New Plymouth District Council Inglewood, Okato, Okoki, and Marfell Park Landfills Monitoring Programme Annual Report 2013-2014

Technical Report 2014-91

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Executive summary

The New Plymouth District Council (NPDC) maintains two reinstated landfills, one at Inglewood and one at Okato. Both landfills have been used in the past, and are now held in reserve to accept refuse on a contingency basis. The Inglewood landfill is located on King Road at Inglewood, in the Waiongana catchment, and the Okato landfill is located on Hampton Road at Okato, in the Kaihihi catchment.

NPDC also maintains two closed landfills; Okoki landfill in the Urenui catchment, and Marfell Park landfill in the Huatoki catchment. Neither of these landfills accept waste for disposal and have been fully reinstated.

This report for the period July 2013-June 2014 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess NPDC's environmental performance during the period under review, and the results and environmental effects of NPDC's activities in regard to these closed landfills.

During the monitoring period NPDC demonstrated an overall high level of environmental performance.

NPDC holds eight resource consents, which include a total of 65 conditions setting out the requirements that they must satisfy. NPDC holds four consents to discharge leachate and stormwater into various streams, two consents to discharge contaminants onto and into land, and two consents to discharge emissions into the air.

The Council's monitoring programme for the year under review included six inspections, two discharge samples, 11 receiving water samples , two biomonitoring surveys of receiving waters, and four ambient air quality analyses. No monitoring was scheduled or required at the Marfell or Okoki landfill sites during the year under review.

During the monitoring year there were no incidents logged by Council associated with NPDC's landfills covered in this report.

Overall, NPDC demonstrated a high level of environmental performance and compliance with their resource consents.

For reference, in the 2013-2014 year, 60% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 29% demonstrated a good level of environmental performance and compliance with their consents.

This report includes recommendations for the 2014-2015 year.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is the Annual Report for the period July 2013-June 2014 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by New Plymouth District Council (NPDC).

NPDC hold consents to discharge leachate and contaminated stormwater from its closed landfills. These are the Okoki landfill in the Urenui catchment, and Marfell Park landfill in the Huatoki catchment. These landfills do not accept waste for disposal to land and have all been fully reinstated.

NPDC also hold consents to discharge solids to land, emissions to air, and leachate and contaminated stormwater to land and water, at two contingency landfills. These are Inglewood landfill in the Waiongana catchment, and Okato landfill in the Kaihihi catchment. These landfills are non-operational and are fully reinstated. They do, however, retain all necessary consents to act as contingency sites if the Regional landfill at Colson Road has to cease accepting waste in the event of an emergency.

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 the discharges of leachate and stormwater within these catchments and discharges of contaminants onto and into land and emissions to air for the Inglewood and Okato sites.

One of the intents of the Resource Management Act 1991 (RMA) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of NPDC's use of water, land, and air, and is the 24rd combined annual report by the 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 RMA and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consents held by NPDC for landfills in the Urenui, Huatoki, Waiongana, and Kaihihi catchments, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted by NPDC.

Sections 2 – 5 focus on each individual landfill. Subsections present the results of monitoring during the period under review, including scientific and technical data, discuss the results, their interpretation, and their significance for the environment, and present recommendations to be implemented in the 2014-2015 monitoring year.

Section 6 contains a summary of recommendations for the 2014-2015 monitoring period.

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

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

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Council is recognising the comprehensive meaning of 'effects' inasmuch as is appropriate for each activity. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental performance

Besides discussing the various details of the performance and extent of compliance by the consent holder/s during the period under review, this report also assigns a rating as to each consent holder's environmental and administrative performance.

Environmental performance is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year. **Administrative performance** is concerned with the Company's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

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

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

Environmental Performance

- **High** No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment .The Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.

- **Good** Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self reports, or in response to unauthorised incident reports, but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

  For example:

  - High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
  - Strong odour beyond boundary but no residential properties or other recipient nearby.

- **Improvement required** Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.

- **Poor** Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

Administrative compliance

- **High** The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.

- **Good** Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

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

- **Poor** Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

For reference, in the 2013-2014 year, 60% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 29% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Process description

NPDC holds consents to discharge leachate and contaminated stormwater from two closed landfills: the Okoki landfill in the Urenui catchment, and Marfell Park landfill in the Huatoki catchment. These landfills do not accept waste for disposal and have been fully closed and reinstated.

NPDC holds consents to discharge solids to land, leachate and emissions to air at the Inglewood landfill in the Waiongana catchment and the Okato landfill in the Kaihihi catchment. These landfills do not currently accept waste but could be re-commissioned if needed.

The Colson Road regional landfill remains operational. The monitoring of this facility is reported separately.

Readers are referred to previous annual compliance monitoring reports that are listed in the bibliography of this report.

1.3 Resource consents

NPDC holds a total of eight consents in relation to its closed and contingency landfills. These are set out in Table 1 below, and further detail on the consents is given in Sections 1.3.1 to 1.3.3.

Table 1 Summary of consents held by NPDC

Site	Consent No.	Purpose	Option for Review	Expires
Inglewood	3954-2	Discharge leachate and stormwater	-	1 June 2020
	4526-3	Discharge emissions to air	June 2020	1 June 2026
	4527-3	Discharge solids to land	June 2020	1 June 2026
Okato	3860-3	To discharge stormwater and leachate	June 2019 June 2025	June 2031
	4528-3	Discharge emission to air	June 2019 June 2025	June 2031

Site	Consent No.	Purpose	Option for Review	Expires
	4529-3	Discharge solids to land	June 2019 June 2025	June 2031
Marfell Park	4902-1	Discharge leachate and stormwater	-	1 June 2014*
Okoki	3955-2	Discharge leachate and stormwater	-	1 June 2015

* 4902-1 expired near the end of the current monitoring period and an application is currently being processed to renew this consent.

1.3.1 Water discharge permits

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

NPDC holds water discharge permit **3954-2** to cover the discharge of up to a total of 4,752 cubic metres/day (55 L/s) of leachate and stormwater from the Inglewood municipal landfill to an unnamed tributary of the Awai Stream, a tributary of the Mangaoraka Stream, in the Waiongana catchment. This permit was issued by the Council on 18 February 2002 under Section 87(e) of the RMA. It is due to expire on 1 June 2020.

It has eight special conditions;

Special condition 1 requires that a site contingency plan be prepared, maintained and adhered to.

Special condition 2 requires the consent holder to prepare a landfill operations and management plan.

Special condition 3 states that the consent holder shall prepare a landfill closure management plan by 1 June 2007 or 3 months prior to the closure of the landfill. Special condition 4 allows for changes to management plans relating to the landfill.

Special conditions 5, 6 and 7 relate to monitoring of water associated with the site, leachate and stormwater collection and discharge, and discharge effects on aquatic life or receiving water quality respectively.

Special condition 8 allows for the review, amendment, deletion or addition to the conditions of the resource consent.

The NPDC holds resource consent **3860-3** to discharge stormwater and leachate from the Okato Municipal Landfill into an unnamed tributary of the Kaihihi Stream. This permit was issued by the Council on 13 September 2013 under Section 87(e) of the RMA. It expires on 1 June 2031

It has seven special conditions;

Special condition 1 requires the consent holder to adopt best practice.

Special condition 2 requires the consent holder to adhere to the landfill management plan as supplied with the application.

Special conditions 3 and 4 deal with the management of stormwater and leachate of the previously filled area.

Special condition 5 requires that leachate from any contingency filling be directed to a lined holding pond.

Special condition 6 is a lapse condition.

Special condition 7 is a review condition.

The NPDC holds resource consent **3955-2** to cover the discharge of up to 864 cubic metres/day [10 litres/second] of stormwater and leachate from a former landfill site into the Urenui River. This permit was issued by the Council on 26 November 1996 under Section 87(e) of the RMA. It is due to expire on 1 June 2015.

It has six special conditions;

Special condition 1 requires that stormwater drains and ground contours be installed and maintained to minimise stormwater movement across or ponding on the site, and shall maintain soil cover on the site.

Special condition 2 states that adequate vegetation cover shall be maintained to prevent dust emission or stormwater erosion of the site.

Special condition 3 stipulates that the best practicable option be adopted to prevent or minimise any adverse effect on the environment associated with the discharge of leachate.

Special condition 4 stipulates that the discharge shall not give rise to any significant adverse effects on aquatic life or receiving water quality in the Urenui River.

Special conditions 5 and 6 are review conditions.

The NPDC holds resource consent **4902-1** to cover the discharge of up to 2 litres/second of leachate from the Marfell Park former landfill site via groundwater into the Mangaotuku Stream in the Huatoki catchment. This permit was issued by the Council on 26 January 1996 under Section 87(e) of the RMA. It expired on 1 June 2014, however as a renewal application had been submitted to Council, NPDC continues to operate the site under section 124 of the RMA until 21 October 2014 at which point a new consent was granted. Resource consent 4902-1 had seven special conditions;

Special condition 1 requires the installation and maintenance of stormwater drains and ground contours to minimise stormwater movement across or ponding on the site.

Special condition 2 requires maintenance of vegetation cover on the site.

Special condition 3 requires adoption of best practicable option to prevent or minimise any adverse effect on the environment associated with the discharge of leachate from the site.

Special condition 4 stipulates that the exercise of the consent shall not cause the level of unionised ammonia in the receiving water to exceed 0.025 g/m^3.

Special condition 5 stipulates that the discharge shall not give rise to any significant adverse effects on aquatic life or receiving water quality.

Special conditions 6 and 7 are review conditions.

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

1.3.2 Air discharge permits

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

The NPDC holds air discharge consent **4526-3** (renewed) to discharge emissions into the air from the Inglewood municipal landfill activity. This permit was issued by the Council on 20 March 2007 under Section 87(e) of the RMA. It is due to expire on 1 June 2026. It has four special conditions;

Special conditions 1 and 2 require the submission of a contingency plan and management plan.

Special condition 3 requires the NPDC to notify Council of any changes to its operations at the site.

Special condition 4 is a review condition.

The NPDC holds resource consent **4528-3** to discharge emissions into the air from the contingency discharge of solid contaminants at the Okato municipal landfill. This permit was issued by the Council on 13 September 2013 under Section 87(e) of the RMA. It will expire on 1 June 2031. It has six special conditions;

Special condition 1 specifies that discharge or refuse only occur on a contingency basis as set out in the management plan supplied with the application.

Special condition 2 requires the consent holder to adopt best practice.

Special condition 3 prohibits objectionable and offensive odours beyond the boundary.

Special condition 4 sets out limits for PM10 and dust deposition.

Special condition 5 is a lapse condition.

Special condition 6 is a review condition.

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

1.3.3 Discharges of wastes to land

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

NPDC holds water discharge permit **4527-3** to discharge cleanfill and inert materials onto and into land at the Inglewood municipal landfill at or about GR: Q19:120-295, and to discharge municipal refuse onto and into land at the Inglewood municipal landfill when, and only when, it cannot be discharged at the Colson Road municipal landfill. The consent expires on 1 June 2026. It has 12 special conditions;

Special condition 1 requires that the consent holder ado pts best practice.

Special conditions 2, 3, 4 and 5 deal with the landfill management plan and the information supplied in the consent applications.

Special condition 6 stipulates the maximum water content of sludges to be disposed.

Special conditions 7 and 8 define the term "clean fill".

Special condition 9 stipulates that discharge to land will not result in contaminants entering surface water.

Special condition 10 and 11 requires that stormwater and leachate systems are maintained.

Special condition 12 is a lapse condition.

NPDC holds resource consent **4529-3** to discharge cleanfill and greenwaste to land and to discharge general refuse on a contingency basis to land. This permit was issued by the Council on 9 September 2013 under Section 87(e) of the RMA. It will expire on 1 June 2031. It has 15 special conditions;

Special condition 1 specifies that contaminants may only be discharged within the footprint of the existing landfill.

Special condition 2 requires the consent holder adopt best practice.

Special condition 3 requires the consent holder to maintain stormwater and diversion drains.

Special condition 4 requires that the existing landfill cap not be disturbed.

Special condition 5 requires any areas used for the discharge of cleanfill and green waste be re-vegetated and reinstated.

Special condition 6 requires that cleanfill be discharged as set out in the landfill management plan as supplied with the application.

Special conditions 7, 8 and 9 deal with what materials are acceptable as cleanfill.

Special condition 10 requires that greenwaste be discharged as set out in the landfill management plan as supplied with the application.

Special condition 11 states that general refuse shall only be discharged as set out in the landfill management plan as supplied with the application.

Special condition 12 deals with notification requirements.

Special condition 13 deals with site reinstatement.

Special condition 14 is a lapse condition.

Special condition 15 is a review condition.

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

1.4 Monitoring programmes

1.4.1 Introduction

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

The 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 NPDC landfill sites consisted of four primary components.

1.4.2 Programme liaison and management

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

1.4.3 Site inspections

A total of six inspections were carried out across all the sites. With regard to consents for the discharge to water, inspections focused on site processes with potential or actual discharges to receiving watercourses, including contaminated stormwater, and any emissions to air.

1.4.4 Chemical sampling

The Council took 11 receiving water and two discharge samples for physicochemical analysis during the monitoring year across all of the NPDC landfill sites covered in this report.

1.4.5 Biomonitoring surveys

A biological survey was performed on two occasions at the Inglewood landfill in two unnamed tributaries of the Awai Stream.

Table 2 Summary of monitoring activities carried out at the NPDC landfills during the monitoring period

Landfill	Number of discharge samples	Number of receiving water samples	Number of inspections	Biomonitoring surveys	Ambient air surveys
Inglewood	2	8	4	2	4
Okato	0	3	2	0	0
Marfell Park	0	0	0	0	0
TOTAL	2	11	6	2	4

2. Inglewood landfill

2.1 Results

2.1.1 Sampling sites

Figure 1 shows the sampling sites used for monitoring the Inglewood landfill.

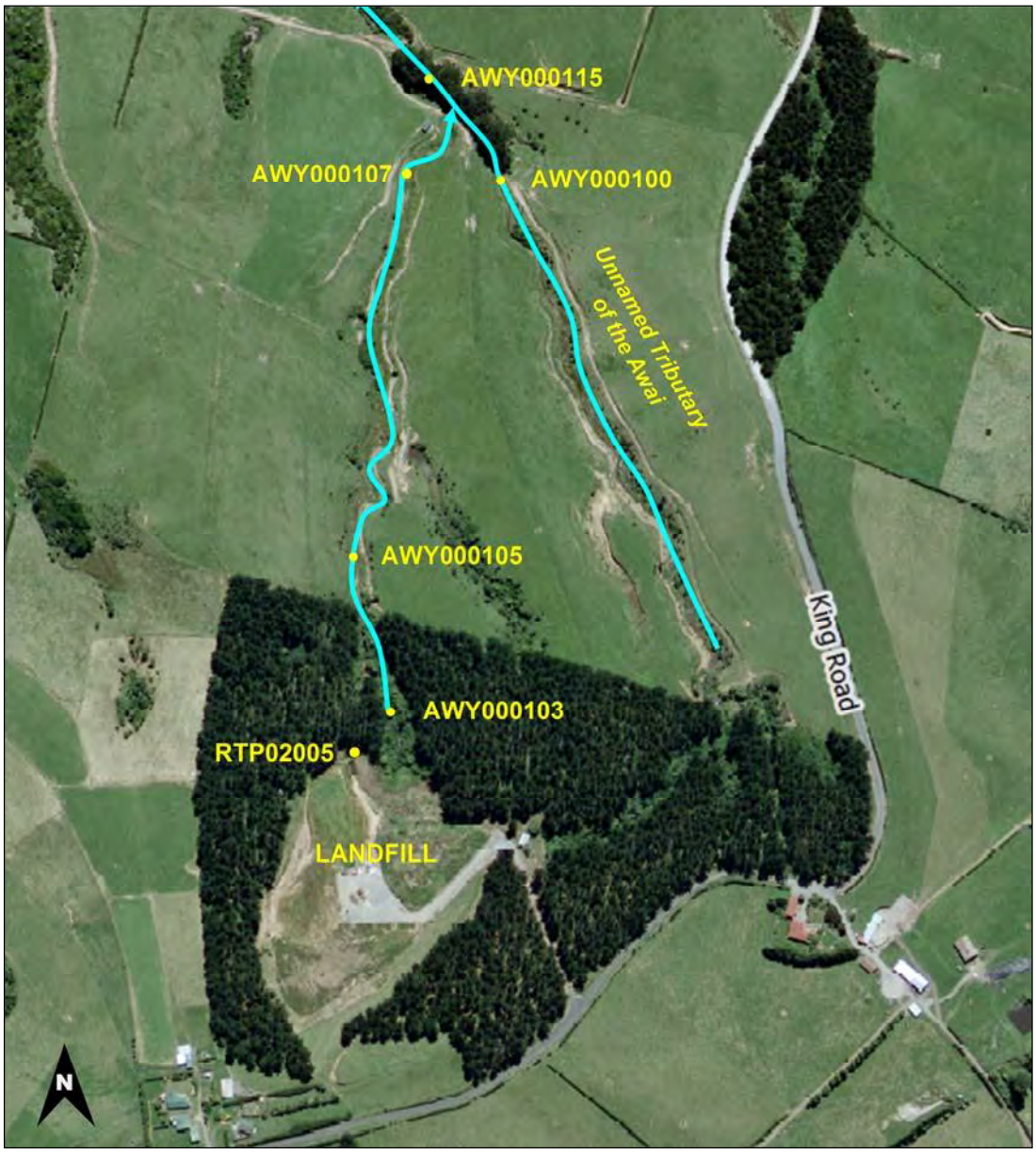

Figure 1 Inglewood landfill and sampling sites

2.1.2 Site inspections

Four site inspections were carried out during the period under review.

