

NPDC – Colson Rd Landfill
Monitoring Programme
Annual Report
2008-2009

Technical Report 2009–60

ISSN: 0114-8184 (Print)
ISSN: 1178-1467 (Online)
Document: 557530

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February 2010

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 which has a design capacity of approximately 500,000 cubic metres. Stages one and two have been closed and are fully reinstated. This report, for the period July 2008 to June 2009, 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 three consents to discharge uncontaminated stormwater into the Puremu Stream, one consent 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.

The Council's monitoring programme for the year under review included ten inspections, 27 samples of surface and groundwater were collected for physicochemical analysis, two biomonitoring surveys of receiving waters, and 26 air quality analyses. NPDC also collected nine leachate samples and three under-liner drainage samples for physicochemical analysis.

As in previous years, the results indicate there is a low level of contamination of the Puremu Stream downstream of the landfill. Groundwater and under liner drainage sampling indicated that there is no significant contamination occurring as result of the landfill. Air quality monitoring showed that whilst suspended particulates are within guideline levels, on occasion the dust deposition guidelines were exceeded at the site entrance.

The low level of contamination in the Puremu Stream has not increased since the previous year and the two biomonitoring surveys carried out show that there are no adverse effects on aquatic life. There were no incidents recorded for the Colson Rd landfill in the 2008-2009 period.

During the 2008-2009 monitoring period NPDC demonstrated a good level of environmental performance in relation the exercise of it's Colson Rd landfill consents

This report includes recommendations for the 2009-2010 year.

Table of contents

	Page
1. Introduction	1
1.1 Compliance monitoring programme reports and the Resource Management Act 1991	1
1.1.1 Introduction	1
1.1.2 Structure of this report	1
1.1.3 The Resource Management Act (1991) and monitoring	2
1.1.4 Evaluation of environmental performance	2
1.2 Process description	3
1.3 Resource consents	5
1.3.1 Water discharge permits	5
1.3.2 Air discharge permit	8
1.3.3 Discharges of wastes to land	10
1.3.4 Water right	11
1.4 Monitoring programme	11
1.4.1 Introduction	11
1.4.2 Programme liaison and management	11
1.4.3 Site inspections	11
1.4.4 Chemical sampling	11
1.4.5 Biomonitoring surveys	12
2. Results	16
2.1 Inspections	16
2.2 Results of discharge monitoring	23
2.2.1 Leachate	23
2.2.2 Stormwater	24
2.3 Results of receiving environment monitoring	25
2.3.1 Surface waters	25
2.3.2 Biological monitoring	28
2.3.3 Under liner drainage monitoring	30
2.3.4 Groundwater	31
2.4 Air - results of receiving environment monitoring	33
2.4.1 Deposition gauging	33
2.4.2 Other ambient monitoring	34
2.5 Register of incidents	34
2.6 Management and reporting	35
2.6.1 Landfill Management Plan	35
2.6.2 Colson Road Landfill Liaison Committee	35
2.6.3 Landfill development	35
2.6.4 Independent Consultant's Reports	36
3. Discussion	37
3.1 Discussion of site performance	37
3.2 Environmental effects of exercise of consents	37
3.3 Evaluation of performance	38

3.4	Recommendation from the 2007-2008 Annual Report	43
3.5	Alterations to monitoring programmes for 2009-2010	44
4.	Recommendation	44
	Glossary of common terms and abbreviations	45
	Bibliography and references	47
Appendix I	Resource consents held by NPDC for Colson Road landfill	
Appendix II	Biomonitoring reports for Colson Road landfill	

List of tables

Table 1	Summary of the resource consents held by NPDC	5
Table 2	Chemical analysis of Colson Rd landfill leachate, 2008-2009	24
Table 3	Results of stormwater monitoring samples taken on 6 March 2009	24
Table 4	Chemical analysis of the Manganaha Stream, sampled during the 2008-2009 period	25
Table 5	Chemical analysis of the Puremu Stream, sampled on 4 September 2008	26
Table 6	Chemical analysis of the Puremu Stream, sampled during on 30 April 2009	27
Table 7	Results for sampling of under liner drainage system, 2008-2009	31
Table 8	Chemical analysis of Colson Rd Landfill groundwater sampled 3 June 2009	32
Table 9	Air deposition monitoring results for November-December 2008	33
Table 10	Air deposition monitoring results for February-March 2009	34
Table 11	Summary of performance for Consent 0226-1 Diversion of Puremu Stream	38
Table 12	Summary of performance for Consent 4779-1 Air discharge	38
Table 13	Summary of performance for Consent 4620-1 uncontaminated stormwater discharge	39
Table 14	Summary of performance for Consent 4619-1 Treated stormwater and leachate discharge	39
Table 15	Summary of performance for Consent 2370-3 contaminated stormwater and leachate discharge	40
Table 16	Summary of performance for Consent 4622-1 Air discharge due to composting	41
Table 17	Summary of performance for Consent 4621-1 Discharge of contaminants onto land	42
Table 18	Summary of performance for Consent 6177-1 Discharge of stormwater	43

List of figures

Figure 1	Aerial view of the Colson Road landfill	4
Figure 2	Aerial photo showing the stormwater and receiving water sampling sites at Colson Rd landfill	13
Figure 3	Aerial view of Colson Rd landfill showing the positions of groundwater monitoring bores	14
Figure 4	Aerial view of Colson Rd landfill and surrounding showing the positions of air quality monitoring sites	15

List of photographs

Photograph 1	Laying the HPDE liner in stage three of Colson Rd Landfill, May 2006	3
Photograph 2	Compost windrows at Colson Rd landfill, 28 October 2008	18
Photograph 3	Specialist compost turning machine at Colson Rd landfill, 28 October 2008	18
Photograph 4	Thirty six tonne rubbish compactor in operation, 28 October 2008	19
Photograph 5	Accumulated silt in the small settling pond, 25 February 2009	21
Photograph 6	Discharged silt from the small silt pond, 5 March 2009	22
Photograph 7	Site after the removal of the discharged silt, 5 March 2009	23

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 2008-June 2009 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 annual reports on the Colson Rd landfill covering the period from 1990-1999. This is the ninth 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 2009-2010 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 NPDC in the catchment 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 trivial (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 year were negligible or minor at most, items of concern were resolved positively, co-operatively, and quickly, the Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices, 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.
- **improvement desirable** indicates that the Council may have been obliged to record a verified unauthorised incident involving significant environmental

impacts against the consent holder, and/or abatement notices may have been issued; there were adverse 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 end of the period under review.

- **poor** performance is used when there were grounds for prosecution or infringement notice.

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 2013. 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 laid down in herring bone configuration over the polyethylene liner. It is intended for stage three to be extended up to the level of the forest line on the eastern side of the landfill.



Photograph 1 Laying the HPDE liner in stage three of Colson Rd Landfill, May 2006



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 three consents to discharge uncontaminated stormwater into the Puremu Stream, one consent 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 condition 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 200 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 Stream 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 four 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 visited 10 times 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 was sampled on two occasions, and the samples were analysed for conductivity, ammoniacal nitrogen, pH, suspended solids, temperature, alkalinity, biochemical oxygen demand, cadmium, dissolved oxygen, and dissolved reactive phosphorus, faecal coliforms, iron, manganese, nitrate nitrogen, lead,

sulphate, zinc and turbidity. The Manganaha Stream was sampled on three occasions, and the samples were analysed for conductivity, ammoniacal nitrogen, pH, suspended solids, temperature, iron, alkalinity, zinc and turbidity.

Stormwater discharge samples were taken on one occasion and analysed for conductivity, ammoniacal nitrogen, pH unionised ammonia, temperature and pH. The Puremu Stream was also sampled in conjunction with the stormwater samples and analysed for the same parameters.

Groundwater in the vicinity of the landfill was sampled on one occasion, and the sample analysed for conductivity, ammoniacal nitrogen, aluminium, boron, beryllium, chloride, chemical oxygen demand, cobalt, chromium, copper, selenium, hardness, vanadium, pH, suspended solids, temperature, alkalinity, biochemical oxygen demand, cadmium, iron, manganese, nitrate nitrogen, lead, sulphate, and zinc. Groundwater sampling sites are shown in Figure 2.

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 three occasions, and the collected samples analysed for conductivity, pH, and solids. Particulate matter and methane level surveys were undertaken on two occasions. Air monitoring sites are shown in Figure 4.

1.4.5 Biomonitoring surveys

A biological survey was performed on two occasions in the Puremu Stream (three sites) and Manganaha Stream (two sites) to determine whether or not the discharge of treated and untreated stormwater, and leachate to groundwater, from the site, has had a detrimental effect upon the communities of the stream.



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 and surrounding showing the positions of air quality monitoring sites

2. Results

2.1 Inspections

3 July 2008

A site visit was made to make a follow up inspection and to conduct a compliance monitoring inspection. There was vast improvement in the level of cover being maintained over the operational area of the landfill. A digger was onsite to excavate cover material and there were stocks piles of cover material in various places around the operational area. The procedure of handling the asbestos bags had been improved. The daily intake of bags was now being positioned directly in the drive-in trench by incoming trucks. Toward the end of each day the bags were being pushed up against the trench face by a bulldozer and then covered from above. This had reduced the amount of handling of the bags and thus reduced the risk of damage. The cover over the previous day's bags was satisfactory and there was no sign of exposed asbestos. The rat control measures were still in place.

There were no dust issues observed; however the ground was wet at the time of the inspection. There was a significant amount of silt and mud on the roadways which may cause a dust problem when it dries out. The usual odour was present on-site but was not detectable at the boundary. There was some windblown litter in the large stormwater pond, but generally the site was quite free of litter.

The grate on the downstream end of the Puremu culvert was free of debris as was the grate below the SPCA roadway.

The following action was to be taken:

- Continue to maintain the daily cover at its present level.

18 August 2008

A site visit was made to conduct a compliance monitoring inspection. There was a south easterly breeze at the time of the inspection and this was causing slight noticeable odors to be detectable on Colson Rd approximately 100 metres from the site entrance. Controlled tipping of refuse was occurring; the tip face was working its way toward the remediated slip area. There was a large area of uncovered waste, the site manager stated that covering operations would commence shortly. The asbestos disposal continues to be managed in a satisfactory manner.

There were far less birds than usual on the site. The site manager stated that they had been training the birds to leave the site via an audible prompt. This system seems to be working well. There were no other vermin seen. Litter collection activities around the site were in evidence and there were no significant issues in regard to windblown litter.

There was a small amount of debris built up in both grates in Puremu Stream as a result of the recent rains which would need removing.

The following action was to be taken:

- Clear the debris in grates on the Puremu Stream

4 September 2008

A site visit was made to take water samples from the Puremu and Manganaha Streams and to conduct a compliance monitoring inspection. Refuse was being deposited at the time of the inspection. A "Moxie" truck was on site and transporting cover material down to the tip face. The area of waste uncovered was smaller than it had been on previous inspections. Bird numbers were down, indicating that the deterrents being used are working. There was no odour detectable at the boundary, nor were there any dust issues.

The grate on the Puremu stream (below the SPCA driveway) was blocked with silt and vegetation. This was reported to the site manager and he said he would have it cleared out.

The following action was to be taken:

- Clear out the lower grate on the Puremu stream.

28 October 2008

A site visit was made to conduct a compliance monitoring inspection. The weather was cool and there had been 2.5 mm rain in the last 24 hours and there was a NW breeze.

Composting:

The site operator was not present at the time of the inspection.

The composting area was very well organised, there were 5 windrows approximately 50 metres long in various stages of the composting process. Specialist compost turning machinery was onsite at the time of the inspection. There was a large pile of completed product stored on the site as well as a pile of green waste waiting to be mulched. The windrows emitted very little odour, indicating that the process was being well managed.

Landfilling:

There was far less uncovered refuse noted on this inspection when compared with previous inspections. Controlled tipping of waste was occurring at the time of the inspection. There was also a purpose built compaction machine in operation. The tip face was now moving across the area of waste that slumped in 2005. There was very little odour at the time of the inspection and far fewer birds than usual. Asbestos is still been received and disposed of in the centre of the landfill. There were some uncovered bags, but there was no evidence of any of the bags being ripped.

The caps over stages one and two were well vegetated and showed evidence of slumping, cracking or erosion.

Litter control activities were in evidence as there were plastic bags full of litter that had being picked in various places around the site. There was far less litter on the site than usual. The silt ponds were relatively litter free also, however the small silt pond has filled up with silt and would need to be cleaned out in near future.

The grate on the lower end of the Puremu Stream culvert was open (it is usually closed) and the grate on the upper end of the culvert that runs under the SPCA driveway was clear and free of debris. There were no problems identified on this visit.



Photograph 2 Compost windrows at Colson Rd landfill, 28 October 2008



Photograph 3 Specialist compost turning machine at Colson Rd landfill, 28 October 2008



Photograph 4 Thirty six tonne rubbish compactor in operation, 28 October 2008

9 January 2009

A site visit was made to conduct a compliance monitoring inspection. The weather was overcast and warm with no rain over the previous five days. There was controlled dumping and spreading of refuse occurring at the time of the inspection. The tipface appeared to be within the guideline size of 900 m² and it also appeared well organised. Some dust was being thrown up by the refuse trucks and the Moxie, but the plumes were quite localized and not noticeable at the boundary. The site manager indicated that a street sweeping truck had been obtained (awaiting minor repairs) and will be used to keep the roadways free of dust.

The large silt pond had more litter in it than previous visits and there was also a dead duck in the water on the concrete spillway at the south end of the pond. The small pond has yet to be de-silted and this needs urgent attention.

There were more birds present on this visit than when compared to the previous visit. No other vermin were seen. The usual onsite odour was present but this was not detectable at the boundary. The grates on the Puremu Stream were both clear of debris. The composting operation appeared to be well organised and there were no issues in regards to flies or odour.

The following actions were to be taken:

- De-silt the small silt pond
- Remove litter, debris, and any dead animals from the large settling pond

25 February 2009

A site visit was made to conduct a compliance monitoring inspection, follow up on works requested on the previous inspection, take water samples and to conduct an ambient air quality survey. Forestry works in the adjacent pine forest were underway at the time of the inspection.

Refuse was being tipped, spread and compacted at the time of the inspection. The tip face was estimated to be within the 900 square metre limit. The usual large numbers of gulls were present, but there was also a flock of mynas which were not usually present.

The large silt pond had litter accumulated at the north and south ends and this would require removing. The small silt pond had yet to be cleaned out and even more silt had built up during the heavy rains over the previous weeks.

The upper grate of the Puremu Stream had a small amount of debris built up in it, and this should be cleaned out. The lower grate was inaccessible due forestry works and could not be inspected.

An ambient air quality survey taken at seven sites in and around the landfill revealed an average of 9.1 ug/m³ of suspended particulate matter which was within acceptable levels. No methane was detected at any of the sites. Odour was detectable on-site but none was noted at any of the boundaries.

Water samples were taken from the upper and lower sites on the Puremu Stream, but all of the other sites were inaccessible due to the forestry works.

NPDC site manager was contacted to discuss the outstanding issues.

The following action was to be taken:

- Clean out the silt from the small silt pond.
- Remove litter from the large silt pond.



Photograph 5 Accumulated silt in the small settling pond, 25 February 2009

4 March 2009

A site visit was made to view the landfill operation before attending the Colson Rd Neighbourhood Liaison Committee meeting. The small silt pond had been cleared out as instructed, however the silt had been spread out on the ground adjacent to the pond creating a potential for silt to run off into the tributary of the Puremu Stream. This matter was raised with the site manager at the meeting and an onsite meeting was arranged for the following day.

