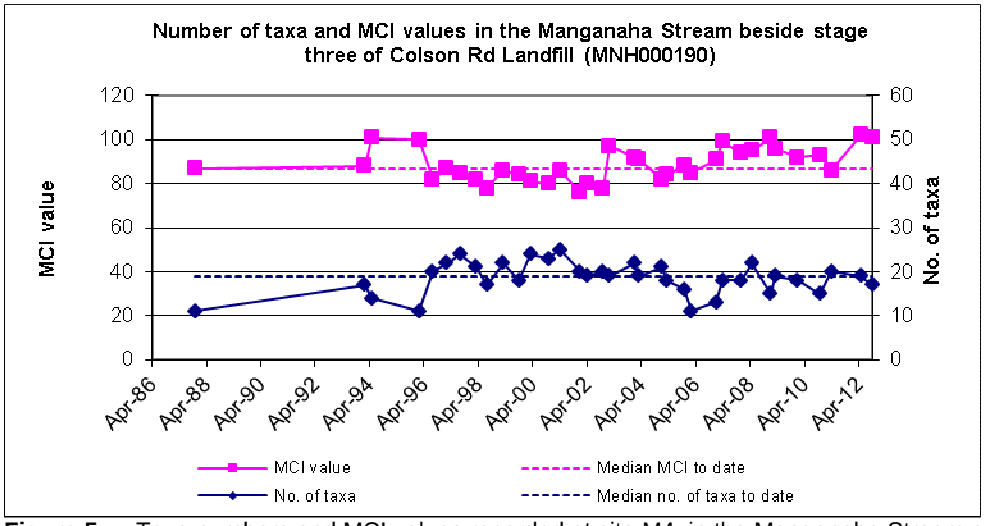

Figure 5 Taxa numbers and MCI values recorded at site M4, in the Manganaha Stream adjacent to Colson Road landfill

Site M6 (MNH000260)

Eighteen taxa were recorded at site M6, one taxon less than the median for the site and similar to that recorded at the upstream site M4 (Table 3 and Figure 6). In this survey, the dominant taxa at this site were the 'highly sensitive' caddisfly *Orthopsyche*, two 'moderately sensitive' taxa (mayflies (*Austroclima* and *Coloburiscus)*), and one 'tolerant' taxon (*Potamopyrgus* snails). This community structure was similar to that found at site M4 (Table 5).

The moderate proportion of 'tolerant' taxa (44%) in the community resulted in an MCI score of 99 units, which was sixteen units higher than the historical median recorded for the site, a statistically significant result (Stark, 1998), and the highest score recorded at this site to date. This result was similar to the MCI score recorded at site M4 (Table 3 and Figure 6).

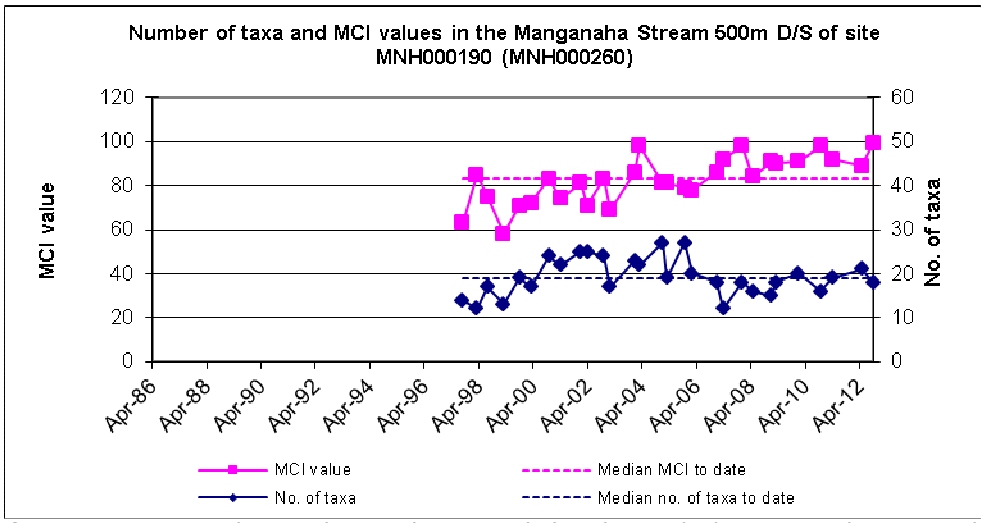

Figure 6 Taxa numbers and MCI values recorded at site M6, in the Manganaha Stream downstream of Colson Road landfill

