

Stratford District Council Landfills
Monitoring Programme
Annual Report
2015-2016

Technical Report 2016-71

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Executive summary

The Stratford District Council (SDC) maintains a closed landfill located on Victoria Road at Stratford, in the Patea catchment. The landfill was closed to the public on 11 March 2002 and to commercial disposers on 23 March 2002. The site has more recently been used to dewater and dispose of oxidation pond sludge from the adjacent municipal waste water treatment plant but this activity ceased in early 2006, and the landfill was recapped and reinstated. The only external material now accepted at the landfill is soil from a local sawmill site remediation project. This activity is covered by separate consent¹ held by a third party.

SDC also maintains closed landfills at Douglas Road, Huiroa, and Wingrove Road, Pukengahu, in the Patea catchment. Both the Huiroa and Pukengahu landfills have been closed since 1991, but are still monitored with regards to maintenance and leachate discharge on a triennial basis. Monitoring of these sites was not undertaken during the 2015-2016 year, with monitoring next scheduled in the 2017-2018 year.

This report for the period July 2015 to June 2016 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess SDC's environmental performance of these closed landfills during the period under review, and the results and environmental effects of SDC's activities.

SDC holds three resource consents, which include a total of 19 special conditions setting out the requirements that SDC must satisfy. The consents for the Huiroa and Pukengahu landfills were renewed during the period under review.

During the monitoring period, SDC demonstrated an overall high level of environmental performance and compliance with resource consent conditions.

The Council's monitoring programme for the closed landfill at Stratford included two inspections, two receiving water and six ground water samples collected for physicochemical analysis, and one biomonitoring survey of receiving waters.

There were no incidents recorded by the Council in regards to SDC's landfill sites during the period under review and the monitoring showed that there were only minor effects on the environment due to the discharges at the closed Stratford landfill site.

During the year, SDC demonstrated a high level of environmental performance and good level of administrative performance with the Stratford landfill resource consent. As with the 2014-2015 year, there was some minor ponding occurring on the site and some re-contouring is needed to ensure that all areas of the cap remain free draining

For reference, in the 2015-2016 year, 71% 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 24% demonstrated a good level of environmental performance and compliance with their consents.

¹ Consent 7645-1 Alby M Limited

In terms of overall environmental and compliance performance by the consent holder over the last several years, this report shows that the consent holder's performance remains at a high level in the year under review.

This report includes recommendations for the 2016-2017 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 for the period July 2015-June 2016 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Stratford District Council (SDC). SDC maintains closed landfills on Victoria Road, Stratford, on Douglas Road, Huiroa, and on Wingrove Road, Pukengahu.

This report includes the results and findings of the monitoring programmes implemented by the Council in respect of the consents held by SDC that relate to discharges of leachate and stormwater to water from the three closed landfills within the Patea catchment, in the Stratford district. During the year under review monitoring was only undertaken at the Stratford landfill site, as the Huiroa and Pukengahu monitoring programmes are triennial and are next scheduled for the 2017-2018 year

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 SDC's use of water, land, and air, and is the 23rd report by the Council for the landfills managed by 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:

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites through annual programmes;
- a summary of the resource consents held by SDC; and
- the nature of the monitoring programme in place for the period under review.

Each of the closed landfills is then discussed in a separate section (Sections 2 to 4).

In each subsection 1 (e.g. Section 2.1) there is a general description of the landfilled site and its discharges, an aerial photograph or map showing the location of the former landfill, and an outline of the matters covered by the water discharge permit.

Subsection 2 presents the results of monitoring of the SDC's activities at each of the sites during the period under review, including scientific and technical data.

Subsection 3 discusses the results, their interpretation, and their significance for the environment in the immediate vicinity of the site under discussion.

Subsection 4 presents recommendations to be implemented in the 2015-2016 monitoring year.

Section 5 contains a summary of recommendations for the 2016-2017 year.

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

1.1.3 The Resource Management Act (1991) and monitoring

The 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 an activity, and may include cultural and social-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 (for example recreational, cultural, or aesthetic); and
- (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 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 courses of non-compliance or failure to maintain good practices. A pro-active approach that, in the first instance, avoids issues occurring is favoured.

The 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 incident register includes events where the consent holder 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).

Any investigations, interventions, and incidents for each site are discussed in subsection 3.

1.1.5 Evaluation of environmental performance

Besides discussing the various details of the performance and extent of compliance by SDC during the period under review, this report also assigns a rating as to their environmental and administrative performance during the period under review.

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 consent holders approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans or water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (that is 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 interpretations, 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 performance

- **High:** The administrative requirements of the resource consents were met, or any failures 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 2015-2016 year, 71% 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 24% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Resource consents

1.2.1 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.

SDC holds water discharge permits **3889-3**, **3890-3** and **3891-3** issued by the Council. The purposes and approximate locations of the consents are provided in Table 1 and Figure 1, and they are each discussed further in the sections of this report covering the individual landfills.

Table 1 Stratford District Council landfill consents

Consent number	Location	Purpose	Next review date	Expiry date
3889-3	Stratford	To discharge leachate into land and into groundwater adjacent to the Patea River	June 2016	1 June 2028
3890-2	Huiroa	To discharge up to 230 cubic metres/day [20 litres/second] of stormwater and leachate from a former landfill site onto and into land in the vicinity of an unnamed tributary of the Makuri Stream in the Patea Catchment	-	1 June 2016
3890-3		To discharge stormwater and leachate from the former Huiroa landfill onto and into land in the vicinity of an unnamed tributary of the Makuri Stream [Renewed consent granted 16 June 2016]	June 2022	1 June 2034
3891-2	Pukengahu	To discharge up to 910 cubic metres/day [84 litres/second] of stormwater and leachate from the former Pukengahu landfill into an unnamed tributary of the Waihapa Stream in the Patea Catchment	-	1 June 2016
3891-3		To discharge stormwater and leachate from the former Pukengahu landfill into an unnamed tributary of the Waihapa Stream [Renewed consent granted 16 June 2016]	June 2022	1 June 2034

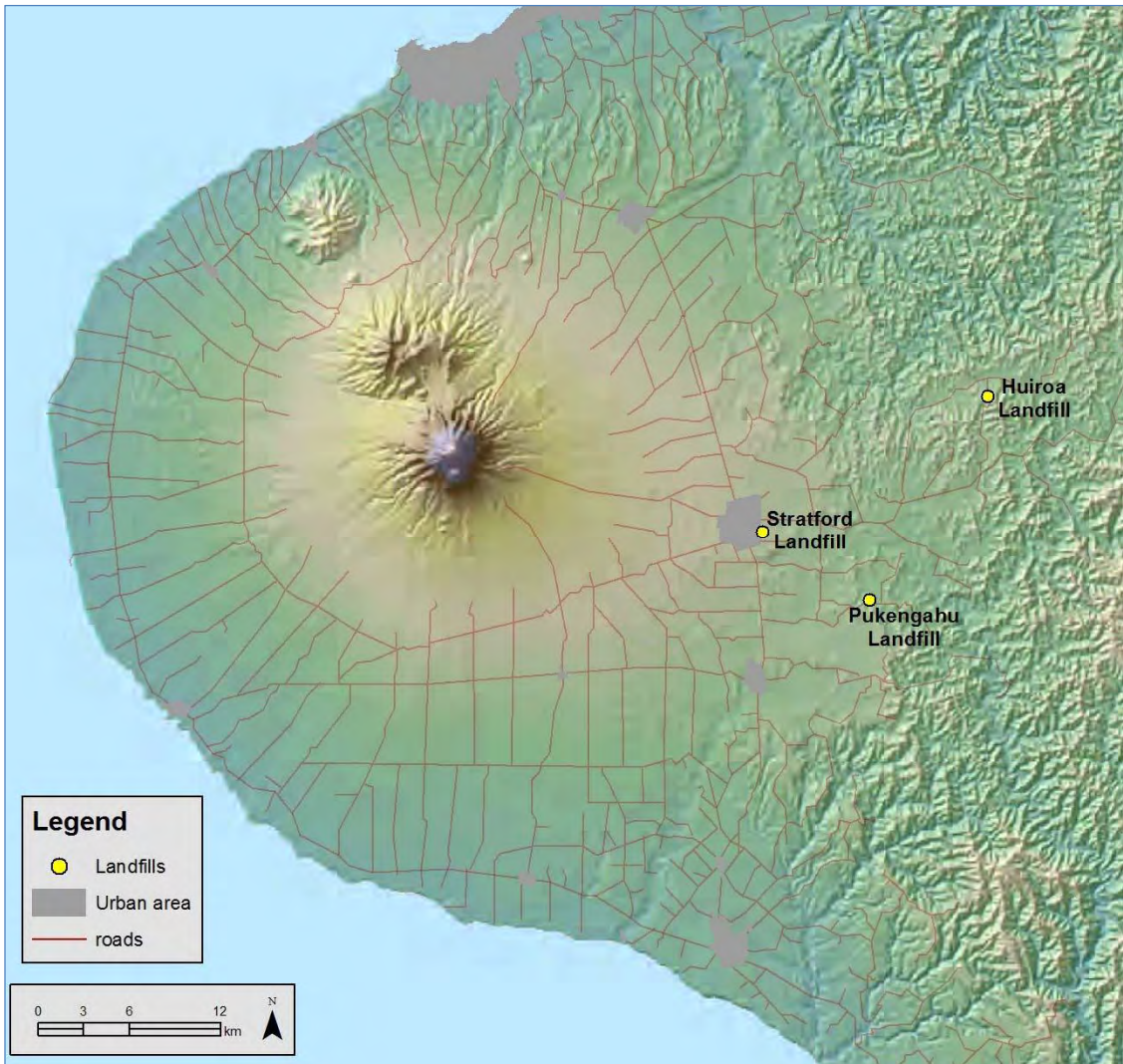


Figure 1 Regional map showing SDC landfill sites

1.3 Monitoring programme

1.3.1 Introduction

Section 35 of the RMA sets out obligations upon the Council to gather information, monitor, and conduct research on the exercise of resource consents within the Taranaki region. The Council is also required to assess the effects arising from the exercising of these consents and report upon them.

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 Stratford landfill closed in 2006 and monitoring is conducted annually.

Both the Huiroa and Pukengahu landfills have been closed since 1991 but are still monitored with regards to leachate discharge and site maintenance on a three yearly basis. Monitoring was undertaken in the 2014-2015 period, and is scheduled to take place again in 2017-2018 as per the triennial programme.

The monitoring programmes for the SDC landfills consist of four primary components as outlined below.

1.3.2 Programme liaison and management

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

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

1.3.3 Site inspections

The Stratford municipal landfill site was visited on two occasions during the monitoring period.

The landfill inspections focused on the stability, integrity, and drainage of the caps, any potential or actual discharges to receiving watercourses, including potential for leachate discharges, and visual assessment of the receiving water quality.

1.3.4 Chemical sampling

The Patea River in the vicinity of the Stratford landfill was sampled on one occasion, and the sample analysed for black disc transparency, biochemical oxygen demand, cadmium, chloride, conductivity, chromium, dissolved oxygen, dissolved reactive phosphorus, faecal coliforms, ammoniacal nitrogen, nitrate/nitrite nitrogen, dissolved oxygen saturation, pH, suspended solids, temperature, turbidity, and zinc.

The Council also undertook sampling of the groundwater at the Stratford landfill. Groundwater was sampled on two occasions, and the sample analysed for alkalinity, bicarbonate, chloride, conductivity, dissolved reactive phosphorus, faecal coliforms, ammoniacal nitrogen, nitrate, pH, temperature, water level and zinc.