Other business discussed at the meeting included the forestry plan, continuing asbestos disposal, second lift construction and improved refuse compaction levels.

The issue of noise complaints arising from the use of the gas cannon bird scarer was also discussed.

The next meeting was tentatively scheduled for 10 June 2009.

5 March 2009

A site visit was made to meet with the site manager and site operators to assess the problem of the silt that had been taken out of the small silt pond and spread over the ground adjacent to the pond. The silt was deep and had a high water content and had flowed down the gradient approximately 20 metres beyond the fence below the pond. The silt had also covered the outlet pipe for the silt pond and water was springing out and cutting a channel through the silt accumulated up against the fence. It appeared that the intention was to use the silt to create a bund to stop stormwater from the road entering the leachate contingency pond.

The site manager and operator agreed to immediately remove the silt using a digger and the moxie and to install silt control measures at the fenceline. They were aware of the urgency of the works as high rainfall was predicted for that evening.

A second visit was made approximately 2 hours later to view the progress of the works. The digger had pulled out most of the silt and some areas had been scraped back to the clay. A silt pond had been dug at the fenceline. The digger operator stated that he would stay on the job until it was finished.



Photograph 6 Discharged silt from the small silt pond, 5 March 2009

6 March 2009

A site visit was made to take stormwater samples and view the works done around the small silt pond. All of the silt above the fence had been removed and the area scraped back to the clay. The silt pond at the base of the clay area (next to the fence) had been enlarged. The system appeared to be working well. A sample was taken of the discharge of the new silt pond. It appeared to be slightly turbid. Photos of the area were taken. Samples were also taken from the large silt pond, Manganaha and Puremu Streams.

4 May 2009

A site visit was made to conduct a compliance monitoring inspection, collect water samples, and take level readings from the monitoring bores. The weather was fine at the time of the inspection with a south-south easterly breeze. Controlled tipping of refuse was occurring. The tip face was tidy and well organised and within the 900 m² guideline area. Asbestos disposal still continues and whilst there were some exposed bags, none appeared to be ripped. The odour on the site was quite strong but it was not noticeable at the boundary.



Photograph 7 Site after the removal of the discharged silt, 5 March 2009

The caps on the stages one and two were in sound condition with no ponding, cracking or erosion being observed. The new silt auxiliary silt pond (below the small pond) seemed to be working well and vegetation was starting to grow around its banks.

There was a small amount of debris in the grate of the Puremu Stream. The lower grate next to the SPCA driveway was significantly blocked with debris and this would need to be removed.

Vermin was not an issue and there were baits set out all around the site.

Samples were taken from the usual receiving waters sites.

2.2 Results of discharge monitoring

2.2.1 Leachate

The NPDC collected nine samples of leachate during the 2008-2009 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 2.

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 2 Chemical analysis of Colson Rd landfill leachate, 2008-2009

Parameter	Unit	2008			2009					
		20-Aug	30-Oct	05-Dec	28-Jan	24-Feb	11-Mar	20-Apr	27-May	03-Jun
pH	pH	7.2	7.4	7.6	7.8	7.4	7.4	7.9	7.6	7.8
BOD	g/m ³	120	40	79	110	54	110	76	72	77
Suspended solids	g/m ³	35	46	50	204	40	217	178	20	64
Conductivity	mS/m	420	406	558	662	503	502	470	501	564
Ammoniacal Nitrogen	g/m ³ -N	270	*	390	540	350	370	312	350	415
Cadmium	g/m ³	<0.03	*	*	<0.03	*	*	*	*	*
Chromium	g/m ³	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Copper	g/m ³	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Iron	g/m ³	17	18	21.3	50	11	24	47	13.5	24
Lead	g/m ³	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
Manganese	g/m ³	3.6	3.2	2.8	2.7	1.9	2	1.8	2.7	2.8
Nickel	g/m ³	<0.06	*	<0.06		<0.06	*	<0.06	<0.06	<0.06
Zinc	g/m ³	0.1	<0.1	0.1	0.1	<0.1	<0.1	0.2	<0.1	<0.1

Key: * not measured

2.2.2 Stormwater

One survey was conducted under high flow conditions when stormwater discharge samples and associated receiving environment samples were taken. The results of the analysis are set out in Table 3.

Table 3 Results of stormwater monitoring samples taken on 6 March 2009

Site	Conductivity	Unionised ammonia	Ammoniacal nitrogen	pH	Suspended solids	Temperature
	mS/m	g/m ³ N	g/m ³ N	pH	g/m ³	Deg C
MNH000190	14.5	0.00007	0.011	7.2	<2	17.7
MNH000250	14.6	0.00012	0.015	7.3	<2	17.7
PMU000100	13.4	0.00005	0.016	6.8	7	19.5
PMU000109	25.9	0.00088	0.205	7	10	18.6
PMU000110	20.7	0.0059	1.09	7.1	2	18.6
PMU000113	21.1	0.00466	0.861	7.1	<2	18.6
STW001006	34.2	0.01414	5.48	6.8	260	17.9
STW002054	28.1	0.00016	0.017	7.3	4	19.5

The discharge from the stormwater settling pond at site STW1006 on this occasion had a higher than usual suspended solids level of 260 g/m³. The highest level recorded previous to this was 66 g/m³. This elevated result is most certainly the result of the removal of silt from the smaller silt pond. The removed silt had been placed next to the pond and it subsequently slid down the slope and then covered the pond discharge point. Immediate works were undertaken to remove the silt, and to dig a second silt pond to receive the discharge from the first. Although the level of suspended solids in the final discharge was quite elevated there was however very little evidence to suggest that it was having a detrimental effect on the Puremu Stream. This is evidenced by the two downstream results at PMU000110 (2 g/m³ suspended solids) and PMU00113 (<2 g/m³ suspended solids).

The ammoniacal nitrogen content of the discharge at site STW001006 was also elevated, however the temperature and pH conditions at the time resulted in very little free unionised ammonia to be present in the water. All levels of free ammonia were well below that given in the Freshwater Plan (of 0.025 g/m³). The highest level (of 0.0059 at PMU000110) was four times lower than the guideline. The discharge itself was approximately half that of the guideline.

2.3 Results of receiving environment monitoring

2.3.1 Surface waters

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 drive and then flows approximately 300 metres to a second culvert that takes it under 2 other properties. Just upstream of the second culvert the unmade 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.

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 4 -6 give the results of the freshwater sampling undertaken during the 2008-2009 period.

Table 4 Chemical analysis of the Manganaha Stream, sampled during the 2008-2009 period

Parameter	Units	4 September 2008		30 April 2009	
		MNH000190 u/s of landfill	MNH000250 d/s of landfill	MNH000190 u/s of landfill	MNH000250 d/s of landfill
Alkalinity	g/m ³ CaCO ₃	22	22	29	30
Conductivity	mS/m	13.9	13.8	15.6	15.6
Acid soluble iron	g/m ³	0.34	0.28	0.56	0.78
Ammonia (unionised)	g/m ³ -N	0.00013	0.00009	0.0001	0.00011
Ammoniacal nitrogen	g/m ³ -N	0.023	0.016	0.019	0.02
pH	pH	7.3	7.3	7.2	7.2
Suspended solids	g/m ³	3	<2	<2	<2

Parameter	Units	4 September 2008		30 April 2009	
		MNH000190 u/s of landfill	MNH000250 d/s of landfill	MNH000190 u/s of landfill	MNH000250 d/s of landfill
Temperature	Deg C	13.1	13.0	15.3	15.6
Dissolved zinc	g/m ³	<0.005	<0.005	<0.005	<0.005

Key: * not measured

On both sampling occasions the Manganaha Stream showed no adverse effects from the landfilling operation. The upstream and downstream results on both sampling occasions show very little difference in water quality. All results were comparable to background levels and similar to those found over the last 5 years.

Table 5 Chemical analysis of the Puremu Stream, sampled on 4 September 2008

Parameter	Unit	PMU000100 500 m u/s of landfill	PMU000109	PMU000110	PMU000113
Alkalinity	g/m ³ CaCO ₃	17	78	45	49
BOD	g/m ³	0.6	1	4.5	4.6
Dissolved cadmium	g/m ³	<0.005	<0.005	<0.005	*
Conductivity	mS/m	13.5	28.5	21.5	21.8
Dissolved oxygen	g/m ³	9.5	6.4	8.9	9.5
Oxygen saturation	%	94	62	86	91
Dissolved reactive phosphorus	g/m ³	<0.003	<0.003	<0.003	*
Fecal coliforms	per 100ml	43	480	64	110
Acid soluble iron	g/m ³	0.35	3.02	1.0	1.1
Acid soluble manganese	g/m ³	0.02	1.08	0.69	0.74
Ammoniacal N	g/m ³ N	0.016	2.45	1.92	1.96
Unionised ammonia	g/m ³ N	0.00005	0.00783	0.00971	0.00992
Nitrate/nitrite N	g/m ³ N	0.88	0.55	1.26	1.35
Dissolved lead	g/m ³	<0.05	<0.05	<0.05	*
pH	pH	7.0	7.0	7.2	7.2
Sulfates	g/m ³	10	8.8	13.6	*
Suspended solids	g/m ³	<2	10	<2	2
Temperature	Deg C	14.6	13.6	13.5	13.2
Dissolved zinc	g/m ³	<0.005	<0.005	<0.005	*

The results from the 4 September 2008 sampling of the Puremu Stream are given in Table 5 above. Biochemical oxygen demand at sites PMU000110 and PMU000113 was slightly elevated when compared to the historical data but still within acceptable levels. Fecal coliforms in this sampling run were much lower than usual and all other parameters were within acceptable levels.

The results from the samples taken on 30 April 2009 are given in Table 6 below. The most notable result is that for fecal coliforms. Site PMU000109 had an elevated fecal coliform count of 3500 cfu/100 mL. At site PMU000113 (just beyond the northern boundary) the coliform count was 2200 cfu/100mL. This is a breach of condition 2 of the consent that states that the discharge shall not cause the Puremu Stream to exceed 1000 cfu/100 mL.

It is worth noting that there has been an intermittent issue with elevated fecal coliform counts at the compliance point since sampling began. However as the site (PMU000100) upstream of the landfill regularly exceeds the 1000 cfu/100mL limit (presumably from the farming activities) it has been difficult to completely link the levels found downstream of the landfill entirely to the presence of the landfill itself.

In this case however the highest count of fecal coliforms was found down stream of the stage three settling pond on a tributary that originates within the landfill site, indicating that the landfill was almost certainly the source of this spike in bacterial activity. Deposited wastes or bird life may be the source of the bacteria. The large silt pond is due to be cleaned out before the end of the 2009 year, which should help mitigate any emergent trend in increased bacterial numbers.

Table 6 Chemical analysis of the Puremu Stream, sampled during on 30 April 2009

Parameter	Unit	PMU000100	PMU000109	PMU000110	PMU000113
Alkalinity	g/m ³ CaCO ₃	24	60	44	*
BOD	g/m ³	1	4.1	2.2	2.8
Dissolved cadmium	g/m ³	<0.005	<0.005	<0.005	*
Conductivity	mS/m	13.3	32	19.4	*
Dissolved oxygen	g/m ³	8.1	6.1	7.4	7.8
Oxygen saturation	%	82	63	75	79
Dissolved reactive phosphorus	g/m ³	0.005	0.007	0.006	*
Fecal coliforms	per 100ml	240	3500	760	2200
Acid soluble iron	g/m ³	0.46	0.6	1.18	0.62
Acid soluble manganese	g/m ³	0.08	0.5	0.42	0.42
Ammoniacal N	g/m ³ N	0.006	0.21	0.619	0.48
Unionised ammonia	g/m ³ N	0.00002	0.00078	0.00274	0.00165
Nitrate/nitrite N	g/m ³ N	0.04	0.94	0.94	*

Parameter	Unit	PMU000100	PMU000109	PMU000110	PMU000113
Dissolved lead	g/m ³	<0.05	<0.05	<0.05	*
pH	pH	6.9	7	7.1	7
Sulfates	g/m ³	13.2	25.6	8.9	*
Suspended solids	g/m ³	<2	7	<2	4
Temperature	Deg C	15.7	16.6	15.9	15.6
Dissolved zinc	g/m ³	0.018	0.026	0.01	*

2.3.2 Biological monitoring

Two biomonitoring surveys were undertaken during the 2008-2009 year.

23 January 2009

The Council's standard 'kick-sampling' technique was used at four established sites and the 'sweep-sampling' technique at one established site to collect streambed macroinvertebrates from an unnamed tributary of the Puremu Stream, and the Puremu and Manganaha Streams on 23 January 2009. 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 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 receiving waters. There was little change in MCI values from site 1 to site 2 in the Puremu Stream, although both sites exhibited values that were slightly below their respective long term median. This suggests that the health of the macroinvertebrate community at site 2 was similar to that recorded at site 1, even though site 1 was showing degradation due to stock access. However, differences in habitat and sampling differences between the sites complicate these results, and the overall macroinvertebrate assemblage at site 2 did not indicate a degradation caused by any discharge and/or seepage from the landfill between these two sites. Banded kokopu were also observed at site 2.

Site PT1, in the tributary which drains the treatment system, recorded MCI and SQMCI_s values not significantly different to their respective medians, suggesting little impact from the landfill discharge. Subtle differences in MCI values between sites can be attributed to substrate differences and the abundance of macrophytes in

these streams. The impact of the different sampling technique used at certain sites also influenced results.

The control site in the Manganaha Stream exhibited above average MCI and SQMCI_S values. This indicates that water quality preceding this survey had been good. There was a 10 unit reduction in MCI recorded at the downstream site (when compared to the control site), but little change in community richness and SQMCI_S value. The reduction in the MCI score at site M6 may indicate impacts from the landfill. However, these changes are more likely related to the significant alterations in habitat at site M6. These alterations, which include the reduction in riparian shading and willow roots resulting from the removal of willows in the 2007-2008 monitoring period, have reduced the number of abundant taxa, and can impact on 'sensitive' taxa, which reduced from ten at site M4 to eight at site M6. This includes the loss of one 'highly sensitive' taxon. It is therefore not thought that this drop is related to a discharge from the landfill.

The macroinvertebrate communities of these streams contained moderate proportions of 'tolerant' taxa at all sites and the communities were generally dominated by a combination of 'tolerant' and 'moderately sensitive' taxa. This presence of 'moderately sensitive' taxa, plus the presence of two 'highly sensitive' taxa at the control site in the Manganaha Stream, indicates that water quality in the weeks preceding this survey had been good.

Taxonomic richness (number of taxa) at all sites was below their respective median richness from previous surveys, but within the values previously recorded. MCI and SQMCI_S scores indicated that the stream communities were of moderate to poor health in the Puremu Stream and tributary, and in good health in the Manganaha Stream, but generally similar to the typical condition recorded in lowland soft-bedded streams elsewhere in Taranaki.

No undesirable biological growths were detected at any of these sites during this January 2009 survey.

30 March 2009

The Council's standard 'kick-sampling' technique was used at four established sites and the 'sweep-sampling' technique at one established site to collect streambed macroinvertebrates from an unnamed tributary of the Puremu Stream, and the Puremu and Manganaha Streams on 23 January 2009. Samples were sorted and identified to provide number of taxa (richness), MCI and SQMCI_S scores for each site.