Similar to site M4, the numerical dominance of the 'highly sensitive' caddisfly *Orthopsyche*, along with the 'moderately sensitive' mayfly *Austroclima* resulted in an $SQMCI_s$ score of 6.3, units which was only 0.1 unit less than the score recorded at the upstream site. This $SQMCI_s$ score of 6.3 units was significantly higher than the median and is the second highest score recorded to date at this site (Table 3).

It is apparent that in the current survey there is little difference in community health or composition between sites M4 and M6. The dominant taxa at each site were very similar, and there were only two significant differences in abundance (Table 5). 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 fair to good water quality and differences in habitat between sites was 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.

Table 5 Macroinvertebrate fauna of the Manganaha Stream in relation to the Colson Road landfill sampled on 1 October 2012

Taxa List	Site Number	MCI score	M4	M6
	Site Code		MNH000190	MNH000260
	Sample Number		FWB12327	FWB12328
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	-	R
ANNELIDA (WORMS)	Oligochaeta	1	A	C
	Lumbricidae	5	R	R
MOLLUSCA	*Potamopyrgus*	4	C	A
CRUSTACEA	Isopoda	5	R	-
	Paracalliope	5	R	-
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	VA	VA
	Coloburiscus	7	VA	A
	Zephlebia group	7	R	R
PLECOPTERA (STONEFLIES)	*Acroperla*	5	C	R
ODONATA (DRAGONFLIES)	*Antipodochlora*	5	-	R
COLEOPTERA (BEETLES)	Ptilodactylidae	8	R	-
MEGALOPTERA (DOBSONFLIES)	*Archichauliodes*	7	-	R
TRICHOPTERA (CADDISFLIES)	Ecnomidae/Psychomyiidae	6	R	C
	Hydrobiosis	5	C	C
	Orthopsyche	9	A	A
	Triplectides	5	-	R
DIPTERA (TRUE FLIES)	*Aphrophila*	5	-	R
	Chironomus	1	C	-
	Orthocladiinae	2	-	C
	Polypedilum	3	R	C
	Austrosimulium	3	R	R
ACARINA (MITES)	Acarina	5	R	-
		No of taxa	17	18
		MCI	101	99
		SQMCIs	6.4	6.3
		EPT (taxa)	7	8
		%EPT (taxa)	41	44
'Tolerant' taxa	'Moderately sensitive' taxa	'Highly sensitive' taxa		

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

Summary and conclusions

The Council's standard 'kick-sampling' technique was used at three established sites (site 2, M4 and M6) , the 'sweep-sampling' technique at one established site (site 1) and a combination of both techniques one other established site (PT1), to collect streambed macroinvertebrates from the Puremu and Manganaha Streams on 1 October 2012. Samples were sorted and identified to provide number of taxa (richness), MCI and $SQMCI_S$ scores for each site.

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

This spring 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 and $SQMCI_s$ scores recorded at the upstream control site on the Puremu Stream were higher than their respective median scores, significantly so for the $SQMCI_S$ score. This was largely attributable to the moderate proportion of 'sensitive taxa' present and the numerical dominance of multiple 'moderately sensitive' taxa, especially the amphipod *Paracalliope*. The 'tolerant' *Potamopyrgus* snail was also found to be extremely abundant in this survey. These results were indicative of good preceding water quality and reflected a well-established macrophyte associated community assemblage.

Downstream, site 2 in the Puremu Stream recorded a similar MCI score, although the $SQMCI_s$ score was significantly reduced, when compared with site 1. Site PT1 in the unnamed tributary recorded an MCI score nine to ten units lower than that recorded in the main stem and a $SQMCI_s$ score significantly lower than that recorded in the main stem. However the results for sites 2 and PT1 were well within the range of previous scores for these sites, and reflected well when compared against their respective medians. Differences in habitat quality were considered to be the most likely reason for the results varying from that recorded at site 1.