1.3.5 Biomonitoring surveys

A biological survey was performed on one occasion in the Patea River to determine whether or not the Stratford landfill has had a detrimental effect upon the macroinvertebrate communities of the river.

2. Stratford landfill at Victoria Road

2.1 Process description

The Stratford District Council (SDC) operated a landfill located on Victoria Road at Stratford, in the Patea catchment. The landfill was closed to the public on 11 March 2002 and to commercial disposers on 23 March 2002. All contaminated surface water from the landfill is pumped to the adjacent oxidation ponds for treatment.

In March 2004 SDC cleared a site on top of the landfill and created a bunded area for the purpose of oxidation pond sludge dewatering. This dewatering process continued through to early 2006 and the sludge was then covered and capped and the site reinstated. There has been no discharge of refuse to the landfill since 2006.

A third party currently holds a consent to discharge chromated copper arsenate (CCA) contaminated soil from the old Fazackerly timber treatment plant site as base fill to the landfill for re-contouring purposes² (under the supervision of SDC). This consent has been exercised. However, due to an excess of clean overburden, further re-contouring is required.

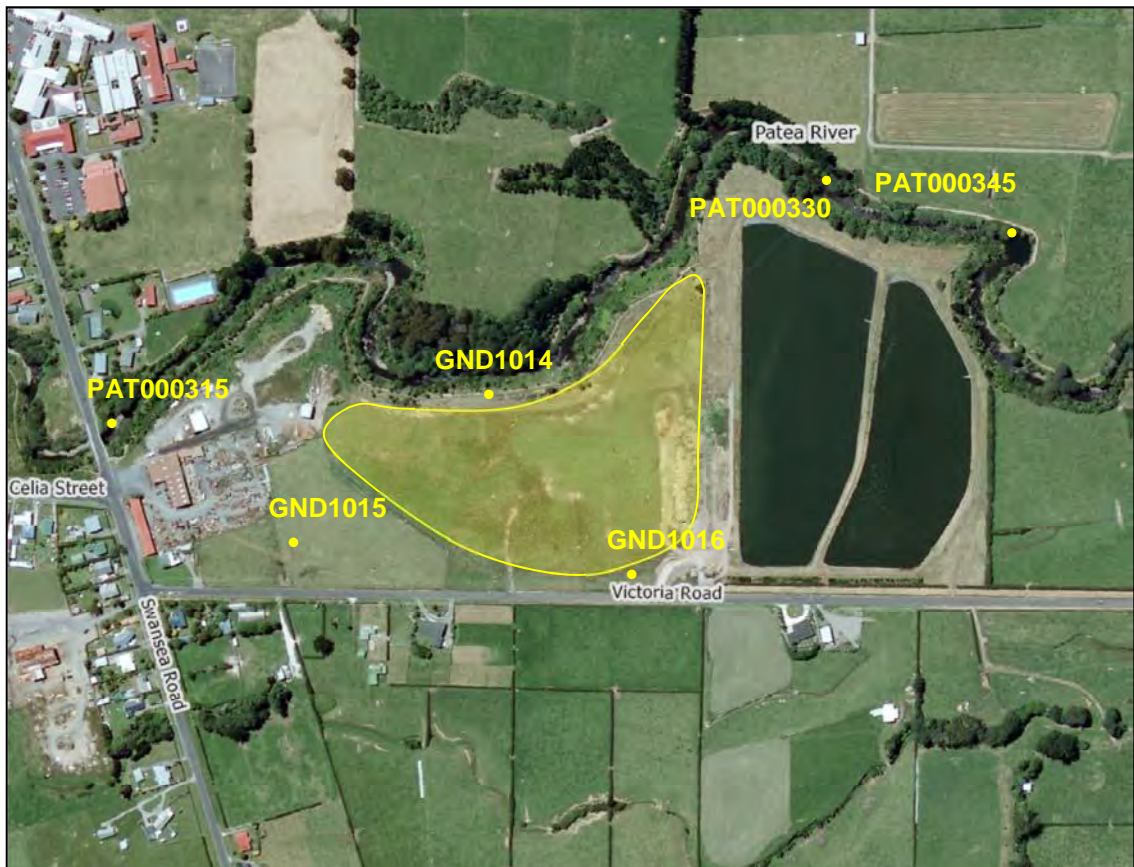


Figure 2 Stratford landfill (shaded in yellow) and sampling locations

² This consent was granted to provide for the remediation of a local sawmill site. The consent (7645-1) is held by Alby M Limited, and compliance monitoring of consent 7645-1 is not included in this report

2.2 Resource consent

2.2.1 Water discharge permit

SDC held consent 3889-2 to cover discharge of stormwater and leachate from Stratford municipal landfill into the Patea River. This permit was issued by the Council on 27 February 1998 under Section 87(e) of the RMA. This consent expired on 1 June 2010. As discharges were still occurring from the landfill, an abatement notice was issued and the consent holder subsequently re-applied for a consent. Consent **3889-3** was issued by the Council on 6 December 2010. It is due to expire on 1 June 2028, with provision for review the conditions of the consent in June 2016 and/or June 2022.

Condition 1 requires that the consent holder adopt best practical option to minimise effects.

Condition 2 requires the preparation and maintenance of a Contingency and Landfill Maintenance Plan.

Condition 3 requires SDC to maintain certain structures at the site.

Condition 4 states that the discharge shall not reduce in-stream water quality after a specified mixing zone.

Condition 5 is a review provision.

The permit is attached to this report in Appendix I.

2.3 Results

2.3.1 Inspections

20 August 2015

The inspection was conducted in fine weather with moderate gusty wind conditions, following two days of heavy rain.

The cap was observed to be intact and well grassed with pasture establishment on going on the cap over the Fazackerly CCA soil area. It was found to be wet underfoot and some minor ponding was present. The site was being grazed by young stock at the time of inspection. The vegetative cover was noted to have a few patchy exposed areas, but no slumping, cracking or exposed refuse was observed.

The batters were found to be intact, well fenced and grassed. There was no slumping or cracking evident. This area was being grazed at time of inspection and although there was some minor damage to the eastern batter, no exposed refuse was observed.

The stormwater drains on the cap were grassed over but clear of obstructions. It was observed that the drains were not well-defined on the top of the cap and therefore were not free-draining in all areas, which had lead to minor ponding. The eastern perimeter drain adjacent to the waste water treatment plant was full, but not discharging to the river.

The site was well fenced, with permanent multi-strand electric fencing around the batters and on the cap. The water troughs on the cap were full but not overflowing.

The following action was to be taken:

Maintain fencing around the exposed areas on the cap to prevent further stock damage.

31 May 2016

The inspection was conducted in overcast conditions with heavy showers. The cap was found to be intact and well grassed. There was some minor ponding on the surface following the recent heavy showers and wet weather. No slumping, cracking or exposed refuse was observed. The water troughs on the cap were not overflowing.

The batters were found to be intact, permanently fenced and well-grassed. No slumping, cracking, exposed refuse or stock damage was found at the time of inspection.

The stormwater drains on the cap were well grassed and free draining. No ponding was observed in the drains.

The site was not being grazed at the time of inspection. There were no odour or dust issues found.

2.3.2 Groundwater

Groundwater samples were taken from monitoring bores upslope (GND1015 and GND1016) and down slope (GND1014) of the landfill on two occasions. The results from these samples are shown in Table 2 and Table 3.

As with the results from previous samples taken from these monitoring bores, the groundwater down gradient of the landfill (as represented by bore GND1014), shows some evidence of contamination from the landfill. The graphs of historical data given in Figures 3, 4 and 5 show how bore GND1014 is affected by landfill indicator species; ammoniacal nitrogen, chloride, and zinc. The graphs also show how the levels of chloride and ammonia are apt to fluctuate against the more stable background levels found in the two bores mid and up gradient from the filled area (more so in the case of chloride and ammoniacal nitrogen). Zinc is found to be higher in the down gradient bore but is also seen to fluctuate in the up gradient bores as well, which may indicate other local effects in the groundwater.

The affected area consists of the narrow riparian strip between the landfill and the Patea River and the contaminated groundwater will eventually permeate through to the Patea River. The results of the monitoring of the Patea River, as discussed below, show that there is, at most, only negligible impact on Patea River water quality. This suggests that either the level of groundwater migration is not of sufficient volume to make any significant changes to the water quality of the Patea River, or that the groundwater contamination is being attenuated by its passage through the soil.

Table 2 Results of the Stratford landfill groundwater quality survey 28 August 2015

Parameter	Unit	GND1014 down-gradient	GND1015 up-gradient	GND1016 up-gradient
Alkalinity	g/m ³	726	24	30
Dissolved arsenic	g/m ³	<0.001	<0.001	<0.001
Chloride	g/m ³	49.4	8.0	8.8
Filtered chemical oxygen demand	g/m ³	42	<5	<5
Conductivity	mS/m	130	9.8	9.37
Dissolved chromium	g/m ³	0.04	<0.03	<0.03
Dissolved copper	g/m ³	<0.001	0.001	0.002
Dissolved reactive phosphorus	g/m ³	0.005	<0.003	0.005
Unionised ammonia	g/m ³ -N	0.09422	<0.00001	<0.00001
Ammoniacal nitrogen	g/m ³ -N	59.6	0.008	0.007
Nitrate/nitrite nitrogen	g/m ³ -N	0.02	2.42	1.0
pH	pH	6.46	5.78	5.6
Temperature	Deg. C	14.4	13.6	12.9
Dissolved zinc	g/m ³	<0.005	<0.005	0.008

Table 3 Results of the Stratford landfill groundwater quality survey, 31 May 2016

Parameter	Unit	GND1014 down-gradient	GND1015 up-gradient	GND1016 up-gradient
Alkalinity	g/m ³	186	29	32
Dissolved arsenic	g/m ³	0.007	0.002	<0.001
Chloride	g/m ³	7.7	9.2	8.0
Filtered chemical oxygen demand	g/m ³	6	<5	<5
Conductivity	mS/m	38.6	11.1	9.8
Dissolved chromium	g/m ³	<0.03	<0.03	<0.03
Dissolved copper	g/m ³	<0.001	<0.001	0.002
Dissolved reactive phosphorus	g/m ³	<0.003	<0.003	<0.003
Unionised ammonia	g/m ³ -N	0.00336	<0.00001	<0.00001
Ammoniacal nitrogen	g/m ³ -N	5.26	0.009	0.019
Nitrate/nitrite nitrogen	g/m ³ -N	0.02	1.93	0.68
pH	pH	5.9	5.77	5.4
Temperature	Deg. C	14.6	13.4	14.1
Dissolved zinc	g/m ³	0.089	<0.005	0.005

