

Stratford District Council
Stratford WWTP
Monitoring Programme
Annual Report
2018-2019

Technical Report 2019-53

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Executive summary

The Stratford District Council (SDC) operates a municipal wastewater treatment plant (WWTP) located on Victoria Road at Stratford, in the Patea catchment. This report for the period July 2018 to June 2019 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess SDC's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of SDC's activities.

SDC holds one resource consent to discharge treated wastewater to the Patea River, which includes a total of 12 conditions setting out the requirements that they must satisfy.

During the monitoring period, SDC demonstrated an overall 'improvement required' level of environmental performance.

The Council's monitoring programme for the year under review included four inspections, wastewater analyses, and physicochemical and biological surveys of the receiving waters of the Patea River.

In recent years, improvements in SDC's maintenance programme have generally enhanced the appearance of the plant and effectively controlled any produced odour. No complaints were received in relation to the operation of the WWTP. Regular inspections indicated no immediate problems with the performance of the plant, with no overflows recorded during the monitoring year. Wastewater and river quality was good at the time of the low flow summer receiving water physicochemical survey. However, spring and summer biomonitoring surveys indicated a continuation of an ecologically significant impact on macroinvertebrate health between sites that were upstream and downstream of the effluent point, coincident with discharges from the Stratford WWTP.

During the year, SDC demonstrated an 'improvement required' level of environmental and a high level of administrative performance with the resource consents. Biological effects from the discharge on the receiving waters continue to be recorded, with impacts on macroinvertebrate communities noted in the downstream mixing zone. The desirability of reducing such effects within the receiving waters has been recognised for some years, and the current short-term consent (now subject to a renewal process) is providing an opportunity for further targeted assessment for improvement, beyond those that have already been put into effect in the most recent period.

For reference, in the 2018-2019 year, consent holders were found to achieve a high level of environmental performance and compliance for 83% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 13% of the consents, a good level of environmental performance and compliance was achieved.

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 good level.

This report includes recommendations for the 2019-2020 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 2018 to June 2019 by the Council describing the monitoring programme associated with the resource consent held by Stratford District Council (SDC). SDC operates a municipal wastewater treatment plant (WWTP) situated on Victoria Road at Stratford.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consent held by the SDC that relate to the discharge of treated wastewater in the Patea catchment. This is the 32nd annual report to be prepared by the Council to cover SDC's discharge and its effects.

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 *Resource Management Act 1991* (RMA) and the Council's obligations;
- the Council's approach to monitoring sites through annual programmes;
- the resource consents held by SDC in the Patea catchment;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted at the Stratford WWTP.

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

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

Section 4 presents recommendations to be implemented in the 2019-2020 monitoring year.

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

1.1.3 The Resource Management Act 1991 and monitoring

The 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 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the Company, this report also assigns them a rating for 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 Company's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (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 interpretation, are as follows:

Environmental Performance

High: No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving 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 during investigations of incidents reported to the Council by a third party, 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 during investigations of incidents reported to the Council by a third party. 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 during investigations of incidents reported

to the Council by a third party. 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 failure to do this had trivial consequences and were addressed promptly and co-operatively.

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

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

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

For reference, in the 2018-2019 year, consent holders were found to achieve a high level of environmental performance and compliance for 83% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 13% of the consents, a good level of environmental performance and compliance was achieved.¹

1.2 WWTP system

Stratford town sewage is treated by an oxidation pond system (Photo 1) and combined successive maturation cell system (2.6 ha and 1.7 ha in area), that was upgraded in 2009. Changes made to the system during the upgrade included:

- flow recorder installation at the inflow structure to the primary pond;
- splitter chamber replaced with an influent chamber (to prevent overflows);
- installation of a step screen system at the influent;
- relocation of the tanker waste disposal area to Esk Road;
- a new trade waste connection from the regional stockyards on Esk Road into the system; and
- improvements to the pond system itself.

¹ The Council has used these compliance grading criteria for 15 years. They align closely with the 4 compliance grades in the MfE Best Practice Guidelines for Compliance, Monitoring and Enforcement, 2018

A full history of the pond system and upgrade process can be found in the 2014-2015 annual report (TRC, 2015). Some industrial wastes are also discharged into the system, which includes an influent chamber fitted with a permanent flow-recording device.