The numerical dominance of 'tolerant' oligochaete worms and *Polypedilum* midge larvae at site PT1 in the unnamed tributary of the Puremu resulted in a low $SQMCI_s$ score (2.0 units). This result was indicative of relatively poor preceding water quality in the tributary, although this result does show recovery from the previous survey, which recorded the lowest $SQMCI_s$ score to date. The presence of two mayfly taxa, including one considered 'highly sensitive', suggested that this low $SQMCI_s$ score was most likely the result of poor habitat quality than from the discharges to the stream from the landfill. At the time of this survey, there was a low, steady flow of water with significant accumulations of iron oxide, woody debris and other organic material present in the stream bed which was the likely reason for the abundance of oligochaete worms, *Chironomus* bloodworms and *Polypedilum* midge larvae.

The upstream site on the Manganaha Stream recorded a moderately high MCI and $SQMCI_s$ score in this survey which was significantly higher than the historical medians recorded at

the site in previous surveys. These results reflected the moderate proportion of 'sensitive' taxa and the numerical dominance of three 'sensitive' taxa, in particular the abundance of two 'moderately sensitive' mayfly taxa and one 'highly sensitive' caddisfly taxon, and was indicative of good preceding water quality.

In the Manganaha Stream downstream of the landfill site, the macroinvertebrate community contained a moderately low proportion of 'tolerant' taxa which resulted in an MCI score of 99 units. This was only an insignificant two units lower than that recorded at the upstream site and indicating little difference in habitat or water quality. In addition to this, the $SQMCI_s$ score recorded at site M6 was moderately high (6.4 units) and was similar to that recorded at site M4.

No undesirable biological growths were detected at any of these sites during this October 2012 survey.

Overall, the results of this survey were indicative of fair to good preceding water quality at most of the sites monitored, with the exception of site PT1 in the unnamed tributary of the Puremu Stream which was indicative of poor water quality. The poor flow and habitat conditions observed in the tributary at the time of this survey were the most likely reason for this as opposed to the effects of the discharges from the landfill. In summary, these results were not indicative of any 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.

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Appendix III

Groundwater Results

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Taranaki Regional Council	**Lab No:**	1150712	SPv1
Contact:	Scott Cowperthwaite	**Date Registered:**	29-Jun-2013	
	C/- Taranaki Regional Council	**Date Reported:**	09-Jul-2013	
	Private Bag 713	**Quote No:**	36283	
	STRATFORD 4352	**Order No:**	38841	
		Client Reference:	Groundwater	
		Submitted By:	Scott Cowperthwaite	

Sample Type: Aqueous

Sample Name:		GND0573 28-Jun-2013 9:45 am	GND0251 28-Jun-2013 10:00 am	GND0598 28-Jun-2013 10:20 am		
Lab Number:		1150712.1	1150712.2	1150712.3		
Individual Tests						
Dissolved Aluminium	g/m³	< 0.003	< 0.003	0.004	-	-
Dissolved Arsenic	g/m³	< 0.0010	< 0.0010	< 0.0010	-	-
Dissolved Beryllium	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Dissolved Boron	g/m³	0.020	0.012	0.052	-	-
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	0.00008	-	-
Dissolved Chromium	g/m³	< 0.0005	0.0005	< 0.0005	-	-
Dissolved Cobalt	g/m³	< 0.0002	< 0.0002	< 0.0002	-	-
Dissolved Copper	g/m³	0.0006	< 0.0005	0.0008	-	-
Dissolved Iron	g/m³	< 0.02	< 0.02	0.07	-	-
Dissolved Lead	g/m³	0.00028	< 0.00010	0.00013	-	-
Dissolved Manganese	g/m³	0.0090	0.0009	0.045	-	-
Dissolved Selenium	g/m³	< 0.0010	< 0.0010	< 0.0010	-	-
Dissolved Vanadium	g/m³	< 0.0010	< 0.0010	0.0013	-	-
Dissolved Zinc	g/m³	0.0133	0.0014	0.0048	-	-
Haloethers Trace in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m³	-	-	< 0.0005	-	-
Bis(2-chloroethyl)ether	g/m³	-	-	< 0.0005	-	-
Bis(2-chloroisopropyl)ether	g/m³	-	-	< 0.0005	-	-
4-Bromophenyl phenyl ether	g/m³	-	-	< 0.0005	-	-
4-Chlorophenyl phenyl ether	g/m³	-	-	< 0.0005	-	-
Haloethers in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m³	< 0.005	< 0.005	-	-	-
Bis(2-chloroethyl)ether	g/m³	< 0.005	< 0.005	-	-	-
Bis(2-chloroisopropyl)ether	g/m³	< 0.005	< 0.005	-	-	-
4-Bromophenyl phenyl ether	g/m³	< 0.005	< 0.005	-	-	-
4-Chlorophenyl phenyl ether	g/m³	< 0.005	< 0.005	-	-	-
Nitrogen containing compounds in SVOC Water Samples by GC-MS						
3,3'-Dichlorobenzidine	g/m³	< 0.03	< 0.03	-	-	-
2,4-Dinitrotoluene	g/m³	< 0.010	< 0.010	-	-	-
2,6-Dinitrotoluene	g/m³	< 0.010	< 0.010	-	-	-
Nitrobenzene	g/m³	< 0.005	< 0.005	-	-	-
N-Nitrosodi-n-propylamine	g/m³	< 0.010	< 0.010	-	-	-
N-Nitrosodiphenylamine	g/m³	< 0.010	< 0.010	-	-	-
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
3,3'-Dichlorobenzidine	g/m³	-	-	< 0.003	-	-
2,4-Dinitrotoluene	g/m³	-	-	< 0.0010	-	-