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 receiving waters. There was a significant improvement in MCI values from site 1 to site 2 in the Puremu Stream, although both sites exhibited values that were slightly below their respective long term median. These results suggest that the health of the macroinvertebrate community at site 2 is better than that recorded at site 1, and that this is primarily related to differences in habitat and sampling technique between the sites. The health of the community at site 1 was particularly poor, and as such did not provide a good comparison with site 2. When the overall macroinvertebrate assemblage downstream at site 2 was compared with the historical results for this

site, there was no indication of a degradation caused by any discharge and/or seepage from the landfill between these two sites.

Site PT1, in the tributary which drains the treatment system recorded an MCI value not significantly different to the median, suggesting little impact from the landfill discharge. However, the SQMCI_s was significantly lower than the median for this site. This poor SQMCI_s value is in part a result of the numerical dominance of the 'tolerant' sphaeriid clams and ostracod seed shrimp which reflects the slower flowing nature at this site. The MCI score suggests no deterioration in macroinvertebrate community health at this site, although the flow conditions at this site have caused a reduction in the abundance of 'sensitive' taxa, when compared with previous surveys.

Subtle differences in MCI values between sites in the Puremu Stream catchment can be attributed to substrate differences and the abundance of macrophytes in these streams. The impact of the different sampling technique used at certain sites also influenced results.

The control site in the Manganaha Stream exhibited above average MCI and SQMCI_s values. This indicates that water quality preceding this survey had been good. There was a 6 unit reduction in MCI recorded at the downstream site (when compared to the control site), and little change in community richness. The SQMCI_s value at site M6 was significantly lower than that recorded at site M4, although this was primarily related to the change in abundance of just two taxa. The reduction in the MCI and SQMCI_s scores at site M6 may indicate impacts from the landfill. However, these changes are more likely related to the significant alterations in habitat at site M6. These alterations, which include the reduction in riparian shading and change in substrate, can impact on 'sensitive' taxa, which reduced slightly from eleven at site M4 to nine at site M6. This includes the loss of one 'highly sensitive' taxon. It is therefore not thought that this drop is related to a discharge from the landfill.

The macroinvertebrate communities of these streams contained moderate proportions of 'tolerant' taxa at all sites and the communities were generally dominated by a combination of 'tolerant' and 'moderately sensitive' taxa. This presence of 'moderately sensitive' taxa, plus the presence of two 'highly sensitive' taxa at the control site in the Manganaha Stream (one in abundance), indicates that water quality in the weeks preceding this survey had not been poor. Taxonomic richness (number of taxa) at all sites was similar to or below their respective median richness from previous surveys, but within the values previously recorded. MCI and SQMCI_s scores indicated that the stream communities were of moderate to poor health in the Puremu Stream and tributary, and in good health in the Manganaha Stream, but generally similar to the typical condition recorded in lowland soft-bedded streams elsewhere in Taranaki.

No undesirable biological growths were detected at any of these sites during this March 2009 survey.

2.3.3 Under liner drainage monitoring

During the monitoring year NPDC undertook sampling of the outflows of the under-liner drainage system. This is a network of pipes that were laid down prior to the

construction of the clay liner. Their purpose is to channel away rising ground water (or any stormwater infiltration) from under the liner. The results of the three samples taken in the 2008-2009 period are set out in Table 7.

Table 7 Results for sampling of under liner drainage system, 2008-2009

Parameter	Units	11-Sep-08	17-Feb-09	19-May-09
pH	pH	6.5	6.5	6.7
BOD	g/m ³	<2	<1	<2
Suspended solids	g/m ³	<5	<5	<5
Fecal coliforms	per 100 mL	<1	<1	<1
Conductivity	mS/M	40.2	35.4	36.0
Turbidity	N.T.U.	3.1	4.3	11.9
Alkalinity	g/m ³	84	80	82
Ammoniacal nitrogen	g/m ³	0.5	0.4	0.5
Cadmium	g/m ³	<0.008	<0.008	<0.008
Chromium	g/m ³	<0.05	<0.05	<0.05
Chloride	g/m ³	62	50	47
Copper	g/m ³	<0.01	<0.01	<0.01
Iron	g/m ³	3.3	2.9	2.5
Lead	g/m ³	<0.02	<0.02	<0.02
Manganese	g/m ³	2.00	1.00	0.90
Nickel	g/m ³	<0.02	<0.02	<0.02
Zinc	g/m ³	<0.02	<0.02	<0.02

After the slip event of 2005 it was feared that the HDPE (high density poly ethylene) liner had torn underneath the slipped refuse. As a result a sampling regime of the sub-liner drainage outflows was instigated to monitor the possibility of leachate outbreaks. As yet there has been no evidence that leachate has been entering the drainage system via the suspected tears in the HDPE liner. The results gathered over the last 4 years are very similar to those gathered in this monitoring period.

The most notable indicator of leachate contamination is chloride, however this parameter has been very stable and in a range of 39-62 g/m³ which is quite normal for local groundwater.

2.3.4 Groundwater

Groundwater was sampled from seven bores on 3 June 2009. The results of the analysis are given in Table 8. As with the subsurface drainage samples, the groundwater results show no 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, hardness and ammonia 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.

Table 8 Chemical analysis of Colson Rd Landfill groundwater sampled 3 June 2009

Parameter	Unit	GND0251	GND0255	GND0573	GND0575	GND0598	GND1300	GND1301
Dissolved aluminum	g/m ³	<0.0030	<0.0030	0.006	<0.0030	0.0059	0.026	<0.0030
Alkalinity	g/m ³ CaCO ₃	39	26	36	86	167	27	97
Dissolved arsenic	g/m ³	<0.0010	<0.0010	<0.00100	<0.0010	<0.0010	<0.0010	<0.0010
Dissolved boron	g/m ³	0.013	0.02	0.025	0.021	0.056	0.02	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	0.00006	<0.00005 0	<0.00005 0	<0.00005 0	<0.00005 0	0.00005
Chloride	g/m ³	16.8	83.5	28.3	18	21.1	18.4	18.4
Dissolved cobalt	g/m ³	<0.00020	0.00022	<0.00020	0.00054	<0.00020	<0.00020	<0.00020
Filtered COD	g/m ³	<5	<5	<5	<5	10	<5	<5
Conductivity	mS/m	13.7	36.2	17.2	19	34.4	12.6	23.6
Dissolved chromium	g/m ³	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.001
Dissolved copper	g/m ³	<0.0050	0.00062	0.00092	<0.0005	0.0013	0.0008	0.0011
Bore depth	m	20.08	17.6	8.97	12.38	20.83	20.17	16.12
Dissolved iron	g/m ³	<0.020	<0.020	<0.020	<0.020	0.11	<0.020	<0.020
Hardness	g/m ³ HCO ₃ ⁻	47.58	31.72	43.92	104.92	203.74	32.94	118.34
Water level	m	11.52	11.62	5.66	9.24	11.52	14.1	9.37
Dissolved manganese	g/m ³	0.0015	0.017	0.019	0.16	0.062	0.0034	0.0016
Ammoniacal N	g/m ³	0.007	0.027	0.014	0.005	1.3	0.009	0.006
Nitrate/nitrite N	g/m ³	1.03	5.51	0.37	0.52	0.02	0.44	0.68
Dissolved lead	g/m ³	<0.00010	<0.00010	<0.00010	<0.00010	0.00024	<0.00010	<0.00010
pH	pH	6.2	5.6	5.8	6.6	7.7	5.6	7
Dissolved selenium	g/m ³	<0.0010	<0.0010	<0.0010	<0.0010	0.0019	<0.0010	<0.0010
Sulphate	g/m ³	10.6	3.5	9.3	4.7	1	7	3.2
Temperature	Deg C	14.5	15	15.2	15.3	*	15.1	15

Parameter	Unit	GND0251	GND0255	GND0573	GND0575	GND0598	GND1300	GND1301
Dissolved vanadium	g/m ³	0.0014	<0.0010	<0.0010	0.013	0.0019	0.0012	0.0073
Dissolved zinc	g/m ³	0.0015	0.012	0.086	<0.0010	0.0085	0.049	0.0074

2.4 Air - results of receiving environment monitoring

2.4.1 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 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 0.13g/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 9.

Table 9 Air deposition monitoring results for November-December 2008

Site	Days deployed	Volume litres	Particulate g/m ² /day
AIR001603 At entrance to landfill	32	1.88	0.14
AIR001604 Adjacent to Manganaha Stream, behind rose nursery	32	2.03	0.06
AIR001608 124 Egmont Road, paddock boundary, west of house	32	1.95	0.04
AIR001613 Grass lawn opposite pay booth, behind workshed	32.1	2.59	0.11
AIR001622 At rear of RSPCA building	32.1	1.23	0.06
AIR001623 Behind 194 Egmont Road	32.1	1.97	0.08

Table 10 Air deposition monitoring results for February-March 2009

Site	Days deployed	Volume litres	Particulate g/m ² /day
AIR001603 At entrance to landfill	27	1.61	0.22
AIR001604 Adjacent to Manganaha Stream, behind rose nursery	27	1.65	0.07
AIR001608 124 Egmont Road, paddock boundary, west of house	27	0.92	0.03
AIR001613 Grass lawn opposite pay booth, behind workshed	27.1	1.79	0.2
AIR001622 At rear of RSPCA building	27.1	0.89	0.02
AIR001623 Behind 194 Egmont Road	27	0.99	0.04

Over the 2008-2009 period, there only two particulate levels obtained that were above the Taranaki Regional Council guideline level for dust deposition of 0.13 g/m²/day. This guideline level was exceeded at one site (AIR001603 –landfill entrance) on both surveys and these are indicated in bold in the tables above. Sample comments however reveal that the deposition gauge at this site was found to have organic matter (algae and insects), which will increase the weight of the solids retained from filtration and thus increase the calculated daily rate of deposition. As site AIR001603 is right next to the entrance driveway it would be affected by the local dust plume effects produced by truck movements, or by activities on adjacent properties. The other sites recorded far lower levels (by a factor of 10 to 100) which indicates that the effect is very localised and that overall the air quality in terms of dust deposition in the vicinity of the landfill is quite high.

2.4.2 Other ambient monitoring

Suspended particulate

Suspended particulate dust monitoring was carried out on two occasions over 7 sites under dry weather conditions. Monitoring was carried out on 4 February 2009 and 29 February 2009. On 4 February 2009 the levels recorded ranged from 13 - 26 ug/m³, the average reading was 20.86 ug/m³. On 27 May 2009 the levels ranged from 6 to 29 ug/m³ with an average of 9.71 ug/m³. The national guideline for air quality (averaged over a 24 hr period) is 50 ug/m³. The results from these two surveys indicate that the national guideline for particulate matter is being met.

Methane monitoring

Two surveys were conducted on the same days as the particulate monitoring. No methane was detected at any of the sites on either occasion.

2.5 Register of incidents

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 register ('unauthorised incident register') includes events where the company concerned has

itself notified the Council. The register contains details of any investigation and corrective action taken.

Incidents may be alleged to be associated with a particular site. If there is 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 2008-2009 year, there were no incidents recorded by the Council associated with Colson Road landfill.

2.6 Management and reporting

2.6.1 Landfill Management Plan

A condition of most of the consents held by the NPDC for the landfill is that the landfill is operated in accordance with the requirements of the 'NPDC Colson Road Landfill: Landfill Management Plan 1994' and that the plan is updated at least yearly.

An updated landfill management plan for Colson Road was provided in March 2006 and accepted by the Taranaki Regional Council. An updated management plan is now overdue. NPDC has undertaken to review and update its Landfill Management Plan by the end of 2009.

2.6.2 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 16 July 2008, 19 November 2008 and 4 March 2009. 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 2009-2010 monitoring period.

2.6.3 Landfill development

The following works were undertaken in the 2008 -2009 period:

- Forestry works removed a 2 metre band of pine trees from the eastern side of the stage three in preparation for the second lift
- New litter fences constructed
- Purpose built 36 tonne compacter brought into use
- Bird scarer trial instigated

- Duffil-Watts completed landfill extension design. Tender process expected to commence July 1 2009

2.6.4 Independent Consultant's Reports

Site inspections were undertaken by WAI Environmental (independent consultants) on 21 October 2008 and 17 April 2009

The report of the 21 October 2008 inspection noted:

- The area of the working tip head appeared to be within the 900 m² limit
- Dust was not an issue at the time, but there was mud on the roadways which may become a problem when dry
- That litter removal was being undertaken
- That the composting operation appeared to be very well organised
- That there were some concerns in regards to the way asbestos was being handled
- That the silt pond appeared to be in good condition and free of litter

The report concluded that the landfill was achieving a high level of compliance.

The report of the 17 April 2009 inspection noted:

- The silt pond was clean and free of litter
- The working tip head appeared to be within the 900 m² limit
- That new litter fences were under construction
- Asbestos waste is not being dealt with in accordance with the Management Plan
- That the 200 tonne/day discharge limit given by consent is being exceeded occasionally even though the average daily tonnage is only 190 tonnes
- Improved refuse compaction is being attained with the introduction of a 36 tonne purpose built Caterpillar compacter
- That the compost operation appeared to very well organised

The report concluded that the landfill was otherwise achieving a high level of compliance.

3. Discussion

3.1 Discussion of site performance

On the issue of site management and operation, the landfill was generally well managed. The working area of the tip face appeared to be better managed in this period with most inspections commenting that it was within the 900 m² limit. Inspection also noted an improvement in daily cover. Both reports made by the independent consultant awarded the landfill a high level of compliance on both occasions, however one report did point out the daily intake of refuse was starting to exceed the 200 tonnes/day stated in the purpose of consent 4621-1. NPDC and Council are currently working together to have the purpose of the consent amended to accommodate this.

The management of the small silt pond did create the risk of adverse effects to the environment, however NPDC and the site contractors acted quickly to rectify the situation. There were some minor dust and litter issues noted during the year, but no complaints were received.

3.2 Environmental effects of exercise of consents

In relation to the Puremu Stream, the NPDC have complied with the consent conditions relating to the receiving water quality. A slight elevation in BOD and nitrogenous species at some sites indicate that there is low level contamination occurring in the Puremu Stream. There was a higher than usual level of fecal coliforms in the Puremu Stream down stream of the stage three settling pond indicating that the discharge from the pond is causing some intermittent contamination.

Groundwater quality remains satisfactory and there is no evidence of significant contamination.

Biological surveys of the Manganaha and Puremu Streams during the monitoring period under review indicate that the landfill is not having an adverse effect on the stream.

Nearly all ambient settleable dust levels obtained were below the Taranaki Regional Council guideline level for dust deposition of 0.13 g/m²/day. These guideline levels were exceeded at one site and only during very dry conditions. The results from the gauging indicate that entrance to the landfill site may, on occasion, exceed guideline values for ambient settleable dust, for urban areas, but overall air quality in and around the site remains good. Odour beyond the boundary was not an issue during the monitoring period. Suspended particulate matter readings indicate that the site is complying with Council's 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 11 - 18.