28 August 2013

A site visit was undertaken to conduct a compliance monitoring inspection. The cap appeared to be in sound condition and was being grazed by sheep. There was no evidence of slumping or erosion, and no issues in regard to vermin, dust or odour anywhere on the site. Methane was not detected during the inspection.

2 October 2013
A site visit was undertaken to conduct a compliance monitoring inspection and to collect water samples. The cap appeared to be in sound condition and was being grazed by sheep. There were no issues in regards to cracking, erosion or slumping.

A track had been cut down to the discharge below the landfill making access easier. The area around the leachate pond had also been cleared. No effects were noted in the lower part of the landfill tributary or the Awai Stream during sampling.

4 February 2014
A site visit was undertaken to conduct a compliance monitoring inspection. The cap appeared to be in sound condition and covered in long grass. There were no issues in regards to cracking, erosion or slumping. No methane was detected on the site.

22 May 2014
A site visit was undertaken to conduct a compliance monitoring inspection. It was fine at the time of the inspection with 5 mm over the previous three days.

The cap appeared to be in sound condition and was covered in grass. Sheep were grazing the cap. There were no issues in regards to cracking, erosion or slumping. Water samples were taken from the usual sites, and usual iron oxide deposits were noted around the culvert discharge, otherwise no other visual effects were noted in the lower reaches of the landfill tributary. The stormwater/leachate pond was full but not discharging. No methane was detected on the site.

2.1.3 Results of stormwater monitoring

Two samples were taken from the stormwater/leachate pond during the monitoring period. The results are presented in Table 3.

Table 3 Chemical analysis of samples taken from the Inglewood Landfill leachate/stormwater pond (site RTP002005)

Parameter	Unit	2 Oct 2013	22 May 2014
Biochemical oxygen demand	g/m^3	2.6	4.8
Conductivity @ 20 °C	mS/m	55.4	20.5
Unionised ammonia	g/m^3 N	0.3404	0.00005
Ammoniacal Nitrogen	g/m^3 N	13.7	0.028
pH	pH	6.9	6.9
Temperature	°C	14.3	9.0
Turbidity	NTU	58	3.1
Dissolved zinc	g/m^3	0.008	<0.005

The pond only discharges directly into the landfill tributary after heavy rain. Accumulated water in the pond tends to be lost to evaporation and seepage so there is usually a significant amount of freeboard present at any given time. However during this monitoring period when sampled on 2 October 2013, the pond was found to be discharging at approximately 0.5 L/s, also on this occasion the level of ammoniacal nitrogen in the discharge was inconsistently high (by over factor of 100) when compared to the samples collected over the previous five years. This may have been

the result of the surrounding area and the drain being cleared of vegetation which may have been providing both physical and bio-remedial barriers to the spring which may contain leachate entering the central inlet drain.

The discharge from the pond enters the unnamed tributary above site AWY00105 and slight elevations in ammoniacal nitrogen were noted during the receiving water sampling, however the level of unionised ammonia was below the 0.0025 g/m^3 guideline value for aquatic ecosystem health and no effects were noted in the unnamed tributary of the Awai Stream.

2.1.4 Results surface water sampling

2.1.4.1 Chemical analysis

Receiving water quality sampling was undertaken at sites AWY00100, AWY100115, AWY000103 and AWY000115 on two occasions, 2 October 2013 and 22 May 2014. The results of the chemical analysis of these samples are shown in Tables 4 & 5.

Table 4 Chemical analysis of the Awai Stream tributaries sites on 2 October 2013

Parameter	Unit	AWY000103	AWY000105	AWY000100	AWY000115
		30 m d/s of landfill(culvert discharge)	130m d/s of landfill	u/s of confluence of landfill trib.	d/s of confluence of landfill trib
Alkalinity	g/m3 $CaCO_3$	327	102	16	33
pH	pH	7.1	7.2	6.9	7.3
Conductivity	mS/m	72.5	33.3	8.8	14.9
Turbidity	NTU	370	2.4	4.2	8.0
Temperature	Deg C	14.2	15.1	15.5	15.1
Dissolved reactive phosphorus	g/m^3	<0.003	<0.003	<0.003	<0.003
BOD	g/m^3	2.2	7.7	<0.5	1.0
Ammoniacal nitrogen	g/m^3-N	34.0	4.38	0.003	0.006
Unionised ammonia	g/m^3-N	0.13276	0.02300	0.00001	0.00004
Nitrate/nitrite nitrogen	g/m^3-N	1.20	7.02	0.85	3.41
Acid soluble iron	g/m^3	34.7	0.40	0.88	1.58
Acid soluble manganese	g/m^3	6.23	2.78	0.07	0.18
Dissolved zinc	g/m^3	<0.005	<0.005	<0005	<0.005
Dissolved oxygen	g/m^3	*	4.47	9.12	9.39
% Oxygen Saturation	%	*	42.5	*	93.9

Key * = not measured

Table 5 Chemical analysis of the Awai Stream tributaries sites on 22 May 2014

Parameter	Unit	AWY000103	AWY000105	AWY000100	AWY000115
		30 m d/s of landfill(culvert discharge)	130m d/s of landfill	u/s of confluence of landfill trib.	d/s of confluence of landfill trib
Alkalinity	g/m3 $CaCO_3$	391	70	20	35
pH	pH	7.0	7.0	6.8	7.2
Conductivity	mS/m	79.8	28.0	8.3	13.6
Turbidity	NTU	510	5.8	14	4.2
Temperature	Deg C	11.7	11.7	11.3	11.4
Dissolved reactive phosphorus	g/m^3	0.007	0.009	0.006	0.012
BOD	g/m^3	10	0.6	<0.5	<0.5
Ammoniacal nitrogen	g/m^3-N	37.7	0.058	0.006	0.009
Unionised ammonia	g/m^3-N	0.09720	0.00015	0.00001	0.00004
Nitrate/nitrite nitrogen	g/m^3-N	0.26	9.67	0.41	2.60
Acid soluble iron	g/m^3	59.7	1.50	3.05	0.64
Acid soluble manganese	g/m^3	5.81	0.14	0.18	0.12
Dissolved zinc	g/m^3	<0.005	<0.005	<0.005	<0.005

As with previous results the discharge from the culvert below the landfill exhibits leachate contamination as indicated by the high levels of conductivity, alkalinity, iron, manganese, ammoniacal nitrogen and ammonia.

The levels of contaminants found 130 m downstream of the discharge (at site AWY000105) are far lower, indicating that the intervening wetland is being effective at reducing contaminant levels. One parameter at this site, biochemical oxygen demand, did show an increase when compared to the upstream result. This has occurred in previous years and is thought to be a result of water flowing off the adjacent cattle race into the landfill tributary. Also as noted in section 2.1.1.3 the level of ammoniacal nitrogen in the upper leachate/stormwater pond was much higher than usual and this may have contributed to the

The unnamed tributary that receives the discharge from the landfill tributary has a slight increases in conductivity, pH, alkalinity and ammoniacal nitrogen and nitrite/nitrate nitrogen when comparing results of the up and downstream sites (AWY000100 and AWY000115). These minor increases have been noted in previous monitoring years and are most likely a result of the presence of the landfill and from inputs from the grazed area in the area immediately downstream of the of the landfill site.

The levels of these contaminants however are within acceptable ranges and unlikely to have any adverse effects on aquatic ecosystems.

2.1.4.2 Biomonitoring

Macroinvertebrate sampling was undertaken on 26 November 2013 and 4 February 2014, at four sites in two tributaries of the Awai Streams, using either the 'sweep-net' or 'kick' sampling technique, both standard sampling techniques used by the Council. This was undertaken to assess whether leachate discharges from Inglewood landfill had had any adverse effects on the macroinvertebrate communities of this stream. Samples were processed to provide number of taxa (richness), MCI and $SQMCI_s$ scores for each site.

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

26 November 2013

The November 2013 survey did not indicate that leachate from the Inglewood landfill had significantly affected the freshwater macroinvertebrate communities in these tributaries. These communities appear to be determined by the physical habitat conditions, particularly the very slow to slow current speeds, soft/fine substrate and changes in macrophyte habitats available to the aquatic invertebrates.

The smaller, landfill drainage tributary sites exhibited slight improvements in taxa richness and $SQMCI_s$ score in a downstream direction. The differences observed between the sites can probably be attributed to the difference in available habitat, with better habitat at site 1b (downstream) resulting in a lower numerical dominance of 'tolerant taxa'. This site has progressively become choked with vegetation, but the wetted area is greater, and water speeds swifter.

Significant differences were recorded in the MCI and $SQMCI_s$ scores between sites 2 and 3 in the larger tributary of the Awai Stream which can be attributed to a number of slight changes in taxa abundances, the result of varying habitat condition.

Site 2 had higher MCI and $SQMCI_s$ scores compared to the two sites in the smaller tributary (1a and 1b), and these scores were also significantly higher than their respective medians, which was indicative of improved water quality at this site. Once again, differences in habitat condition were thought to be the main reason for these differences in the macroinvertebrate communities at all sites.

No sites supported any undesirable biological growths.

4 February 2014

The February 2014 survey did not indicate that leachate from the Inglewood landfill had significantly affected the freshwater macroinvertebrate communities in these tributaries. These communities appear to be determined by the physical habitat conditions, particularly the very low and very slow flows, soft/fine substrate and changes in macrophyte habitats available to the aquatic invertebrates.

The smaller, landfill drainage tributary sites (1a and 1b) exhibited slight improvement in $SQMCI_s$ score in a downstream direction, however taxa richness was the same and the MCI score decreased slightly. The differences observed between the sites can probably be attributed to the available habitat.

Significant differences were recorded in the MCI and $SQMCI_s$ scores between sites 2 and 3 in the larger tributary of the Awai Stream which can be attributed to four significant changes in taxa abundances, the result of varying habitat condition.

Site 3 had higher MCI and $SQMCI_s$ scores compared to the two sites in the smaller tributary (1a and 1b), and these scores were also higher than their respective medians (the $SQMCI_s$ score significantly), which was indicative of improved water quality at this site. Once again, differences in habitat condition were thought to be the main reason for these differences in the macroinvertebrate communities at all sites.

No sites supported any undesirable biological growths.

The results of both the November and February surveys provide no indication that the discharge of leachate into the unnamed tributary of the Awai Stream was having a significant adverse effect on the macroinvertebrate communities in the tributaries monitored.

2.1.5 Air quality

Methane readings were taken at the landfill entrance gate and at the culvert at the toe of the landfill during routine site inspections.

No methane was detected at either monitoring point at the landfill in the monitoring period under review. No objectionable odours were noted on the site beyond the site boundary during any inspection.

2.2 Investigations, interventions, and incidents

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the consent holder. During the year matters may arise which require additional activity by the Council for example, provision of advice and information, or investigation of potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

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

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

In the 2013-2014 period, it was not necessary for the Council to undertake significant additional investigations and interventions, or record incidents, in association with NPDC's conditions in resource consents or provisions in Regional Plans in relation to the consent holder's activities at the Inglewood landfill during the monitoring period.

2.3 Discussion

2.3.1 Discussion of site performance

The landfill at Inglewood continues to act as a contingency landfill for NPDC. There were no issues noted in regards to management of the site over the 2013-2014 period. There were no complaints in regard to the landfill received by Council during this period. NPDC were cooperative in improving site access for Council staff during the period under review.

2.3.2 Environmental effects of exercise of consents

Water sampling undertaken during the year shows that the tributary immediately below the landfill continues to experience contamination from the landfill, however the levels of these contaminants are significantly attenuated 130 m downstream of the landfill.

The larger tributary of the Awai Stream (downstream of the land fill tributary) appears to be relatively unaffected by the discharges into the landfill tributary.

Biomonitoring surveys undertaken during the 2013-2014 period indicated that there were no significant effects to aquatic life in either of the unnamed tributaries of the Awai Stream downstream of the landfill.

Based on the results of this monitoring period the presence of the landfill has not been found to have significant adverse effects on the water quality downstream of the site.

The results from inspections and air quality monitoring also show that the presence of the landfill is unlikely to have any significant effects in terms of emissions to air.

2.4 Evaluation of performance

A tabular summary of NPDC's compliance record for the year under review is set out in Tables 6-8.

Table 6 Summary of performance for consent 3954-2 to discharge leachate and stormwater

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Prepare and maintain a site contingency plan	Updated incident response plan provided	Yes
2. Prepare and maintain a landfill operations and management plan	Site specific monitoring programme in place – programme supervision	Yes
3. Provide a landfill closure management plan by 1 June 2007	Plan provided	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
4. Advise of any changes being made to the operation and management plan or closure management plan	Site specific monitoring programme in place – programme supervision	Yes
5. Monitor ground and surface water on and near the site	Site specific monitoring programme in place – water sampling	Yes
6. Maintain all stormwater and collection systems	Site specific monitoring programme in place – inspection	Yes
7. No adverse impact on aquatic life	Site specific monitoring programme in place – biomonitoring and water sampling	Yes
8. Optional review provision re environmental effects		N/A
Overall assessment of environmental performance in respect of this consent Overall assessment administrative performance in respect of this consent		High High

N/A = not applicable

Table 7 Summary of performance for Consent 4526-2 to discharge emissions to air

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Prepare and maintain a site contingency plan	Updated incident response plan provided	Yes
2. Prepare and maintain a landfill operations and management plan	Site specific monitoring programme in place – programme supervision	Yes
3. Advise of any changes being made to the operation and management plan	Site specific monitoring programme in place – programme supervision	Yes
4. Optional review provision re environmental effects	Next optional review scheduled in June 2020	N/A
Overall assessment of environmental performance in respect of this consent Overall assessment administrative performance in respect of this consent		High High

N/A = not applicable

Table 8 Summary of performance for Consent 4527-3 to discharge contaminants onto land

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. The consent holder shall adopt the best practicable option	Site specific monitoring programme in place – programme supervision	Yes
2. The activity shall be undertaken in accordance with the application documents	Site specific monitoring programme in place – programme supervision	Yes
3. Notification of changes to landfill management plan	Site specific monitoring programme in place – programme supervision	Yes

4. Maintain and adhere to management plan	Site specific monitoring programme in place – programme supervision and inspection	Yes
5. Consent conditions to prevail over management plan	Site specific monitoring programme in place – programme supervision and inspection	Yes
6. Liquid waste shall not be accepted at the landfill	Site specific monitoring programme in place – water sampling	Yes
7. Acceptable cleanfill criteria	Site specific monitoring programme in place – inspection	Yes
8. Unacceptable cleanfill criteria	Site specific monitoring programme in place – programme supervision	Yes
9. Discharge shall not result in contaminants directly entering water	Site specific monitoring programme in place – programme supervision	Yes
10. Install leachate retention structures	Site specific monitoring programme in place – inspection	Yes
11. Install stormwater systems	Site specific monitoring programme in place – inspection	Yes
12. Optional review provision re environmental effects	Next optional review scheduled in June 2020	N/A
Overall assessment of environmental performance in respect of this consent		High
Overall assessment administrative performance in respect of this consent		High

N/A = not applicable

During the year, NPDC demonstrated a high level of environmental performance and compliance with the resource consents in relation to the Inglewood landfill. During the year under review there were no complaints regarding the site and no significant environmental effects due to the operation of the site.

2.5 Recommendation from the 2012-2013 Annual Report

In the 2012-2013 Annual Report, it was recommended:

THAT monitoring of discharges from Inglewood landfill in the 2013-2014 year continues at the same level as in 2012-2013.

This recommendation was implemented in full.

2.6 Alterations to monitoring programmes for 2014-2015

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account the extent of information made available by previous authorities, its relevance under the RMA, the obligations of the Act in terms of monitoring emissions/discharges and effects, and subsequently reporting to the regional community, the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere/discharging to the environment.

It is proposed that for 2014-2015, monitoring of the Inglewood landfill continue at the same level as in 2013-2014.

2.7 Recommendation

THAT monitoring of discharges from Inglewood landfill in the 2014-2015 year continues at the same level as in 2013-2014.

3. Okato landfill

The Okato landfill stopped accepting general waste for discharge to land in 2005. The landfill was capped and the site became a transfer station. The applicant also continued to exercise consent 4529-3 (discharge of contaminants to land) for the purpose of accepting and discharging greenwaste and cleanfill. All other refuse accepted at the site is transferred to New Plymouth for disposal or recycling. The site is also designated as a contingency landfill in the event that Colson Road landfill and/or Inglewood landfill became unusable or inaccessible.