Sample Type: Aqueous						
Sample Name:		GND0573 28-Jun-2013 9:45 am	GND0251 28-Jun-2013 10:00 am	GND0598 28-Jun-2013 10:20 am		
Lab Number:		1150712.1	1150712.2	1150712.3		
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
2,6-Dinitrotoluene	g/m³	-	-	< 0.0010	-	-
Nitrobenzene	g/m³	-	-	< 0.0005	-	-
N-Nitrosodi-n-propylamine	g/m³	-	-	< 0.0010	-	-
N-Nitrosodiphenylamine	g/m³	-	-	< 0.0010	-	-
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Aldrin	g/m³	-	-	< 0.0005	-	-
alpha-BHC	g/m³	-	-	< 0.0005	-	-
beta-BHC	g/m³	-	-	< 0.0005	-	-
delta-BHC	g/m³	-	-	< 0.0005	-	-
gamma-BHC (Lindane)	g/m³	-	-	< 0.0005	-	-
4,4'-DDD	g/m³	-	-	< 0.0005	-	-
4,4'-DDE	g/m³	-	-	< 0.0005	-	-
4,4'-DDT	g/m³	-	-	< 0.0010	-	-
Dieldrin	g/m³	-	-	< 0.0005	-	-
Endosulfan I	g/m³	-	-	< 0.0010	-	-
Endosulfan II	g/m³	-	-	< 0.0010	-	-
Endosulfan sulfate	g/m³	-	-	< 0.0010	-	-
Endrin	g/m³	-	-	< 0.0010	-	-
Endrin ketone	g/m³	-	-	< 0.0010	-	-
Heptachlor	g/m³	-	-	< 0.0005	-	-
Heptachlor epoxide	g/m³	-	-	< 0.0005	-	-
Hexachlorobenzene	g/m³	-	-	< 0.0005	-	-
Organochlorine Pesticides in SVOC Water Samples by GC-MS						
Aldrin	g/m³	< 0.005	< 0.005	-	-	-
alpha-BHC	g/m³	< 0.005	< 0.005	-	-	-
beta-BHC	g/m³	< 0.005	< 0.005	-	-	-
delta-BHC	g/m³	< 0.005	< 0.005	-	-	-
gamma-BHC (Lindane)	g/m³	< 0.005	< 0.005	-	-	-
4,4'-DDD	g/m³	< 0.005	< 0.005	-	-	-
4,4'-DDE	g/m³	< 0.005	< 0.005	-	-	-
4,4'-DDT	g/m³	< 0.010	< 0.010	-	-	-
Dieldrin	g/m³	< 0.005	< 0.005	-	-	-
Endosulfan I	g/m³	< 0.010	< 0.010	-	-	-
Endosulfan II	g/m³	< 0.010	< 0.010	-	-	-
Endosulfan sulfate	g/m³	< 0.010	< 0.010	-	-	-
Endrin	g/m³	< 0.010	< 0.010	-	-	-
Endrin ketone	g/m³	< 0.010	< 0.010	-	-	-
Heptachlor	g/m³	< 0.005	< 0.005	-	-	-
Heptachlor epoxide	g/m³	< 0.005	< 0.005	-	-	-
Hexachlorobenzene	g/m³	< 0.005	< 0.005	-	-	-
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m³	-	-	< 0.0003	-	-
Acenaphthylene	g/m³	-	-	< 0.0003	-	-
Anthracene	g/m³	-	-	< 0.0003	-	-
Benzo[a]anthracene	g/m³	-	-	< 0.0003	-	-
Benzo[a]pyrene (BAP)	g/m³	-	-	< 0.0005	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	-	-	< 0.0005	-	-
Benzo[g,h,i]perylene	g/m³	-	-	< 0.0005	-	-
Benzo[k]fluoranthene	g/m³	-	-	< 0.0005	-	-
2-Chloronaphthalene	g/m³	-	-	< 0.0003	-	-
Chrysene	g/m³	-	-	< 0.0003	-	-
Dibenzo[a,h]anthracene	g/m³	-	-	< 0.0005	-	-
Fluoranthene	g/m³	-	-	< 0.0003	-	-