Table 11 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

N/A = not applicable

Table 12 Summary of performance for Consent 4779-1 Air discharge

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Minimise adverse effects on the environment	Site specific monitoring programme in place	Yes
2. No offensive odours or dust or noxious concentrations	Air monitoring carried out	Yes
3. No burning on site	Site specific monitoring programme - site inspection	Yes
4. No adverse ecological effects on any ecosystem	Site specific monitoring programme - inspection and water sampling	Yes
5. No venting untreated landfill 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	Review not due till 1/06/2012	NA
11. Optional review provision re collection, extraction, venting and combustion of landfill gas	Review not due till 1/06/2012	NA
Overall assessment of consent compliance and environmental performance in respect of this consent		High

N/A = not applicable

Table 13 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	Minor non-compliance (suspended solids)
3. No leachate discharge	Inspections show no direct discharges	Yes
4. Channels shall minimise erosion	Site specific monitoring programme - site inspections	Yes
5. Channels shall minimise instability of the surrounding land	Site specific monitoring programme – site inspections	Yes
6. Repair land eroded/made unstable due to construction/maintenance	Site specific monitoring programme – site inspections	Yes
7. Notification of any proposal which may affect areas contributing runoff	Site specific monitoring programme – programme supervision	Yes
8. Discharge shall not alter the Puremu Stream in the way of films, foams or suspended materials, change colour or visibility, objectionable odour, harm aquatic or farm animals, or increase temperature by more than 2.0° C	Site specific monitoring programme - inspection and water sampling	Yes
9. No excavation or landfilling if any runoff water will contain suspended solids	Site specific monitoring programme - inspection and water sampling	Yes
10. Conform with the 'New Plymouth District Council Colson Road Landfill: Landfill Management Plan July 2004'	Site specific monitoring programme – programme supervision	Minor non-compliance (updated plan over due)
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	Review not due till 1/06/2012	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

N/A = not applicable

Table 14 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	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
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 2004'	Site specific monitoring programme – programme supervision	YEs
5. Maintain and comply with a monitoring programme	Site specific monitoring programme – programme supervision	Yes
6. Consent will lapse after six years if not exercised	N/A	N/A
7. Optional review provision re environmental effects	Review not due till 1/06/2012	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

N/A = not applicable

Table 15 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
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

Condition requirement	Means of monitoring during period under review	Compliance achieved?
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 due till 1/06/2012	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

N/A = not applicable

Table 16 Summary of performance for Consent 4622-1 Air discharge due to composting

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Minimise adverse effects on the environment	Site specific monitoring programme	Yes
2. No offensive odours	Site specific monitoring programme – air monitoring	Yes
3. No adverse ecological effects on any ecosystem	Site specific monitoring programme	Yes
4. Materials accepted for composting comply with the 'Assessment of Discharges to Air' July 1994 and the New Plymouth District Council Colson Road Landfill Management Plan July 1994	Site specific monitoring programme	Yes
5. All composting to occur 300 m from any dwelling existing as of 21 March 1999	Site specific monitoring programme - site inspections	Yes
6. Composting piles must consist of no less than 95% plant-derived material	Site specific monitoring programme - site inspections	Yes – as could be best estimated

Condition requirement	Means of monitoring during period under review	Compliance achieved?
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	Review not due till 1/06/2012	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

N/A = not applicable

Table 17 Summary of performance for Consent 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 July 1994'	Site specific monitoring programme – site inspection	Minor non-compliance (updated plan over due)
8. Disposal of waste shall comply with the 'criteria for calculating landfill potentials' and the 'Draft Health and Environment Guidelines for selected Timber Treatment Chemicals'	Site specific monitoring programme – programme supervision and site inspection	Yes
9. Consent will lapse after six years if not exercised	N/A	N/A
10. Optional review provision re environmental effects	Review not due till 1/06/2012	Yes
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

N/A = not applicable

Table 18 Summary of performance for Consent 6177-1 Discharge of stormwater

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Discharge quality within specified parameters	Site specific monitoring programme – programme supervision	Yes
2. No leachate discharged	Site specific monitoring programme – programme supervision	Yes
3. Maintenance of drains to prevent erosion and sedimentation.	Site specific monitoring programme – site inspection	Yes
4. No conspicuous effect on clarity or colour of receiving waters.	Site specific monitoring programme – programme supervision	Yes
5. No significant effect on aquatic life	Site specific monitoring programme – water sampling	Yes
6. Maintain and comply with a monitoring programme	Site specific monitoring programme – programme supervision	Yes
7. Preparation and adherence to a management plan	Site specific monitoring programme – programme supervision and site inspection	Minor non-compliance (updated plan over due)
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	Review not due until 1/06/2014	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

* N/A = Not applicable

During the year, the NPDC demonstrated a good level of environmental performance and compliance with the resource consents. During the year under review there were some problems associated with the landfill, the most notable of these was the management of the small silt pond.

The reinstatement of stages one and two was completed to a very high standard. The NPDC has dealt with any issues that arose during the monitoring year (including those issues in regard to the disposal of asbestos) positively and co-operatively.

3.4 Recommendation from the 2007-2008 Annual Report

In the 2007-2008 Annual Report it was recommended:

THAT monitoring of Colson Road landfill in the 2008-2009 year continue at the same level as in 2007-2008.

This programme was implemented in full.

3.5 Alterations to monitoring programmes for 2009-2010

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.

In the case of Colson Road landfill, the programme for 2008-2009 was unchanged changed from that of 2007-2008. It is now proposed that for 2009-2010, that the monitoring programme remains unchanged to that of the 2008-2009 monitoring period.

A recommendation to this effect is attached to this report.

4. Recommendation

1. THAT monitoring of Colson Road landfill in the 2009-2010 year continue at the same level as in 2008-2009.

Glossary of common terms and abbreviations

The following abbreviations and terms are used within this report:

Al*	aluminium
As*	arsenic
Biomonitoring	assessing the health of the environment using aquatic organisms
BOD	biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate
BODF	biochemical oxygen demand of a filtered sample
bund	a wall around a tank to contain its contents in the case of a leak
CBOD	carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate
cfu	colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample
COD	chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction
Condy	conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m
Cu*	copper
DO	dissolved oxygen
DRP	dissolved reactive phosphorus
<i>E.coli</i>	<i>escherichia coli</i> , an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample
Ent	enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample
F	fluoride
FC	faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample
fresh	elevated flow in a stream, such as after heavy rainfall
g/m 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
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
UIR	Unauthorised Incident Register entry- an event recorded by the Council on the basis that it had 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.VF V2 *AB*

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.

AB

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

Special Conditions

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

AL Bray
Secretary



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

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number
on all correspondence

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

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:
- The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended material;
 - any conspicuous change in colour or visual clarity;
 - any emission of objectionable odour;
 - the rendering of fresh water unsuitable for consumption by farm animals;
 - any significant adverse effects on aquatic life.
 - an increase in the temperature of the Puremu Stream by more than 2.0° Celsius
14. The discharge shall not be shown to reduce the quality of the Puremu Stream at or beyond the mixing zone below the following criteria:

constituent	maximum concentration or level
aluminium	5.0 mg/l
arsenic	0.1 mg/l
beryllium	0.1 mg/l
boron	0.5 mg/l
cadmium	0.01 mg/l
chromium	0.1 mg/l
cobalt	0.05 mg/l
copper	0.2 mg/l
fluoride	1.0 mg/l
iron	5.0 mg/l
lead	0.1 mg/l
manganese	1.0 mg/l
nitrate + nitrite (NO 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

Consent 2370-3

- 
15. The discharge shall not be shown to reduce the concentration of dissolved oxygen in the Puremu Stream below 5 mg/litre, beyond the mixing zone specified in special condition 12 above.
 16. The discharge shall not, in the opinion of the Chief Executive, Taranaki Regional Council, contain substances or constituents other than those listed in condition 14, nor pathogenic organisms, which would render the water of the Puremu Stream, beyond the mixing zone specified in condition 12 above, unpalatable or unfit for stock consumption purposes.
 17. The maintenance, management and operation of the leachate and collection and treatment systems shall be to the satisfaction of the Chief Executive, Taranaki Regional Council, to ensure that the conditions attached to this consent can be met.
 18. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2004 and/or June 2006 and/or June 2008 and/or June 2014 and/or June 2020, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 20 July 2004

For and on behalf of
Taranaki Regional Council



Director Resource Management

TRK994619



DISCHARGE PERMIT

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

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

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

Consent
Granted Date: 21 March 1999

CONDITIONS OF CONSENT

Consent Granted: TO DISCHARGE UP TO 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.

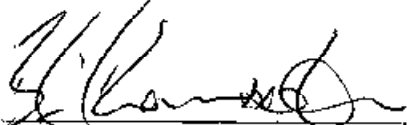
6. THAT this consent shall lapse on the expiry of six years after the date of commencement of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(b) of the Resource Management Act 1991.

TRK994619

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

TRK994779



DISCHARGE PERMIT

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

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

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

Consent
Granted Date: **21 March 1999**

CONDITIONS OF CONSENT

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

Expiry Date: **1 June 2025**

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

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

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

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

TRK994779

General conditions

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

Special conditions

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

TRK994779

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

Signed at Stratford on 21 March 1999

For and on behalf of
TARANAKI REGIONAL COUNCIL


GENERAL MANAGER

TRK994620



DISCHARGE PERMIT

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

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

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

Consent
Granted Date: **21 March 1999**

CONDITIONS OF CONSENT

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

Expiry Date: **1 June 2025**

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

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

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

Catchment: **WAIWHAKAIHO 392.000**

Tributary: **MANGAONE 392.010
PUREMU 392.012**

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

TRK994620

General conditions

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

Special conditions

- 1. THAT the water quality in the Manganaha Stream above its confluence with the Mangaone Stream shall not be changed as a result of this discharge.
- 2. THAT the water quality of uncontaminated stormwater discharged to the Puremu Stream shall meet the following criteria:

pH	6.5-8.5
suspended solids	maximum concentration of 100 gm 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.

TRK994620

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

Signed at Stratford on 21 March 1999

For and on behalf of
TARANAKI REGIONAL COUNCIL



GENERAL MANAGER

TRK994621



DISCHARGE PERMIT

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

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

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

Consent
Granted Date: **21 March 1999**

CONDITIONS OF CONSENT

Consent Granted: **TO DISCHARGE UP TO 200 TONNES/DAY OF
CONTAMINANTS ONTO AND INTO LAND IN AREAS B1, C1
AND C2 AT THE COLSON ROAD LANDFILL 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**

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

TRK994621

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 install and maintain to the satisfaction of the General Manager, 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 General Manager, 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 General Manager, 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 General Manager, 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.

TRK994621

6. 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.
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 General Manager, 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 21 March 1999

For and on behalf of
TARANAKI REGIONAL COUNCIL



GENERAL MANAGER

TRK994622



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 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



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

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number
on all correspondence

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

Consent Granted
Date: 11 June 2003

Conditions of Consent

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

Expiry Date: 1 June 2020

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

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

Legal Description: Sec 223 Hua Dist Blk VI Paritutu SD

Catchment: Waiwhakaiho

Tributary: Mangaone
Puremu

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

Consent 6177-1

General conditions

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

Special conditions

1. The water quality of uncontaminated stormwater discharge to the Puremu Stream shall meet the following criteria:

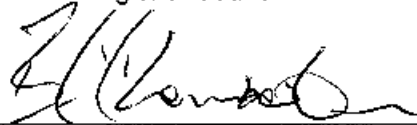
pH	6.5-8.5
suspended solids	maximum concentration of 100gm ⁻³
ammoniacal nitrogen	maximum concentration of 0.5 gm ⁻³ as nitrogen
2. No leachate discharge shall be permitted by the exercise of this consent.
3. All stormwater diversion and channels shall be designed, constructed and maintained so as to 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.

Consent 6177-1

11. The consent holder shall maintain stormwater drains, sediment detention ponds, and ground contours at the site, in order to minimise stormwater movement across, or ponding on the site, to the satisfaction of the Chief Executive, Taranaki Regional Council.
12. After allowing for reasonable mixing the consent holder shall ensure that the discharge shall not give rise to any of the following effects in the receiving waters of the Puremu Stream:
 - a) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended material;
 - b) any conspicuous change in colour or visual clarity;
 - c) any emission of objectionable odour;
 - d) the rendering of fresh water unsuitable for consumption by farm animals;
 - e) any significant adverse effects on aquatic life.
 - f) an increase in the temperature of the Puremu Stream by more than 2.0 degrees Celsius.
13. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2004 and/or June 2006 and/or June 2008 and/or June 2014, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 11 June 2003

For and on behalf of
Taranaki Regional Council



Chief Executive

Appendix II

Biomonitoring reports for Colson Road landfill

To Job Manager, Scott Cowperthwaite
From Scientific Officer, Bart Jansma
File 03-02-005-09/01; 2370; 4619; 4620; 6177;
Report No BJ074
Document No 666214
Date 28 September 2009

Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, January 2009

Introduction

Biological surveys have been performed in the Puremu Stream since 1986 to assess potential adverse effects of leachate from the Colson Road landfill on the macroinvertebrate communities of the stream. The Manganaha Stream has been sampled since 1994 to establish baseline data on the communities of the stream, before the proposed extension of the landfill in the direction of the stream. Earthworks for the Stage III extension of the landfill began in July 2001 and disposal into this area began in May 2002. The current survey is the first of two biological surveys scheduled for the Puremu and Manganaha Streams in the 2008-2009 monitoring year.

The consents related to this survey are:

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 the Puremu Stream and;
4621 to discharge contaminants into land.

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 23 January 2009 at three established sampling sites in the Puremu Stream catchment and two established sites in the Manganaha Stream (Figure 1, Table 1). 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 the remaining two sites in the Puremu Stream (2, PT1) and the Manganaha stream (M4 & M6) below the landfill extension. This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

Table 1 Biomonitoring sites in the Puremu and Manganaha Streams related to the Colson Road Landfill

Site No.	Site code	Map reference	Location
1	PMU000104	P19: 072373	Puremu Stream, upstream of landfill
2	PMU000110	P19: 071382	Puremu Stream, 400 m downstream of landfill
PT1	PMU000109	P19: 071380	Puremu Stream tributary, 10 m upstream of confluence
M4	MNH000190	P19: 077380	Manganaha Stream, beside proposed landfill extension
M6	MNH000260	P19: 074385	Manganaha Stream, 500 metres downstream of site M4

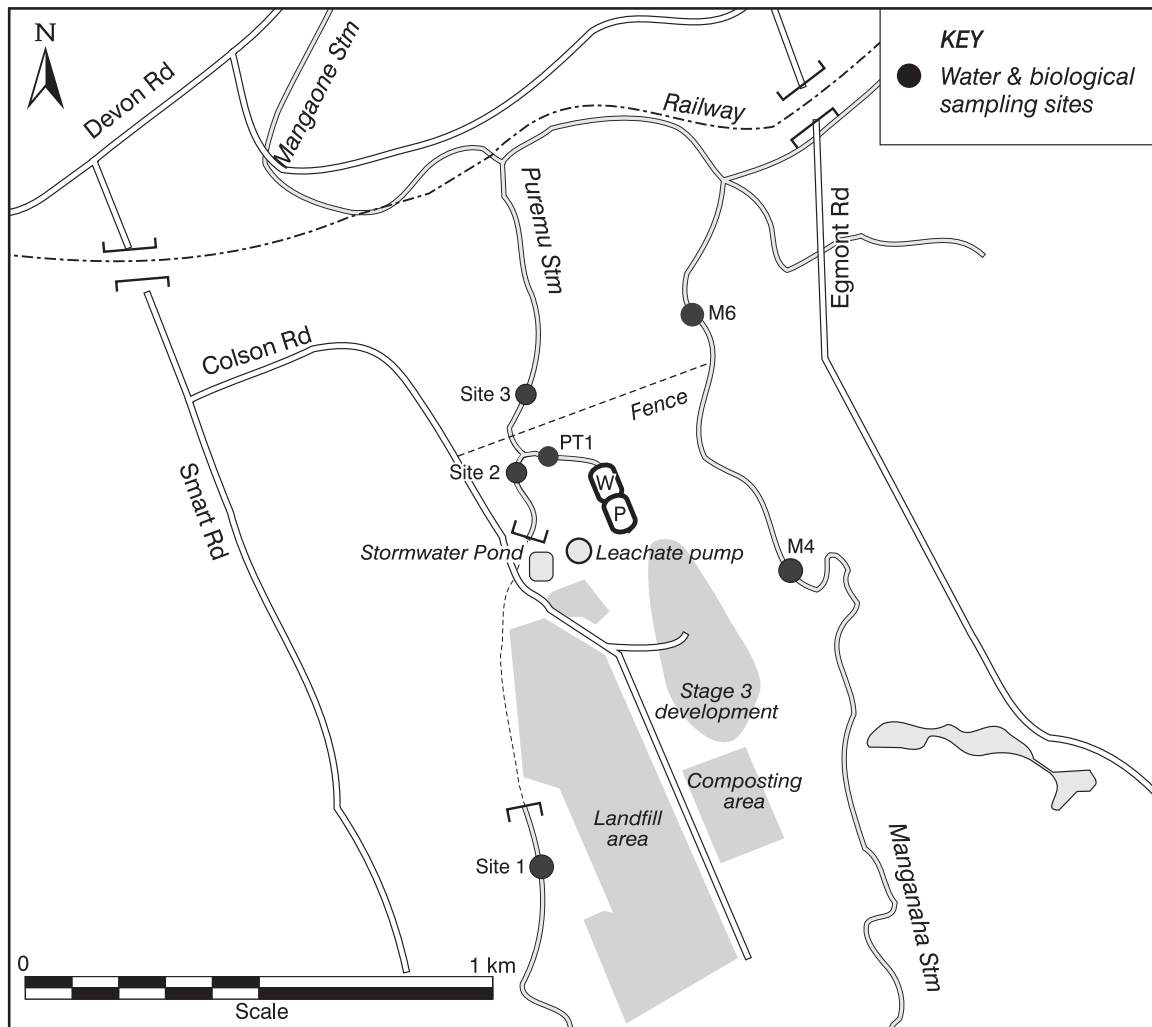


Figure 1 Biomonitoring sites related to the Colson Road landfill, New Plymouth. The stage III treatment systems are illustrated by P (= pond), and W (= wetland).