Photo 1 Stratford WWTP

1.2.1 Inflow and infiltration reduction

SDC continue to report on progress with the implementation of the inflow and infiltration reduction programme to minimise stormwater inflow. This programme includes visual infiltration surveys in winter and summer, followed by CCTV surveys within the reticulation to determine sections requiring repairs or replacement.

During the 2018-2019 year, SDC relined 588 meters of earthenware sewer pipe with PVC pipe. In conjunction with the work fiberglass inserts were installed to ensure proper seals were achieved. Five manholes were sealed to prevent groundwater entering the system.

The pipe lining and manhole rehabilitation work was completed at a cost of \$183,500.

1.3 Resource consents

SDC holds one resource consent, the details of which are summarised in the table below. Summaries of the conditions attached to the permit are set out in Section 3 of this report. The consent expired on 1 June 2016 but SDC continues to operate under the consent as per Section 124 of the RMA while the consent renewal is processed.

A summary of the various consent types issued by the Council is included in Appendix I, as is a copy of the permit held by the SDC during the period under review.

Table 1 Resource consent held by SDC for the Stratford WWTP

Consent number	Purpose	Granted	Review	Expires
0196-4	To discharge treated wastewater from the Stratford WWTP into the Patea River	November 2013	-	June 2016

1.4 Monitoring programme

1.4.1 Introduction

Section 35 of the RMA sets 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 monitoring programme for the Stratford WWTP consisted of four primary components.

1.4.2 Programme liaison and management

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

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

1.4.3 Site inspections

The Stratford WWTP was visited four times during the monitoring period. The main points of interest were plant operation, maintenance, upgrades, and performance and the discharges of treated wastewater. These inspections provided for the operation, internal monitoring, and supervision of the plant to be reviewed by the Council.

1.4.4 Chemical sampling

The Council undertook sampling of the discharge from the site, as well as the water quality either side of the discharge point and mixing zone.

The Stratford WWTP final effluent from the maturation cells was sampled for dissolved oxygen and microfloral component on four occasions; and for pH, conductivity, BOD, SS, turbidity, faecal coliform, nutrient and metal analyses on one occasion in summer.

Sampling of the Patea River either side of the discharge was carried out on four occasions, and the samples analysed for BOD, chloride, pH, turbidity, and nutrient analyses. Additional bacteriological (faecal coliform) and metal analyses were included during one sampling occasion under summer low flow conditions.

1.4.5 Biomonitoring surveys

Two biological surveys were performed in the Patea River (one spring, one summer), to determine whether or not the discharge of treated wastewater from the site has had a detrimental effect upon the communities of the stream.

2 Results

2.1 Inspections

27 August 2018

The step screen was operating and wastes were fully contained. The influent flow rate was 114 m³/hr. A trade waste sampler has been installed and was operating, and contractors were installing influent and effluent flow meters. All four aerators were operating, creating a swift pond circulation. The pond surface was free of scum and wavebands were relatively clear of debris. The pond level was slightly higher than normal and was a light green brown colour.

The secondary treatment cell levels were fairly high after recent rainfall. Cell 1 was flowing via the open channels on top of the dividing walls. All cells were relatively clear and pale green in colour. No odours were noted around the ponds.

The discharge flow rate into Patea River was estimated at approximately 40 L/s, with no visual environmental impact at the point of discharge.

The Esk Rd septic wastes unloading facility was found to be satisfactory with no odour issues noted.

16 October 2018

The step screen was operating and wastes were fully contained. It was noted that improved housekeeping was required around this area to minimize the odour that was noticeable from some distance. The influent flow rate was 64 m³/hr. The four aerators were operating, creating a swift pond circulation. No scum was noted on the pond surface and wavebands were relatively clear of debris. It was noted that gorse was becoming established between the ponds. The pond was at a normal level and turbid brown in colour. An auto sampler had been installed on the outlet of the main pond. Debris was noted around the outlet screen.

The level in cells 1 and 2 was slightly lower than normal. All cells were slightly turbid and green brown in colour. Wave erosion was noticeable, mainly between cells 2 and 3. No significant downwind odour was noted.