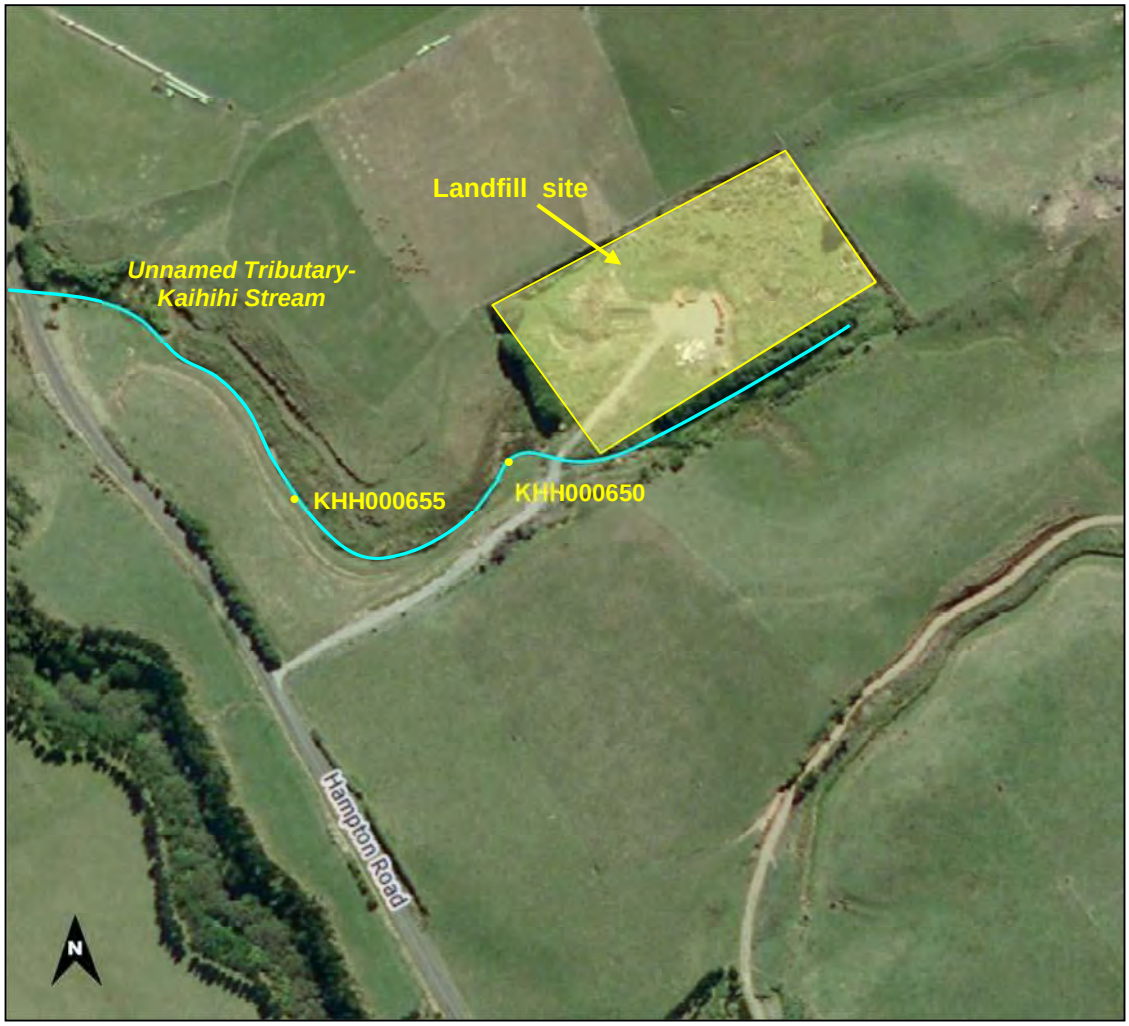

Figure 2 Okato landfill and sampling sites

3.1 Results

3.1.1 Inspections

9 January 2014

A site visit was undertaken to conduct a compliance monitoring inspection and to collect water samples. The weather was fine with 3.5 mm of rain falling over the previous 24 hours.

The transfer station area was tidy and well drained and no ponding was observed. Greenwaste was being discharged, covered and contoured at the usual site. A water sample was taken from the site immediately below the landfill (KHI000650), a sample

could not be obtained from the site further downstream (KHH000655) due to insufficient flow.

6 June 2014
A site visit was undertaken to conduct a compliance monitoring inspection and to collect water samples. The weather was overcast with no rain recorded over the previous three days.

The site was found to be tidy and well drained. Materials discharged to land were in compliance with consent conditions. Pampas and other weeds had been sprayed.

Samples were collected from both sampling sites below the landfill.

3.1.2 Results of surface water sampling

Samples were collected from the tributary of the Kaihihi Stream below the landfill on two occasions on 9 January 2014 and 6 June 2014.

Figure 2 shows the Okato sampling sites and Tables 9 & 10 present the water quality results.

Table 9 Chemical analysis of a tributary of the Kaihihi Stream, sampled on 9 January 2014

Parameter	Units	KHH000650 30m d/s of landfill	KHH000655 200 m d/s of landfill
Alkalinity	g/m^3 $CaCO_3$	106	Insufficient flow
Conductivity	mS/m	33.8	
Dissolved reactive phosphorus	g/m^3-P	<0.003	
Acid soluble iron	g/m^3	3.37	
Unionised ammonia	g/m^3-N	0.00305	
Ammoniacal nitrogen	g/m^3-N	0.501	
Nitrate/nitrite nitrogen	g/m^3-N	1.79	
pH	pH	7.1	
Temperature	Deg C	20.2	
Dissolved zinc	g/m^3	0.005	

Table 10 Chemical analysis of a tributary of the Kaihihi Stream, sampled on 6 June 2014

Parameter	Units	KHH000650 30m d/s of landfill	KHH000655 200 m d/s of landfill
Alkalinity	g/m^3 $CaCO_3$	74	61
Conductivity	mS/m	31.3	26.4
Dissolved reactive phosphorus	g/m^3-P	<0.003	0.018
Acid soluble iron	g/m^3	0.55	4.64
Unionised ammonia	g/m^3-N	0.00078	0.00011
Ammoniacal nitrogen	g/m^3-N	0.274	0.027
Nitrate/nitrite nitrogen	g/m^3-N	2.52	0.84
pH	pH	7.0	7.2
Temperature	C	13.1	11.2
Dissolved zinc	g/m^3	0.006	<0.005

As with previous monitoring results there is no indication that the presence of the landfill is having any significant adverse effects on the environment. The levels of ammonia immediately below the land-filled area and other indicator contaminants are low, indicating only low levels of leachate contamination. An elevated level of iron was found at the downstream site on 6 June 2014, however this site is very swampy and samples are often contaminated with sediments which may contribute to this.

Based on the results of this period, and from previous monitoring periods, the presence of the landfill is unlikely to have a significant adverse effect on the receiving environment.

3.1.3 Air quality

Objectionable odour and dust nuisance were checked for during each inspection in the monitoring period. There were no problems in regard to dust or odour during any of the inspections for the period under review.

3.2 Investigations, interventions, and incidents

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the consent holder. During the year matters may arise which require additional activity by the Council for example provision of advice and information, or investigation of potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

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

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

In the 2013-2014 period, it was not necessary for the Council to undertake significant additional investigations and interventions, or record incidents, in association with NPDC's conditions in resource consents or provisions in Regional Plans in relation to the consent holders activities at the Okato landfill during the monitoring period.

3.3 Discussion

3.3.1 Discussion of site performance

Overall, the site was managed well during the 2013-2014 period. There were no issues in regards to cap condition. It was considered that there was good control over the site and its operation during the monitoring period.

3.3.2 Environmental effects of exercise of consents

The landfill will carry on generating leachate, some of which will continue to enter the stream below the site via ground and spring water.

Physicochemical analysis of the unnamed tributary indicates that the landfill is having no significant adverse effect on water quality at this site.

There were no issues of concern during the 2013-2014 monitoring period. No odour or dust problems were observed at or beyond the boundary of the site.

3.4 Evaluation of performance

A tabular summary of NPDC's compliance record for the year under review is set out in Tables 11-13.

Table 11 Summary of performance for consent 3860-3 to discharge leachate and stormwater

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option	Site specific monitoring programme – programme supervision	Yes
2. Discharges in accordance with management plan	Site specific monitoring programme – inspection	Yes
3. Install and maintain stormwater diversion drains	Site specific monitoring programme – inspection	Yes
4. Surface runoff and leachate directed to leachate stormwater/collection drain	Site specific monitoring programme – inspection	Yes
5. All leachate generated from a contingency discharge to be directed to a lined pit and removed from site	No contingency dicharge during monitoirng period	N/A
6. Consent lapse September 2018	N/A	N/A
7. Optional review provision re environmental effects	N/A	N/A
Overall assessment of environmental performance in respect of this consent		High
Overall assessment administrative performance in respect of this consent		High

N/A = not applicable

Table 12 Summary of performance for consent 4528-3 to discharge emissions to air

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Discharge to occur on contingency basis only	Consent not exercised	N/A
2. Optional review provision re environmental effects	Consent not exercised	N/A
3. Discharge not to result in offensive or objectionable odours at or beyond the boundary	Consent not exercised	N/A
4. Limits on deposited and suspended dust	Consent not exercised	N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
5. Lapse of consent	N/A	N/A
6. Optional review provision re environmental effects	Next optional review scheduled in June 2019	N/A
Overall assessment of environmental performance in respect of this consent		High
Overall assessment administrative performance in respect of this consent		High

N/A = not applicable

Table 13 Summary of performance for consent 4529-3 to discharge solids to land

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Discharges to occur within existing landfill footprint	Site specific monitoring programme – inspection	Yes
2. Best practicable option to prevent or minimise environmental effects	Site specific monitoring programme – inspection	Yes
3. Consent holder to install stormwater diversion drains	Site specific monitoring programme – inspection	Yes
4. Existing landfill cap to remain undisturbed	Site specific monitoring programme – inspection	Yes
5. Areas used for discharge of waste to be stabilised and revegetated	Site specific monitoring programme – inspection	Yes
6. Cleanfill may be discharged at any time in accordance with Management Plan	Site specific monitoring programme – inspection	Yes
7. Allowable cleanfill materials	Site specific monitoring programme – inspection	Yes
8. Materials not to be discharged	Site specific monitoring programme – inspection	Yes
9. Written approval required where uncertainty of acceptability of waste	Site specific monitoring programme – inspection	Yes
10. Greenwaste may be discharged at any time in accordance with Management Plan	Site specific monitoring programme – inspection	Yes
11. Discharge of general refuse on a contingency basis only	No discharge to landfill during the monitoring period	N/A
12. Notification of contingency discharge	No discharge to landfill during the monitoring period	N/A
13. Contingency discharge to be capped and revegetated	No discharge to landfill during the monitoring period	N/A
14. Consent lapse September 2018	N/A	N/A
15. Optional review of consent	Next optional review scheduled in June 2019	N/A
Overall assessment of environmental performance in respect of this consent		High
Overall assessment administrative performance in respect of this consent		High

N/A = not applicable

During the year, NPDC demonstrated a high level of environmental performance and compliance with the resource consents relating to the Okato landfill. During the year under review there were no complaints regarding the site and no significant environmental effects due to the presence of the landfill observed.

3.5 Recommendations from the 2012-2013 Annual Report

In the 2012-2013 Annual Report, it was recommended:

THAT monitoring of discharges from the Okato landfill in the 2013-2014 year continue at the same level as in 2012-2013.

This recommendation was implemented in full.

3.6 Alterations to monitoring programmes for 2014-2015

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account the extent of information made available by previous authorities, its relevance under the RMA, the obligations of the Act in terms of monitoring emissions/discharges and effects, and subsequently reporting to the regional community, the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere/discharging to the environment.

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

3.7 Recommendation

THAT monitoring of discharges from the Okato landfill in the 2014-2015 year continue at the same level as in 2013-2014.

4. Okoki Road landfill

The Okoki Road landfill operated as an uncontrolled landfill from around 1984. In 1991 NPDC obtained consent to discharge leachate and stormwater to the Urenui River and undertook to take control of the site with a view to closing it off within 3 years. The site was closed off and reinstated by September 1994.

Post closure management and monitoring of the site is still necessary. One inspection is undertaken triennially and leachate samples are taken by New Plymouth District Council triennially.

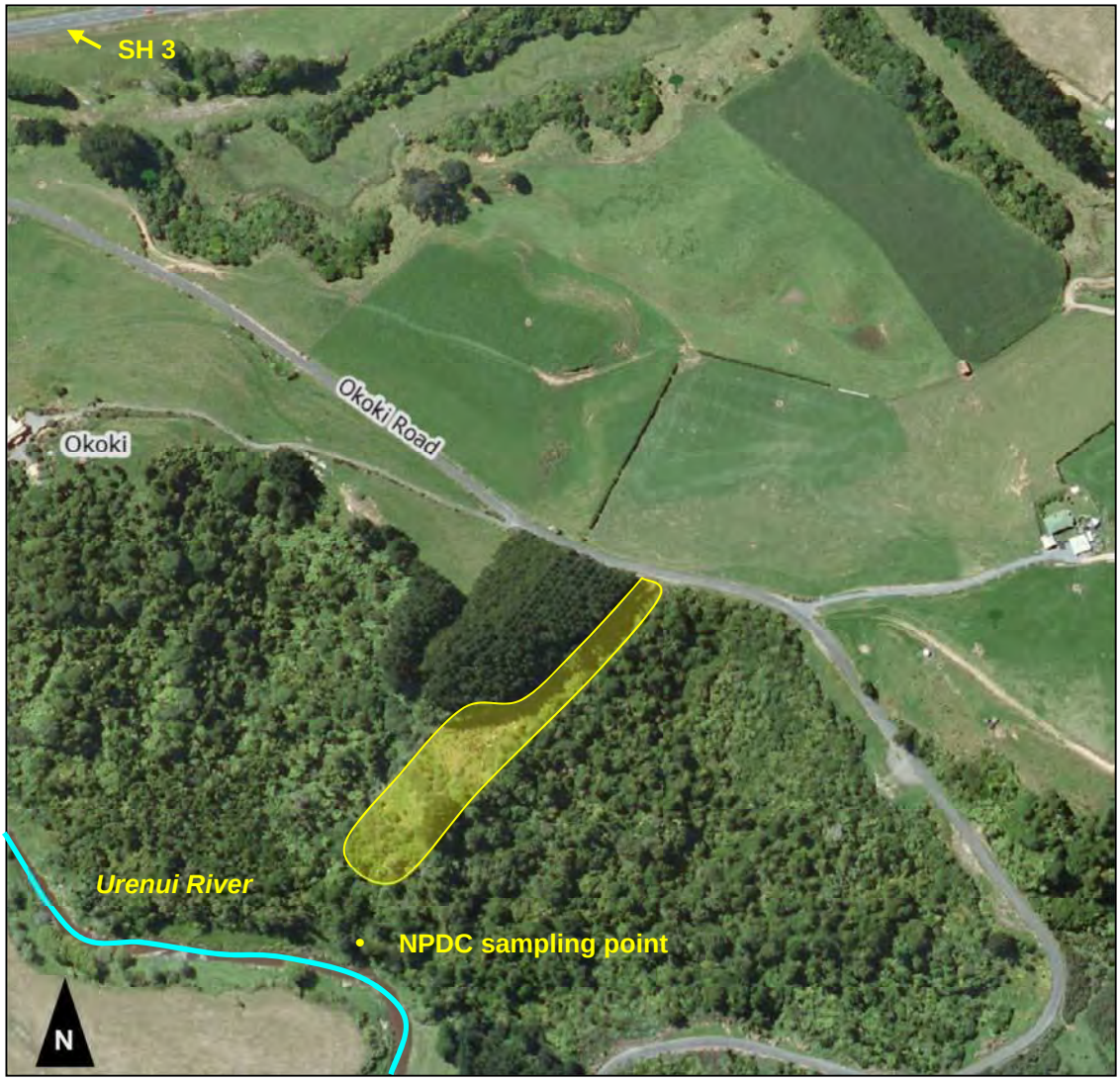

Figure 3 Aerial view of the former landfill at Okoki

4.1 Results

The closed landfill at Okoki is monitored on a triennial basis. No sampling or inspections were scheduled for this period.

4.2 Investigations, interventions, and incidents

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the consent holder. During the year matters may arise which require additional activity by the Council e.g. provision of advice and information, or investigation of potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

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

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

In the 2013-2014 period, it was not necessary for the Council to undertake significant additional investigations and interventions, or record incidents, in association with NPDC's conditions in resource consents or provisions in Regional Plans in relation to the consent holders activities at the Okoki landfill during the monitoring period.

4.3 Discussion

4.3.1 Discussion of site performance

Council received no complaints about the site during the 2013-2014 year.

4.3.2 Environmental effects of exercise of consents

No monitoring was undertaken during the period under review. However based on data gathered in previous monitoring periods, the site is unlikely to be having an adverse effect on the Urenui River. The site remains secure and well vegetated and no odour issues have been noted during previous inspections.

4.4 Evaluation of performance

A tabular summary of NPDC's compliance record for the year under review is set out in Table 14.

Table 14 Summary of performance for consent 3955-2 to discharge leachate

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Maintain drains, and contours on site to minimise unwanted water movement and ponding on site	Not monitored during period under review	N/A
2. Maintain an adequate vegetative cover	Not monitored during period under review	N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
3. Adopt best practice to prevent or minimise any adverse effects on the environment	Not monitored during period under review	N/A
4. The discharge Is not to give rise to certain effects in the Urenui River	Not monitored during period under review	N/A
5. Optional review provision re contamination in discharge	No review this period	N/A
6. Optional review provision re environmental effects	No review this period	N/A
Overall assessment of environmental performance in respect of this consent Overall assessment administrative performance in respect of this consent		N/A

N/A = not applicable

4.5 Recommendation from the 2012-2013 Annual Report

The 2012-2013 annual report recommended;

THAT the triennial monitoring of discharges at the Okoki landfill continue unchanged and next be implemented in the 2014-2015 period.

This recommendation was fully implemented.

4.6 Alterations to monitoring programmes for 2014-2015

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account the extent of information made available by previous authorities, its relevance under the RMA, the obligations of the Act in terms of monitoring emissions/discharges and effects, and subsequently reporting to the regional community, the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere/discharging to the environment.

It is now proposed that the triennial monitoring of discharges at the Okoki landfill continue unchanged with the programme next being implemented in the 2014-2015 period.

4.7 Recommendation

THAT the triennial monitoring of discharges at the Okoki landfill continue unchanged and next be implemented in the 2014-2015 period.

5. Marfell Park landfill

The landfill at Marfell closed in 1982. Due to effects cause by leachate discharging into the Mangaotukutuku Stream, NPDC applied for consent to discharge leachate in 1996. In 1998 NPDC captured the main leachate flow and directed it to the trade waste system. The discharge from the site now is predominantly stormwater. The site is now a park with sports field, playground, and a BMX track.

Figure 4 An aerial view showing former landfill at Marfell Park and sampling sites

5.1 Results

The closed landfill at Marfell Park is monitored on a biennial basis. No sampling or inspections were scheduled during the 2013-2014 period.