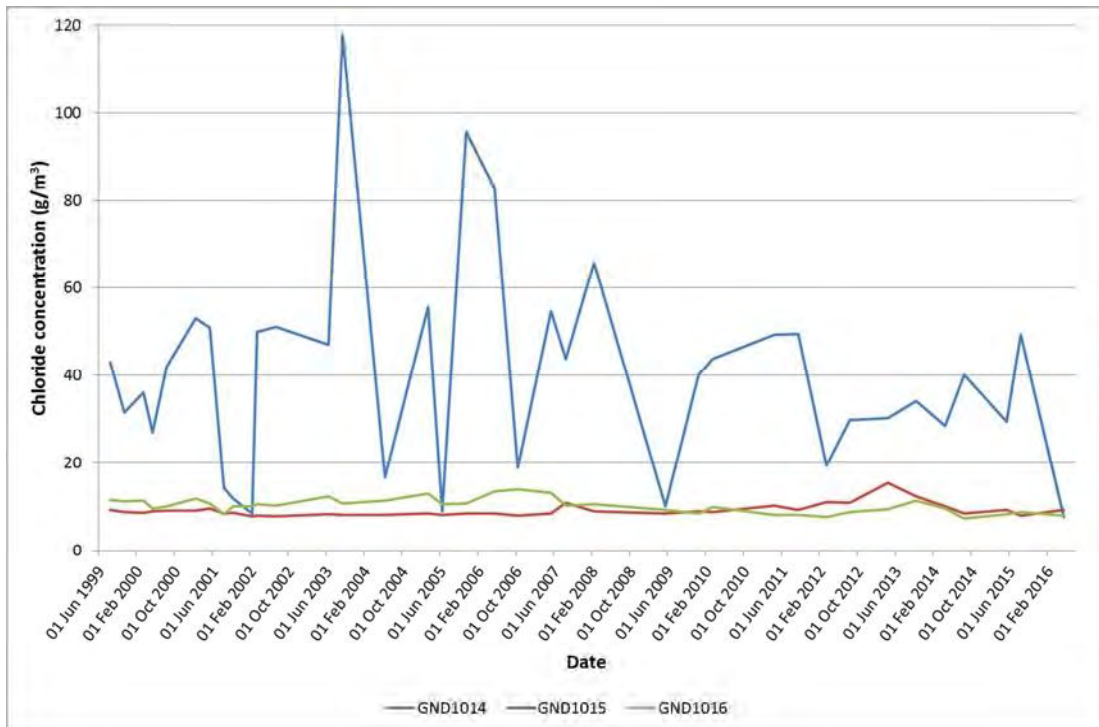


Figure 3 Graph showing chloride levels in groundwater at the Stratford landfill

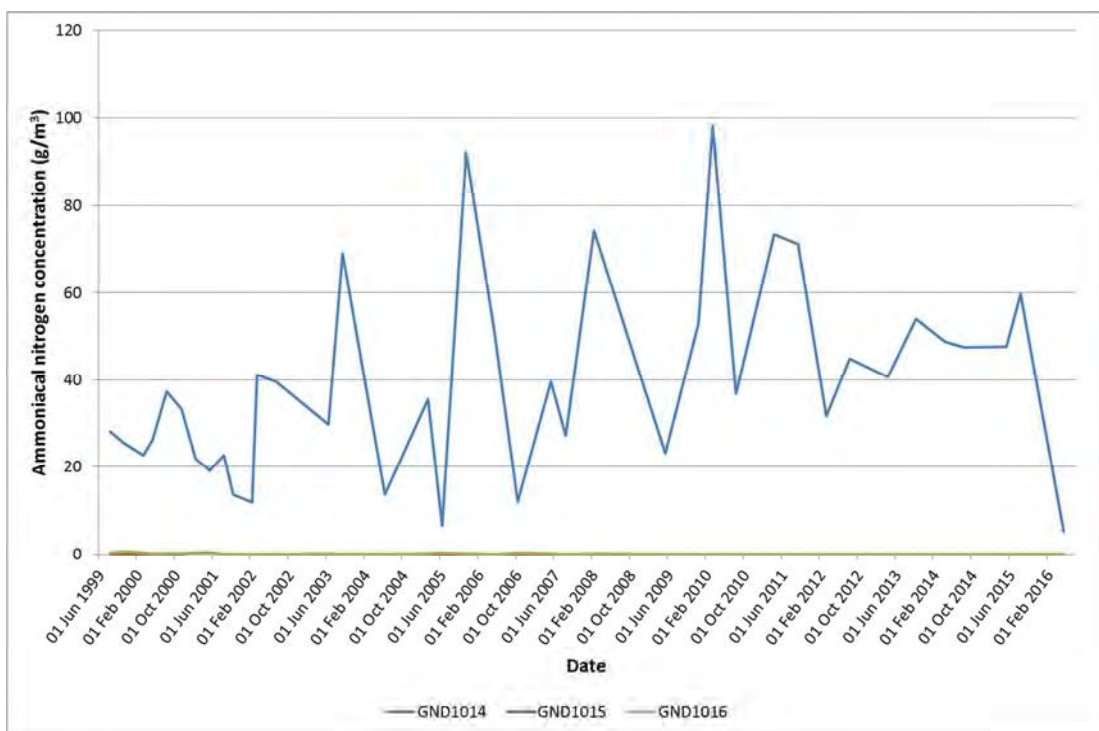


Figure 4 Graph showing ammoniacal nitrogen levels in groundwater at the Stratford landfill

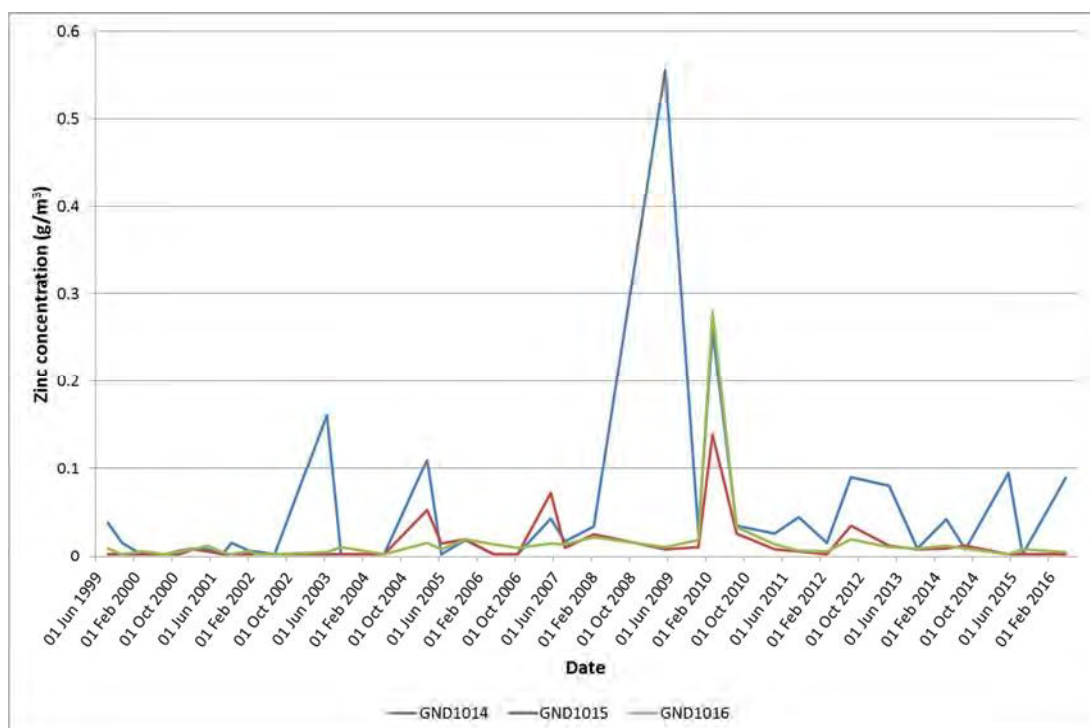


Figure 5 Graph showing zinc levels in groundwater at the Stratford landfill

2.3.3 Surface waters

Samples were collected from the Patea River on 24 February 2016 and the results are set out in Table 4. This sampling was undertaken in conjunction with the monitoring of the Stratford waste water treatment plant (WWTP), which is discussed in a separate report.

It is noted that there is an increase in the faecal coliform counts in the stream between the upstream and downstream sites, with the value obtained for the downstream site being just below the “action” level given in the MfE Microbiological Water Quality Guidelines for contact recreation. However, it is considered that this increase was associated with municipal oxidations ponds rather than with the landfill and was addressed with the consent holder under that programme.

As with the results from previous monitoring periods, the results from this period indicate that the Stratford landfill had only a very minor, if not negligible, effect on the physicochemical water quality of the Patea River.

In relation to the parameters tested for, there was no significant difference in the physicochemical water quality between the upstream and downstream sites. There was a slight rise in ammoniacal nitrogen, however, the level of unionised ammonia downstream of the landfill was well below the 0.025 g/m³ guideline for the long term protection of aquatic ecosystems.

Table 4 Results of the Stratford landfill water quality survey

Parameter	Units	16 February 2015	
		Above landfill PAT000315	Below landfill PAT000345
Black disc transparency	m	2.87	2.74
Biochemical oxygen demand	g/m ³	<0.5	0.5
Filtered biochemical oxygen demand	g/m ³	<0.5	<0.5
Cadmium (dissolved)	g/m ³	<0.005	<0.005
Chloride	g/m ³	8.0	8.3
Conductivity	mS/m	8.6	8.7
Chromium (dissolved)	g/m ³	<0.03	<0.03
Dissolved oxygen	g/m ³	9.58	9.63
Dissolved reactive phosphorus	g/m ³ -P	0.029	0.029
Faecal coliforms	/100ml	240	540
Unionised ammonia	g/m ³ -N	0.00024	0.00052
Ammoniacal nitrogen	g/m ³ -N	0.018	0.040
Nitrate/nitrite nitrogen	g/m ³ -N	0.65	0.64
Dissolved oxygen saturation	%	98.0	98.0
pH	pH	7.6	7.6
Suspended solids	g/m ³	<2	<2
Temperature	Deg.C	15.1	15.0
Turbidity	NTU	1.1	1.0
Dissolved zinc	g/m ³	<0.005	0.007

Figure 6 shows the ammoniacal nitrogen data gathered over the past 25 years. It is noted that, as the Stratford WWTP had an upgrade in 2009, the discharge point of the WWTP was moved and the sites used to monitor the downstream effects of the landfill have also changed. Monitoring at site PAT000330 ceased in March 2009, with monitoring continuing at site PAT000345, further downstream.

Whilst there is some separation between the site's locations, the graph indicates that a similar, stable, and modest rise in ammoniacal nitrogen has occurred in the Patea River as result of the landfill's presence. The highest level of ammoniacal nitrogen found downstream of the landfill since monitoring began was 0.87 g/m³ at site PAT000345, on 16 March 2005 (prior to the WWTP upgrade and not plotted in Figure 6). Under the pH and temperature conditions prevailing at the time of sampling, this ammoniacal nitrogen concentration would have resulted in an unionised ammonia concentration of 0.014 g/m³, well below the 0.025 g/m³ unionised ammonia guideline used for the long term protection of aquatic ecosystems.