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







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

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

Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1 and 0.1 in hard bottomed and soft bottomed streams respectively. The sensitivity scores for certain taxa found in hard bottomed streams have been modified in accordance with Taranaki experience. After extensive use of the MCI, categories were assigned to the sensitivity scores, to clarify their 'relative' sensitivity e.g. taxa that scored between 1 and 4 inclusive are considered tolerant (see Table 3).

By averaging the scores obtained from a list of taxa taken from one site and multiplying by a scaling factor of 20, a Macroinvertebrate Community Index value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. More 'sensitive' communities inhabit less polluted waterways.

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

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

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

Sub-samples of periphyton (algae and other micro flora) taken from the macroinvertebrate samples were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ("undesirable biological growths") at a microscopic level. The presence of masses of these organisms can be an indicator of organic enrichment within a stream.

Results and discussion

At the time of this January 2009 biomonitoring survey, the water temperatures in the Puremu Stream and tributary ranged from 18.0 °C to 21.3°C. Site 1 in the Puremu Stream had an uncoloured clear but slow flow, closely resembling a swamp, while site 2 had a swifter flow. The unnamed tributary had a moderate steady flow, which was also clear and uncoloured.

Sites 1 and P1 had substrates consisting entirely of silt, while site 2 consisted entirely of wood and willow roots. All sites were coated in either silt or iron oxide. No site had any periphyton or moss, except for site 1 which had some algal filaments in patches. This was also the only site to have aquatic vegetation, which was growing throughout the stream. Site PT had a lot of pine needles on the bed and was partially shaded. Site 1 in the main stem had no shading, while site 2 was completely shaded by willows.

It was noted at the time of the survey that site 1 had recently experienced significant stock damage. Unrestricted access had led to stock defecating in the stream, and pugging of the stream bed.

No unusual bacterial, fungal or protozoan growths were found by microscopic examination for 'heterotrophic growths' at any of the Puremu Stream sites in this January 2009 survey.

The Manganaha Stream had a moderate, swift flow, which was clear and uncoloured at sites M4 and M6. Water temperature was slightly cooler to that seen in the Puremu Stream, 16.2°C at M4 and 17.3°C at M6. Site M4 sites enjoyed complete shading, while site M4 was only partially shaded, with neither sites supporting any aquatic vegetation. Substrate at site M4 was predominantly wood and willow roots, with some hard clay also, while M6 had a substrate comprising entirely of hard clay, a change from the previous survey which recorded silt and willow roots as the substrate. No periphyton was present at site M4, while filaments were very widespread at site M6.

One significant change that occurred during the 2008-2009 was the complete removal of willows at site M6. Associated earthworks had resulted in noticeable sediment entering the stream. This site used to be completely shaded, and so the removal of the riparian vegetation may result in a change in the macroinvertebrate community at this site. Much of the sediment present during the previous survey had been scoured away, and the resultant substrate was not ideal for more 'sensitive' taxa.

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 2, together with current results.

Table 2 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	Number of previous surveys	Numbers of taxa			MCI values			SQMCI _s			
		Range	Median	Current survey	Range	Median	Current survey	No.	Range	Median	Current survey
1	33	8-27	18	11	66-88	72	67	19	2.4-4.3	3.5	4.1
2	45	7-24	18	14	51-87	73	66	19	1.5-3.9	2.6	3.5
PT1	18	11-22	17	14	55-79	71	76	17	2.1-3.7	3.1	2.5
M4	28	11-25	19	15	76-101	86	101	19	2.3-6.5	4.4	5.5
M6	22	12-27	20	15	58-98	81	91	19	2.8-5.5	3.6	5.3

Puremu Stream

Site 1 (PMU000104)

A poor, below average taxa richness (11 taxa) was recorded in the macroinvertebrate community at site 1, upstream of Colson Road landfill (Table 2 and Figure 2). The taxa characteristic (abundant) of this site (Table 3) were typical of slower flowing, more weedy habitats, being 'tolerant' ostracod seed shrimps and 'moderately sensitive' amphipods (*Paracalliope*). The moderately high proportion of 'tolerant', low-scoring taxa (73% of total taxa) in the community was reflected in the MCI score (67 units). This was 5 units lower than the median for this site, and only one unit higher than the previous minimum MCI score recorded at this site (Table 2, Figure 2).

The SQMCI_s value of 4.1 is above the median for this site, and is a significant improvement on the previous surveys (Stark, 1998) (Figure 3). This figure has improved due to damage to the habitat caused by stock, causing a significant reduction in macroinvertebrate abundance at this site. This survey only recorded two taxa in abundance, compared with seven in the survey undertaken in December 2007. The stock damage also contributed to the poor taxa richness recorded at this site.

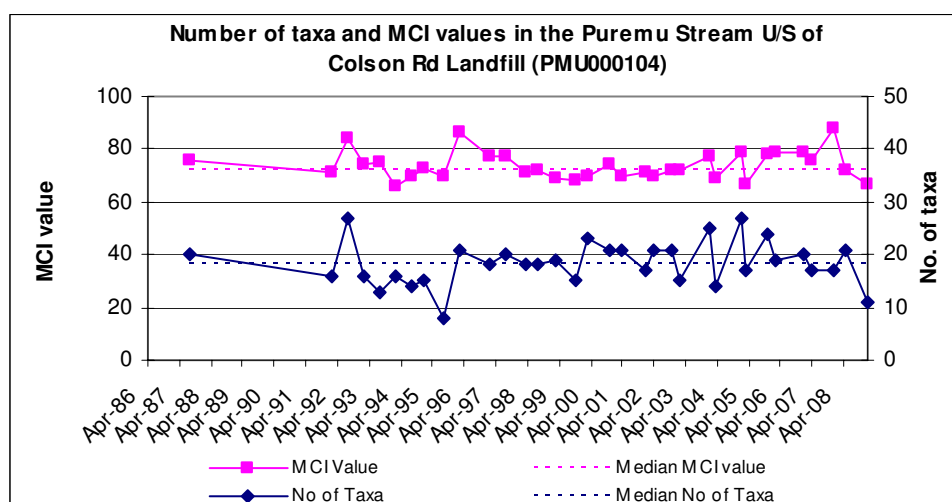


Figure 2 Taxa numbers and MCI values recorded at site 1, upstream of Colson Rd Landfill

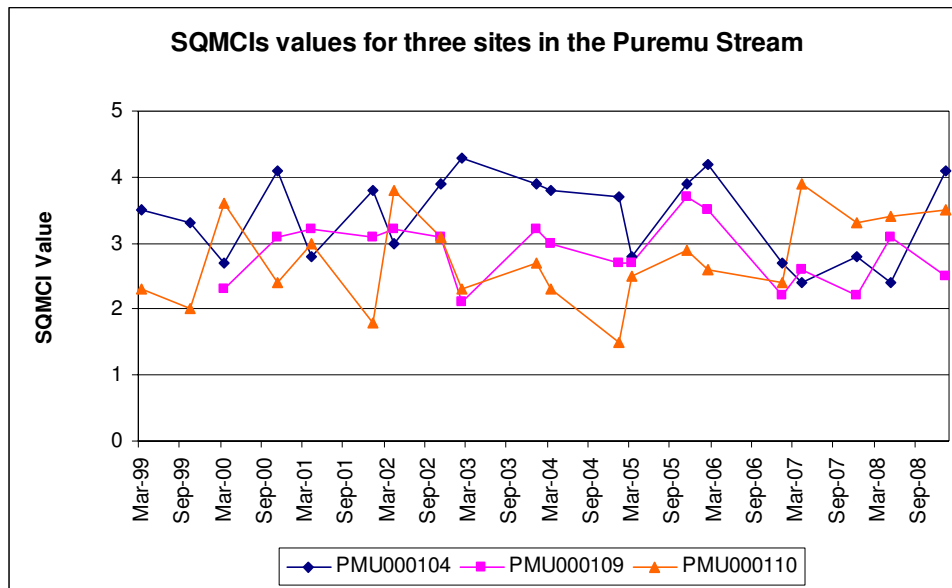


Figure 3 SQMCI_s values recorded at sites in the Puremu Stream and tributary since March 1999

Table 3 Macroinvertebrate fauna of the Puremu Stream (sites 1 & 2) and tributary (site PT1) in relation to the Colson Road landfill sampled on 23 January 2009

Taxa List	Site Number	MCI score	1	2	PT1
	Site Code		PMU000104	PMU000110	PMU000109
	Sample Number		FWB09027	FWB09028	FWB09029
HIRUDINEA (LEECHES)	Hirudinea	3	-	-	R
COELENTERATA	Coelenterata	3	-	R	-
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	R	-	R
NEMERTEA	Nemertea	3	C	-	-
ANNELIDA (WORMS)	Oligochaeta	1	C	C	A
MOLLUSCA	<i>Physa</i>	3	R	-	-
	<i>Potamopyrgus</i>	4	C	VA	A
	Sphaeriidae	3	R	R	VA
CRUSTACEA	Ostracoda	1	A	R	VA
	Isopoda	5	-	C	-
	<i>Paracalliope</i>	5	VA	-	C
	Talitridae	5	-	R	-
HEMIPTERA (BUGS)	<i>Microvelia</i>	3	-	R	-
TRICHOPTERA (CADDISFLIES)	<i>Hydrobiosis</i>	5	-	R	-
	<i>Polyplectropus</i>	6	-	-	A
	<i>Psilochorema</i>	6	-	-	R
	<i>Oxyethira</i>	2	-	-	R
	<i>Triplectides</i>	5	-	R	R
DIPTERA (TRUE FLIES)	<i>Paralimnophila</i>	6	R	-	R
	Orthoclaadiinae	2	-	R	-
	<i>Polypedilum</i>	3	-	VA	C
	Tanypodinae	5	R	-	R
	Empididae	3	-	R	-
	<i>Austrosimulium</i>	3	R	C	-
No of taxa			11	14	14
MCI			67	66	76
SQMCI _s			4.1	3.5	2.5
EPT (taxa)			0	2	3
%EPT (taxa)			0	14	21
'Tolerant' taxa		'Moderately sensitive' taxa	'Highly sensitive' taxa		

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

Site 2 (PMU000110)

Fourteen taxa were found at this site, slightly lower than the median of previous surveys at this second site, but an improvement on that recorded upstream and in the previous survey at this site (Table 2, Figure 4). This suggests some recovery from the previous survey, which attributed the low community richness at that time to a recent drought.

Only two taxa were abundant at this site, both 'tolerant' taxa (*Potamopyrgus* snails and *Polypedilum* midge larvae). The low proportion of 'sensitive' taxa in the community at this site (29% of richness) resulted in a poor MCI value (66 units) which was seven units lower than the median value of previously recorded scores at this site (Figure 4), but similar to that recorded upstream of the landfill at site 1. These results suggest little recovery from that recorded at site 1, although there has been a slight improvement in community richness. The SQMCI_s at site 2 (3.5) was slightly lower than that seen at site 1. This was due in part to the significant increase in abundance of the less 'tolerant' *Potamopyrgus* snails coupled with a significant decrease in abundance of the 'moderately sensitive' amphipod *Paracalliope* (Table 1).

Banded kokopu were also observed at this site.

These results suggest that the health of the macroinvertebrate community at site 2 is similar to that recorded at site 1, even though site 1 was showing degradation due to stock access. However, differences in habitat and sampling differences between the sites complicate these results, and the overall macroinvertebrate assemblage at site 2 does not indicate a degradation caused by any discharge and/or seepage from the landfill between these two sites.

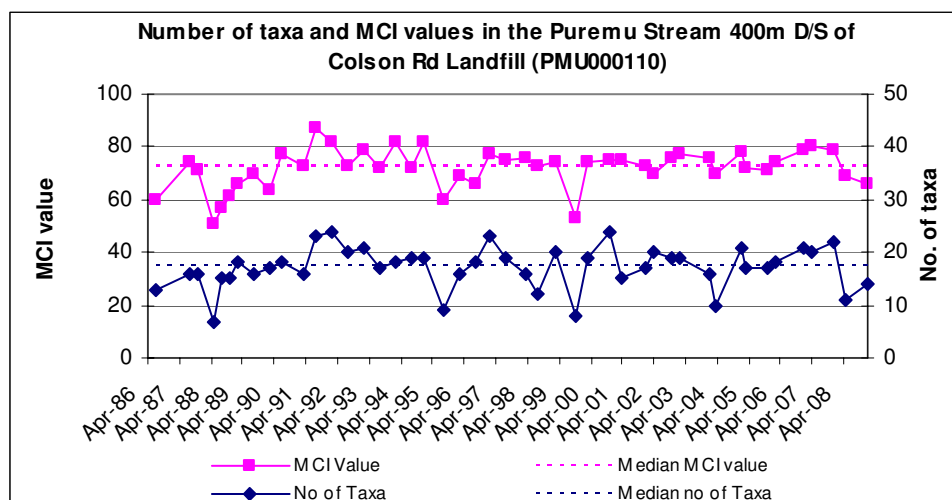


Figure 4 Taxa numbers and MCI values recorded at site 2, 400 m downstream of Colson Rd Landfill

Site PT1 (PMU000109)

The macroinvertebrate community at this site in the tributary stream, draining the treatment system, had a richness of 14 taxa, slightly less than the median of previous values at this site, and within the range of values in the sites in the Puremu Stream proper in the current survey (Figure 5 and Table 2). Five taxa were abundant at this site, four 'tolerant' taxa (oligochaete worms, *Potamopyrgus* snails, sphaeriid clams and ostracod seed shrimp) and one 'moderately sensitive' taxon (*Polypsectropus* caddisfly larvae).