5.2 Investigations, interventions, and incidents

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the consent holder. During the year matters may arise which require additional activity by the Council for example provision of advice and information, or investigation of potential or actual

causes of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

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

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

In the 2013-2014 period, it was not necessary for the Council to undertake significant additional investigations and interventions, or record incidents, in association with NPDC's conditions in resource consents or provisions in Regional Plans in relation to the consent holders activities at the Marfell Park landfill during the monitoring period.

5.3 Discussion

5.3.1 Discussion of site performance

Council received no complaints about the site during the 2013-2014 year.

5.3.2 Environmental effects of exercise of consents

No monitoring was undertaken during the period under review. However, based on data gathered in previous monitoring periods, the site is unlikely to be having an adverse effect on the Mangaotukutuku Stream. The site remains secure and well vegetated and no odour issues have been noted during previous inspections.

5.4 Evaluation of performance

A tabular summary of NPDC's compliance record for the year under review is set out in Table 15.

Table 15 Summary of performance for consent 4902 -1 to discharge leachate

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Maintain drains, and contours on site to minimise unwanted water movement and ponding on site	Not monitored during period under review	N/A
2. Maintain an adequate vegetative cover	Not monitored during period under review	N/A
3. Adopt best practice to prevent or minimise any adverse effects on the environment	Not monitored during period under review	N/A
4. The discharge shall not cause free ammonia levels to exceed 0.025 g/m^3 in the Mangaotukutuku Stream	Not monitored during period under review	N/A
5. The discharge Is not to give rise to certain effects in the Mangaotukutuku Stream	Not monitored during period under review	N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
6. Optional review provision re contamination in discharge	No review this period	N/A
7. Optional review provision re environmental effects	No review this period	N/A
Overall assessment of environmental performance in respect of this consent Overall assessment administrative performance in respect of this consent		N/A

N/A = not applicable

5.5 Recommendation from the 2012-2013 Annual Report

In the 2012-2013 Annual Report, it was recommended:

THAT the biennial monitoring of discharges at the Marfell Park landfill continue unchanged and that the programme next be implemented in the 2014-2015 period.

This recommendation was implemented.

5.6 Alterations to monitoring programmes for 2014-2015

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account the extent of information made available by previous authorities, its relevance under the RMA, the obligations of the Act in terms of monitoring emissions/discharges and effects, and subsequently reporting to the regional community, the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere/discharging to the environment.

It is proposed that the biennial monitoring of discharges at the Marfell Park landfill continue unchanged with the programme next being implemented in 2014-2015.

5.7 Recommendation

THAT the biennial monitoring of discharges at the Marfell Park landfill continue unchanged and that the programme next be implemented in the 2014-2015 period.

6. Summary of recommendations

The following is a summary of the recommendations for each landfill as presented in the individual sections of this report.

6.1 Inglewood landfill

1. THAT monitoring of discharges from Inglewood landfill in the 2014-2015 year continue at the same level as in 2013-2014.

6.2 Okato landfill

2. THAT monitoring of discharges from the Okato landfill in the 2014-2015 year continue at the same level as in 2013-2014.

6.3 Okoki landfill

3. THAT the triennial monitoring of discharges at the Okoki landfill continue unchanged with the programme next being implemented in the 2014-2015 period.

6.4 Marfell Park landfill

4. THAT the biennial monitoring of discharges at the Marfell Park landfill continue unchanged and that the programme next be implemented in the 2014-2015 period.

Glossary of common terms and abbreviations

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

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.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
DO	dissolved oxygen.
DRP	Dissolved reactive phosphorus
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.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
mS/m	Millisiemens per metre.
Mixing zone	The zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point.
NH_4	Ammonium, normally expressed in terms of the mass of nitrogen (N).
NH_3	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
NO_3	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
Pb*	Lead.
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.

Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
PM_{10}	relatively fine airborne particles (less than 10 micrometre diameter)
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	Resource Management Act 1991 and including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turbidity	Turbidity, expressed in NTU.
UI	Unauthorised Incident
UIR	Unauthorised Incident Register – contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
Zn*	Zinc.

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

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

Bibliography and references

Taranaki Regional Council (1990): 'New Plymouth District Council Waitara and New Plymouth Landfill. Annual Report 1989/90'. Technical Report 90-31.

Taranaki Regional Council (1991): 'New Plymouth District Council Waitara and New Plymouth Landfill. Annual Report 1990/91'. Technical Report 91-12.

Taranaki Regional Council (1992): 'New Plymouth District Council Landfills, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara Annual Report 1991-92'. Technical Report 92-23.

Taranaki Regional Council (1993): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara. Annual Report 1992-93'. Technical Report 93-65.

Taranaki Regional Council (1994): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara. Annual Report 1993-94'. Technical Report 94-22.

Taranaki Regional Council (1995): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 1994-95'. Technical Report 95-51.

Taranaki Regional Council (1996): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 1995-96'. Technical Report 96-45.

Taranaki Regional Council (1997): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 1996-97'. Technical Report 97-56.

Taranaki Regional Council (1998): 'New Plymouth District Council, Inglewood, New Plymouth, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 1997-98'. Technical Report 98-51.

Taranaki Regional Council (1999): 'New Plymouth District Council, Inglewood, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 1998-1999'. Technical Report 99-44.

Taranaki Regional Council (2000): 'New Plymouth District Council, Inglewood, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 1999-2000'. Technical Report 00-37.

Taranaki Regional Council (2001): 'New Plymouth District Council, Inglewood, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 2000-2001'. Technical Report 01-40.

Taranaki Regional Council (2002): 'New Plymouth District Council, Inglewood, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 2001-2002'. Technical Report 02-58.

Taranaki Regional Council (2003): 'New Plymouth District Council, Inglewood, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 2002-2003'. Technical Report 03-89.

Taranaki Regional Council (2004): 'New Plymouth District Council, Inglewood, Okato, Okoki, Tongaporutu and Waitara Landfills Annual Report 2003-2004'. Technical Report 04-65.

Taranaki Regional Council (2005): 'New Plymouth District Council, Inglewood, Okato, Okoki, and Waitara Landfills Annual Report 2004-2005'. Technical Report 05-97.

Taranaki Regional Council (2006): 'New Plymouth District Council, Inglewood, Okato, Okoki, and Waitara Landfills Annual Report 2005-2006'. Technical Report 06-64.

Taranaki Regional Council (2007): 'New Plymouth District Council, Inglewood, Okato, Okoki, and Waitara Landfills Annual Report 2007-2008'. Technical Report 07-12.

Taranaki Regional Council (2008): 'New Plymouth District Council, Inglewood, Okato, Okoki, and Waitara Landfills Annual Report 2008-2009'. Technical Report 09-62.

Taranaki Regional Council (2009): 'New Plymouth District Council, Inglewood, Okato, and Okoki Landfills Annual Report 2009-2010'. Technical Report 10-46.

Pattle Delamore Partners Ltd (2009): 'Marfell Park, New Plymouth, environmental investigation'. August 2009, prepared for Taranaki Regional Council.

Taranaki Regional Council (2010): 'New Plymouth District Council, Inglewood, Okato, and Okoki Landfills Annual Report 2010-2011'. Technical Report 11-26.

Taranaki Regional Council (2012): 'New Plymouth District Council, Inglewood, Okato, and Okoki Landfills Annual Report 2011-2012'. Technical Report 12-65.

Taranaki Regional Council (2013): 'New Plymouth District Council, Inglewood, Okato, Okoki, Oakura and Marfell Park Landfills Annual Report 2012-2013'. Technical Report 13-61.

Appendix I

Resource consents held by NPDC

Inglewood

Consent 3954-2

TARANAKI
REGIONAL
COUNCIL

PRIVATE BAG 713
47 CLOTEN 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:	18 February 2002

Conditions of Consent

Consent Granted:	To discharge up to a total of 4,752 cubic metres/day (55 litres/second) of leachate and stormwater from the Inglewood Municipal Landfill into an unnamed tributary of the Awai Stream, a tributary of the Mangaoraka Stream in the Waiongana Catchment at or about GR: Q19:124-296
Expiry Date:	1 June 2020
Review Date(s):	June 2008, June 2014
Site Location:	Inglewood Municipal Landfill, 277 King Road, Inglewood
Legal Description:	Lot 1 DP 16116 Blk XI Paritutu SD
Catchment:	Waiongana
Tributary:	Mangaoraka Awai

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

General conditions

a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (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) 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. Within three months of granting of this consent the consent holder shall prepare and maintain a site contingency plan to the satisfaction of the Chief Executive, Taranaki Regional Council, outlining measures and procedures undertaken to prevent spillage or accidental discharge of contaminants and procedures carried out should such a spillage or discharge occur. This shall be reviewed by the Council on an annual basis.

2. Within three months of granting of this consent the consent holder shall prepare and maintain a landfill operations and management plan to the satisfaction of the Chief Executive, Taranaki Regional Council, and shall adhere to such a plan in so far as they concern the exercise of this consent at all times.

3. The consent holder shall provide a landfill closure management plan to the satisfaction of the Chief Executive, Taranaki Regional Council, by 1 June 2007 or 3 months prior to the closure of the landfill should this occur before 1 June 2007; such plan to address site security, litter control, vegetation cover, stormwater diversion, leachate control, site contouring, and cover placement and compaction, in addition to any other matters relevant to the exercise of this consent.

4. The consent holder shall advise the Taranaki Regional Council one month prior to any changes being made to the operation and management plan or landfill closure management plan. Should the Taranaki Regional Council wish to review either of these plans, one month's notice shall be provided to the consent holder.

5. The monitoring of the site and adjacent surface and groundwaters shall be to the satisfaction of the Chief Executive, Taranaki Regional Council

6. The leachate and stormwater diversion, collection, treatment and discharge systems shall be maintained to the satisfaction of the Chief Executive, Taranaki Regional Council

7. Any discharge shall not, in the opinion of the Chief Executive, Taranaki Regional Council, cause nor be likely to cause any significant adverse effects on aquatic life or receiving water quality.

8. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 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 18 February 2002

For and on behalf of
Taranaki Regional Council

Director-Resource Management

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 4600
Consent Granted Date:	20 March 2007

Conditions of Consent

Consent Granted:	To discharge contaminants, being landfill gas, and odours associated with a landfill, into the air from the Inglewood Municipal Landfill at or about GR: Q19:120-295
Expiry Date:	1 June 2026
Review Date(s):	June 2014, June 2020
Site Location:	Inglewood Municipal Landfill, 277 King Road, Inglewood
Legal Description:	Lot 1 DP 16116 Blk XI Paritutu SD

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 4475, 1611 and 94/118. In the case of any contradiction between the documentation submitted in support of applications 4475, 1611 and 94/118 and the conditions of this consent, the conditions of this consent shall prevail.

3. The consent holder shall advise the Taranaki Regional Council one month prior to any changes being made to the landfill management plan, and/or landfill closure management plan. Should the Taranaki Regional Council wish to review any of these plans, one month's notice shall be provided to the consent holder.

4. The consent holder shall maintain the landfill management plan to the satisfaction of the Chief Executive, Taranaki Regional Council, and shall adhere to such a plan in so far as it concerns the exercise of this consent at all times.

5. In case of any contradiction between the landfill management plan and the conditions of this consent, the conditions of this consent shall prevail.

6. 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.

7. No material is to be burnt at the landfill site.

8. 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.

9. The consent holder shall keep a record of any complaints received relating to discharges to air with respect to the landfill activity. The complaints record shall include the following where possible:

   a) name and address of complainant;
   b) nature of complaint;
   c) date and time of the complaint and alleged event;
   d) weather conditions at the time of the event; and
   e) any action taken in response to the complaint.

10. 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 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 March 2007

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

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 4600
Consent Granted Date:	20 March 2007

Conditions of Consent

Consent Granted:	To discharge cleanfill and inert materials onto and into land at the Inglewood Municipal Landfill at or about GR: Q19:120-295, and to discharge municipal refuse onto and into land at the Inglewood Municipal Landfill when, and only when, it cannot be discharged at the Colson Road Municipal Landfill
Expiry Date:	1 June 2026
Review Date(s):	June 2014, June 2020
Site Location:	Inglewood Municipal Landfill, 277 King Road, Inglewood
Legal Description:	Lot 1 DP 16116 Blk XI Paritutu SD
Catchment:	Waiongana
Tributary:	Awai Mangaoraka

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 4476, 1613 and 94/119. In the case of any contradiction between the documentation submitted in support of applications 4476, 1613 and 94/119 and the conditions of this consent, the conditions of this consent shall prevail.

3. The consent holder shall advise the Taranaki Regional Council one month prior to any changes being made to the landfill management plan, and/or landfill closure management plan. Should the Taranaki Regional Council wish to review any of these plans, one month's notice shall be provided to the consent holder.

4. The consent holder shall maintain the landfill management plan to the satisfaction of the Chief Executive, Taranaki Regional Council, and shall adhere to such a plan in so far as it concerns the exercise of this consent at all times.

5. In case of any contradiction between the landfill management plan and the conditions of this consent, the conditions of this consent shall prevail.

6. Waste, including liquid and sludges, with a solids content of 20% or less, shall not be accepted at the landfill.

7. For the purposes of this consent, "clean fill and inert materials" are defined as materials consisting of any solid concrete, cement or cement wastes, bricks, mortar, tiles (clay, ceramic or concrete), non-tanalised timber, porcelain, glass, gravels, boulders, shingles, fibreglass, plastics, sand, soils and clays, and/or tree stumps and roots, whether singly or in combination or mixture, or any other material that when placed onto and into land will not render that land or any vegetation grown on that land toxic to vegetation or animals consuming vegetation.

8. For the purposes of this consent, "clean fill and inert materials" excludes: food wastes, paper and cardboard, grass clippings, vegetative wastes other than tree stumps and roots, textiles, steel, galvanised metals, construction materials containing paint or fillers or sealers or their containers, oils or greases or any liquids or sludges or their containers, any industrial process by-products other than as permitted under condition 7, any poisons or solvents or their containers, batteries, general domestic refuse not otherwise described, or any wastes with the potential to render land or any vegetation grown on the land toxic to vegetation or to animals consuming such vegetation.

9. The discharge to land shall not result in any contaminant entering surface water.

10. Silt and leachate retention structures shall be installed and maintained to the satisfaction of the Chief Executive, Taranaki Regional Council.

11. The consent holder shall install and maintain stormwater diversion drains to minimise stormwater movement across, or ponding on the site, to the satisfaction of the Chief Executive, Taranaki Regional Council.

12. 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 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 March 2007

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Okato

Discharge Permit

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

Name of Consent Holder:	New Plymouth District Council Private Bag 2025 NEW PLYMOUTH 4342
Decision Date:	13 September 2013
Commencement Date:	13 September 2013

Conditions of Consent

Consent Granted:	To discharge stormwater and leachate from the Okato Municipal Landfill into an unnamed tributary of the Kaihihi Stream
Expiry Date:	1 June 2031
Review Date(s):	June 2019, June 2025
Site Location:	Okato Municipal Landfill, Hampton Road, Okato
Legal Description:	Lot 1 DP 13150 Blk I Cape SD (Discharge site)
Grid Reference (NZTM)	1674817E-5663981N
Catchment:	Kaihihi

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

General condition

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

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. All discharges permitted under this consent shall be undertaken in accordance with the "Okato Landfill Contingency Disposal Management Plan" as supplied with the application (5831).

3. The consent holder shall install and maintain all stormwater diversion drains to minimise stormwater entering or flowing across the discharge area.

4. During routine operations all surface runoff and leachate from the previously filled area of the landfill shall be directed to the leachate stormwater/ collection drain.

5. During and after any contingency discharge of general refuse (as permitted under consent 4529-2), all leachate generated from the new fill shall be directed to a lined pond and removed from the site.

6. This consent shall lapse on 30 September 2018, 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(1)(b) of the Resource Management Act 1991.

7. 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 2019 and/or June 2025 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 13 September 2013

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Discharge Permit

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

Name of Consent Holder:	New Plymouth District Council Private Bag 2025 NEW PLYMOUTH 4342
Decision Date:	13 September 2013
Commencement Date:	13 September 2013

Conditions of Consent

Consent Granted:	To discharge emissions into the air from the contingency discharge of solid contaminants at the Okato Municipal Landfill
Expiry Date:	1 June 2031
Review Date(s):	June 2019, June 2025
Site Location:	Okato Municipal Landfill, Hampton Road, Okato
Legal Description:	Lot 1 DP 13150 Blk I Wairau SD (Discharge source & site)
Grid Reference (NZTM)	1674817E-5663981N

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

General condition

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

Special conditions

1. The discharge of general refuse at the site shall only occur on a contingency basis and in accordance with the Okato Landfill Contingency Disposal Management Plan as submitted with application 5832.

2. The consent holder shall at all times adopt the best practicable option or options [as defined in section 2 of the Resource Management Act 1991] to prevent or minimise any actual or potential effect on the environment arising from any discharge at the site.

3. That the discharge of contaminants into the air shall not result in offensive or objectionable odours or dangerous or noxious ambient concentrations of any airborne contaminant that, in the opinion of at least one enforcement officer of the Taranaki Regional Council, is offensive or objectionable at or beyond the boundary of the site.

4. The discharges authorised by this consent shall not give rise to suspended or deposited dust at or beyond the boundary of the site that is offensive or objectionable. For the purpose of this condition, discharges in excess of the following limits are deemed to be offensive or objectionable:

   a) dust deposition rate 0.13 $g/m^2/day$; and/or
   b) suspended dust level 3 mg/m^3.

5. That this consent shall lapse on 1 June 2031, 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(1)(b) of the Resource Management Act 1991.

6. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2019 and or June 2025, 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 13 September 2013

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Discharge Permit

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

Name of Consent Holder:	New Plymouth District Council Private Bag 2025 NEW PLYMOUTH 4342
Decision Date:	13 September 2013
Commencement Date:	13 September 2013

Conditions of Consent

Consent Granted:	To discharge cleanfill and greenwaste to land and to discharge general refuse on a contingency basis to land
Expiry Date:	1 June 2031
Review Date(s):	June 2019, June 2025
Site Location:	Okato Municipal Landfill, Hampton Road, Okato
Legal Description:	Lot 1 DP 13150 Blk I Wairau SD (Discharge source & site)
Grid Reference (NZTM)	1674817E-5663981N
Catchment:	Kaihihi

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

General condition

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

Special conditions

1. All discharges permitted by this consent shall occur within the existing landfill footprint as shown by the red dotted line on the attached plan (appendix 1).

2. The consent holder shall at all times adopt the best practicable option or options [as defined in section 2 of the Resource Management Act 1991] to prevent or minimise any actual or potential effect on the environment arising from any discharge at the site.

3. The consent holder shall install and maintain stormwater diversion drains to minimise stormwater entering or flowing across the discharge area.

4. The existing landfill cap shall at all times be maintained in its existing condition and shall not be disturbed during any activities permitted by this consent.

5. Prior to the expiry or surrender of this consent all areas used to discharge greenwaste and/or cleanfill shall be stabilised and re-vegetated to minimise erosion, sedimentation and stormwater infiltration.

Cleanfill

6. Cleanfill as defined by special conditions seven and eight may be discharged at any time and shall be undertaken in accordance with the Okato Landfill Contingency Disposal Management Plan as submitted with application 5833.

7. The contaminants to be discharged shall be limited to cleanfill and/or inert materials. For the purposes of this condition, "clean fill and inert materials" are defined as materials consisting of any concrete, cement or cement wastes, bricks, mortar, tiles [clay, ceramic or concrete], non-tanalised timber, porcelain, glass, gravels, boulders, shingles, fibreglass, plastics, sand, soils and clays, and/or tree stumps and roots, whether singly or in combination or mixture, or any other material [subject to condition 8] that when placed onto and into land will not render that land or any vegetation grown on that land toxic to vegetation or animals consuming vegetation.

8. The discharge of the following contaminants shall not occur: food wastes, paper and cardboard, grass clippings, garden wastes including but not limited to wastes containing foliage or other vegetation [other than tree stumps and roots as permitted under condition 7], textiles, steel, galvanised metals, construction materials containing paint or fillers or sealers or their containers, oils or greases or any liquids or sludges or their containers, any industrial process by-products other than as permitted under condition 7, any poisons or solvents or their containers, batteries, general domestic refuse not otherwise described, or any wastes with the potential to render land or any vegetation grown on the land toxic to vegetation or to animals consuming such vegetation.

9. If the consent holder is uncertain as to the acceptability or not of a certain material the consent holder shall obtain written approval from the Consents Manager, Taranaki Regional Council, prior to its discharge.

Greenwaste

10. Green waste may be discharged at any time and shall be undertaken in accordance with the Okato Landfill Contingency Disposal Management Plan as submitted with application 5833.

Contingency Landfilling

11. The discharge of general refuse at the site shall only occur on a contingency basis and in accordance with the Okato Landfill Contingency Disposal Management Plan as submitted with application 5833.

12. In the event that contingency filling is required, the consent holder shall notify Council within 48 hours via email at worksnotification@trc.govt.nz . The notification shall include, reasons for using the site, likely volume of material to be discharged and likely duration of the contingency discharge.
13. Upon completion of any contingency discharge, the discharged refuse shall be capped and re-vegetated to the specifications set out in section 4.10.3 of the Okato Landfill Contingency Disposal Management plan as submitted with application 5833.

14. This consent shall lapse on 30 September 2018, 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(1)(b) of the Resource Management Act 1991

15. 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 2019 and or June 2025, 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 13 September 2013

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Appendix 1

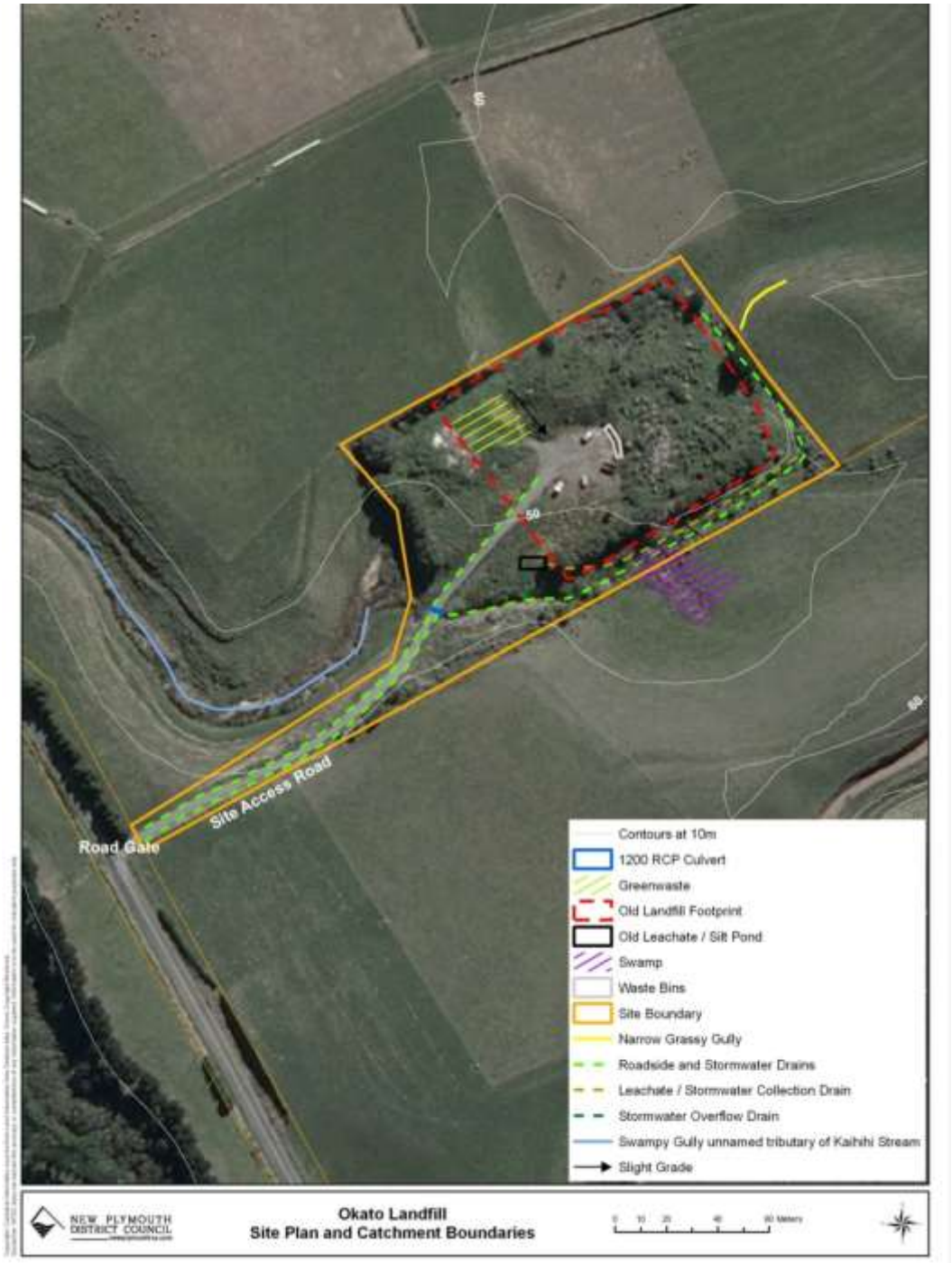

Figure 1 Aerial plan of Okato landfill site

Marfell Park

TRK964902

COPY

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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:	26 January 1996

CONDITIONS OF CONSENT

Consent Granted:	TO DISCHARGE UP TO 2 LITRES/SECOND OF LEACHATE FROM THE MARFELL PARK FORMER LANDFILL SITE VIA GROUNDWATER INTO THE MANGAOTUKU STREAM IN THE HUATOKI CATCHMENT AT OR ABOUT GR: P19:006-365
Expiry Date:	1 June 2014
Review Date[s]:	June 2002 and June 2008
Site Location:	MARFELL PARK, GRENVILLE STREET, NEW PLYMOUTH
Legal Description:	LOT 1 DP9295 BLK IV PARITUTU SD

Catchment:	HUATOKI	389.000
Tributary:	MANGAOTUKU	389.030

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

TRK964902

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;
(ii) charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
(iii) charges authorised by regulations.

SPECIAL CONDITIONS

1) THAT the consent holder shall install and maintain stormwater drains and ground contours at the site, to the satisfaction of the General Manager, Taranaki Regional Council, in order to minimise stormwater movement across, or ponding on the site.

2) THAT the consent holder shall maintain an adequate vegetative cover on the site to the satisfaction of the General Manager, Taranaki Regional Council.

3) THAT the consent holder shall at all times adopt the best practicable option to prevent or minimise any or likely adverse effect on the environment associated with the discharges of leachate from the site.

4) THAT the discharge shall not be shown to raise the concentration of un-ionised ammonia in the receiving water above 0.025 gm^{-3} at any point.

5) THAT after allowing for reasonable mixing within a mixing zone extending 15 metres downstream of the discharge point, the discharge shall not give rise to any of the following effects in the receiving waters of the Mangaotuku 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

6) THAT the Taranaki Regional Council may review any or all of the conditions of this consent should further chemical sampling of the Mangaotuku Stream reveal levels of contamination resulting in significant adverse environmental effects.

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7) THAT the Taranaki Regional Council may review any or all of the conditions of this consent, by giving notice of review during June 1999 and/or June 2005, 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 consent.

Signed at Stratford on 26 January 1996

For and on behalf of
TARANAKI REGIONAL COUNCIL

OPERATIONS MANAGER

Okoki

TRK963955

TARANAKI REGIONAL COUNCIL
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DISCHARGE PERMIT

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

Name of Consent Holder:	NEW PLYMOUTH DISTRICT COUNCIL PRIVATE BAG 2025 NEW PLYMOUTH
Consent Granted Date:	26 November 1996

CONDITIONS OF CONSENT

Consent Granted:	TO DISCHARGE UP TO 864 CUBIC METRES/DAY [10 LITRES/SECOND] OF STORMWATER AND LEACHATE FROM A FORMER LANDFILL SITE INTO THE URENUI RIVER AT OR ABOUT GR: Q19:347-455
Expiry Date:	1 June 2015
Review Date[s]:	June 2003 and June 2009
Site Location:	FORMER URENUI MUNICIPAL LANDFILL, OKOKI ROAD, URENUI
Legal Description:	PT URENUI 7B PT SUBSEC 24 SO9850 BLK IV WAITARA SD
Catchment:	URENUI 399.000

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

TRK963955

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;
(ii) charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
(iii) charges authorised by regulations.

SPECIAL CONDITIONS

1. THAT the consent holder shall install and maintain stormwater drains and ground contours at the site, to the satisfaction of the General Manager, Taranaki Regional Council, in order to minimise stormwater movement across, or ponding on, the site; and shall maintain soil cover on the site.

2. THAT the consent holder shall maintain an adequate vegetative cover on the site, to the satisfaction of the General Manager, Taranaki Regional Council, to prevent dust emission or stormwater erosion of the site.

3. THAT the consent holder shall at all times adopt the best practicable option to prevent or minimise any adverse effect or any likely adverse effect on the environment associated with the discharges of leachate from the site. Without restriction or limitation, the best practicable option shall include the measures specified in conditions 1 and 2 above.

4. THAT the discharge shall not give rise to any of the following effects in the receiving waters of the Urenui River:

a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;

b) any conspicuous change in the colour or visual clarity;

c) any emission of objectionable odour;

d) the rendering of fresh water unsuitable for consumption by farm animals;

e) any significant adverse effects on aquatic life.

TRK963955

5. THAT the Taranaki Regional Council may review any or all of the conditions of this consent, should further chemical sampling of the discharge at the base of the landfill biomass reveal levels of contamination resulting in, or likely to result in, significant adverse environmental effects.

6. THAT the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2003 and/or June 2009, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this consent, which were not foreseen at the time the application was considered and which it was not appropriate to deal with at the time.

Signed at Stratford on 26 November 1996

For and on behalf of
TARANAKI REGIONAL COUNCIL

OPERATIONS MANAGER

TARANAKI REGIONAL COUNCIL

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Appendix II

Biomonitoring reports

To	Job Manager, Scott Cowperthwaite
From	Scientific Officer, Brooke Thomas
Report No	BT028
Document No	1403216
Date	15 September 2014

Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, November 2013

Introduction

This was the first biological survey undertaken of the two surveys scheduled for the 2013-2014 monitoring year in two tributaries of the Awai Stream in relation to the Inglewood landfill. Leachate from the landfill discharges to a small tributary, which then joins a larger tributary approximately 450m below the face of the landfill. Results of biological surveys performed in the tributaries since the 2001-2002 monitoring year are discussed in the series of reports referenced at the end of this report.

Methods

This survey was undertaken on 26 November 2013 at four sites on the two tributaries of the Awai Stream; sites 1(a) and 1 (b) were located in the smaller tributary and sites 2 and 3 on the larger tributary (Figure 1).

The standard 400 ml 'vegetation-sweep' sampling technique was used to collect streambed macroinvertebrates from sites 1a and 1b. The 'vegetation-sweep' sampling technique is very similar to Protocol C2 (soft-bottomed, semi-quantitative).

The standard 400 ml 'kick-sampling' technique was used to collect streambed macroinvertebrates from sites 2 and 3. The '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 tributaries of the Awai Stream

Site	Site code	Location
1a	AWY000105	Smaller tributary, 100 metres below tip face
1b	AWY000107	Smaller tributary, 400 metres below tip face
2	AWY000100	Larger tributary, above confluence with small tributary
3	AWY000115	Larger tributary, 80 metres below confluence with small tributary

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

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

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams (MCI). 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 (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. More 'sensitive' communities inhabit less polluted waterways.

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

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

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

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

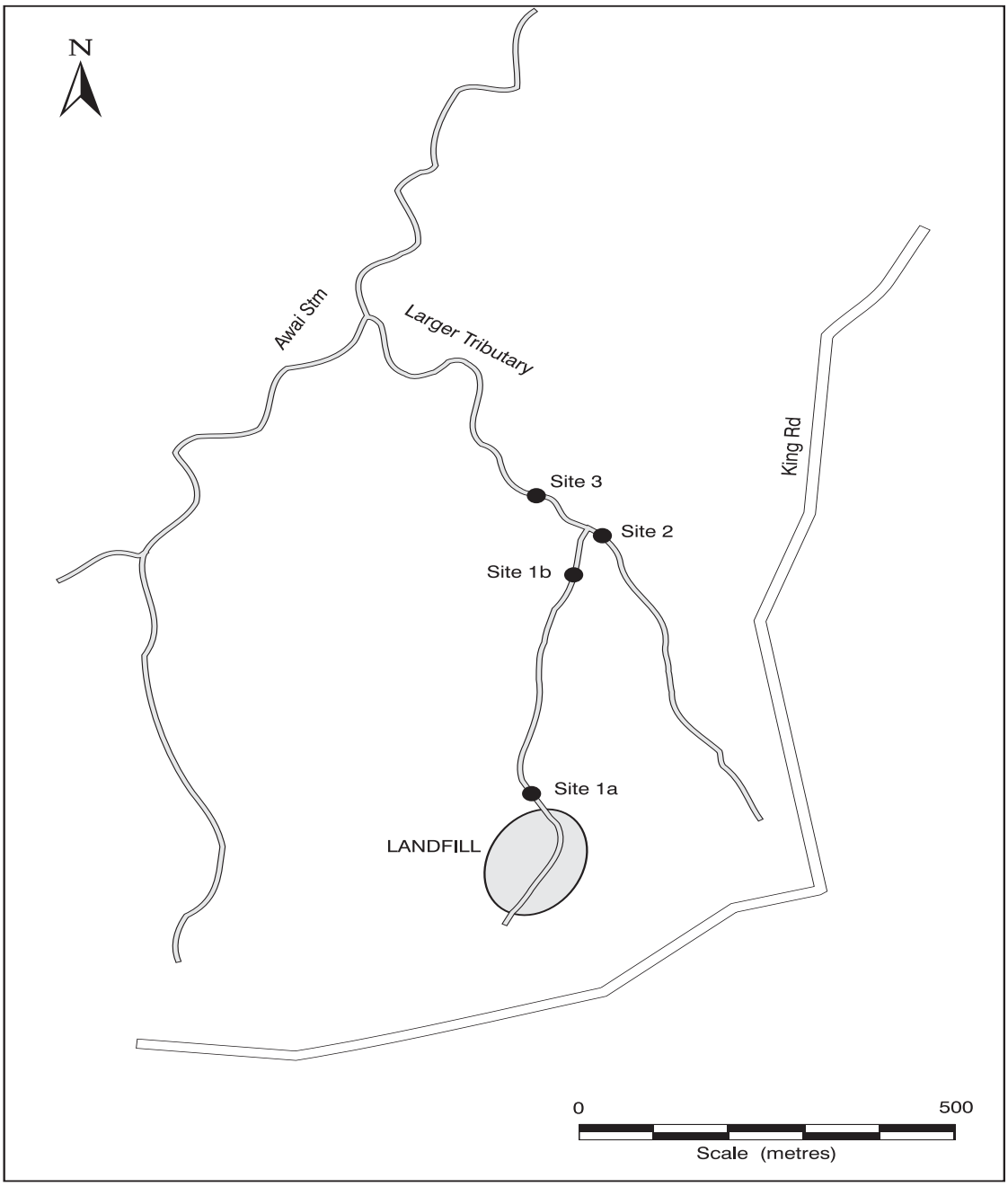

Figure 1 Biomonitoring sites in tributaries of the Awai Stream related to the Inglewood landfill

Results

This November 2013 survey was carried out under either very low and very slow flow conditions (site 1a and site 3) to low and slow flow conditions (site 2). Site 1b had a very low, but slow flow. The water at all sites was clear and uncoloured, although the streambed at site 1a was coloured orange due to an abundance of iron oxide. It had been 18 days since the nearby Mangaoraka Stream flowed at more than three times its median flow and 25 days since flows exceeded seven times median.