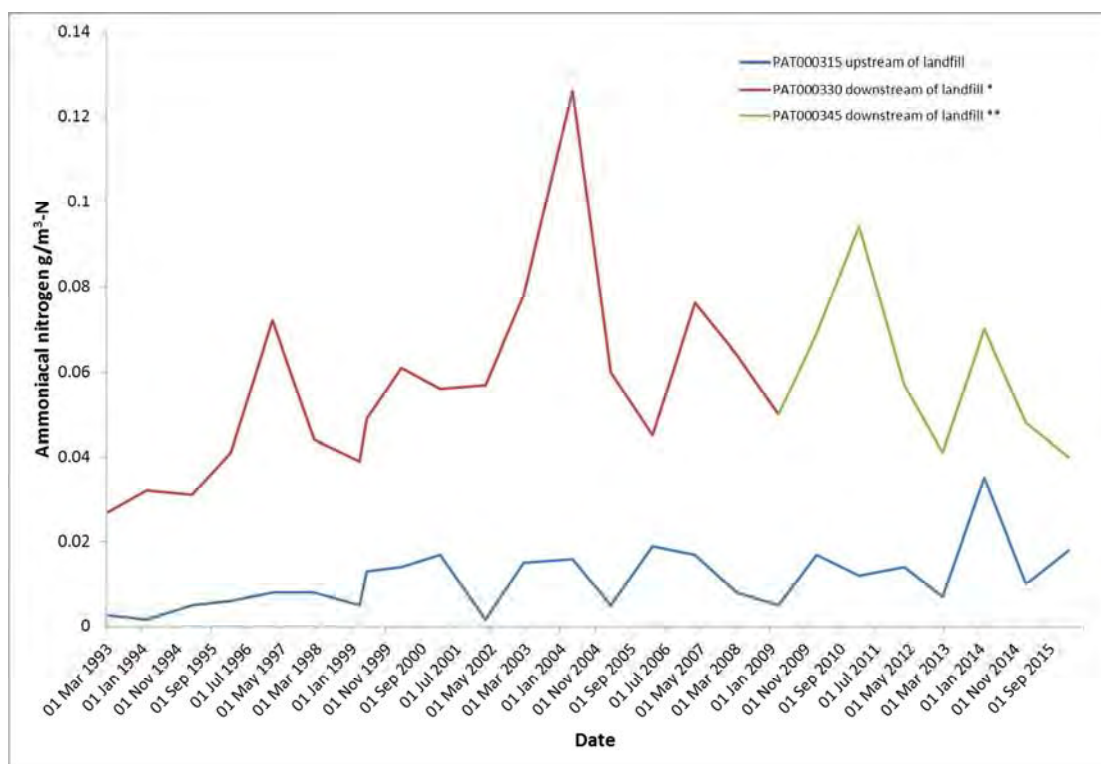


Figure 6 Graph showing ammoniacal nitrogen levels in the Patea Stream up and downstream of the landfill (where comparative data is available).

*Downstream site prior to WWTP upgrade

**Downstream site after WWTP upgrade

2.3.4 Biomonitoring

The Council's standard 'kick-sampling' technique was used at four established sites to collect streambed macroinvertebrates from the Patea River on 29 February 2016. Samples were sorted and identified and the number of taxa (richness), MCI score, and SQMCI_s score were calculated for each site. It is noted that although this monitoring is predominantly carried out for monitoring of the WWTP, it also provides information in relation to effects, if any, on the Patea River as a result of discharges from the former landfill.

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

Overall, the results of this summer macroinvertebrate survey indicated that the discharge from the Stratford WWTP and leachate from the closed Stratford landfill site had not had any recent significant detrimental effects on the macroinvertebrate communities of the Patea River. A noticeable deterioration in condition at the most downstream site was likely due to nutrient enrichment from adjacent farmland and unrelated to the discharges, and ideally a 'secondary impact' site should be established closer to the discharge point.

A copy of the full biomonitoring report is provided in Appendix II.

2.3.5 Investigations, interventions, and incidents

In the 2015-2016 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with conditions in the SDC' Stratford landfill resource consent or provisions in Regional Plans.

2.4 Discussion

2.4.1 Discussion of site performance

In terms of the management of the landfill, only a few minor issues were noted during the monitoring period. The site had good vegetative cover and the newly capped areas had stabilised. Extra capping soil was required to cover the additional area that had been affected by cross contamination during the discharge of the CCA soils at the start of the monitoring period. As a result, the cap still required surface drains in and around the crown of the east batter to ensure effective stormwater drainage. Although work was undertaken during the 2014-2015 and 2015-2016 years to re-contour some areas of the cap to rectify drainage issues and re-establish vegetative cover on the site, there was still one very small area where ponding was again found, due to a truncated stormwater drain. At the time of the preparation of this report, there was capping material present on site that, once the weather becomes drier, would be used to re-contour the areas affected by ponding.

2.4.2 Environmental effects of exercise of consents

Groundwater bore GND1014 continues to exhibit some signs of contamination, however there is no evidence from surface water sampling or biomonitoring that the discharge of groundwater is having a significant effect on the Patea River. There was no evidence of odour or dust problems at the site during any inspection.

2.4.3 Evaluation of performance

A tabular summary of the SDC's compliance record for the year under review in regard to the Stratford landfill is set out in Table 5.

Table 5 Summary of performance for Consent 3889-3 (Stratford landfill)

Purpose: To discharge leachate into land and into groundwater adjacent to the Patea River		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adopt best practical option	Site specific monitoring programme – programme supervision	Some minor ponding requiring recontouring
2. Prepare a Contingency and Maintenance Plan	Site specific monitoring programme – programme supervision	Yes
3. Maintain landfill site	Site specific monitoring programme – inspection	Some minor ponding requiring recontouring
4. Effects beyond mixing zone	Water quality monitoring of the Patea River upstream and downstream of the landfill	Yes
5. Optional review	Provision for review June 2016	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		Good

N/A = not applicable

During the year, SDC demonstrated a high level of environmental performance and good level of administrative performance with the Stratford landfill resource consent as defined in Section 1.1.5. As with the 2014-2015 year, there was some minor ponding occurring on the site and some re-contoring is needed to ensure that all areas of the cap remain free draining.

2.4.4 Recommendation from the 2014-2015 Annual Report

In the 2014-2015 Annual Report, it was recommended:

THAT monitoring of the Stratford landfill in the 2015-2016 year continues at the same level as in 2014-2015 period.

The monitoring programme was implemented as recommended.

2.4.5 Alterations to monitoring programmes for 2016-2017

In designing and implementing the monitoring programmes for air and 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;
- its obligations to monitor emissions and discharges and their effects under the RMA; and
- to report to the regional community.

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial

processes within Taranaki emitting to the atmosphere and discharging to the environment.

It is proposed that for 2016-2017, the monitoring programme remains unchanged.

A recommendation to this effect is presented in Section 2.5 of this report, and summary of recommendations is given in Section 5.

2.5 Recommendation

1. THAT monitoring of the consented activities at the Stratford landfill in the 2016-2017 year continues at the same level as in 2015-2016 period.

3. Huiroa landfill

3.1 Process description

The Huiroa landfill is sited within an elbow of Douglas Road. The dump was an uncontrolled roadside landfill used by local residents to dispose of domestic waste. The site was closed in 1991 and reinstated by SDC.

This closed landfill is monitored on a triennial basis, with inspections and sampling due next in 2017-2018. The location of the landfill and monitoring sites are shown in Figure 7.

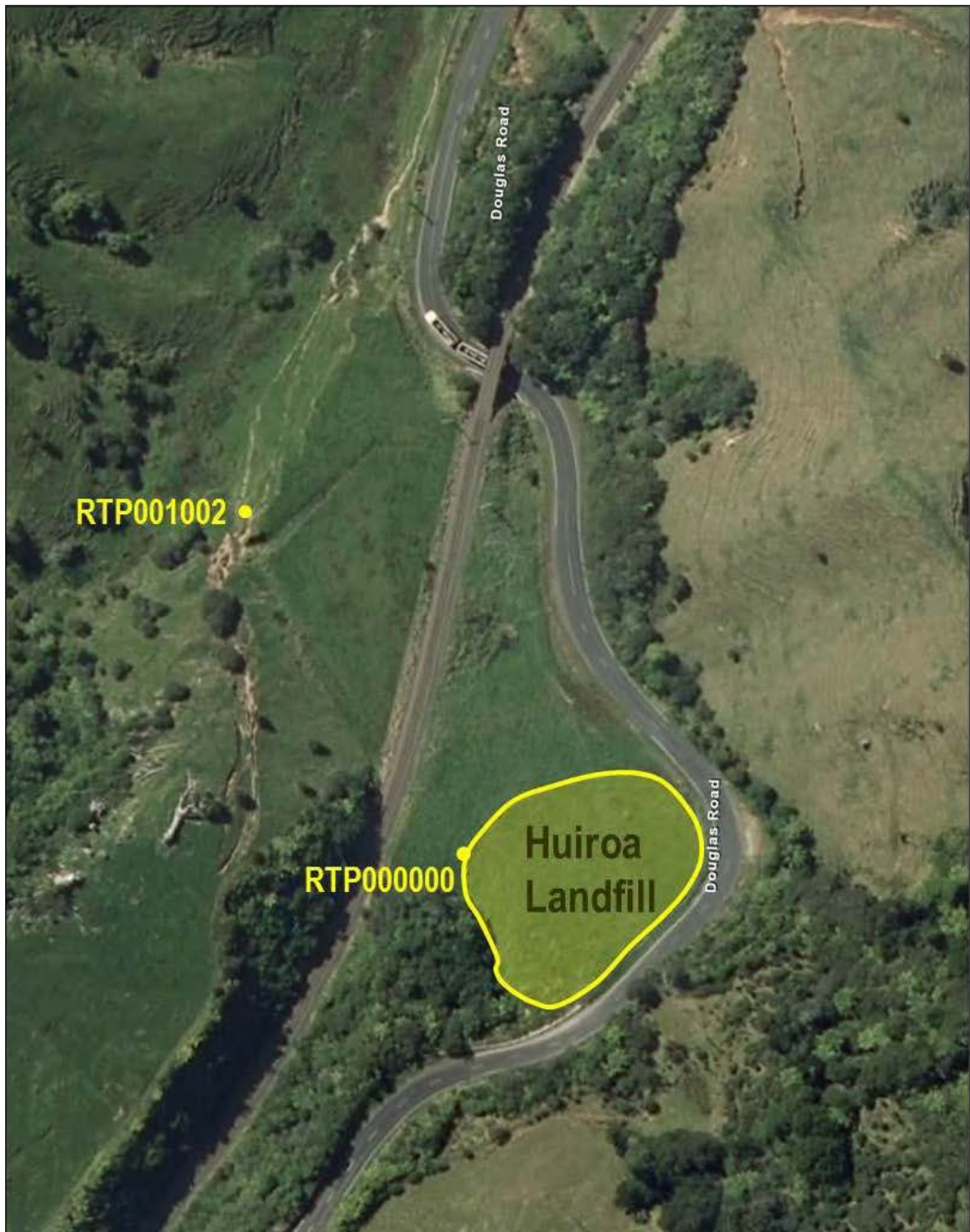


Figure 7 Huiroa landfill and approximate sampling locations

3.2 Resource consent

3.2.1 Water discharge permit

SDC held water discharge permit **3890-2** to cover discharge of stormwater and leachate from the former Huiroa landfill into an unnamed tributary of the Makuri Stream. This permit was issued by the Council on 17 October 1996 under Section 87(e) of the RMA. It expired on 1 June 2016.

Condition 1 requires SDC to maintain stormwater drains on the site.

Condition 2 requires SDC to maintain vegetative cover on the site.

Condition 3 requires that SDC adopts the best practicable option at the site.

Condition 4 states that the discharge from the site shall not cause detrimental effect on water quality or aquatic life of the Makuri Stream.

Conditions 5 and 6 are review conditions.

A renewed consent (**3890-3**) was granted on 16 June 2016 to cover the discharge of stormwater and leachate from the former Huiroa landfill onto and into land in the vicinity of an unnamed tributary of the Makuri Stream. This consent is due to expire on 1 June 2034.

Condition 1 requires that SDC adopts the best practicable option at the site.

Condition 2 requires SDC to maintain stormwater and leachate drains on the site to minimise stormwater infiltration and ensure adequate diversion away from the cap.