The discharge flow rate into Patea River was estimated at approximately 40 L/s, and there was no visual environmental impact at the point of discharge.

The Esk Road septic wastes unloading facility was found to be satisfactory with no odour issues noted.

23 January 2019

The step screen was operating and wastes were fully contained. The influent flow rate was 41 m³/hr. The primary pond was a turbid dark brown and all aerators were operating. Numerous wildlife was present, with an estimated 1000+ mallard and paradise ducks on the pond surface. SDC was advised that the bird population needed to be controlled and it was suggested by the inspecting officer that they contact Fish & Game for advice on control measures. Removal of gorse and weeds was required from around the pond perimeter, including pond bunds and cell dividing walls.

The effluent discharge into the Patea River was estimated at approximately 15 L/s and there was a small but noticeable reduction in the black disc measurement downstream from the discharge.

The Esk Road unloading facility was also inspected and found to be satisfactory.

2 May 2019

The step screen was found to be raised above the influent channel due to a high influent flow rate (243 m³/hr (68 L/s). The high influent flow rates appear to be related to significant stormwater ingress, despite the implementation of the Inflow and Infiltration Reduction Programme. Wastes were covered and fully

contained and there was minimal odour around the area. All aerators were operating and the pond was a slightly turbid, green brown. The pond level was relatively high as the outlet screen was partially blocked by debris from the pond. SDC was asked to ensure this is checked and cleared, especially during periods of high flows. Numerous black swans and mallard and teal ducks were present. There was direct flow between cells 1 and 2 via overtopping channels on top of the dividing walls. The cells also had numerous black swans and mallard and teal ducks present

The treated effluent discharge flow rate into the Patea River was estimated at 60 L/s, with no significant visual environmental effect at the point of discharge. Overall the SDC WWTP and surrounds were found to be satisfactory with no significant odour noted. Gorse and weeds from around the pond perimeter including the pond bunds had recently been sprayed.

The Esk Road trade waste facility was inspected and found to be compliant.

2.2 Results of effluent monitoring

Effluent analysis for dissolved oxygen (Section 2.2.1) and microfloral component (Section 2.2.2) was carried out at the outlet of the tertiary maturation cell on all four inspection occasions. Samples were also analysed for BOD, chloride, conductivity, faecal coliform bacteria, pH, suspended solids, turbidity, temperature, unionised ammonia (NH₃), ammonia-N (NH₄), nitrate-nitrite nitrogen (NNN), dissolved reactive phosphorus (DRP), and metal analyses on one occasion in summer. These results are presented in Table 2.

Table 2 Results of effluent monitoring on 23 January 2019 at site OXP005002

Parameter	Unit	Result	2009-2018 Range
BOD	g/m ³	12	20 - 58
BODCF	g/m ³	2.7	2.9 - 45
Chloride	g/m ³	30	11.7 - 35.2
Conductivity	mS/m@25°C	37.3	*
E. coli	/100ml	1,789	8,660
pH	pH	8.2	7.1 - 8.8
SS	g/m ³	57	5.0 - 86
Turbidity	NTU	25	5.7 - 71
Temperature	°C	19.3	6.2 - 22.1
Nutrient Analyses			
NH ₃	g/m ³	0.40	0.0438 - 0.4699
NH ₄	g/m ³ N	7.8	0.870 - 25.4
NNN	g/m ³ N	0.85	1.13 - 4.28
DRP	g/m ³ P	2.7	0.695 - 4.97
Metal Analyses (acid soluble)			
Cadmium	g/m ³	<0.0010	<0.005 - 0.005
Chromium	g/m ³	<0.010	<0.03 - 0.03
Zinc	g/m ³	<0.02	0.008 - 0.035
Appearance	Turbid, dark brown		

* Conductivity previously measured at 20°C

The tertiary cell effluent quality (Table 2) was typical of a well-treated secondary oxidation pond waste with low filtered BOD₅ and moderate suspended solids levels and faecal coliform bacteria number. Nutrient levels were typical of the secondary oxidation pond treated effluent.

Metal concentrations were less than minimum detectable levels. None of these metals' concentrations measured in the effluent at the time of the survey would be expected to exceed toxic levels for aquatic fauna given the dilution provided in the receiving waters of the Patea River.