At sites 1a and 1b, the bed substrate consisted almost entirely of silt and wood/roots. Macrophytes dominated the bed and banks of the stream. The iron oxide coating noted at site 1a, was not recorded at any other site during this survey. At the time of this survey the

water temperatures recorded were 16.8°C (site 1a) and 17.7°C (site 1b). There was partial shading at site 1b but no shading at site 1a.

In the larger tributary, the substrate at site 2 predominantly consisted of wood and roots with gravels, silt, cobbles and sand. At site 3 the substrate predominantly consisted of gravels with silt, sand and cobbles. There was no periphyton recorded at any of the sites. Site 2 had complete shading whereas site 3 had partial shading. The water temperature recorded at these sites was 15.2 °C at site 2 and 16.5°C at site 3. No site supported any undesirable biological growths.

Macroinvertebrate communities

A summary of results from previous surveys performed in the tributaries of the Awai Stream in relation to the Inglewood landfill are presented together with current results in Table 2. The full results of the present survey are provided in Table 3.

Table 2 Numbers of taxa and MCI values recorded in previous surveys related to the Inglewood landfill, together with current results

Site No	No. Taxa				MCI values				$SQMCI_s$ values			
	No. samples	Range	Median	Current result	No. Samples	Range	Median	Current result	No. samples	Range	Median	Current result
1a	38	4-23	15	18	38	60-84	72	86	28	1.2-3.5	2.6	2.9
1b	41	11-29	19	22	41	69-88	76	82	28	2.1-4.5	3.2	3.9
2	42	8-29	19	13	42	79-108	90	106	28	1.4-6.1	3.8	4.7
3	42	9-27	19	14	42	74-105	91	90	28	1.3-5.8	3.3	2.1

Table 3 Macroinvertebrate fauna of unnamed tributaries of the Awai Stream sampled in relation to the Inglewood landfill on 26 November 2013

Taxa List	Site Number	MCI score	Site 1a	Site 1b	Site 2	Site 3
	Site Code		AWY000105	AWY000107	AWY000100	AWY000115
	Sample Number		FWB13364	FWB13365	FWB13366	FWB13367
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	-	R	-	-
NEMERTEA	Nemertea	3	-	R	-	-
NEMATODA	Nematoda	3	-	-	-	R
ANNELIDA (WORMS)	Oligochaeta	1	-	R	A	VA
	Lumbricidae	5	-	R	R	-
MOLLUSCA	Lymnaeidae	3	-	R	-	-
	Potamopyrgus	4	-	XA	-	-
CRUSTACEA	Ostracoda	1	VA	A	-	-
	Paraleptamphopidae	5	-	-	A	A
	Paranephrops	5	-	-	R	R
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	-	R	-	-
	Zephlebia group	7	-	-	A	R
PLECOPTERA (STONEFLIES)	*Zelandobius*	5	-	R	-	-
ODONATA (DRAGONFLIES)	*Xanthocnemis*	4	C	C	-	-
HEMIPTERA (BUGS)	*Microvelia*	3	R	-	-	-
COLEOPTERA (BEETLES)	Elmidae	6	R	-	-	-
	Dytiscidae	5	R	-	-	-
	Hydrophilidae	5	C	-	-	-
	Ptilodactylidae	8	-	-	C	R
TRICHOPTERA (CADDISFLIES)	*Hydrobiosis*	5	R	R	-	-
	Orthopsyche	9	-	-	R	-
	Polyplectropus	6	A	R	R	-
	Psilochorema	6	R	R	-	-
	Oeconesidae	5	-	C	-	R
	Triplectides	5	-	R	-	R
DIPTERA (TRUE FLIES)	Eriopterini	5	-	-	R	-
	Hexatomini	5	-	-	R	R
	Paralimnophila	6	R	-	-	-
	Zelandotipula	6	-	R	-	R
	Orthocladiinae	2	C	A	-	R
	Polypedilum	3	XA	C	R	C
	Tanypodinae	5	A	A	R	-
	Empididae	3	R	R	-	-
	Ephydridae	4	R	-	-	-
	Austrosimulium	3	A	C	-	R
	Stratiomyidae	5	C	R	-	-
ACARINA (MITES)	Acarina	5	C	-	R	C
		No of taxa	18	22	13	14
		MCI	86	82	106	90
		SQMCIs	2.9	3.9	4.7	2.1
		EPT (taxa)	3	7	3	3
		%EPT (taxa)	17	32	23	21

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

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

Site 1a

A total of 18 taxa was recorded at site 1a, 100 metres downstream of the landfill face. This result was three taxa more than the median richness recorded at this site. The majority of taxa (56%) recorded at the site were 'sensitive' taxa which was reflected in the moderate MCI score of 86 units. This MCI score was significantly higher than the median and the highest MCI recorded to date (Stark, 1998). There was a significant increase of thirteen units in the MCI score at this site from the previous February 2013 survey (Figure 2) (Stark, 1998).

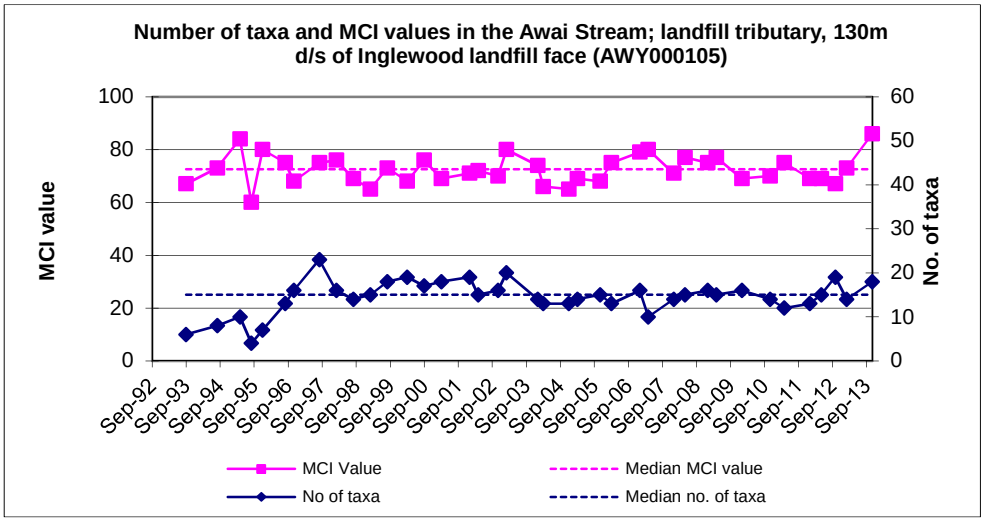

Figure 2 Number of taxa and MCI values at site 1a in a tributary of the Awai Stream

The macroinvertebrate community at this site was characterised by three 'tolerant' taxa (ostracod seed shrimps, *Polypedilum* midge larvae and sandfly larvae *Austrosimulium*) and two 'sensitive' taxa (free-living caddis *Polyplectropus* and chironomid midge Tanypodinae) (Table 3). The numerical dominance by tolerant taxa resulted in a moderate $SQMCI_s$ score of 2.9 units which was similar to the median $SQMCI_s$ score for the site, and within the range of scores recorded at site 1a previously.

Site 1b

Twenty two taxa were recorded at site 1b, approximately 400 metres downstream of the landfill face, three taxa more than the median recorded at this site and four taxa higher than that recorded at site 1a in this same survey. At the time of this survey, an equal proportion 'tolerant' and 'sensitive' taxa was recorded. A moderate MCI score of 82 units was recorded, six units higher than the median score for the site (Figure 3) but four units lower than the MCI score recorded at site 1a in this survey, a statistically insignificant reduction (Stark, 1998).

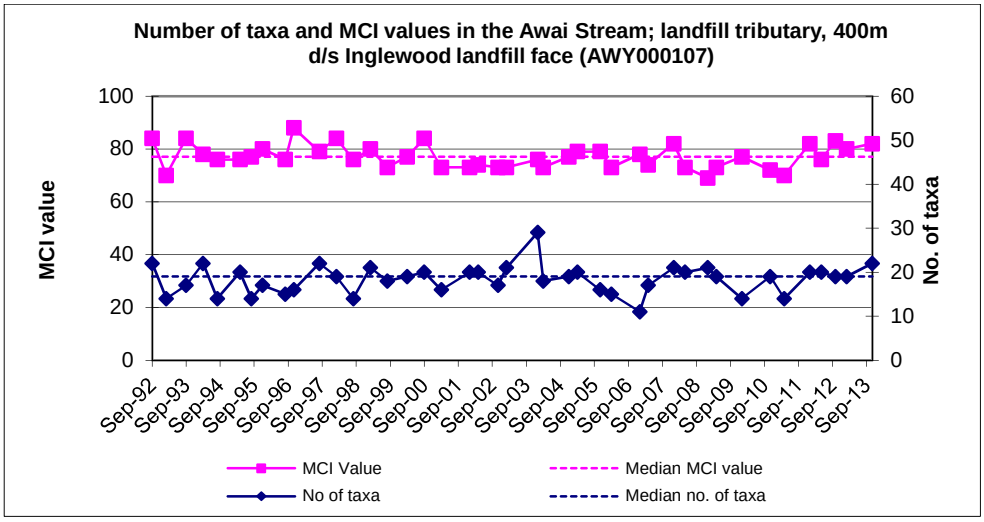

Figure 3 Number of taxa and MCI values at site 1b in a tributary of the Awai Stream

In this survey, the macroinvertebrate community was dominated by three 'tolerant' taxa (*Potamopyrgus* snail, ostracod seed shrimp and orthoclad midge larvae) and one 'sensitive' taxon (chironomid midge Tanypodinae) (Table 3). The $SQMCI_s$ score of 3.9 units recorded at site 1b was an insignificant 0.7 unit higher than the median score for the site, but a significant 1.0 unit higher than that recorded at site 1a in this survey (Stark, 1998). The significant change in $SQMCI_s$ score can be attributed to six significant changes in taxa abundance between the sites 1a and 1b.

Site 2

The 'control' site 2 upstream of the confluence with the landfill tributary had a community richness of 13 taxa, six taxa lower than the median number found by previous surveys (Table 2, Figure 4). A high proportion of the community recorded at this site in the current survey were 'sensitive' taxa (85%) which resulted in a relatively high MCI score of 106 units for the site (Table 3). This MCI score was 16 units higher than the median score recorded at the site previously, a significant improvement and was significantly higher than the MCI score recorded at the two sites in the small unnamed tributary (1a and 1b) (by 20 and 24 units respectively) (Stark 1998).

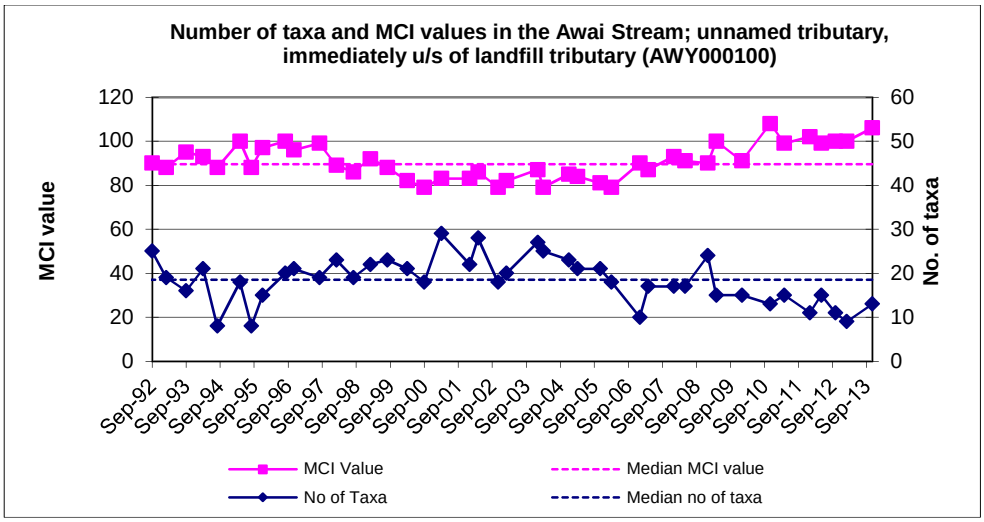

Figure 4 Number of taxa and MCI values at site 2 in a tributary of the Awai Stream

The community was dominated by two abundant 'sensitive' taxa (amphipod *Paraleptamphopidae* and mayfly *Zephlebia)* and one abundant 'tolerant' taxon (oligochaete worms) which resulted in a moderate $SQMCI_s$ score of 4.7 units (Table 3). This $SQMCI_s$ score was significantly higher than the median score recorded at the site previously (by 0.9 unit) and also significantly higher than score recorded at site 1a in the small unnamed tributary (by 1.8 units) (Stark, 1998).

Site 3

A total of 14 taxa was found at site 3 below the confluence with the landfill drainage tributary, which was five taxa less than the median richness recorded by previous surveys. The MCI score of 90 units reflected the moderate proportion of 'sensitive' taxa (64%) present in the community at this site in the current survey. This MCI score was similar to the median for this site but a significant 13 units fewer than that recorded in the previous survey (Figure 5).

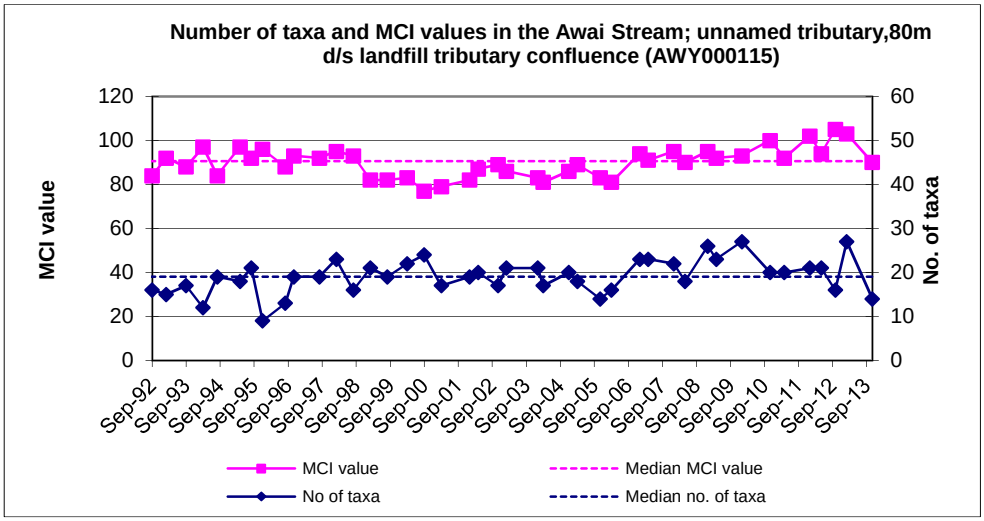

Figure 5 Number of taxa and MCI values at site 3 in a tributary of the Awai Stream

The macroinvertebrate community at this site was characterised by one 'sensitive' taxon (paraleptamphopid amphipods) and one 'tolerant' taxon (oligochaete worms) (Table 3). The numerical dominance of 'tolerant' taxa in the community resulted in a low $SQMCI_s$ score of 2.1 units, which was significantly lower than the median score of 3.3 units recorded at this site in previous surveys. This score was also significantly lower than the scores recorded at site 1b in the smaller tributary and upstream at site 2 (Stark, 1998).

Discussion and conclusions

Wetland and grassy stream habitats such as at sites 1a and 1b often support abundances of molluscs, crustacea, true flies (dipterans), and certain caddisflies, and this was reflected in the current survey.

At the time of this November survey, there was a very low flow of very slow moving water recorded at site 1a which was indicative of a seepage feed stream. This was reflected in the macroinvertebrate community recorded at the site which was numerically dominated by low scoring 'tolerant' taxa. This resulted in a moderate MCI of 86 units and a moderately

low $SQMCI_s$ score of 2.9 units. This MCI was the highest score recorded to date, however the $SQMCI_s$ score was well within the range of scores recorded at the site in previous surveys.

Previous surveys typically recorded a poorer community at site 1a than at site 1b.Other than the MCI score the results of this survey were consistent with this. There was a four taxa increase in taxa richness between the sites, and the $SQMCI_s$ score increased, although not significantly (Stark 1998). The MCI score was slightly lower at site 1b compared with site 1a, although the difference was not significant (Stark, 1998). A difference in flow conditions and the quality of available macrophyte habitat between the two sites was considered to be the two main reasons for these results. At site 1b the stream adopted a more 'creek-like' flow, and as a consequence could support a more diverse macroinvertebrate community. The macrophyte community at site 1b consisted of pasture grass and watercress which was considered to provide more favourable habitat conditions compared to the reed and grass dominated macrophyte community at site 1a.