Sample Type: Aqueous						
Sample Name:		GND0573 28-Jun-2013 9:45 am	GND0251 28-Jun-2013 10:00 am	GND0598 28-Jun-2013 10:20 am		
Lab Number:		1150712.1	1150712.2	1150712.3		
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Fluorene	g/m³	-	-	< 0.0003	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	-	-	< 0.0005	-	-
2-Methylnaphthalene	g/m³	-	-	< 0.0003	-	-
Naphthalene	g/m³	-	-	< 0.0003	-	-
Phenanthrene	g/m³	-	-	< 0.0003	-	-
Pyrene	g/m³	-	-	< 0.0003	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Water Samples by GC-MS						
Acenaphthene	g/m³	< 0.003	< 0.003	-	-	-
Acenaphthylene	g/m³	< 0.003	< 0.003	-	-	-
Anthracene	g/m³	< 0.003	< 0.003	-	-	-
Benzo[a]anthracene	g/m³	< 0.003	< 0.003	-	-	-
Benzo[a]pyrene (BAP)	g/m³	< 0.005	< 0.005	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	< 0.005	< 0.005	-	-	-
Benzo[g,h,i]perylene	g/m³	< 0.005	< 0.005	-	-	-
Benzo[k]fluoranthene	g/m³	< 0.005	< 0.005	-	-	-
2-Chloronaphthalene	g/m³	< 0.003	< 0.003	-	-	-
Chrysene	g/m³	< 0.003	< 0.003	-	-	-
Dibenzo[a,h]anthracene	g/m³	< 0.005	< 0.005	-	-	-
Fluoranthene	g/m³	< 0.003	< 0.003	-	-	-
Fluorene	g/m³	< 0.003	< 0.003	-	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	< 0.005	< 0.005	-	-	-
2-Methylnaphthalene	g/m³	< 0.003	< 0.003	-	-	-
Naphthalene	g/m³	< 0.003	< 0.003	-	-	-
Phenanthrene	g/m³	< 0.003	< 0.003	-	-	-
Pyrene	g/m³	< 0.003	< 0.003	-	-	-
Phenols in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m³	< 0.010	< 0.010	-	-	-
2-Chlorophenol	g/m³	< 0.005	< 0.005	-	-	-
2,4-Dichlorophenol	g/m³	< 0.005	< 0.005	-	-	-
2,4-Dimethylphenol	g/m³	< 0.005	< 0.005	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	g/m³	< 0.010	< 0.010	-	-	-
2-Methylphenol (o-Cresol)	g/m³	< 0.005	< 0.005	-	-	-
2-Nitrophenol	g/m³	< 0.010	< 0.010	-	-	-
Pentachlorophenol (PCP)	g/m³	< 0.10	< 0.10	-	-	-
Phenol	g/m³	< 0.010	< 0.010	-	-	-
2,4,5-Trichlorophenol	g/m³	< 0.010	< 0.010	-	-	-
2,4,6-Trichlorophenol	g/m³	< 0.010	< 0.010	-	-	-
Phenols Trace (drinkingwater) in SVOC Water Samples by GC-MS						
2-Chlorophenol	g/m³	-	-	< 0.0005	-	-
2,4-Dichlorophenol	g/m³	-	-	< 0.0005	-	-
2,4,6-Trichlorophenol	g/m³	-	-	< 0.0010	-	-
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m³	-	-	< 0.0010	-	-
2,4-Dimethylphenol	g/m³	-	-	< 0.0005	-	-
3 & 4-Methylphenol (m- + p-cresol)	g/m³	-	-	< 0.0010	-	-
2-Methylphenol (o-Cresol)	g/m³	-	-	< 0.0005	-	-
2-Nitrophenol	g/m³	-	-	< 0.0010	-	-
Pentachlorophenol (PCP)	g/m³	-	-	< 0.010	-	-
Phenol	g/m³	-	-	< 0.0010	-	-
2,4,5-Trichlorophenol	g/m³	-	-	< 0.0010	-	-
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m³	-	-	< 0.0010	-	-
Diethylphthalate	g/m³	-	-	< 0.0010	-	-