2.2.1 Dissolved oxygen levels

The dissolved oxygen (DO) concentration in WWTPs varies both seasonally and during the day as a result of a combination of factors. The photosynthetic activity of the pond's microflora together with fluctuations in influent waste loadings on the system are the major influencing factors. Minimum DO concentrations are generally recorded in the early hours of daylight, and therefore pond performance has been evaluated by standardising sampling times toward mid-morning for all regular inspection visits during the monitoring period.

The Stratford WWTP effluent was analysed for DO, chloride and temperature, and the results are displayed in Table 3.

Table 3 Dissolved oxygen measurements from the Stratford WWTP

Date	Time (NZST)	Temperature (°C)	Chloride (g/m ³)	Dissolved Oxygen	
				Concentration (g/m ³)	Saturation (%)
27 Aug 2018	09:30	11.6	14	5.1	48
16 Oct 2018	08:45	14.8	24	3.5	35
23 Jan 2019	09:00	19.3	30	7.4	88
2 May 2019	09:35	12.9	15	1.3	12

Results in Table 3 indicate a relatively wide range of DO concentrations (between 12% and 88% saturation) in the surface layer of the tertiary maturation cell near the outlet. This was typical of the results generally recorded at this point (i.e. supersaturation is seldom recorded), and indicates that DO was present at all times in the surface layer of the cell. The highest DO reading was recorded during summer, in conjunction with a high chlorophyll-a level (indicating a significant phytoplankton component). The variation in saturation levels measured to date has been typical of a biological treatment system in which the photosynthetic contribution of the microfloral population often causes wide dissolved oxygen variations.

2.2.2 Microfloral component

Pond microflora are very important for the stability of the symbiotic relation between aerobic bacteria in the pond. These phytoplankton may be used as a bio-indicator of pond conditions, for example cyanobacteria are often present in under-loaded conditions and chlorophyceae are present in over-loaded conditions. To maintain facultative conditions in a pond system, there must be an algal community present in the surface layer.

The principal function of algae is the production of oxygen which maintains aerobic conditions while the main nutrients are reduced by biomass consumption. Elevated pH (due to algal photosynthetic activity) and solar radiation combine to reduce faecal bacteria numbers significantly.

Samples of the tertiary cell effluent were collected on all inspections for chlorophyll-a analyses. Chlorophyll-a concentration can be a useful indicator of the algal population present in the system. Pearson (1996) suggested that a minimum in-pond chlorophyll-a concentration of 300 mg/m³ was necessary to maintain

stable facultative conditions. However, seasonal change in algal populations and also dilution by stormwater infiltration might be expected to occur in any WWTP which, together with fluctuations in waste loadings, would result in chlorophyll-a variability.

The results of the maturation cell effluent analyses are provided in Table 4 together with field observations of pond appearance.

Table 4 Chlorophyll-a levels and tertiary cell appearance

Date	Time (NZST)	Appearance	Chlorophyll-a (mg/m ³)	Range for the period 2013-2018	
				Range	Median
27 Aug 2018	09:30	Clear, pale green brown	50	4.6 - 474	89
16 Oct 2018	08:45	Turbid brown	53		
23 Jan 2019	09:00	Turbid, dark brown	520		
2 May 2019	09:35	Slightly turbid, green brown	45		

Relatively poor microfloral populations were indicated by low chlorophyll-a concentrations in the cooler months. These results have been attributed to wet weather conditions and stormwater dilution through the WWTP system. The summer concentration was higher, indicating a significant phytoplanktonic component.



Photo 2 View of Stratford WWTP primary pond with aerators operating

2.3 Results of receiving environment monitoring

Monitoring of the impacts of the Stratford WWTP on the receiving waters was measured using both chemical analyses of the receiving waters of the Patea River beyond the boundary of the mixing zone, and biological monitoring surveys at the same locations. Chemical sampling was carried out on four occasions

during the 2018-2019 period (Section 2.3.1). Two biomonitoring surveys were conducted, one during spring 2018 and one in summer 2019 (Section 2.3.2). The locations of sampling sites are listed in Table 5 and displayed in Figure 1 below.