In the current survey, the macroinvertebrate community recorded at the upstream 'control' site (2) consisted of a high proportion of 'sensitive taxa' including two abundant 'moderately sensitive' taxa (*Zephlebia* mayfly and the paraleptamphopid amphipods). This was reflected in the moderately high MCI and $SQMCI_s$ scores recorded at the site in this survey. The MCI score at site 2 was higher than that recorded at site 1b and significantly (Stark 1998) higher than that recorded at site 1a in the smaller tributary if the Awai Stream. The $SQMCI_s$ score recorded at site 2 was significantly (Stark, 1998) higher than that recorded at site 1a and site 1b. This is most likely the result of marked differences in the habitat quality at site 2 compared to sites 1a and 1b. In contrast to sites 1a and 1b, the stream at site 2 was completely shaded and the bed substrate consisted primarily of gravels and wood and root as opposed to silt and wood and root. These conditions are more conducive to supporting a community containing more 'sensitive taxa' such as the mayfly *Zephlebia*. This site did record lower taxa richness however, and this is likely to be a reflection of the reduced habitat availability and sampling difficulty, as this site becomes more overgrown with time.

The MCI and $SQMCI_s$ scores recorded at site 3 downstream of the confluence with the small tributary were significantly less (Stark, 1998) than those recorded at site 2 in this survey although the taxa richness and community composition were very similar, with only one significant difference in taxon abundance. The significant differences in MCI and $SQMCI_s$ scores can be attributed to several minor differences in taxa abundances between the sites including an increase of five 'tolerant' taxa and a decrease of seven 'sensitive' taxa. Once again, these differences are equated to differences in habitat quality, particularly to the very low and very slow flows recorded at site 3 at the time of this survey.

Overall, the results suggest that differences in the macroinvertebrate communities between the four sites relate to differences in habitat rather than the effects of any discharge from the landfill site.

Summary

Macroinvertebrate sampling was undertaken on 26 November 2013, at four sites in two tributaries of the Awai Streams, using either the 'sweep-net' or 'kick' sampling technique, both standard sampling techniques used by the Council. This was undertaken to assess whether leachate discharges from Inglewood landfill had had any adverse effects on the

macroinvertebrate communities of this stream. Samples were processed to provide number of taxa (richness), MCI and $SQMCI_s$ scores for each site.

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

This November 2013 survey did not indicate that leachate from the Inglewood landfill had significantly affected the freshwater macroinvertebrate communities in these tributaries. These communities appear to be determined by the physical habitat conditions, particularly the very slow to slow current speeds, soft/fine substrate and changes in macrophyte habitats available to the aquatic invertebrates.

The smaller, landfill drainage tributary sites exhibited slight improvements in taxa richness and $SQMCI_s$ score in a downstream direction. The differences observed between the sites can probably be attributed to the difference in available habitat, with better habitat at site 1b (downstream) resulting in a lower numerical dominance of 'tolerant taxa'. This site has progressively become choked with vegetation, but the wetted area is greater, and water speeds swifter.

Significant differences were recorded in the MCI and $SQMCI_s$ scores between sites 2 and 3 in the larger tributary of the Awai Stream which can be attributed to a number of slight changes in taxa abundances, the result of varying habitat condition.

Site 2 had higher MCI and $SQMCI_s$ scores compared to the two sites in the smaller tributary (1a and 1b), and these scores were also significantly higher than their respective medians, which was indicative of improved water quality at this site. Once again, differences in habitat condition were thought to be the main reason for these differences in the macroinvertebrate communities at all sites.

No sites supported any undesirable biological growths.

The results of this survey provide no indication that the discharge of leachate into the unnamed tributary of the Awai Stream was having a significant adverse effect on the macroinvertebrate communities in the tributaries monitored.

References

Dunning KJ, 2002a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2002. TRC report KD93.

Dunning KJ, 2002b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, April 2002. TRC report KD127.

Fowles CR and Colgan BG, 2004. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2004. TRC report CF324.

Fowles CR and Hope KJ, 2005a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, December 2004. TRC report CF367.

Fowles CR and Hope KJ, 2005b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, March 2005. TRC report CF374.

Fowles CR and Moore SC, 2004. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, March 2004. TRC report CF325.

Hope KJ, 2005. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, November 2005. TRC Report KH060.

Jansma B, 2006. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, March 2006. TRC Report BJ005.

Jansma B, 2007a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2007. TRC Report BJ016.

Jansma B, 2007b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, April 2007. TRC Report BJ017.

Jansma B, 2008a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2008. TRC Report BJ046.

Jansma B, 2008b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, May 2008. TRC Report BJ047.

Jansma B, 2008c: Biomonitoring of the Mangati Stream, in relation to the Bell Block industrial area, February 2008. TRC report BJ043.

Jansma B, 2009a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2009. TRC Report BJ069.

Jansma B, 2009b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, April 2009. TRC Report BJ070.

Jansma B, 2010. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2010. TRC Report BJ119.

Jansma, B 2011a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the

Inglewood landfill, November 2010. TRC report BJ155.

Jansma, B 2011b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, April 2011. TRC report BJ156.

Jansma, B 2012a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2012. TRC report BJ179.

Jansma, B 2013. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, February 2013. TRC report BJ208.

Jansma, B & Smith, K 2013. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, October 2012. TRC report BJ207.

Jansma, B & Smith, K 2013. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, February 2013. TRC report BJ208.

McWilliam H, 1999. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, August 1999. TRC report HM186.

McWilliam H, 2000. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, March 2000. TRC report HM222.

Moore S, 2003a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, November 2002. TRC report SM578.

Moore S, 2003b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, February 2003. TRC report SM579.

Smith K, 2012. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, May 2012. TRC report KS016.

Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. *Water and Soil Miscellaneous Publication No. 87.*

Stark JD, 1998: SQMCI: a biotic index for freshwater macroinvertebrate coded abundance data. *New Zealand Journal of Marine and Freshwater Research 32(1*): 55-66.

Stark JD, 1999: An evaluation of Taranaki Regional Council's SQMCI biomonitoring index. Cawthron Institute, Nelson. Cawthron Report No. 472.

Stark JD, Boothroyd IKG, Harding JS, Maxted JR, Scarsbrook MR, 2001: Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for the Ministry for the Environment. Sustainable Management Fund Project No. 5103. 57p.

Stark JD and Maxted JR, 2004. Macroinvertebrate community indices for Auckland's soft-bottomed streams and applications to SOE reporting. Prepared for Auckland Regional Council. Cawthron Report No. 970. Cawthron Institute, Nelson. ARC Technical Publication 303. 59p.

Stark JD and Maxted JR, 2007. A biotic index for New Zealand's soft bottomed streams. New Zealand Journal of Marine and Freshwater Research 41(1).

Stark JD and Maxted JR, 2007a. A user guide for the macroinvertebrate community index. Cawthron Institute, Nelson. Cawthron Report No. 1166.

To	Job Manager, Scott Cowperthwaite
From	Scientific Officer, Brooke Thomas
Report No	BT029
Document No	1405116
Date	17 September 2014

Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, February 2014

Introduction

This was the second biological survey undertaken of the two surveys scheduled for the 2013-2014 monitoring year in two tributaries of the Awai Stream in relation to the Inglewood landfill. Leachate from the landfill discharges to a small tributary, which then joins a larger tributary approximately 450m below the face of the landfill. Results of biological surveys performed in the tributaries since the 2001-2002 monitoring year are discussed in the series of reports referenced at the end of this report.

Methods

This survey was undertaken on 04 February 2014 at four sites on the two tributaries of the Awai Stream; sites 1(a) and 1 (b) were located in the smaller tributary and sites 2 and 3 on the larger tributary (Figure 1).

The standard 400 ml 'sweep-net' sampling technique was used to collect streambed macroinvertebrates from sites 1a and 1b. The 'sweep-net' sampling technique is very similar to Protocol C2 (soft-bottomed, semi-quantitative).

A combination of the 'sweep-net' and the standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from sites 2 and 3. The '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 tributaries of the Awai Stream

Site	Site code	Location
1a	AWY000105	Smaller tributary, 100 metres below tip face
1b	AWY000107	Smaller tributary, 400 metres below tip face
2	AWY000100	Larger tributary, above confluence with small tributary
3	AWY000115	Larger tributary, 80 metres below confluence with small tributary

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

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

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams (MCI). 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 (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. More 'sensitive' communities inhabit less polluted waterways.

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

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

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

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

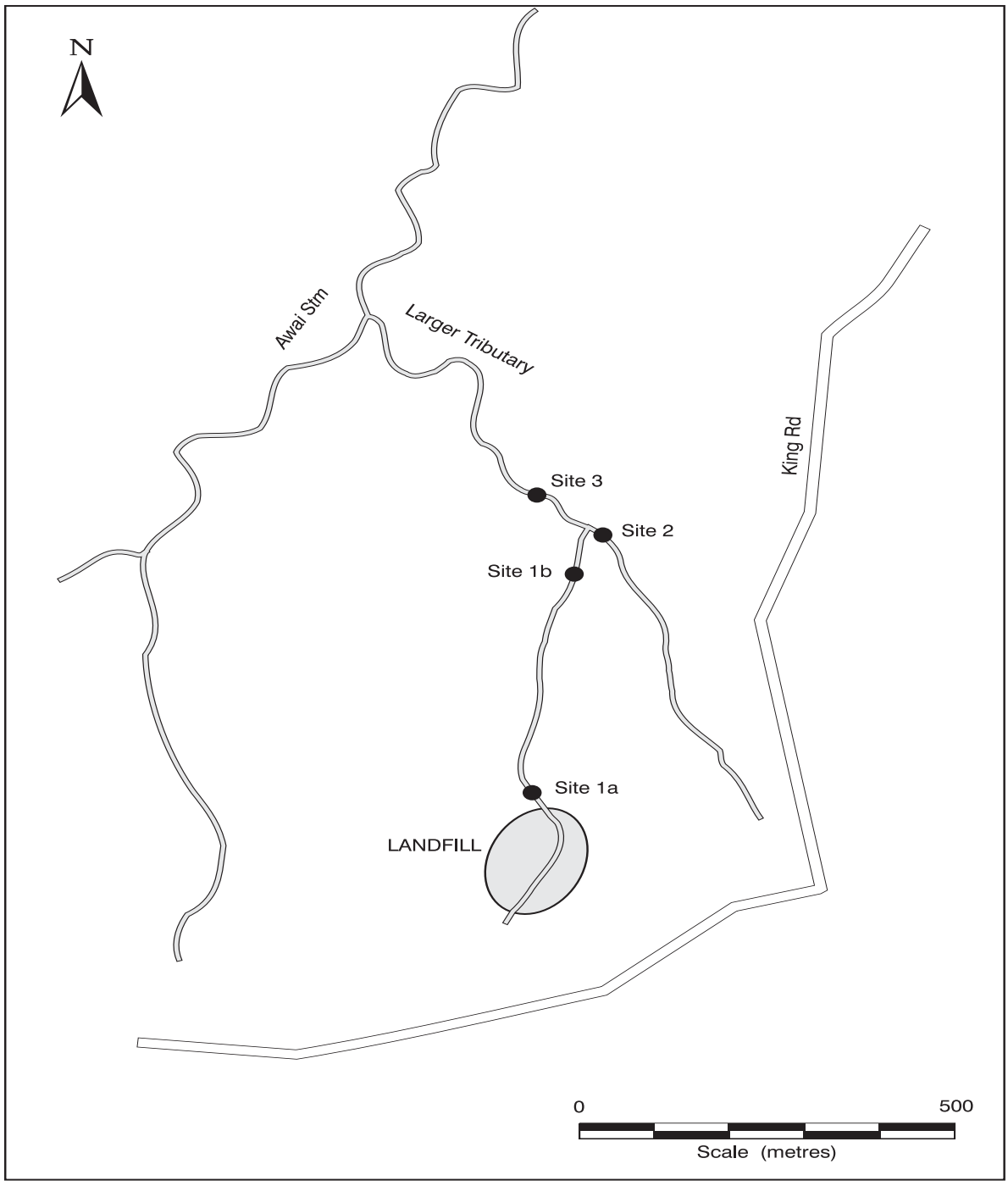

Figure 1 Biomonitoring sites in tributaries of the Awai Stream related to the Inglewood landfill

Results

This February 2014 survey was carried out under very low and very slow flow conditions at all sites. At sites 1a and 1b the flow was uncoloured and clear. The flow at site 2 was brown and cloudy and at site 3, grey and cloudy. It had been 27 days since the nearby Mangaoraka Stream flowed at more than three times its median flow and 30 days since flows exceeded seven times median.

At sites 1a and 1b, the bed substrate consisted entirely of silt, and macrophytes dominated the bed and banks of the stream. No algae was recorded at either of the two sites. There was

no shading at site 1a and partial shading at site 1b by long over hanging grasses. The iron oxide coating frequently noted at site 1a, was not recorded at the site during this survey. At the time of this survey the water temperatures recorded in the small tributary ranged from 15.3°C to 17.6°C.

In the larger tributary, the substrate at site 2 consisted entirely of silt, and no macrophytes were recorded growing at either the edges or on the bed of the stream. At site 3 the substrate consisted predominantly of cobbles and silt with sand and fine and coarse gravels. No algae was recorded at either of the two sites, and both sites were completely shaded. The water temperature recorded at these sites was 14.2°C at site 2 and 14.7°C at site 3. No site supported any undesirable biological growths.

Macroinvertebrate communities

A summary of results from previous surveys performed in the tributaries of the Awai Stream in relation to the Inglewood landfill are presented together with current results in Table 2. The full results of the present survey are provided in Table 3.

Table 2 Numbers of taxa and MCI values recorded in previous surveys related to the Inglewood landfill, together with current results

Site No	No. Taxa				MCI values				$SQMCI_s$ values			
	No. samples	Range	Median	Current result	No. Samples	Range	Median	Current result	No. samples	Range	Median	Current result
1a	38	4-23	15	18	38	60-86	72	84	28	1.2-3.5	2.6	3.6
1b	41	11-29	19	18	41	69-88	77	81	28	2.1-4.5	3.2	4.0
2	42	8-29	19	12	42	79-108	90	83	28	1.4-6.1	3.9	4.3
3	42	9-27	19	21	42	74-105	90	99	28	1.3-5.8	3.3	5.0

Table 3 Macroinvertebrate fauna of unnamed tributaries of the Awai Stream sampled in relation to the Inglewood landfill on 04 February 2014

Taxa List	Site Number	MCI score	Site 1a	Site 1b	Site 2	Site 3
	Site Code		AWY000105	AWY000107	AWY000100	AWY000115
	Sample Number		FWB14053	FWB14054	FWB14055	FWB14056
NEMATODA	Nematoda	3	-	-	R	-
ANNELIDA (WORMS)	Oligochaeta	1	-	C	C	C
MOLLUSCA	*Gyraulus*	3	-	R	-	-
	Lymnaeidae	3	-	C	-	-
	Potamopyrgus	4	R	VA	R	C
CRUSTACEA	Ostracoda	1	A	C	R	-
	Isopoda	5	-	-	-	R
	Paraleptamphopidae	5	-	R	R	VA
	Paranephrops	5	-	-	R	R
EPHEMEROPTERA (MAYFLIES)	*Coloburiscus*	7	-	-	-	R
	Zephlebia group	7	-	-	C	R
ODONATA (DRAGONFLIES)	*Xanthocnemis*	4	A	C	-	-
	Antipodochlora	5	-	-	-	R
HEMIPTERA (BUGS)	*Microvelia*	3	R	R	-	-
COLEOPTERA (BEETLES)	Dytiscidae	5	R	-	-	-
	Hydrophilidae	5	C	R	-	R
	Ptilodactylidae	8	-	-	-	R
TRICHOPTERA (CADDISFLIES)	*Hydrobiosis*	5	R	R	-	R
	Orthopsyche	9	-	-	-	C
	Polyplectropus	6	A	R	-	C
	Psilochorema	6	C	-	R	-
	Oeconesidae	5	-	A	R	R
	Triplectides	5	-	-	-	C
DIPTERA (TRUE FLIES)	Hexatomini	5	R	-	-	-
	Limonia	6	-	-	-	R
	Paralimnophila	6	-	R	-	-
	Zelandotipula	6	R	R	-	-
	Orthocladiinae	2	R	-	-	R
	Polypedilum	3	VA	R	R	R
	Tanypodinae	5	C	A	R	-
	Dolichopodidae	3	-	-	-	R
	Empididae	3	R	-	-	-
	Austrosimulium	3	A	C	-	R
	Stratiomyidae	5	C	-	-	-
ACARINA (MITES)	Acarina	5	A	R	C	C
		No of taxa	18	18	12	21
		MCI	84	81	83	99
		SQMCIs	3.6	4.0	4.3	5.0
		EPT (taxa)	3	3	3	7
		%EPT (taxa)	17	17	25	33
'Tolerant' taxa	'Moderately sensitive' taxa	'Highly sensitive' taxa				

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

Site 1a

A total of 18 taxa was recorded at site 1a, 100 metres downstream of the landfill face. This result was three taxa more than the median richness recorded at this site. A moderate proportion of taxa (56%) recorded at the site were 'sensitive' taxa which was reflected in the

MCI score of 84 units. This MCI score was significantly (Stark, 1998) higher than the median and only just below the highest MCI recorded to date (Figure 2).