Sample Type: Aqueous						
Sample Name:		GND0573 28-Jun-2013 9:45 am	GND0251 28-Jun-2013 10:00 am	GND0598 28-Jun-2013 10:20 am		
Lab Number:		1150712.1	1150712.2	1150712.3		
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Dimethylphthalate	g/m³	-	-	< 0.0010	-	-
Di-n-butylphthalate	g/m³	-	-	< 0.0010	-	-
Di-n-octylphthalate	g/m³	-	-	< 0.0010	-	-
Plasticisers in SVOC Water Samples by GC-MS						
Bis(2-ethylhexyl)phthalate	g/m³	< 0.03	< 0.03	-	-	-
Butylbenzylphthalate	g/m³	< 0.010	< 0.010	-	-	-
Di(2-ethylhexyl)adipate	g/m³	< 0.005	< 0.005	-	-	-
Diethylphthalate	g/m³	< 0.010	< 0.010	-	-	-
Dimethylphthalate	g/m³	< 0.010	< 0.010	-	-	-
Di-n-butylphthalate	g/m³	< 0.010	< 0.010	-	-	-
Di-n-octylphthalate	g/m³	< 0.010	< 0.010	-	-	-
Plasticisers Trace (drinkingwater) in SVOC Water Samples by GCMS						
Bis(2-ethylhexyl)phthalate	g/m³	-	-	< 0.003	-	-
Di(2-ethylhexyl)adipate	g/m³	-	-	< 0.0010	-	-
Other Halogenated compounds in SVOC Water Samples by GC-MS						
1,2-Dichlorobenzene	g/m³	< 0.010	< 0.010	-	-	-
1,3-Dichlorobenzene	g/m³	< 0.010	< 0.010	-	-	-
1,4-Dichlorobenzene	g/m³	< 0.010	< 0.010	-	-	-
Hexachlorobutadiene	g/m³	< 0.010	< 0.010	-	-	-
Hexachloroethane	g/m³	< 0.010	< 0.010	-	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.005	< 0.005	-	-	-
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,2-Dichlorobenzene	g/m³	-	-	< 0.0010	-	-
1,3-Dichlorobenzene	g/m³	-	-	< 0.0010	-	-
1,4-Dichlorobenzene	g/m³	-	-	< 0.0010	-	-
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m³	-	-	< 0.0010	-	-
Hexachloroethane	g/m³	-	-	< 0.0010	-	-
1,2,4-Trichlorobenzene	g/m³	-	-	< 0.0005	-	-
Other SVOC Trace in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m³	-	-	< 0.005	-	-
Carbazole	g/m³	-	-	< 0.0005	-	-
Dibenzofuran	g/m³	-	-	< 0.0005	-	-
Isophorone	g/m³	-	-	< 0.0005	-	-
Other compounds in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m³	< 0.05	< 0.05	-	-	-
Carbazole	g/m³	< 0.005	< 0.005	-	-	-
Dibenzofuran	g/m³	< 0.005	< 0.005	-	-	-
Isophorone	g/m³	< 0.005	< 0.005	-	-	-