Condition 3 requires that the site is managed in accordance with a "Management Plan" that is to be provided within three months of the granting of the consent.

Conditions 4 and 5 state that discharges from the site shall not cause detrimental effects on water quality or aquatic life of the Makuri Stream, and include specific limits for unionised ammonia, ammoniacal nitrogen, pH and dissolved zinc.

Condition 6 is a review condition.

The permits are attached to this report in Appendix I.

3.3 Results

The closed landfill at Huiroa is monitored on a triennial basis. Monitoring is next scheduled for the 2017-2018 year. No inspections or sampling were undertaken during the year under review.

3.3.1 Investigations, interventions, and incidents

In the 2015-2016 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with conditions in SDC's Huiroa landfill resource consent or provisions in Regional Plans.

3.4 Discussion

3.4.1 Evaluation of performance

A tabular summary of SDC's compliance record for the Huiroa landfill during the period under review is set out in Table 6 and Table 7.

Table 6 Summary of performance for Consent 3890-2 (Huiroa)

Purpose: To discharge up to 230 cubic metres/day [20 litres/second] of stormwater and leachate from a former landfill site onto and into land in the vicinity of an unnamed tributary of the Makuri Stream in the Patea Catchment		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Maintenance of site	Not monitored during this period	Not assessed
2. Maintenance of vegetative cover	Not monitored during this period	Not assessed
3. Adoption of best practicable option	Not monitored during this period	Not assessed
4. Water quality after mixing	Not monitored during this period	Not assessed
5. Provision for review on sample results	Not monitored during this period	Not assessed
6. Optional review	Consent expired 1 June 2016	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		N/A
Overall assessment of administrative performance in respect of this consent		N/A

N/A = not applicable

Table 7 Summary of performance for Consent 3890-3 (Huiroa)

Purpose: To discharge stormwater and leachate from the former Huiroa landfill onto and into land in the vicinity of an unnamed tributary of the Makuri Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adoption of best practicable option	Not monitored during this period	Not assessed
2. Maintenance of cap and drainage systems	Not monitored during this period	Not assessed
3. Site to be operated in accordance with a 'Management Plan' that is to be within 3 months of granting of consent	Not monitored during this period	N/A
4. Component concentration limits on water quality after mixing	Not monitored during this period	Not assessed
5. General water quality after mixing	Not monitored during this period	Not assessed
6. Optional review	Next opportunity for review June 2022	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		N/A
Overall assessment of administrative performance in respect of this consent		N/A

N/A = not applicable

During the year, the environmental performance and administrative performance of SDC was not assessed in relation to their Huiroa landfill resource consent.

3.4.2 Recommendation from the 2014-2015 Annual Report

In the 2014-2015 Annual Report, it was recommended:

THAT, in the 2015-2016 year, the triennial monitoring for the Huiroa landfill remains unchanged, and it be noted that the monitoring is next scheduled to be implemented in the 2017-2018 period.

The monitoring programme was implemented as recommended.

3.4.3 Alterations to monitoring programmes for 2016-2017

In designing and implementing the monitoring programmes for air and 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;
- its obligations to monitor emissions and discharges and their effects under the RMA; and
- to report to the regional community.

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere and discharging to the environment.

It is proposed that for 2016-2017, the monitoring programme remains unchanged.

A recommendation to this effect is presented in Section 3.5 of this report, and summary of recommendations is given in Section 5.

3.5 Recommendation

1. THAT, in the 2016-2017 year, the triennial monitoring for the Huiroa landfill remains unchanged, and it be noted that the monitoring is next scheduled to be implemented in the 2017-2018 period.

4. Pukengahu landfill

4.1 Process description

The site is situated in a small gully off Wingrove Road (Figure 8). At the base of the gully is a small wetland area, which is fed by a spring that is culverted beneath the road and feeds into a small unnamed stream. The dump was unmanaged but was mostly used for the discharge of domestic waste by local residents. The landfill closed in 1991 and the site was reinstated by SDC. It is monitored on a triennial basis, with inspections and sampling undertaken during the period under review.

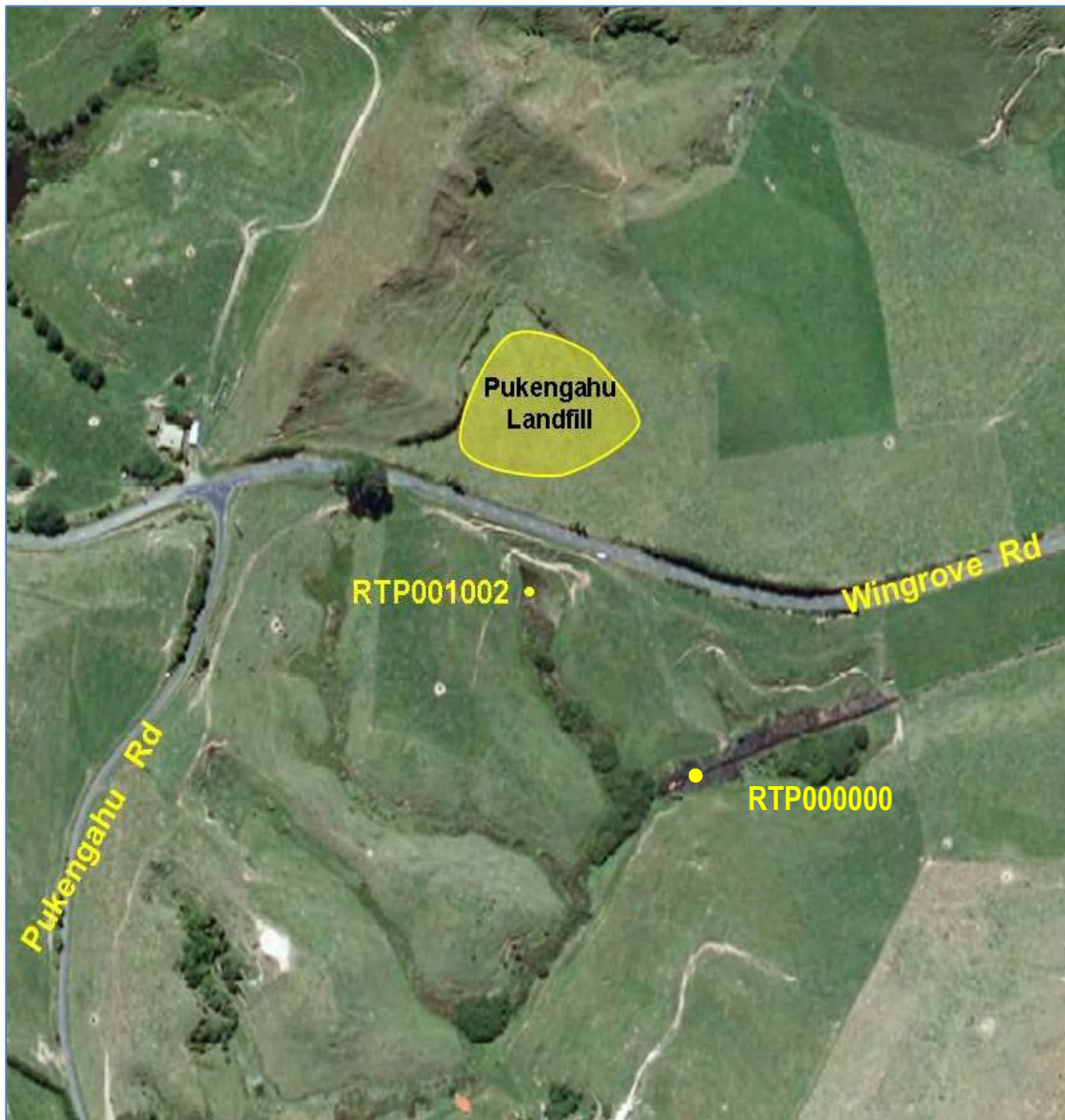


Figure 8 Pukengahu landfill and approximate sampling locations

4.2 Resource consent

4.2.1 Water discharge permit

SDC held water discharge permit **3891-2** to cover discharge of stormwater and leachate from the former Pukengahu landfill into an unnamed tributary of the

Waihapa Stream. This permit was issued by the Council on 12 February 1998 under Section 87(e) of the RMA. It expired on 1 June 2016.

Condition 1 requires SDC to manage ground contours, final cover and illegal dumping at the site.

Condition 2 states that the discharge from the site shall not cause detrimental effect on water quality or aquatic life of the Waihapa Stream.

Condition 3 is a review provision.

A renewed consent (**3891-3**) was granted on 16 June 2016 to cover the discharge of stormwater and leachate from the former Pukengahu landfill into an unnamed tributary of the Waihapa Stream. This consent is due to expire on 1 June 2034.

Condition 1 requires that SDC adopts the best practicable option at the site.

Condition 2 requires SDC to maintain stormwater and leachate drains on the site to minimise stormwater infiltration and ensure adequate diversion away from the cap.

Condition 3 requires that the site is managed in accordance with a “Management Plan” that is to be provided within three months of the granting of the consent.

Conditions 4 and 5 state that discharges from the site shall not cause detrimental effects on water quality or aquatic life of the Makuri Stream, and include specific limits for unionised ammonia, ammoniacal nitrogen, pH and dissolved zinc.

Condition 6 is a review condition.

The permits are attached to this report in Appendix I.

4.3 Results

The closed landfill at Pukengahu is monitored on a triennial basis. Monitoring is next scheduled for the 2017-2018 year. No inspections or sampling were undertaken during the year under review.

4.3.1 Investigations, interventions, and incidents

In the 2015-2016 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with conditions in SDC’s Pukengahu landfill resource consent or provisions in Regional Plans.

4.4 Discussion

4.4.1 Evaluation of performance

A tabular summary of SDC’s compliance record for the Pukengahu landfill during the period under review is set out in Table 8 and Table 9.

Table 8 Summary of performance for Consent 3891-2 (Pukengahu)

Purpose: To discharge up to 910 cubic metres/day [84 litres/second] of stormwater and leachate from the former Pukengahu Landfill into an unnamed tributary of the Waihapa Stream in the Patea Catchment		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Maintenance of site	Not monitored during this period	Not assessed
2. Water quality after mixing	Not monitored during this period	Not assessed
3. Optional review	Consent expired 1 June 2016.	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		N/A
Overall assessment of administrative performance in respect of this consent		N/A

N/A = not applicable

Table 9 Summary of performance for Consent 3890-2 (Pukengahu)

Purpose: To discharge stormwater and leachate from the former Pukengahu Landfill into an unnamed tributary of the Waihapa Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adoption of best practicable option	Not monitored during this period	Not assessed
2. Maintenance of cap and drainage systems	Not monitored during this period	Not assessed
3. Site to be operated in accordance with a 'Management Plan' that is to be within 3 months of granting of consent	Not monitored during this period	N/A
4. Component concentration limits on water quality after mixing	Not monitored during this period	Not assessed
5. General water quality after mixing	Not monitored during this period	Not assessed
6. Optional review	Next opportunity for review June 2022	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		N/A
Overall assessment of administrative performance in respect of this consent		N/A

N/A = not applicable

During the year, the environmental performance and administrative performance of SDC was not assessed in relation to their Pukengahu landfill resource consent.

4.4.2 Recommendation from the 2014-2015 Annual Report

In the 2014-2015 Annual Report, it was recommended:

THAT, in the 2015-2016 year, the triennial monitoring for the Pukengahu landfill remains unchanged, and it be noted that the monitoring is next scheduled to be implemented in the 2017-2018 period.

The monitoring programme was implemented as recommended.