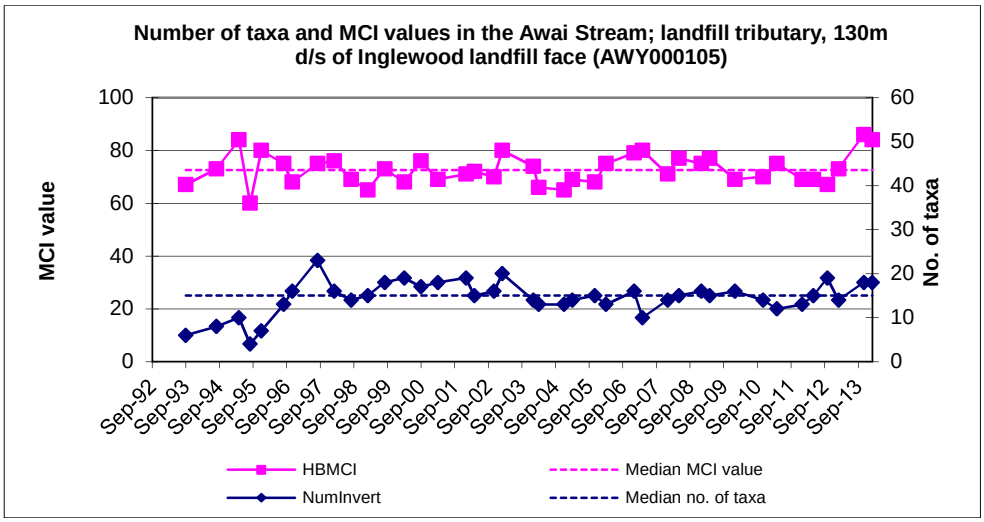

Figure 2 Number of taxa and MCI values at site 1a in a tributary of the Awai Stream

The macroinvertebrate community at this site was characterised by four 'tolerant' taxa (ostracod seed shrimps, *Polypedilum* midge larvae, damselfly larvae *Xanthocnemis* and sandfly larvae *Austrosimulium*) and two 'sensitive' taxa (free-living caddis *Polyplectropus* and Acarina mites) (Table 3). The numerical dominance of the tolerant taxa resulted in a moderate $SQMCI_s$ score of 3.6 units which a significant (Stark, 1998) 1.0 unit higher than the median $SQMCI_s$ score for the site, and the highest $SQMCI_s$ score recorded at this site to date.

Site 1b

Eighteen taxa were recorded at site 1b, approximately 400 metres downstream of the landfill face, one taxon less than the median recorded at this site and the same number of taxa recorded at site 1a in this same survey. At the time of this survey, equal proportions of 'tolerant' and 'sensitive' taxa were recorded. A moderate MCI score of 81 units was recorded, four units higher than the median score for the site (Figure 3) but three units lower than the MCI score recorded at site 1a in this survey, a statistically insignificant reduction (Stark, 1998).

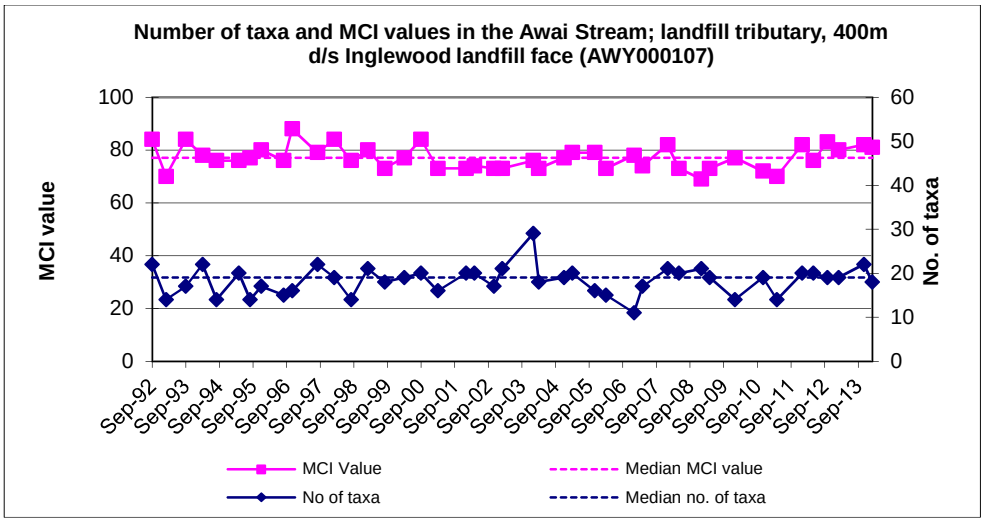

Figure 3 Number of taxa and MCI values at site 1b in a tributary of the Awai Stream

In this survey, the macroinvertebrate community was dominated by one 'tolerant' taxon (*Potamopyrgus* snail) and two 'sensitive' taxa (chironomid midge Tanypodinae and cased caddis Oeconesidae) (Table 3). The $SQMCI_s$ score of 4.0 units recorded at site 1b was an insignificant 0.8 unit higher than the median score for the site, and an insignificant 0.4 unit higher than that recorded at site 1a in this survey (Stark, 1998).

Site 2

The 'control' site 2 upstream of the confluence with the landfill tributary had a community richness of 12 taxa, seven taxa lower than the median number found by previous surveys (Table 2, Figure 4). A moderate proportion of the community recorded at this site in the current survey were 'sensitive' taxa (58%) which resulted in the MCI score of 83 units for the site (Table 3). This MCI score was an insignificant (Stark, 1998) seven units less than the median score recorded at the site previously, although was not significantly different to the MCI score recorded at the two sites in the small unnamed tributary (1a and 1b) (Stark, 1998). This score was significantly less than the MCI recorded in the previous survey (by 23 units) (Stark, 1988).

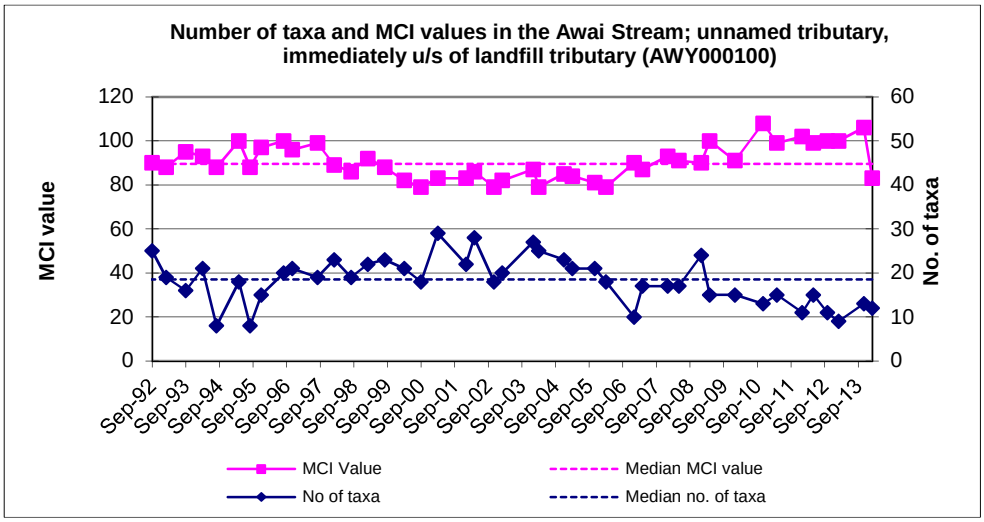

Figure 4 Number of taxa and MCI values at site 2 in a tributary of the Awai Stream

The community was sparse, with all taxa recorded as either common (5-19 individuals) or rare (less than 5 individuals). The community was comprised of five 'tolerant' taxa and seven 'sensitive' taxa. Common taxa included 'tolerant' oligochaete worms and 'sensitive' *Zephlebia* mayfly and Acarina mites which resulted in a moderate $SQMCI_s$ score of 4.3 units (Table 3). This $SQMCI_s$ score was an insignificant (Stark, 1998) 0.4 unit higher than the median score recorded at the site previously and also slightly higher than score recorded at the two sites in the small unnamed tributary (1a and 1b).

Site 3

A total of 21 taxa was found at site 3 below the confluence with the landfill drainage tributary, which was two taxa more than the median richness recorded by previous surveys. The MCI score of 99 units reflected the moderately high proportion of 'sensitive' taxa (72%) present in the community at this site in the current survey. This MCI score was insignificantly higher (by 9 units) than the median and to that recorded in the previous survey (Stark, 1998) (Figure 5).

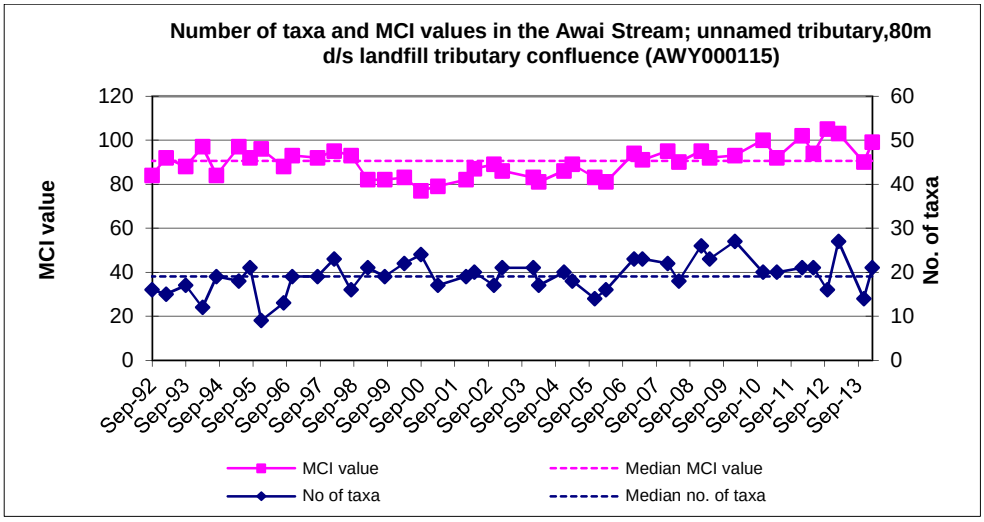

Figure 5 Number of taxa and MCI values at site 3 in a tributary of the Awai Stream

The macroinvertebrate community at this site was characterised by one 'sensitive' taxon (paraleptamphopid amphipods) (Table 3). The numerical dominance of this 'sensitive' taxon resulted in a relatively high SQMCI$_s$ score of 5.0 units, which was significantly higher than the median score of 3.3 units recorded at this site in previous surveys. This score was also significantly higher than the scores recorded at sites 1a and 1b in the smaller tributary of the Awai Stream (Stark, 1998).

Discussion and conclusions

Wetland and grassy stream habitats such as at sites 1a and 1b often support abundances of molluscs, crustacea, true flies (dipterans), and certain caddisflies, and this was reflected in the current survey.

At the time of this February survey, there was a very low flow of very slow moving water recorded at site 1a which was indicative of a seepage feed stream. This was reflected in the macroinvertebrate community recorded at the site which was numerically dominated by low scoring 'tolerant' taxa. This resulted in a moderate MCI of 84 units and a moderate SQMCI$_s$ score of 3.6 units. The MCI score was only just below the highest MCI score recorded to date and the SQMCI score was the highest score ever recorded at this site.

Previous surveys typically recorded a poorer community at site 1a than at site 1b however the taxa richnesses and MCI and SQMCI$_s$ score results of the current survey were very similar. Taxa richnesses were the same at both sites and there was only a three unit decrease in MCI score from site 1a to site 1b. The SQMCI$_s$ score was only slightly higher at site 1b (by 0.4 unit). Despite this, the community composition was quite different between the two sites and included nine significant differences in taxon abundances. This included an increase of three individual 'tolerant' taxa, a decrease in four individual 'sensitive' taxa, a decrease in one 'tolerant' taxon and an increase in one 'sensitive' taxon between sites 1a and 1b. A difference in the available macrophyte habitat between the two sites was considered to be the main reason for these results. At site 1b the macrophyte community consisted of pasture grass and watercress compared to the reed and grass that dominated the macrophyte community at site 1a. Site 1b also lacked the abundant iron oxide recorded at site 1b. Shading differed between the two sites, with the bed of the stream completely unshaded at site 1a, whereas there was partial shading at site 1b.

In the current survey, the macroinvertebrate community recorded at the upstream 'control' site (2) consisted of a moderate proportion of 'sensitive taxa'. The site however was relatively sparse with no abundant taxa recorded. A slight dominance of 'sensitive' taxa was reflected in the moderate MCI score of 83 units and the $SQMCI_s$ score of 4.3 units. The low taxa numbers can be attributed to a lack of habitat at this site, including a very low and very slow flow, an entirely silt substrate and lack of macrophytes. The MCI score at site 2 however was higher than that recorded at site 1b and only slightly lower than that recorded at site 1a in the smaller tributary if the Awai Stream. The $SQMCI_s$ score recorded at site 2 was insignificantly (Stark, 1998) higher than that recorded at site 1a and site 1b. This site recorded a lower taxa richness compared to site 1a and site 1b, likely a reflection of the reduced habitat availability and sampling difficulty, as this site becomes more overgrown with time.

The MCI score recorded at site 3 downstream of the confluence with the small tributary was significantly higher than that recorded upstream at site (Stark, 1998). The $SQMCI_s$ score was also higher, but not significantly (Stark, 1998). Taxa richness was much higher downstream at site 3 however there were only four significant changes in taxa abundances between site 2 and site 3. Once again, these differences are equated to differences in habitat quality, particularly to the change in substrate, with only silt recorded at site 2 and a combination of silt, gravels, cobbles and sand recorded at site 3. The differences may also be attributed to sampling difficulty at site 2.

Overall, the results suggest that differences in the macroinvertebrate communities between the four sites relate to differences in habitat rather than the effects of any discharge from the landfill site.

Summary

Macroinvertebrate sampling was undertaken on 04 February 2014, at four sites in two tributaries of the Awai Streams, using either the 'sweep-net' or a combination of the 'sweep-net' and 'kick' sampling techniques, both standard sampling techniques used by the Council. This was undertaken to assess whether leachate discharges from Inglewood landfill had had any adverse effects on the macroinvertebrate communities of this stream. Samples were processed to provide number of taxa (richness), MCI and $SQMCI_s$ scores for each site.

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

This February 2014 survey did not indicate that leachate from the Inglewood landfill had significantly affected the freshwater macroinvertebrate communities in these tributaries. These communities appear to be determined by the physical habitat conditions, particularly the very low and very slow flows, soft/fine substrate and changes in macrophyte habitats available to the aquatic invertebrates.

The smaller, landfill drainage tributary sites (1a and 1b) exhibited slight improvement in $SQMCI_s$ score in a downstream direction, however taxa richness was the same and the MCI score decreased slightly. The differences observed between the sites can probably be attributed to the available habitat.

Significant differences were recorded in the MCI and $SQMCI_s$ scores between sites 2 and 3 in the larger tributary of the Awai Stream which can be attributed to four significant changes in taxa abundances, the result of varying habitat condition.

Site 3 had higher MCI and $SQMCI_s$ scores compared to the two sites in the smaller tributary (1a and 1b), and these scores were also higher than their respective medians (the $SQMCI_s$ score significantly), which was indicative of improved water quality at this site. Once again, differences in habitat condition were thought to be the main reason for these differences in the macroinvertebrate communities at all sites.

No sites supported any undesirable biological growths.

The results of this survey provide no indication that the discharge of leachate into the unnamed tributary of the Awai Stream was having a significant adverse effect on the macroinvertebrate communities in the tributaries monitored.

References

Dunning KJ, 2002a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2002. TRC report KD93.

Dunning KJ, 2002b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, April 2002. TRC report KD127.

Fowles CR and Colgan BG, 2004. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2004. TRC report CF324.

Fowles CR and Hope KJ, 2005a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, December 2004. TRC report CF367.

Fowles CR and Hope KJ, 2005b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, March 2005. TRC report CF374.

Fowles CR and Moore SC, 2004. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, March 2004. TRC report CF325.

Hope KJ, 2005. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, November 2005. TRC Report KH060.

Jansma B, 2006. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, March 2006. TRC Report BJ005.

Jansma B, 2007a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2007. TRC Report BJ016.

Jansma B, 2007b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, April 2007. TRC Report BJ017.

Jansma B, 2008a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2008. TRC Report BJ046.

Jansma B, 2008b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, May 2008. TRC Report BJ047.

Jansma B, 2008c: Biomonitoring of the Mangati Stream, in relation to the Bell Block industrial area, February 2008. TRC report BJ043.

Jansma B, 2009a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2009. TRC Report BJ069.

Jansma B, 2009b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, April 2009. TRC Report BJ070.

Jansma B, 2010. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2010. TRC Report BJ119.

Jansma, B 2011a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, November 2010. TRC report BJ155.

Jansma, B 2011b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, April 2011. TRC report BJ156.

Jansma, B 2012a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, January 2012. TRC report BJ179.

Jansma, B 2013. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, February 2013. TRC report BJ208.

Jansma, B & Smith, K 2013. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, October 2012. TRC report BJ207.

McWilliam H, 1999. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, August 1999. TRC report HM186.

McWilliam H, 2000. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, March 2000. TRC report HM222.

Moore S, 2003a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, November 2002. TRC report SM578.

Moore S, 2003b. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, February 2003. TRC report SM579.

Smith K, 2012. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, May 2012. TRC report KS016.

Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. *Water and Soil Miscellaneous Publication No. 87.*

Stark JD, 1998: SQMCI: a biotic index for freshwater macroinvertebrate coded abundance data. *New Zealand Journal of Marine and Freshwater Research 32(1*): 55-66.

Stark JD, 1999: An evaluation of Taranaki Regional Council's SQMCI biomonitoring index. Cawthron Institute, Nelson. Cawthron Report No. 472.

Stark JD, Boothroyd IKG, Harding JS, Maxted JR, Scarsbrook MR, 2001: Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for the Ministry for the Environment. Sustainable Management Fund Project No. 5103. 57p.

Stark JD and Maxted JR, 2004. Macroinvertebrate community indices for Auckland's soft-bottomed streams and applications to SOE reporting. Prepared for Auckland Regional Council. Cawthron Report No. 970. Cawthron Institute, Nelson. ARC Technical Publication 303. 59p.

Stark JD and Maxted JR, 2007. A biotic index for New Zealand's soft bottomed streams. New Zealand Journal of Marine and Freshwater Research 41(1).

Stark JD and Maxted JR, 2007a. A user guide for the macroinvertebrate community index. Cawthron Institute, Nelson. Cawthron Report No. 1166.

Thomas, B 2014a. Biomonitoring of two unnamed tributaries of the Awai Stream, below the Inglewood landfill, November 2013. TRC report BT028.