The moderate proportion of ‘tolerant’ lower-scoring taxa (71% of richness) in the community resulted in the MCI score of 76 units, an insignificant 5 units higher than the median for this site (Figure 5), and only three units below the maximum MCI score recorded at this site. It was also 9 and 10 units higher than that recorded at sites 1 and 2 respectively, in the Puremu Stream (Table 2). The SQMCI_s was significantly lower than that seen at sites 1 and 2 in the Puremu Stream (Stark, 1998) and 0.6 units less than the median for this site.

This lower SQMCI_s value is in part a result of the numerical dominance of the ‘tolerant’ sphaeriid clams and ostracod seed shrimp which reflects the slower flowing nature at this site. The MCI score suggests no deterioration in macroinvertebrate community health at this site, and this is supported by the ‘moderately sensitive’ caddisfly *Polyplectropus* being found in abundance.

Earlier surveys have discussed how the abundance of amphipods reduces from site 1 to site 2. This variation was compared with the unionised ammonia concentration in water quality samples taken at site 2. There has been little correlation found between the unionised ammonia concentration and abundance of amphipods at site 2. It has therefore been concluded that the primary reason for this reduction in abundance of amphipods at site 2 is shading of the stream. This shading has spread over the years to completely cover the bed of the stream, reducing the amount of vegetation growing on the bed of the stream, which is the prime habitat for amphipods. This shading has not occurred at site 1, and therefore this site has consistently had macrophytes growing on the bed, and therefore more amphipods.

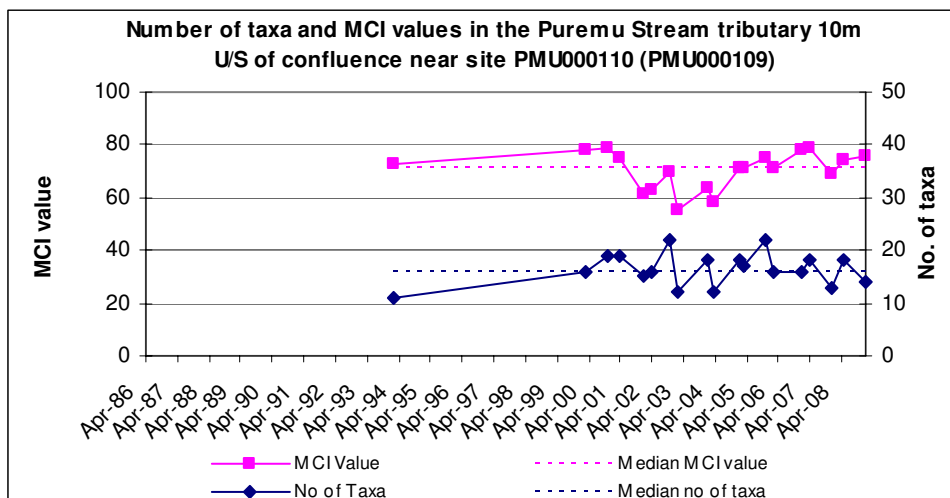


Figure 5 Numbers of taxa and MCI values recorded to date at site PT1, downstream of Colson Rd Landfill

Manganaha Stream

Site M4 (MNH000190)

Fifteen taxa were recorded at this ‘control’ site adjacent to the stage 3 development of the landfill. This is slightly less than the median for all the surveys undertaken at this completely shaded site (Figure 6). Dominant taxa included two ‘tolerant’ taxa (oligochaete worms and *Potamopyrgus* snails), and three ‘moderately sensitive’ taxa (*Paracalliope* amphipod and *Austroclima* and *Coloburiscus* mayfly larvae) (Table 4). This is very similar to that recorded in the previous survey.

The high proportion of 'sensitive' taxa (67% of total taxa) in the community resulted in an MCI score of 101 units, equal to the previous maximum MCI score recorded at this site and significantly higher than the historical median for this site (Figure 6), and the scores recorded in the nearby Puremu Stream (Table 2) (Stark, 1998). This, and the presence of two 'highly sensitive' taxa, indicates that preceding water quality had been good.

The numerical dominance of several 'moderately sensitive' taxa resulted in the moderate SQMCI_s value of 5.5 units, also significantly higher than the long term median for the site (Stark, 1998) (Table 2). This supports the conclusion of good preceding water quality.

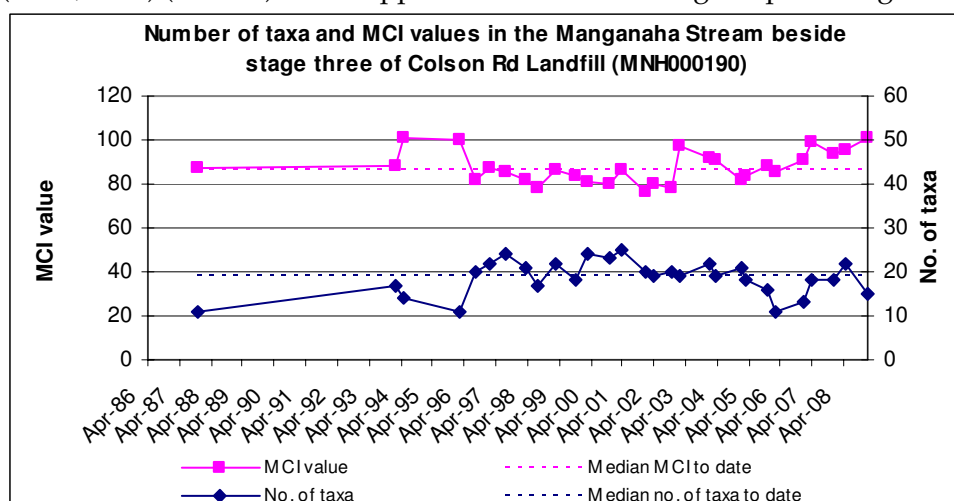


Figure 6 Taxa numbers and MCI values recorded at site M4, in the Manganaha Stream adjacent to Colson Road landfill

Table 4 Macroinvertebrate fauna of the Manganaha Stream in relation to the Colson Road landfill sampled on 23 January 2009

Taxa List	Site Number	MCI score	M4	M6
	Site Code		MNH000190	MNH000260
	Sample Number		FWB09030	FWB09031
NEMERTEA	Nemertea	3	R	R
NEMATODA	Nematoda	3	-	R
ANNELIDA (WORMS)	Oligochaeta	1	A	C
	Lumbricidae	5	R	-
MOLLUSCA	<i>Potamopyrgus</i>	4	A	C
CRUSTACEA	<i>Paracalliope</i>	5	VA	C
	<i>Paratya</i>	3	R	-
	<i>Paranephrops</i>	5	R	-
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	VA	A
	<i>Coloburiscus</i>	7	A	R
	<i>Zephlebia group</i>	7	R	R
PLECOPTERA (STONEFLIES)	<i>Acroperla</i>	5	-	R
COLEOPTERA (BEETLES)	Ptilodactylidae	8	R	-
TRICHOPTERA (CADDISFLIES)	<i>Hydrobiosis</i>	5	R	R
	<i>Orthopsyche</i>	9	C	C
	<i>Oxyethira</i>	2	-	C
	<i>Tripletides</i>	5	R	-
DIPTERA (TRUE FLIES)	<i>Aphrophila</i>	5	-	R
	Orthoclaadiinae	2	C	R
	Empididae	3	-	R
No of taxa			15	15
MCI			101	91
SQMCI_s			5.5	5.3
EPT (taxa)			6	6
%EPT (taxa)			40	40
'Tolerant' taxa	'Moderately sensitive' taxa		'Highly sensitive' taxa	

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

Site M6 (MNH000260)

Fifteen taxa were found at this site, equal to that recorded upstream at site M4 but five taxa lower than the historical median richness for site M6 (Table 2). Only one taxon was abundant at this site during this survey, the 'moderately sensitive' mayfly larvae *Austroclima* (Table 4). This low number of abundant taxa reflects the recent change in habitat, with the loss of willow roots and loose substrate. When the substrate consists entirely of hard clay, there simply isn't the habitat available to sustain a number of abundant taxa.

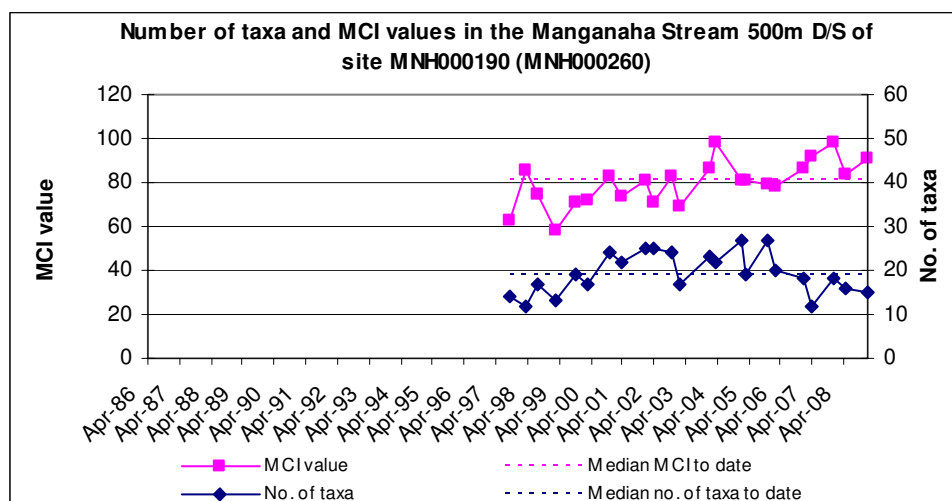


Figure 7 Taxa numbers and MCI values recorded at site M6, 500 m downstream of Colson Road Landfill

The proportion of 'tolerant' taxa (47% of total taxa) in this community was higher than that seen upstream, and consequently the MCI score (91 units) was lower, by a sizeable 10 units. However, this score was five units higher than the historical median for site M6 (Figure 7). There was a reduced abundance in most taxa at this site, being relatively balanced across both tolerant and 'moderately sensitive' taxa. This means the relative abundance of the taxa was unchanged, and consequently there was little change in the SQMCI_s value (5.3).

The reduction in the MCI score at site M6 may indicate impacts from the landfill. However, these changes are more likely related to the significant alterations in habitat at site M6. These alterations, which include the reduction in riparian shading and willow roots have reduced the number of abundant taxa, and can impact on 'sensitive' taxa, which reduced from ten at site M4 to eight at site M6. This includes the loss of one 'highly sensitive' taxon. It is therefore not thought that this drop is related to a discharge from the landfill.

Summary and Conclusions

The Council's standard 'kick-sampling' technique was used at four established sites and the 'sweep-sampling' technique at one established site to collect streambed macroinvertebrates from an unnamed tributary of the Puremu Stream, and the Puremu and Manganaha Streams on 23 January 2009. 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 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 receiving waters. There was little change in MCI values from site 1 to site 2 in the Puremu Stream, although both sites exhibited values that were slightly below their respective long term median. This suggests that the health of the macroinvertebrate community at site 2 was similar to that recorded at site 1, even though site 1 was showing degradation due to stock access. However, differences in habitat and sampling differences between the sites complicate these results, and the overall macroinvertebrate assemblage at site 2 did not indicate a degradation caused by any discharge and/or seepage from the landfill between these two sites. Banded kokopu were also observed at site 2.

Site PT1, in the tributary which drains the treatment system recorded MCI and SQMCI_s values not significantly different to their respective medians, suggesting little impact from the landfill discharge. Subtle differences in MCI values between sites can be attributed to substrate differences and the abundance of macrophytes in these streams. The impact of the different sampling technique used at certain sites also influenced results.

The control site in the Manganaha Stream exhibited above average MCI and SQMCI_s values. This indicates that water quality preceding this survey had been good. There was a 10 unit reduction in MCI recorded at the downstream site (when compared to the control site), but little change in community richness and SQMCI_s value. The reduction in the MCI score at site M6 may indicate impacts from the landfill. However, these changes are more likely related to the significant alterations in habitat at site M6. These alterations, which include the reduction in riparian shading and willow roots resulting from the removal of willows in the 2007-2008 monitoring period, have reduced the number of abundant taxa, and can impact on 'sensitive' taxa, which reduced from ten at site M4 to eight at site M6. This includes the loss of one 'highly sensitive' taxon. It is therefore not thought that this drop is related to a discharge from the landfill.

The macroinvertebrate communities of these streams contained moderate proportions of 'tolerant' taxa at all sites and the communities were generally dominated by a combination of 'tolerant' and 'moderately sensitive' taxa. This presence of 'moderately sensitive' taxa, plus the presence of two 'highly sensitive' taxa at the control site in the Manganaha Stream, indicates that water quality in the weeks preceding this survey had not been poor.

Taxonomic richness (number of taxa) at all sites was below their respective median richness from previous surveys, but within the values previously recorded. MCI and SQMCI_s scores indicated that the stream communities were of moderate to poor health in the Puremu Stream and tributary, and in good health in the Manganaha Stream, but generally similar to the typical condition recorded in lowland soft-bedded streams elsewhere in Taranaki.

No undesirable biological growths were detected at any of these sites during this January 2009 survey.

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To Job Manager, Scott Cowperthwaite
From Scientific Officer, Bart Jansma
File 03-02-005-09/01; 2370; 4619; 4620; 6177;
Report No BJ075
Document No 666998
Date 30 September 2009

Biomonitoring of the Puremu and Manganaha Streams in relation to the NPDC Colson Road landfill, March 2009

Introduction

Biological surveys have been performed in the Puremu Stream since 1986 to assess potential adverse effects of leachate from the Colson Road landfill on the macroinvertebrate communities of the stream. The Manganaha Stream has been sampled since 1994 to establish baseline data on the communities of the stream, before the proposed extension of the landfill in the direction of the stream. Earthworks for the Stage III extension of the landfill began in July 2001 and disposal into this area began in May 2002. The current survey is the second of two biological surveys scheduled for the Puremu and Manganaha Streams in the 2008-2009 monitoring year.

The consents related to this survey are:

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 the Puremu Stream and;
4621 to discharge contaminants into land.

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 30 March 2009 at three established sampling sites in the Puremu Stream catchment and two established sites in the Manganaha Stream (Figure 1, Table 1). 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 the remaining two sites in the Puremu Stream (2, PT1) and the Manganaha stream (M4 & M6) below the landfill extension. 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). Some macroinvertebrates were also collected from macrophytes at site PT1.