4.4.3 Alterations to monitoring programmes for 2016-2017

In designing and implementing the monitoring programmes for air and 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;
- its obligations to monitor emissions and discharges and their effects under the RMA; and
- to report to the regional community.

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere and discharging to the environment.

It is proposed that for 2016-2017, the monitoring programme remains unchanged.

A recommendation to this effect is presented in Section 4.5 of this report, and summary of recommendations is given in Section 5.

4.5 Recommendation

1. THAT, in the 2016-2017 year, the triennial monitoring for the Pukengahu landfill remains unchanged, and it be noted that the monitoring is next scheduled to be implemented in the 2017-2018 period.

5. Summary of recommendations

1. THAT monitoring of the consented activities at the Stratford landfill in the 2016-2017 year continues at the same level as in 2015-2016 period.
2. THAT, in the 2016-2017 year, the triennial monitoring for the Huiroa landfill remains unchanged, and it be noted that the monitoring is next scheduled to be implemented in the 2017-2018 period.
3. THAT, in the 2016-2017 year, the triennial monitoring for the Pukengahu landfill remains unchanged, and it be noted that the monitoring is next scheduled to be implemented in the 2017-2018 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.
Bund	A wall around a tank to contain its contents in the case of a leak.
CBOD	Carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate.
cfu	Colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample.
COD	Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
Condy	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
Cu*	Copper.
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
FC	Faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m ³	Grammes per cubic metre, and equivalent to milligrammes 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
L/s	Litres per second.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
mS/m	Millisiemens per metre.
Mixing zone	The zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point.
NH ₄	Ammonium, normally expressed in terms of the mass of nitrogen (N).

NH ₃	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
NO ₃	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (for example 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.
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	<i>Resource Management Act 1991</i> and subsequent amendments.
SQMCI	Semi quantitative macroinvertebrate community index.
SS	Suspended solids.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
Zn*	Zinc.

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

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

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Appendix I

Resource consents held by Stratford District Council

**(For a copy of the signed resource consent
please contact the TRC consent department)**

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

Name of
Consent Holder: Stratford District Council
P O Box 320
STRATFORD 4352

Decision Date: 6 December 2010

Commencement
Date: 6 December 2010

Conditions of Consent

Consent Granted: To discharge leachate into land and into groundwater
adjacent to the Patea River at or about (NZTM)
1712119E-5644346N

Expiry Date: 1 June 2028

Review Date(s): June 2016, June 2022

Site Location: Swansea Road, Stratford

Legal Description: Lots 5-6 DP Pt Lot 4 DP 1942 Lot 2 DP 11213 Blk II
Ngaere SD [Discharge source & site]

Catchment: Patea

*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 to section 36 of the Resource Management Act.

Special conditions

1. The consent holder shall at all time adopt the best practical option as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site.
2. Before 31 March 2011 the consent holder shall submit a Landfill Maintenance and Contingency Plan to the satisfaction to the Chief Executive of the Taranaki Regional Council that;
 - a) sets out the requirements and scheduling for the maintenance of the landfill cap;
 - b) identifies all other structures on the site [drains, stock watering troughs, and groundwater bores etc] that require ongoing maintenance and sets out requirements and scheduling for their maintenance;
 - c) outlines the proposed responses to inadvertent exposure of refuse, significant cap disturbance, and leachate breakouts; and
 - d) provides a list of contact details for all appropriate staff and agencies to be contacted during an emergency at the site.
3. In addition to adhering to the Landfill Maintenance and Contingency Plan as required by condition 2, the consent holder shall at all times take all reasonable steps to ensure;
 - a) that the cap is contoured is maintained in a manner that prevents ponding, stormwater infiltration and minimises leachate production;
 - b) that the cap retains a reasonable cover of appropriate vegetation;
 - c) that any stock water troughs on the site are maintained to ensure that they do not leak or overflow;
 - d) that any existing drains or other diversion structures are kept clear and functional; and
 - e) that the cap depth is maintained to the original specifications as set out in the Swansea Street Sanitary Landfill Management Plan of 1992.

Consent 3889-3

4. That downstream of the discharge zone in the Patea River , beyond grid reference 1712256E-5644543N, the discharge shall not give rise to any of the following effects in the receiving waters of the Patea River:
 - a) the production of any conspicuous oil or grease films, scums or foams or floatable or suspended materials;
 - 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 effects of aquatic life.

5. 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 2016 and/or June 2022, 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 6 December 2010

For and on behalf of
Taranaki Regional Council

Director-Resource Management

TRK963890

DISCHARGE PERMIT

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

Name of STRATFORD DISTRICT COUNCIL
Consent Holder: PO BOX 320 STRATFORD

Renewal
Granted Date: 17 October 1996

CONDITIONS OF CONSENT

Consent Granted: TO DISCHARGE UP TO 230 CUBIC METRES/DAY [20 LITRES/SECOND] OF STORMWATER AND LEACHATE FROM A FORMER LANDFILL SITE ONTO AND INTO LAND IN THE VICINITY OF AN UNNAMED TRIBUTARY OF THE MAKURI STREAM IN THE PATEA CATCHMENT AT OR ABOUT GR: Q20:370-150

Expiry Date: 1 June 2016

Review Date[s]: June 2004 and June 2010

Site Location: HUIROA LANDFILL, DOUGLAS ROAD, DOUGLAS

Legal Description: ROAD RESERVE BLK IX NGATIMARU SD

Catchment: PATEA 343.000

Tributary: MAKURI 343.250
UNNAMED TRIBUTARY

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

TRK963890

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 the maintenance of 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 unnamed tributary of the Makuri Stream:
 - 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.
- 5. THAT the Taranaki Regional Council may review any or all of the conditions of this consent should further chemical sampling of the unnamed tributary of the Makuri Stream reveal levels of contamination resulting in or likely to result in significant adverse environmental effects.

TRK963890

6.THAT the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2004 and/or June 2010, 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 17 October 1996

For and on behalf of
TARANAKI REGIONAL COUNCIL

OPERATIONS MANAGER

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

Name of
Consent Holder: Stratford District Council
PO Box 320
Stratford 4352

Decision Date: 16 June 2016

Commencement Date: 16 June 2016

Conditions of Consent

Consent Granted: To discharge stormwater and leachate from the former Huiroa landfill onto and into land in the vicinity of an unnamed tributary of the Makuri Stream

Expiry Date: 1 June 2034

Review Date(s): June 2022, June 2028

Site Location: Huiroa Landfill, Douglas Road, Huiroa

Grid Reference (NZTM) 1726881E-5653373N

Catchment: Patea

Tributary: Makuri

*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 all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

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 landfill cap and stormwater and leachate drainage systems shall be maintained in a manner that:
 - a) minimises stormwater infiltration into the filled area; and
 - b) ensures stormwater is adequately diverted and/or drained away from the landfill cap.
3. The site shall be operated in accordance with a 'Management Plan' prepared by the consent holder within 3 months of granting of this consent, and approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity. The plan shall detail how the site will be managed to achieve compliance with the conditions of this consent and shall include but not be limited to:
 - a) specifying the consent holders monitoring schedule for the site;
 - b) maintenance of the landfill cap to minimise ponding and stormwater infiltration;
 - c) maintenance and management of the stormwater drains on and around the landfill to ensure stormwater is adequately diverted and/or drained away from the landfill cap.
4. After reasonable mixing the receiving waters of the unnamed tributary of the Makuri Stream downstream of the discharge shall meet the following standards:
 - a) unionised ammonia concentration less than 0.025 g/m³;
 - b) ammoniacal nitrogen level concentration less than 0.9 g/m³;
 - c) pH within the range of 6.0 and 9.0; and
 - d) dissolved zinc concentration less than or equal to 0.05 g/m³.
5. The discharge shall not cause the following effects in the receiving waters of the unnamed tributary of the Makuri Stream;
 - 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.

Consent 3890-3.0

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 2022 and/or June 2028 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 16 June 2016

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

TRK983891

DISCHARGE PERMIT

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

Name of STRATFORD DISTRICT COUNCIL
Consent Holder: PO BOX 320 STRATFORD

Renewal
Granted Date: 12 February 1998

CONDITIONS OF CONSENT

Consent Granted: TO DISCHARGE UP TO 910 CUBIC METRES/DAY [84 LITRES/SECOND] OF STORMWATER AND LEACHATE FROM THE FORMER PUKENGAHU LANDFILL INTO AN UNNAMED TRIBUTARY OF THE WAIHAPA STREAM IN THE PATEA CATCHMENT AT OR ABOUT GR: Q20:292-016

Expiry Date: 1 June 2016

Review Date[s]: June 2004 and June 2010

Site Location: FORMER LANDFILL, WINGROVE ROAD, STRATFORD

Legal Description: ROAD RESERVE WINGROVE ROAD PUKENGAHU BLK VII
NGAERE SD

Catchment: PATEA 343.000

Tributary: WAIHAPA 343.280
UNNAMED TRIBUTARY

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

TRK983891

General conditions

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

Special Conditions

- 1. THAT the consent holder shall ensure, to the satisfaction of the General Manager, Taranaki Regional Council, that:
 - a) the site contours are maintained so that no ponding, damming or retention of water occurs on the site;
 - b) the integrity of the cover is maintained so as to minimise infiltration of stormwater; and
 - c) access to the site is restricted so that illegal dumping of wastes is discouraged.
- 2. THAT allowing for a mixing zone of 50 metres downstream of the discharge, the discharge shall not give rise to any of the following effects in the unnamed tributary of the Waihapa Stream:
 - 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 effects on aquatic life.
- 3. THAT the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 2004 and/or June 2010, 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 that time.

Signed at Stratford on 12 February 1998

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: Stratford District Council
PO Box 320
Stratford 4352

Decision Date: 16 June 2016

Commencement Date: 16 June 2016

Conditions of Consent

Consent Granted: To discharge stormwater and leachate from the former Pukengahu Landfill into an unnamed tributary of the Waihapa Stream

Expiry Date: 1 June 2034

Review Date(s): June 2022, June 2028

Site Location: Wingrove Road, Pukengahu

Grid Reference (NZTM) 1719066E-5639665N

Catchment: Patea

Tributary: Waihapa

*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 all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

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 landfill cap and stormwater and leachate drainage systems shall be maintained in a manner that:
 - a) minimises stormwater infiltration into the filled area; and
 - b) ensures stormwater is adequately diverted and/or drained away from the landfill cap.
3. The site shall be operated in accordance with a 'Management Plan' prepared by the consent holder within 3 months of granting of this consent, and approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity. The plan shall detail how the site will be managed to achieve compliance with the conditions of this consent and shall include but not be limited to:
 - a) specifying the consent holders monitoring schedule for the site;
 - b) maintenance of the landfill cap to minimise ponding and stormwater infiltration;
 - c) maintenance and management of the stormwater drains on and around the landfill to ensure stormwater is adequately diverted and/or drained away from the landfill cap.
4. After reasonable mixing the receiving waters downstream of the discharge shall meet the following standards:
 - a) unionised ammonia concentration less than 0.025 g/m³;
 - b) ammoniacal nitrogen level concentration less than 0.9 g/m³;
 - c) pH within the range of 6.0 and 9.0; and
 - d) dissolved zinc concentration less than or equal to 0.05 g/m³.
5. The discharge shall not cause the following effects in the receiving waters after reasonable mixing:
 - 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.