Table 5 Location of sampling sites

Site no.	Location	Site code
1	At Swansea Road bridge (u/s of landfill and WWTP discharges)	PAT000315
2	Approx. 250 m d/s of the WWTP original discharge (and 350 m u/s of the new outfall)	PAT000345
(Discharge)	At discharge point from rock riprap outfall	OSP005002
3a	Approx. 130 m d/s of the WWTP new outfall	PAT000350
4	Approx. 1 km u/s of the Kahouri Stream confluence	PAT000356



Figure 1 Aerial location map of sampling sites in relation to Stratford WWTP

2.3.1 Receiving water surveys of August 2018, October 2018, and May 2019

Receiving water samples were collected on the 27 August 2018, 16 October 2018, and 2 May 2019 at two sites in the Patea River, upstream and downstream of the Stratford WWTP discharge point. The results of these surveys are displayed in Table 6.

Table 6 Receiving water results August 2018, October 2018, and May 2019

Site		PAT000345				PAT000350			
Date		27 Aug 2018	16 Oct 2018	2 May 2019	2009-2018 Range	27 Aug 2018	16 Oct 2018	2 May 2019	2009-2018 Range
Parameter	Unit	10:00	09:15	10:25		10:30	09:45	10:45	
BOD	g/m ³	< 2	< 2	< 1	<0.5-0.6	< 2	< 2	< 1	<0.5-0.8
Chloride	g/m ³	9.1	8.6	8.7	7.5-11.8	9.3	9.2	9.0	7.6-10.0
pH	pH	7.3	7.4	7.6	7.5-9.5	7.7	7.4	7.5	7.4-10
Turbidity	NTU	1.0	1.6	1.2	0.54-1.8	2.9	2.1	0.53	0.74-4.8
Temp	°C	9.3	9.6	10.1	7.7-17.0	9.3	9.6	10.2	8.0-17.5
NH ₃	g/m ³ N	0.00020	0.00022	0.00013	0.00019-0.00187	0.0029	0.0035	0.0027	0.00013-0.01274
NH ₄	g/m ³ N	0.046	0.054	0.019	0.037-0.148	0.27	0.80	0.41	0.038-1.07

These results show that there were no significant effects noted in the Patea River as a result of the WWTP discharge. Filtered BOD₅ concentration was well within the 2.0 gm³ limit imposed by Special Condition 11, as was unionised ammonia (NH₃). On 27 August 2018 turbidity increased by 190%, significantly more than the 50% allowed by condition 8. Compliance with this condition was achieved on the other two occasions.

2.3.2 Low flow receiving water survey of January 2019

A summer low flow assessment of the impact of the WWTP's effluent discharge on the receiving waters of the Patea River was performed on 23 January 2019. River flow (at the Skinner Road recorder) was 0.754 m³/s during a low flow period, 50 days after a river fresh three times over the median flow. The flow was below both the average January mean monthly flow (1.05 m³/s) and the mean monthly flow for the period 1978 to 2019 (2.953 m³/s). There was a moderate rate of discharge from the ponds system (estimated at approximately 15 L/s) at the time of the survey. The results of the survey are displayed in Table 7.

A dilution ratio of approximately 31 parts river flow to one part effluent discharge at the time of the sampling survey was indicated by reference to selected analytical results assuming complete mixing at the sampling site (PAT000350).

There was a 34% decrease in black disc clarity coincidental with an increase in turbidity of 0.5 NTU (42% increase) but minimal rise in suspended solids levels in the receiving waters. Nutrient concentrations increased over upstream concentrations by a factor of 5 or 6 for most parameters, although remaining lower than typical. No significant impacts on the river were recorded for the other parameters measured (Table 5) with minimal or no increases in measured levels of pH, total nitrogen (NNN), conductivity, suspended solids, bacteria, and filtered BOD₅. These results were indicative of compliance with Special Conditions 8, 10, and 11 of the consent.

The river appearance was light brown and slightly turbid at the upstream sites, with a slight noticeable visual impact downstream of the WWTP discharge. Dissolved oxygen concentrations were near to or exceeded 100% saturation at all sites upstream and downstream of the discharge.