Table 1 Biomonitoring sites in the Puremu and Manganaha Streams related to the Colson Road Landfill

Site No.	Site code	Map reference	Location
1	PMU000104	P19: 072373	Puremu Stream, upstream of landfill
2	PMU000110	P19: 071382	Puremu Stream, 400 m downstream of landfill
PT1	PMU000109	P19: 071380	Puremu Stream tributary, 10 m upstream of confluence
M4	MNH000190	P19: 077380	Manganaha Stream, beside proposed landfill extension
M6	MNH000260	P19: 074385	Manganaha Stream, 500 metres downstream of site M4

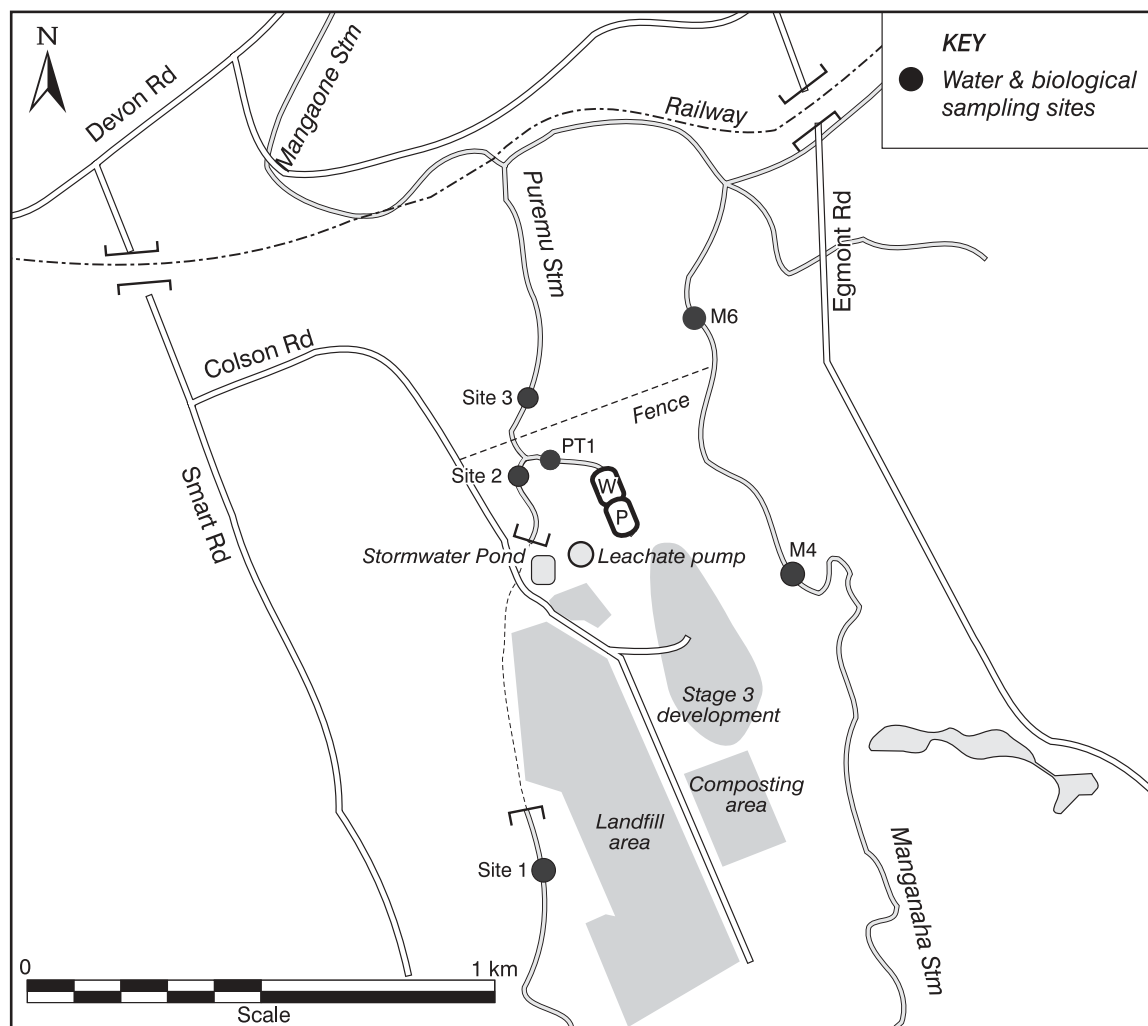


Figure 1 Biomonitoring sites related to the Colson Road landfill, New Plymouth. The stage III treatment systems are illustrated by P (= pond), and W (= wetland).

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 NZMVG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001). Macroinvertebrate taxa found in each sample were recorded as:







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

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

Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1 and 0.1 in hard bottomed and soft bottomed streams respectively. The sensitivity scores for certain taxa found in hard bottomed streams have been modified in accordance with Taranaki experience. After extensive use of the MCI, categories were assigned to the sensitivity scores, to clarify their 'relative' sensitivity e.g. taxa that scored between 1 and 4 inclusive are considered tolerant (see Table 3).

By averaging the scores obtained from a list of taxa taken from one site and multiplying by a scaling factor of 20, a Macroinvertebrate Community Index value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. More 'sensitive' communities inhabit less polluted waterways.

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

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

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

Sub-samples of periphyton (algae and other micro flora) taken from the macroinvertebrate samples were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ("undesirable biological growths") at a microscopic level. The presence of masses of these organisms can be an indicator of organic enrichment within a stream.

Results and discussion

At the time of this March 2009 biomonitoring survey, the water temperatures in the Puremu Stream and tributary ranged from 16. °C to 17.8°C. Site 1 in the Puremu Stream had an uncoloured and clear flow, which was low, and very slow, closely resembling a swamp, while site 2 had a slow flow. The unnamed tributary also had a low and slow flow, which was also clear and uncoloured.

Sites 1 and P1 had substrates consisting entirely of silt, while site 2 consisted predominantly of silt, with a significant component of willow roots. All sites were coated in either silt or iron oxide. No site had any periphyton or moss. Aquatic vegetation was present at both site 1 and PT1, where it was growing throughout the stream. It was noted that site PT1 had a lot of iron oxide on the bed, and quite some woody debris. Site 1 in the main stem had no shading, while sites 2 and PT1 were partially shaded.

No unusual bacterial, fungal or protozoan growths were found by microscopic examination for 'heterotrophic growths' at any of the Puremu Stream sites in this March 2009 survey.

The Manganaha Stream had a moderate, clear and uncoloured flow, which was swift at site M4 and steady at site M6. Water temperature was slightly cooler to that seen in the Puremu Stream, 14.5°C at M4 and 15.2°C at M6. Both sites were partially shaded, with site M4 also supporting some macrophytes. No macrophytes were present at site M6, and both sites supported some periphyton, as patchy filaments at site M4 and patchy mats and filaments at site M6. The substrate at site M4 was predominantly wood and willow roots, with some hard clay and fine sediment also, while M6 had a substrate comprising equal amounts of hard clay and willow roots, with some fine sediment also present.

One significant change that occurred during the 2008-2009 was the complete removal of willows at site M6. Associated earthworks had resulted in noticeable sediment entering the stream. This site used to be completely shaded, and so the removal of the riparian vegetation may result in a change in the macroinvertebrate community at this site. Much of the sediment present during the previous survey had been scoured away, and the resultant substrate was not ideal for more 'sensitive' taxa.

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 2, together with current results.

Table 2 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	Number of previous surveys	Numbers of taxa			MCI values			SQMCI's			
		Range	Median	Current survey	Range	Median	Current survey	No.	Range	Median	Current survey
1	34	8-27	18	15	66-88	72	60	20	2.4-4.3	3.6	1.4
2	46	7-24	18	16	51-87	73	71	20	1.5-3.9	2.7	3.7
PT1	19	11-22	13	13	55-79	71	72	18	2.1-3.7	3.1	1.8
M4	29	11-25	19	19	76-101	86	96	20	2.3-6.5	4.5	5.8
M6	23	12-27	19	18	58-98	81	90	20	2.8-5.5	3.8	4.7

Puremu Stream

Site 1 (PMU000104)

A low, below average taxa richness (15 taxa) was recorded in the macroinvertebrate community at site 1, upstream of Colson Road landfill (Table 2 and Figure 2). The taxa characteristic (abundant) of this site (Table 3) were typical of slower flowing, more weedy habitats, being 'tolerant' leeches (hirudinea), nemertean and oligochaete worms and ostracod seed shrimps and 'moderately sensitive' amphipods (*Paracalliope*). The high proportion of 'tolerant', low-scoring taxa (80% of total taxa) in the community was reflected in the poor MCI score (60 units). This was six units lower than the minimum MCI score of the 34 previous surveys undertaken at this site, and a statistically significant 12 units lower than the long term median MCI score (Table 2, Figure 2). This poor result may be a reflection of some remaining impact from the stock access noted in the previous survey, but is also a reflection of the low and slow flow recorded at this site during the current survey.

The SQMCI_s value of 1.4 is significantly lower than the previous minimum recorded at this site, and is a significant 2.2 units below the median for this site (Stark, 1998). This is a significant deterioration on the previous survey (Stark, 1998) (Figure 3), caused by the extreme abundance of 'tolerant' worms and ostracod seed shrimps. The abundance of these two taxa is a direct reflection of the slow flow, swamp like habitat present at this site.

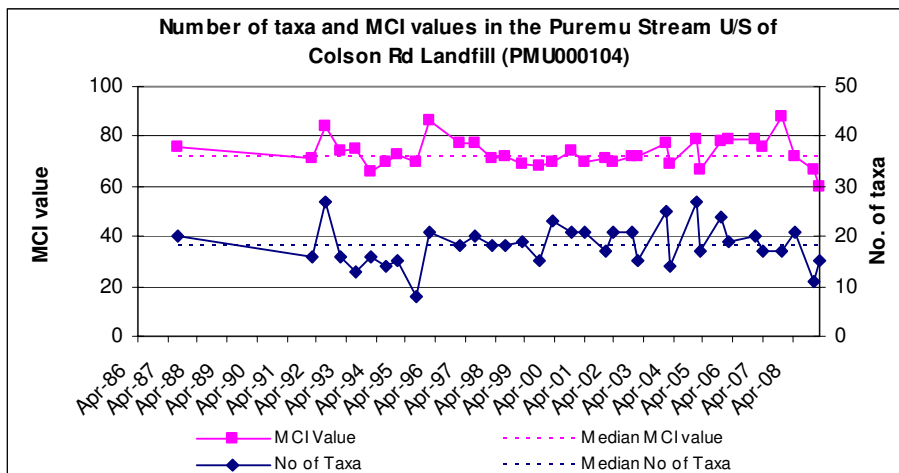


Figure 2 Taxa numbers and MCI values recorded at site 1, upstream of Colson Rd Landfill

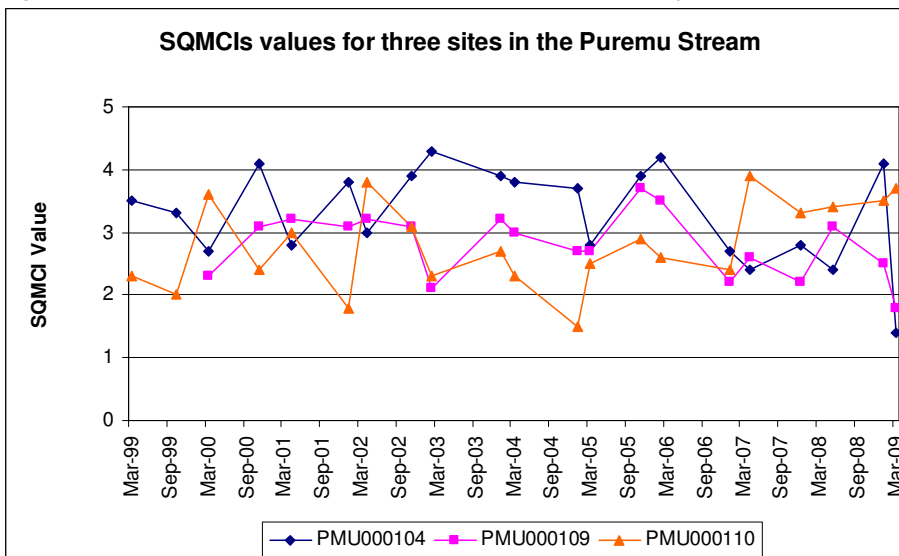


Figure 3 SQMCI_s values recorded at sites in the Puremu Stream and tributary since March 1999

Table 3 Macroinvertebrate fauna of the Puremu Stream (sites 1 & 2) and tributary (site PT1) in relation to the Colson Road landfill sampled on 23 January 2009

Taxa List	Site Number	MCI score	1	2	PT1
	Site Code		PMU000104	PMU000110	PMU000109
	Sample Number		FWB09193	FWB09194	FWB09195
HIRUDINEA (LEECHES)	Hirudinea	3	A	-	C
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	C	-	C
NEMERTEA	Nemertea	3	A	R	C
NEMATODA	Nematoda	3	R	-	C
ANNELIDA (WORMS)	Oligochaeta	1	XA	C	C
MOLLUSCA	Lymnaeidae	3	-	R	-
	<i>Potamopyrgus</i>	4	-	VA	-
	Sphaeriidae	3	R	-	A
CRUSTACEA	Copepoda	5	-	R	-
	Ostracoda	1	XA	C	VA
	Isopoda	5	-	R	-
	<i>Paracalliope</i>	5	VA	R	R
COLEOPTERA (BEETLES)	Hydrophilidae	5	-	-	R
TRICHOPTERA (CADDISFLIES)	<i>Hydrobiosis</i>	5	R	-	-
	<i>Polypsectropus</i>	6	-	-	C
	<i>Oxyethira</i>	2	R	-	-
	<i>Triplectides</i>	5	-	R	-
DIPTERA (TRUE FLIES)	<i>Paralimnophila</i>	6	-	R	R
	Orthoclaadiinae	2	R	C	-
	<i>Polypedilum</i>	3	-	R	-
	Tanypodinae	5	R	R	R
	Ceratopogonidae	3	C	R	R
	Empididae	3	R	-	-
	Sciomyzidae	3	-	R	-
	<i>Austrosimulium</i>	3	R	R	-
No of taxa			15	16	13
MCI			60	71	72
SQMCI _s			1.4	3.7	1.8
EPT (taxa)			1	1	1
%EPT (taxa)			7	6	8
'Tolerant' taxa		'Moderately sensitive' taxa	'Highly sensitive' taxa		

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

Site 2 (PMU000110)

Sixteen taxa were found at this site, slightly lower than the median of previous surveys at this second site, but an improvement on that recorded upstream and in the previous survey at this site (Table 2, Figure 4). This suggests continued recovery from the May 2008 survey, which attributed the low community richness at that time to a recent drought.

Only one taxon was abundant at this site, the 'tolerant' snail *Potamopyrgus*. The moderately low proportion of 'sensitive' taxa in the community at this site (37% of richness) resulted in a poor MCI value (71 units), although this was only two units lower than the median value of previously recorded scores at this site (Figure 4), and a significant 11 units higher than that recorded upstream of the landfill at site 1 (Stark, 1998). These results reflect the improved habitat at site 2 (when compared with site 1), and suggest an improvement in macroinvertebrate community health at this site from the previous survey.

The SQMCI_s at site 2 (3.7) was significantly higher than that seen at site 1 and the long term median for this site. This was due to the significant decrease in the abundance of a number of 'tolerant' taxa, especially oligochaete worms and ostracod seed shrimps, that are less

suiting to swifter flowing habitat, such as that present at site 2 (Table 1).

These results suggest that the health of the macroinvertebrate community at site 2 is better than that recorded at site 1, and that this is primarily related to differences in habitat and sampling technique between the sites. The health of the community at site 1 was particularly poor, and as such did not provide a good comparison with site 2. When the overall macroinvertebrate assemblage downstream at site 2 was compared with the historical results for this site, there was no indication of a degradation caused by any discharge and/or seepage from the landfill between these two sites.