Consent 3891-3.0

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 2022 and/or June 2028 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 16 June 2016

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Appendix II
Biomonitoring report

To Technical Officer, Rae West
From Scientific Officer, Darin Sutherland
Doc No 1668921
Report No DS045
Date April 2016

Summer biomonitoring of the Patea River in relation to the Stratford District Council's upgraded Wastewater Treatment Plant, February 2016

Introduction

The upgrading of the wastewater treatment plant (WWTP) completed in 2009, required by conditions attached to the renewed consent 0196 (TRC, 2013), has been the subject of an additional investigative assessment of the upgrade's effectiveness in terms of system performance and its impacts on the receiving waters of the Patea River. A component of the assessment included two spring biomonitoring surveys of the river specifically in association with the upgraded treatment system and relocated, improved outfall structure (some 600 m downstream of the sealed-off original outfall). The summer survey (CF486) performed soon after completion of the WWTP upgrade, and the subsequent spring, 2009 (CF491), scheduled summer, 2010 (CF501), spring, 2010 (CF517), and summer, 2011 (CF526) surveys completed the requisite assessments. Subsequently, summer surveys (including the current survey) have been requirements of scheduled monitoring programmes for compliance monitoring purposes.

Methods

The standard '400 ml kick sampling' technique was used to collect streambed (benthic) macroinvertebrates from three established sites and one more recently established site in the Patea River (illustrated in Figures 1 and 2), on 29 February 2016.

These sites were:

Site No	Site code	GPS reference	Location
1	PAT 000315	E1711801 N5644382	Swansea Road bridge (upstream of landfill and oxidation ponds' discharge)
2	PAT 000330	E1712403 N5644580	Upstream of WWTP discharge (and downstream of landfill)
3a	PAT 000350	E1712956 N5644292	Approximately 130 m downstream of the WWTP new outfall
4	PAT 000356	E1714497 N5645112	Approximately 1 km upstream of the Kahouri Stream confluence

The upgrade to the WWTP system had included a new outfall (via rock rip-rap) to the river located a further 600m downstream of the original discharge point. The original site 3 was not required for the purpose of the current survey as no discharge from the sealed 'old' outfall was occurring at the time nor had any recent leakages occurred.

This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWWG 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) = 20-99 individuals;
- VA (very abundant) = 100-499 individuals;
- XA (extremely abundant) = 500 or more individuals

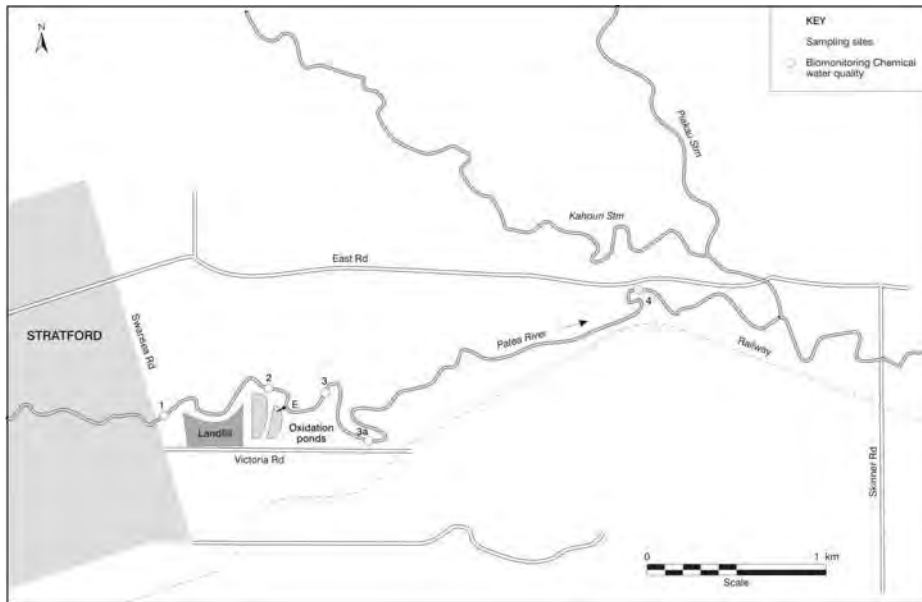


Figure 1 Biomonitoring sites in the Patea River in relation to Stratford landfill and oxidation ponds discharge



Figure 2 Aerial photo of site and location of sampling sites

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. By averaging the scores obtained from a list of taxa collected 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 difference of 11 units or more in MCI values is considered significantly different (Stark 1998).

A semi-quantitative MCI value, SQMCIs (Stark 1999) 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 scores, and dividing by the sum of the loading factors. 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).

Where necessary sub-samples of algal and detrital material taken from the macroinvertebrate samples were scanned 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 or river.

Results

Site habitat characteristics and hydrology

This summer survey was performed under moderately low flow conditions (approximately half median flow), 11 days after a fresh in excess of both 3 times and 7 times median flow in the Patea River (flow gauging site at the Patea River at Skinner Road). The survey followed a relatively dry period where only one extremely large fresh (31 times median flow) was recorded over the preceding month.

The water temperatures during the survey were in the range 17.4-18.0 °C. Water levels were low and water speed was swift. The water was uncoloured and clear. The substrate at all four sites comprised gravel/cobble/boulder.

Site 1 had no periphyton but there was patchy moss, leaves and wood. Site 2 also had no periphyton and there were patchy leaves on the streambed. Site 3a had patchy algal mats and filamentous algae, and there were again patchy leaves on the streambed. Site 4 had patchy periphyton and widespread filamentous algae on the streambed. There was also patchy moss and leaves. Only site 3a did not have partial shading and overhanging vegetation.

Macroinvertebrate communities

A summary of the results of previous surveys is presented in Table 1.

Table 1 Summary of macroinvertebrate taxa numbers and MCI values for previous surveys performed between February 1985 and March 2015

Site No.	N	No of taxa			MCI value			SQMCI _s value		
		Median	Range	Feb 2016	Median	Range	Feb 2016	Median	Range	Feb 2016
1	47	26	20-33	21	110	98-130	113	5.9	3.2-7.6	6.3
2	33	24	11-36	17	105	95-119	111	5.6	3.6-7.8	6.9
3a	10	26	21-29	24	101	95-116	113	5.9	3.4-7.1	5.0
4	42	24	17-31	21	99	82-116	93	4.1	2.3-7.2	3.3

Survey results since February 1986 are illustrated in Figure 2, while the results of the current survey are presented in Table 2 and discussed beneath.

Table 2 Macroinvertebrate fauna of the Patea River in relation to Stratford District Council WWTP discharge and closed landfill leachate discharges sampled on 29 February, 2016

Taxa List	Site Number	MCI score	1	2	3a	4	
	Site Code		PAT000315	PAT000330	PAT000350	PAT000356	
	Sample Number		FWB16100	FWB16101	FWB16103	FWB16104	
ANNELIDA (WORMS)	Oligochaeta	1	R	R	C	C	
	Lumbricidae	5	-	-	-	R	
MOLLUSCA	<i>Potamopyrgus</i>	4	-	R	R	R	
CRUSTACEA	<i>Paracalliope</i>	5	-	-	-	R	
EPHEMEROPTERA (MAYFLIES)	<i>Ameletopsis</i>	10	-	-	R	-	
	<i>Austroclima</i>	7	R	R	R	-	
	<i>Coloburiscus</i>	7	VA	A	A	R	
	<i>Deleatidium</i>	8	VA	VA	VA	A	
	<i>Nesameletus</i>	9	C	R	R	-	
	<i>Zephlebia group</i>	7	-	-	R	-	
	<i>Megaleptoperla</i>	9	-	-	R	-	
PLECOPTERA (STONEFLIES)	<i>Zelandoperla</i>	8	R	R	-	-	
	Elmidae	6	A	A	C	C	
COLEOPTERA (BEETLES)	Hydraenidae	8	A	C	R	R	
	MEGALOPTERA (DOBSONFLIES)	<i>Archichauliodes</i>	7	C	C	R	R
TRICHOPTERA (CADDISFLIES)	<i>Hydropsyche (Aoteapsyche)</i>	4	VA	A	A	A	
	<i>Costachorema</i>	7	R	R	R	R	
	<i>Hydrobiosis</i>	5	R	C	-	R	
	<i>Neurochorema</i>	6	R	-	-	-	
	<i>Beraeoptera</i>	8	R	-	R	-	
	<i>Confluens</i>	5	R	-	-	R	
	<i>Oxyethira</i>	2	-	-	R	R	
	<i>Pycnocentroides</i>	5	C	-	R	-	
DIPTERA (TRUE FLIES)	<i>Aphrophila</i>	5	A	C	C	C	
	<i>Maoridiamesa</i>	3	R	-	C	C	
	Orthocladiinae	2	R	R	VA	VA	
	Tanypodinae	5	-	-	R	-	
	Tanytarsini	3	-	R	C	C	
	Empididae	3	-	-	-	C	
	<i>Austrosimulium</i>	3	R	R	C	C	
	Stratiomyidae	5	R	-	-	-	
ACARINA (MITES)	Acarina	5	-	-	R	R	
No of taxa			21	17	24	21	
MCI			113	111	113	93	
SQMCI_s			6.3	6.9	5.0	3.3	
EPT (taxa)			12	8	11	6	
%EPT (taxa)			57	47	46	29	
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa			

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

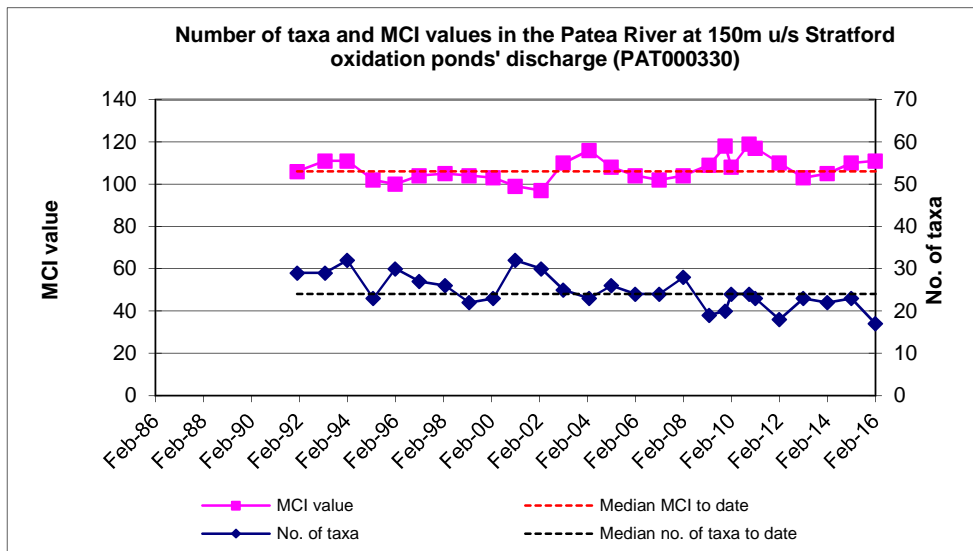
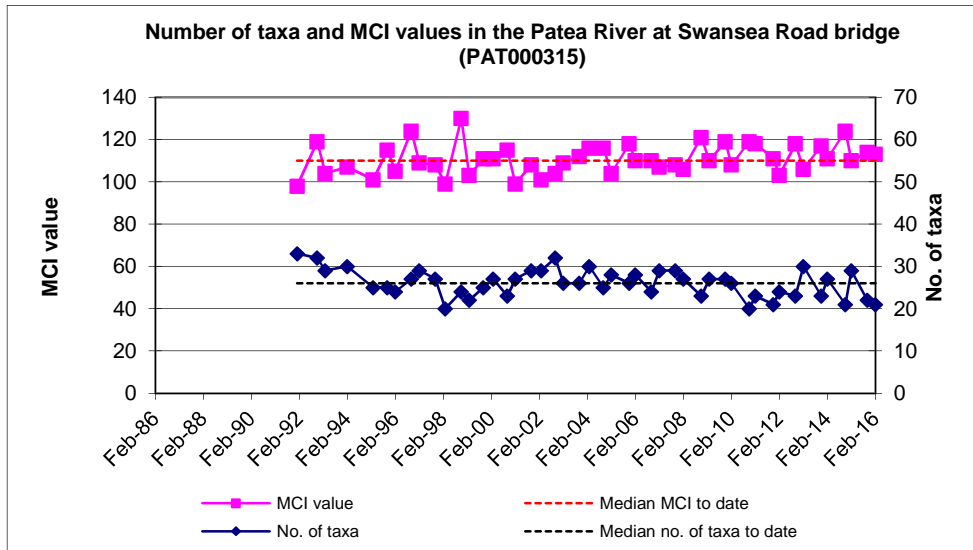