Analyst's Comments

Samples 1-3 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**	**Samples**
Semivolatile Organic Compounds Screening in Water by GC-MS	Liquid/Liquid extraction, GPC cleanup (if required), GC-MS FS analysis	-	1-2
Semivolatile Organic Compounds Trace in Water by GC-MS	Liquid/Liquid extraction, GPC cleanup (if required), GC-MS FS analysis	-	3

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Samples**
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 21st ed. 2005.	-	1-3
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.003 g/m³	1-3
Dissolved Arsenic	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-3
Dissolved Beryllium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.00010 g/m³	1-3
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.005 g/m³	1-3
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.00005 g/m³	1-3
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0005 g/m³	1-3
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0002 g/m³	1-3
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0005 g/m³	1-3
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.02 g/m³	1-3
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.00010 g/m³	1-3
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0005 g/m³	1-3
Dissolved Selenium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-3
Dissolved Vanadium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-3
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-3

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.

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

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ANALYSIS REPORT

Client:	Taranaki Regional Council	**Lab No:**	1149336	SPv1
Contact:	Scott Cowperthwaite	**Date Registered:**	26-Jun-2013	
	C/- Taranaki Regional Council	**Date Reported:**	08-Jul-2013	
	Private Bag 713	**Quote No:**	36283	
	STRATFORD 4352	**Order No:**	38841	
		Client Reference:	Groundwater	
		Submitted By:	Scott Cowperthwaite	

Sample Type: Aqueous

Sample Name:		GND1301 25-Jun-2013 1:45 pm	GND0575 25-Jun-2013 1:30 pm	GND1300 25-Jun-2013 11:30 am	GND0255 25-Jun-2013 10:45 am	
Lab Number:		1149336.1	1149336.2	1149336.3	1149336.4	
Individual Tests						
Dissolved Aluminium	g/m³	< 0.003	< 0.003	< 0.003	< 0.003	-
Dissolved Arsenic	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Dissolved Beryllium	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	-
Dissolved Boron	g/m³	0.023	0.016	0.020	0.025	-
Dissolved Cadmium	g/m³	0.00005	0.00006	< 0.00005	0.00021	-
Dissolved Chromium	g/m³	0.0015	0.0007	< 0.0005	< 0.0005	-
Dissolved Cobalt	g/m³	< 0.0002	< 0.0002	0.0003	< 0.0002	-
Dissolved Copper	g/m³	< 0.0005	0.0005	0.0006	0.0008	-
Dissolved Iron	g/m³	< 0.02	< 0.02	< 0.02	< 0.02	-
Dissolved Lead	g/m³	< 0.00010	0.00010	< 0.00010	< 0.00010	-
Dissolved Manganese	g/m³	< 0.0005	0.0061	0.0041	0.0087	-
Dissolved Selenium	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Dissolved Vanadium	g/m³	0.0084	0.0056	< 0.0010	< 0.0010	-
Dissolved Zinc	g/m³	0.0091	0.0165	0.0028	0.029	-
Haloethers Trace in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Bis(2-chloroethyl)ether	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Bis(2-chloroisopropyl)ether	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
4-Bromophenyl phenyl ether	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
4-Chlorophenyl phenyl ether	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
3,3'-Dichlorobenzidine	g/m³	< 0.003	< 0.03	< 0.003	< 0.007	-
2,4-Dinitrotoluene	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
2,6-Dinitrotoluene	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Nitrobenzene	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
N-Nitrosodi-n-propylamine	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
N-Nitrosodiphenylamine	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Aldrin	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
alpha-BHC	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
beta-BHC	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
delta-BHC	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
gamma-BHC (Lindane)	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
4,4'-DDD	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
4,4'-DDE	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
4,4'-DDT	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-