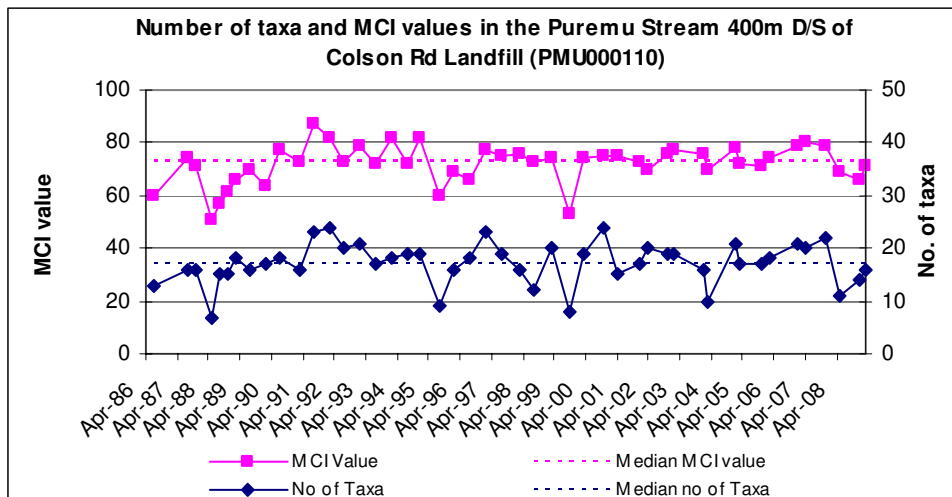


Figure 4 Taxa numbers and MCI values recorded at site 2, 400 m downstream of Colson Rd Landfill

Site PT1 (PMU000109)

The macroinvertebrate community at this site in the tributary stream, draining the treatment system, had a richness of 13 taxa, slightly less than the median of previous values at this site, and below the range of values in the sites in the Puremu Stream proper in the current survey (Figure 5 and Table 2). Two taxa were abundant at this site, both 'tolerant' taxa (sphaeriid clams and ostracod seed shrimp).

The moderate proportion of 'tolerant' lower-scoring taxa (62% of richness) in the community resulted in the MCI score of 72 units, an insignificant 1 unit higher than the median for this site (Figure 5), and 12 and 1 units higher than that recorded at sites 1 and 2 respectively, in the Puremu Stream (Table 2). The SQMCI_s score (1.8 units) was the lowest recorded to date for this site, was significantly lower than that seen at site 2 in the Puremu Stream (Stark, 1998) and significantly lower than the median for this site.

This poor SQMCI_s value is in part a result of the numerical dominance of the 'tolerant' sphaeriid clams and ostracod seed shrimp which reflects the slower flowing nature at this site. The MCI score suggests no deterioration in macroinvertebrate community health at this site, although the flow conditions at this site have caused a reduction in abundance of 'sensitive' taxa, when compared with previous surveys.

Earlier surveys have discussed how the abundance of amphipods reduces from site 1 to site 2. This variation was compared with the unionised ammonia concentration in water quality samples taken at site 2. There has been little correlation found between the unionised ammonia concentration and abundance of amphipods at site 2. It has therefore been concluded that the primary reason for this reduction in abundance of amphipods at site 2 is

shading of the stream. This shading has spread over the years to completely cover the bed of the stream, reducing the amount of vegetation growing on the bed of the stream, which is the prime habitat for amphipods. This shading has not occurred at site 1, and therefore this site has consistently had macrophytes growing on the bed, and therefore more amphipods.

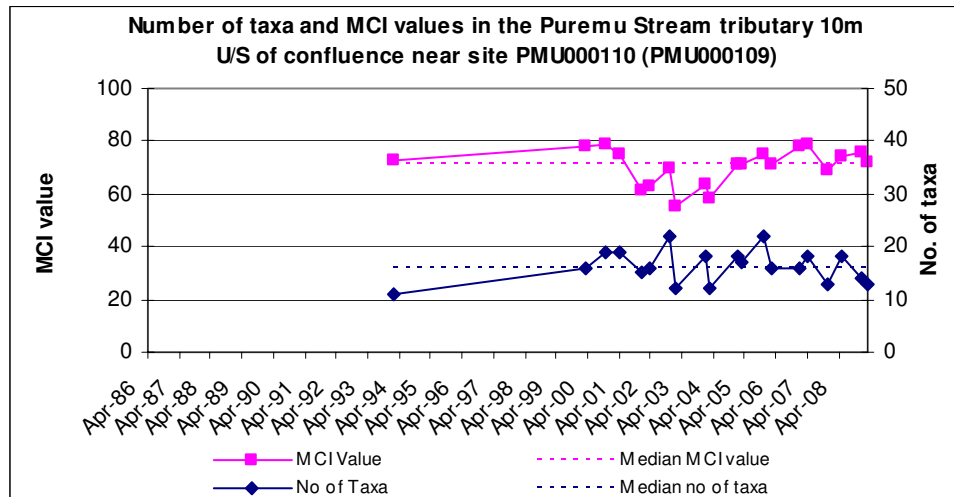


Figure 5 Numbers of taxa and MCI values recorded to date at site PT1, downstream of Colson Rd Landfill

Manganaha Stream

Site M4 (MNH000190)

Nineteen taxa were recorded at this 'control' site adjacent to the stage 3 development of the landfill. This is equal to the median for all the surveys undertaken at this partially shaded site (Figure 6). Dominant taxa included two 'tolerant' taxa (*Potamopyrgus* snails and *Austrosimulium* sandfly larvae), three 'moderately sensitive' taxa (*Paracalliope* amphipod and *Austroclima* and *Coloburiscus* mayfly larvae), and one 'highly sensitive' taxon (*Orthopsyche* caddisfly larvae) (Table 4). This is similar to that recorded in the previous survey.

The moderate proportion of 'sensitive' taxa (58% of total taxa) in the community resulted in an MCI score of 96 units, 10 units higher than the historical median for this site (Figure 6), and significantly higher than the scores recorded in the nearby Puremu Stream (Table 2) (Stark, 1998). This, and the presence of two 'highly sensitive' taxa (one in abundance), indicates that preceding water quality had been good.

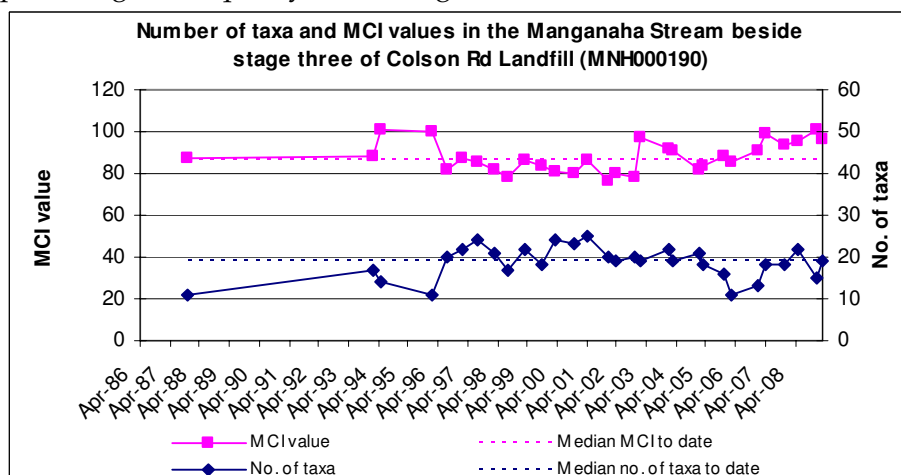


Figure 6 Taxa numbers and MCI values recorded at site M4, in the Manganaha Stream adjacent to Colson Road landfill

The numerical dominance of several 'moderately sensitive' taxa resulted in the moderate SQMCI_s value of 5.8 units, also significantly higher than the long term median for the site (Stark, 1998) (Table 2). This supports the conclusion of good preceding water quality.

Table 4 Macroinvertebrate fauna of the Manganaha Stream in relation to the Colson Road landfill sampled on 23 January 2009

Taxa List	Site Number	MCI score	M4	M6
	Site Code		MNH000190	MNH000260
	Sample Number		FWB09196	FWB09197
HIRUDINEA (LEECHES)	Hirudinea	3	-	R
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	R	R
NEMERTEA	Nemertea	3	R	C
ANNELIDA (WORMS)	Oligochaeta	1	C	VA
MOLLUSCA	<i>Potamopyrgus</i>	4	VA	VA
	Sphaeriidae	3	R	-
CRUSTACEA	Ostracoda	1	R	R
	Isopoda	5	R	-
	<i>Paracalliope</i>	5	XA	XA
	<i>Paratya</i>	3	-	R
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	XA	VA
	<i>Coloburiscus</i>	7	A	A
	<i>Zephlebia group</i>	7	C	A
COLEOPTERA (BEETLES)	Ptilodactylidae	8	R	-
TRICHOPTERA (CADDISFLIES)	Ecnomidae/Psychomyiidae	6	R	C
	<i>Hydrobiosis</i>	5	R	C
	<i>Orthopsyche</i>	9	A	C
	<i>Psilochorema</i>	6	R	C
	<i>Triplectides</i>	5	C	C
DIPTERA (TRUE FLIES)	<i>Polypedilum</i>	3	C	C
	<i>Austrosimulium</i>	3	A	C
No of taxa			19	18
MCI			96	90
SQMCI _s			5.8	4.7
EPT (taxa)			8	8
%EPT (taxa)			42	44
'Tolerant' taxa		'Moderately sensitive' taxa	'Highly sensitive' taxa	

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

Site M6 (MNH000260)

Eighteen taxa were found at this site, similar to that recorded upstream at site M4 but and to the historical median richness for site M6 (Table 2). Six taxa were abundant at this site, two 'tolerant' taxa (oligochaete worms and *Potamopyrgus* snails) and four 'moderately sensitive' taxa (*Paracalliope* amphipods and mayfly larvae (*Austroclima*, *Coloburiscus* and *Zephlebia*) (Table 4). This is an improvement on the previous survey which only recorded one taxon in abundance. This improved number of abundant taxa reflects the return of variation to the substrate, particularly the return of willow roots.

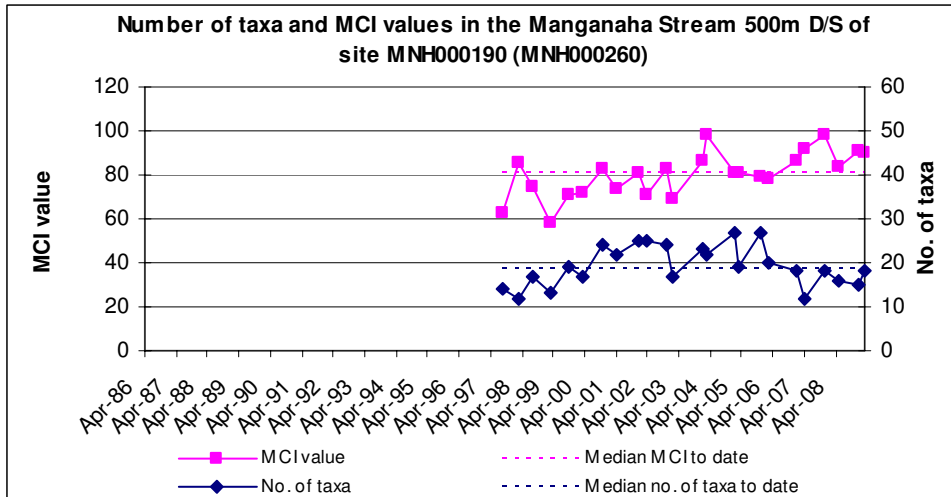


Figure 7 Taxa numbers and MCI values recorded at site M6, 500 m downstream of Colson Road Landfill

The proportion of ‘tolerant’ taxa (50% of total taxa) in this community was higher than that seen upstream, and consequently the MCI score (90 units) was lower, but only by an insignificant 6 units. This score was nine units higher than the historical median for site M6 (Figure 7, Table 2). There were no significant changes in abundance of individual taxa from site M4, except for a significant increase in the abundance of ‘tolerant’ oligochaete worms. This increase, coupled with a decrease in the abundance of *Austroclima* mayfly larvae, caused a significant decrease in the SQMCI_s score (4.7).

The reduction in the MCI and SQMCI_s scores at site M6 may indicate impacts from the landfill. However, these changes are more likely related to the significant alterations in habitat at site M6. These alterations, which include the reduction in riparian shading and change in substrate, can impact on ‘sensitive’ taxa, which reduced slightly from eleven at site M4 to nine at site M6. This includes the loss of one ‘highly sensitive’ taxon. It is therefore not thought that this drop is related to a discharge from the landfill.

Summary and Conclusions

The Council’s standard ‘kick-sampling’ technique was used at four established sites and the ‘sweep-sampling’ technique at one established site to collect streambed macroinvertebrates from an unnamed tributary of the Puremu Stream, and the Puremu and Manganaha Streams on 23 January 2009. 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 receiving waters. There was

a significant improvement in MCI values from site 1 to site 2 in the Puremu Stream, although both sites exhibited values that were slightly below their respective long term median. These results suggest that the health of the macroinvertebrate community at site 2 is better than that recorded at site 1, and that this is primarily related to differences in habitat and sampling technique between the sites. The health of the community at site 1 was particularly poor, and as such did not provide a good comparison with site 2. When the overall macroinvertebrate assemblage downstream at site 2 was compared with the historical results for this site, there was no indication of a degradation caused by any discharge and/or seepage from the landfill between these two sites.

Site PT1, in the tributary which drains the treatment system recorded an MCI value not significantly different to the median, suggesting little impact from the landfill discharge. However, the SQMCI_s was significantly lower than the median for this site. This poor SQMCI_s value is in part a result of the numerical dominance of the 'tolerant' sphaeriid clams and ostracod seed shrimp which reflects the slower flowing nature at this site. The MCI score suggests no deterioration in macroinvertebrate community health at this site, although the flow conditions at this site have caused a reduction in the abundance of 'sensitive' taxa, when compared with previous surveys.

Subtle differences in MCI values between sites in the Puremu Stream catchment can be attributed to substrate differences and the abundance of macrophytes in these streams. The impact of the different sampling technique used at certain sites also influenced results.

The control site in the Manganaha Stream exhibited above average MCI and SQMCI_s values. This indicates that water quality preceding this survey had been good. There was a 6 unit reduction in MCI recorded at the downstream site (when compared to the control site), and little change in community richness. The SQMCI_s value at site M6 was significantly lower to that recorded at site M4, although this was primarily related to the change in abundance of just two taxa. The reduction in the MCI and SQMCI_s scores at site M6 may indicate impacts from the landfill. However, these changes are more likely related to the significant alterations in habitat at site M6. These alterations, which include the reduction in riparian shading and change in substrate, can impact on 'sensitive' taxa, which reduced slightly from eleven at site M4 to nine at site M6. This includes the loss of one 'highly sensitive' taxon. It is therefore not thought that this drop is related to a discharge from the landfill.

The macroinvertebrate communities of these streams contained moderate proportions of 'tolerant' taxa at all sites and the communities were generally dominated by a combination of 'tolerant' and 'moderately sensitive' taxa. This presence of 'moderately sensitive' taxa, plus the presence of two 'highly sensitive' taxa at the control site in the Manganaha Stream (one in abundance), indicates that water quality in the weeks preceding this survey had not been poor.

Taxonomic richness (number of taxa) at all sites was similar to or below their respective median richness from previous surveys, but within the values previously recorded. MCI and SQMCI_s scores indicated that the stream communities were of moderate to poor health in the Puremu Stream and tributary, and in good health in the Manganaha Stream, but generally similar to the typical condition recorded in lowland soft-bedded streams elsewhere in Taranaki.

No undesirable biological growths were detected at any of these sites during this March 2009 survey.

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