Figure 3 Taxa richness and MCI scores recorded to date at the Patea River sites upstream of the WWTP discharge

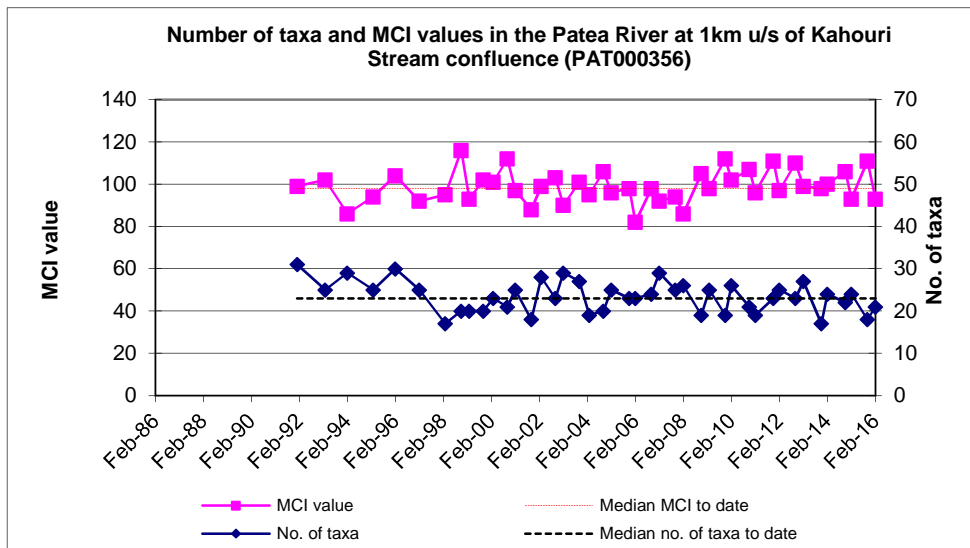
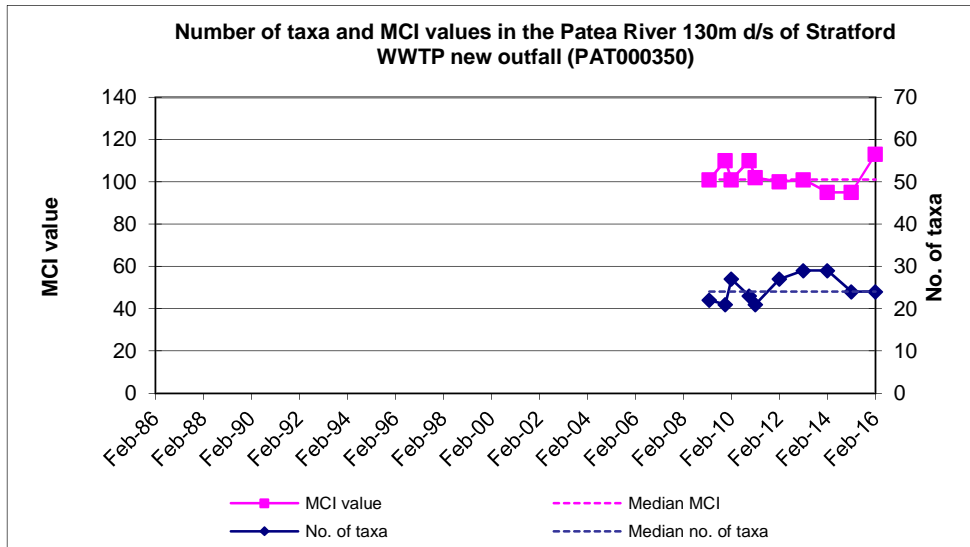


Figure 4 Taxa richness and MCI scores recorded to date at the Patea River sites downstream of the WWTP discharge

Site 1 (Swansea Road)

A moderate macroinvertebrate community richness of 21 taxa was found at site 1 ('primary control' site) at the time of the summer survey (Table 1).

The MCI score of 113 units indicated a community of 'good' biological health which was not significantly different (Stark, 1998) to the median MCI score of 110 units. The MCI score was very similar to the preceding survey on October 2015 (114 units). Predicted score for the site using the equation $MCI=130.230 - 1.411 \cdot D$ (D= distance from source) was 112 units. The SQMCI_S score of 6.3 units was also similar to the median SQMCI_S score of 5.9 units (Table 1).

The community was dominated by three 'very abundant' taxa which included one 'tolerant' taxon [caddisfly (*Hydropsyche/Aoteapsyche*)], one moderately sensitive taxon [mayfly (*Coloburiscus*)] and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 2).

Site 2 (upstream of original oxidation ponds outfall)

A moderately low macroinvertebrate community richness of 17 taxa was found at site 2 ('secondary control' site) at the time of the survey (Table 1).

The MCI score of 111 units indicated a community of 'good' biological health which was not significantly different (Stark, 1998) to the median MCI score of 105 units. The MCI score was very similar to the preceding survey on October 2015 (110 units). Predicted score for the site using the equation $MCI=130.230 - 1.411 \cdot D$ (D= distance from source) was 111 units. The SQMCI_S score of 6.9 units was higher than the median SQMCI_S score of 5.6 units (Table 1).

The community was dominated by one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 2).

Site 3a (130m downstream of new WWTP riprap outfall)

A moderate macroinvertebrate community richness of 24 taxa was found at site 3a ('primary impact' site) at the time of the survey (Table 1).

The MCI score of 113 units indicated a community of 'good' biological health which was significantly higher (Stark, 1998) than the median MCI score of 101 units. The MCI score was significantly higher than the preceding survey on February 2015 (95 units). Predicted score for the site using the equation $MCI=130.230 - 1.411 \cdot D$ (D= distance from source) was 109 units. The SQMCI_S score of 5.0 units was lower than the median SQMCI_S score of 5.9 units (Table 1).

The community was dominated by two 'very abundant' taxa which included one 'tolerant' taxon [midges (Orthocladiinae)] and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 2).

Site 4 (upstream of discharge at East Road)

A moderate macroinvertebrate community richness of 21 taxa was found at site 4 ('secondary impact' site) at the time of the survey (Table 1).

The MCI score of 93 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the median MCI score of 99 units. The MCI score was significantly lower than the preceding survey on October 2015 (111 units). Predicted score for the site using the equation $MCI=130.230 - 1.411 \cdot D$ (D= distance from source) was 106 units

which was significantly more than the observed result. The SQMCI_s score of 3.3 units was lower than the median SQMCI_s score of 4.1 units (Table 1).

The community was dominated by one 'very abundant' 'tolerant' taxon [midges (Orthocladiinae)].

Riverbed heterotrophic growth assessment

Microscopic assessment of material from the riverbed at the four sampling sites indicated that there were no unusual heterotrophic growths present in the river at the two upstream and two downstream sites. This was consistent with the visual absence of such growths noted at all sites at the time of the survey.

Discussion and conclusions

Macroinvertebrate richnesses were slightly lower than historical medians which may have been due to the very large fresh which occurred only 11 days prior to the survey. Differences among sites were not particularly large though there was a seven taxa increase between sites 2 and 3a. Often, nutrient enrichment can raise taxa numbers in rivers with relatively good water quality.

The MCI scores categorised sites 1, 2 and 3a as having 'good' generic river health with the furthest downstream site (site 4) only being of 'fair' health. Considering the considerable distance site 4 is from the discharge (approximately 2.5 km) its use as an 'impact' site is questionable and a new site should be established a short distance downstream of site 3a.

This survey was relatively consistent with river health recorded by previous surveys except that the macroinvertebrate community at the 'primary impact' site was in better health than normal, strongly indicating that there had been no impacts from the Stratford WWTP. MCI scores were relatively consistent with expected values for the Patea River except for the most downstream site which was in significantly worse condition, probably as a result of nutrient enrichment occurring between the WWTP discharge and the site (Stark and Fowles, 2009).

There were several significant changes in individual taxon abundances including amongst some dominant taxa as reflected in a reduction in SQMCI_s value between sites 2 and 3a of 1.9 units and sites 2 and 4 of 3.6 units. These lower SQMCI_s scores at sites 3a and 4 (2.5 km downstream of the wastewater discharge) reflected lower abundances in certain 'highly sensitive' taxa, particularly some mayfly taxa, and increased numbers within 'tolerant' taxa, particularly chironomid midges. Both downstream sites had 'very abundant' orthoclad midges which feed on streambed algae and are often abundant in unshaded, nutrient enriched streams with substantial algal growths.

Microscopic assessment of material from the riverbed at the four sampling sites indicated that there were no unusual heterotrophic growths present in the river at the two upstream and two downstream sites. This was consistent with the visual absence of such growths noted at all sites at the time of the survey.

Effects of discharges on the macroinvertebrate communities of the Patea River vary in relation to the treatment provided by the WWTP, dilution available in the receiving waters, preceding climatic conditions and the microfloral component of the wastewaters. Such variations in effects have been documented by previous summer biomonitoring surveys.

Overall, the results of this summer macroinvertebrate survey indicated that the discharge from the Stratford wastewater treatment plant and leachate from the closed Stratford landfill site had not had any recent significant detrimental effects on the macroinvertebrate communities of the Patea River. A noticeable deterioration in condition at the most downstream site was likely due to nutrient enrichment from adjacent farmland and unrelated to the discharges, and ideally a 'secondary impact' site should be established closer to the discharge point.

Summary

The Council's standard 'kick-sampling' technique was used at four established sites to collect streambed macroinvertebrates from the Patea River. Samples were sorted and identified and the number of taxa (richness), MCI score, and SQMCI_s score were calculated for each site.

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

Macroinvertebrate richnesses were slightly lower than historical medians which may have been due to a large fresh. The MCI scores categorised sites 1, 2 and 3a as having 'good' generic river health while site 4 only being of 'fair' health. However, all values were not significantly different to historical median or expected values apart from site 3a being higher than normal and site 4 being lower than expected which suggests that there was no impact from the Stratford WWTP discharges and that site 4 is positioned too far away (2.5 km) from the discharge point to be useful as a 'secondary impact' site and should be shifted further upstream. Furthermore, no undesirable heterotrophic growths were found on the substrate of the river at the sites surveyed downstream of the discharge.

Overall, the survey indicated that the discharge from the Stratford wastewater treatment plant and leachate from the closed Stratford landfill site had not had any recent significant detrimental effects on the macroinvertebrate communities of the Patea River.

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