Table 7 Low flow receiving water results, January 2019

Site		PAT000315		PAT000345		PAT000350		PAT000356	
Date		23 Jan 2019	2009-2018 Range	23 Jan 2019	2009-2018 Range	23 Jan 2019	2009-2018 Range	23 Jan 2019	2009-2018 Range
Parameter	Unit								
Black disc	m	2.50	1.94-3.13	2.51	1.27-3.92	1.66	1.10-3.02	2.32	1.21-2.46
BOD	g/m ³	<0.8	<0.5-0.8	<0.8	<0.5-0.8	0.9	1.3-3.6	<0.8	1.1-2.7
BODF	g/m ³	<1.0	<0.5-0.6	<1.0	<0.5-0.6	<1.0	<0.5-0.8	<1.0	<0.5-0.8
Chloride	g/m ³	7.5	8.0-10.1	8.0	7.5-9.5	7.9	7.6-10	8.6	8.8-9.6
Conductivity	mS/m @25°C	11.5	8.6-10.1	11.6	7.2-10.6	12.4	7.7-11.8	12.1	9.2-10.9
DO (concentration)	g/m ³	9.43	9.2-10.4	9.43	9.1-10.3	9.65	9.20-10.3	10.6	10.2-11.4
DO (saturation)	%	98.8	95-101	100	94-101	104	96-104	117	102-115
<i>E.coli</i>	/100ml	214	154	461	461	153	345	88	326
pH	pH	7.8	7.4-7.7	7.7	7.3-8.2	7.7	7.3-7.8	8.4	7.5-8.3
SS	g/m ³	<3	2.0-9.0	<3	<2.0-4.0	3	<2-5	<3	2.0-4.0
Turbidity	NTU	1.3	0.58-3.6	1.2	0.54-1.8	1.7	0.74-4.8	1.1	1.2-3.6
Temperature	°C	15.9	11.9-16.5	16.7	7.70-17.0	17.3	8.0-17.5	18.8	12.8-17.8
Nutrient Analyses									
NH ₃	g/m ³ N	0.00022	0.00009-0.00064	0.00061	0.00019-0.00187	0.0040	0.00055-0.01274	0.0010	0.00041-0.00484
NH ₄	g/m ³ N	0.013	0.006-0.035	0.044	0.037-0.148	0.23	0.038-1.07	0.012	0.006-0.123
NNN	g/m ³ N	0.45	0.42-0.78	0.44	0.4-0.8	0.48	0.58-0.91	0.55	0.74-1.1
DRP	g/m ³ P	0.021	0.019-0.057	0.017	0.006-0.051	0.100	0.020-0.206	0.087	0.051-0.152
Metal Analyses (dissolved)									
Cadmium	g/m ³	<0.00005	<0.005-0.005	<0.00005	<0.005-0.005	<0.00005	<0.005-0.005	<0.00005	<0.005-0.005
Chromium	g/m ³	<0.0005	<0.003-0.003	<0.0005	<0.03-0.03	<0.0005	<0.03-0.03	<0.0005	<0.03-0.03
Zinc	g/m ³	0.0014	<0.005-0.005	0.0015	<0.005-0.007	0.0031	<0.005-0.007	0.0011	<0.005-0.005
Appearance		Light brown, slightly turbid		Light brown, slightly turbid		Green-brown, turbid		Green-brown, slightly turbid	

2.3.3 Biological monitoring surveys

Subsequent to the WWTP upgrade in 2009, spring and summer biological monitoring surveys were undertaken in order to assess the effectiveness of the upgraded system. Summer biomonitoring surveys

only have been conducted since 2011, but due to concerns about impacts on river health from the discharge, spring and summer biomonitoring surveys will now be undertaken.

The Council collected streambed macroinvertebrates from four sites in the Patea River in spring (7 November 2018) and summer (4 March 2019) to investigate the effects of the Stratford WWTP discharge on macroinvertebrate health. Macroinvertebrates were identified and the number of different types of taxa counted (taxa richness), and MCI and SQMCI scores were calculated for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of nutrient pollution in streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to pollution. The SQMCI takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities. Significant differences in either the MCI or the SQMCI between sites indicate the degree of adverse effects (if any) of the discharges being monitored and enable the overall health of the macroinvertebrate communities to be determined.