Sample Type: Aqueous						
Sample Name:		GND1301 25-Jun-2013 1:45 pm	GND0575 25-Jun-2013 1:30 pm	GND1300 25-Jun-2013 11:30 am	GND0255 25-Jun-2013 10:45 am	
Lab Number:		1149336.1	1149336.2	1149336.3	1149336.4	
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Dieldrin	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Endosulfan I	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Endosulfan II	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Endosulfan sulfate	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Endrin	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Endrin ketone	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Heptachlor	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Heptachlor epoxide	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Hexachlorobenzene	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m³	< 0.0003	< 0.003	< 0.0003	< 0.0007	-
Acenaphthylene	g/m³	< 0.0003	< 0.003	< 0.0003	< 0.0007	-
Anthracene	g/m³	< 0.0003	< 0.003	< 0.0003	< 0.0007	-
Benzo[a]anthracene	g/m³	< 0.0003	< 0.003	< 0.0003	< 0.0007	-
Benzo[a]pyrene (BAP)	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Benzo[g,h,i]perylene	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Benzo[k]fluoranthene	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
2-Chloronaphthalene	g/m³	< 0.0003	< 0.003	< 0.0003	< 0.0007	-
Chrysene	g/m³	< 0.0003	< 0.003	< 0.0003	< 0.0007	-
Dibenzo[a,h]anthracene	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Fluoranthene	g/m³	< 0.0003	< 0.003	< 0.0003	< 0.0007	-
Fluorene	g/m³	< 0.0003	< 0.003	< 0.0003	< 0.0007	-
Indeno(1,2,3-c,d)pyrene	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
2-Methylnaphthalene	g/m³	< 0.0003	< 0.003	< 0.0003	< 0.0007	-
Naphthalene	g/m³	< 0.0003	< 0.003	< 0.0003	< 0.0007	-
Phenanthrene	g/m³	< 0.0003	< 0.003	< 0.0003	< 0.0007	-
Pyrene	g/m³	< 0.0003	< 0.003	< 0.0003	< 0.0007	-
Phenols Trace (drinkingwater) in SVOC Water Samples by GC-MS						
2-Chlorophenol	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
2,4-Dichlorophenol	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
2,4,6-Trichlorophenol	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
2,4-Dimethylphenol	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
3 & 4-Methylphenol (m- + p-cresol)	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
2-Methylphenol (o-Cresol)	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
2-Nitrophenol	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Pentachlorophenol (PCP)	g/m³	< 0.010	< 0.10	< 0.010	< 0.03	-
Phenol	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
2,4,5-Trichlorophenol	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Diethylphthalate	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Dimethylphthalate	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Di-n-butylphthalate	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Di-n-octylphthalate	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Plasticisers Trace (drinkingwater) in SVOC Water Samples by GCMS						
Bis(2-ethylhexyl)phthalate	g/m³	< 0.003	< 0.02	< 0.003	< 0.005	-
Di(2-ethylhexyl)adipate	g/m³	< 0.0010	< 0.005	< 0.0010	< 0.0013	-
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,2-Dichlorobenzene	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
1,3-Dichlorobenzene	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-

Sample Type: Aqueous						
Sample Name:		GND1301 25-Jun-2013 1:45 pm	GND0575 25-Jun-2013 1:30 pm	GND1300 25-Jun-2013 11:30 am	GND0255 25-Jun-2013 10:45 am	
Lab Number:		1149336.1	1149336.2	1149336.3	1149336.4	
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,4-Dichlorobenzene	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
Hexachloroethane	g/m³	< 0.0010	< 0.010	< 0.0010	< 0.003	-
1,2,4-Trichlorobenzene	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Other SVOC Trace in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m³	< 0.005	< 0.05	< 0.005	< 0.013	-
Carbazole	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Dibenzofuran	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-
Isophorone	g/m³	< 0.0005	< 0.005	< 0.0005	< 0.0013	-

Analyst's Comments

Due to in-house QC failure in the original extraction of samples 1149336.2 and .4 for SVOC, the re-extraction was done on limited sample. Hence the higher detection limits reported.

Samples 1-4 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**	**Samples**
Semivolatile Organic Compounds Trace in Water by GC-MS	Liquid/Liquid extraction, GPC cleanup (if required), GC-MS FS analysis	-	1-4
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 21st ed. 2005.	-	1-4
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.003 g/m³	1-4
Dissolved Arsenic	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-4
Dissolved Beryllium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.00010 g/m³	1-4
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.005 g/m³	1-4
Dissolved Cadmium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.00005 g/m³	1-4
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0005 g/m³	1-4
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0002 g/m³	1-4
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0005 g/m³	1-4
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.02 g/m³	1-4
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.00010 g/m³	1-4
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0005 g/m³	1-4
Dissolved Selenium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-4
Dissolved Vanadium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-4
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.0010 g/m³	1-4

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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Ara Heron BSc (Tech)
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