In the spring survey the MCI scores categorised sites 1, 2 and 3a as having 'good' health while site 4 was only in 'fair' health. However, as usual there was an ecologically significant decline between site 2 and sites 3a and 4, the two sites downstream of the Stratford wastewater treatment plant discharge. This indicated a deterioration in macroinvertebrate health in river sites below the discharge from the ecological condition of the site upstream.

The SQMCI scores categorised sites 1 and 2 as being in 'excellent' health. This was largely due to the extremely high numbers of pollution sensitive mayfly present at both sites. In contrast, site 3a was in 'poor' health and site 4 was in 'fair' health. In particular, pollution tolerant midges were 'very abundant' at site 3a, strongly indicating that there was nutrient pollution at this site. Furthermore, site 3a had a SQMCI score that was significantly lower than its historical median. Site 4 was newly established and therefore had no historical median to sue for comparative purposes.

In the summer survey the MCI scores categorised sites 1 and 2 as having 'good' health while sites 3 and 4 were only in 'fair' health. There was little difference in MCI score between sites 1 and 2, indicating that the closed landfill was not having an effect on macroinvertebrate health. However, there was a significant decrease in MCI scores between site 2 and sites 3a and 4 of 33 and 28 MCI units respectively. Sites 3a and 4 are the two sites downstream of the Stratford wastewater treatment plant discharge. This result was consistent with the spring survey results and with those of previous years, and indicated a significant deterioration in macroinvertebrate health in the river below the discharge. The SQMCI can be more sensitive to organic pollution compared with the MCI as it also takes into account taxa abundances. The SQMCI categorised sites 1 being in 'fair' health and site 2 being in 'good' health. In contrast, site 3a was in 'very poor' health and site 4 was in 'poor' health with both the latter sites' SQMCI scores significantly lower than that of sites 1 and 2.

Overall, these results indicate that the WWTP had caused a significant, but not severe, decline in macroinvertebrate health. This was probably due to nutrient enrichment between sites 2 and 3a, coincident with discharges from the Stratford WWTP and consistent with results from previous surveys. Examination of water quality results in relation to macroinvertebrate results showed there had not been any recent deterioration in discharge quality at the WWTP.

2.4 Incidents, investigations, and interventions

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 SDC. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach, that in the first instance avoids issues occurring, is favoured.

For all significant compliance issues, as well as complaints from the public, the Council maintains a database record. The record includes events where the individual/organisation concerned has itself notified the Council. Details of any investigation and corrective action taken are recorded for non-compliant events.

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 individual/organisation is indeed the source of the incident (or that the allegation cannot be proven).

In the 2018-2019 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with the Company's conditions in resource consents or provisions in Regional Plans.

3 Discussion

3.1 Discussion of site performance

The Stratford WWTP system has continued to perform satisfactorily, with aerobic conditions maintained and a generally high standard of treated wastewater discharged throughout the monitoring period. Effluent quality was of a good standard, particularly when diluted during wet weather conditions. Monitoring of the microfloral component of the tertiary cell of the secondary pond (using chlorophyll-a measurements) indicated that the system had a low algal content, particularly following heavy rainfall events. Microfloral populations have not indicated poor performance of the treatment system to date and generally indicate an improvement in conditions in the tertiary cell since the last WWTP upgrade.

Screening of the outlet from the secondary oxidation pond was well maintained. The inlet system functioned as designed during the monitoring period, and any overflows from the inlet following heavy rainfall were contained and directed into the primary pond. Longer term remedial work to the reticulation system will provide additional capacity and be necessary to markedly reduce stormwater reticulation infiltration. These measures have been identified and planned by the consent holder in conjunction with the system upgrades required by the consent as renewed in 2013. A consent was granted on a short-term basis at that time, in order to allow further investigation of additional upgrade options.

In anticipation of the current consent renewal process, SDC has investigated a number of options to improve the performance of the WWTP system (and hence decrease the amount of nutrients discharging to the river). Chemical dosing to reduce phosphorus was initially proposed, however this does not remove the phosphorus, merely locking it up and then requiring mechanical removal and disposal. Also investigated were land disposal options and nitrogen reduction using in-pond media. SDC now proposes to reduce the phosphorus in the influent (via a new Trade Waste Policy and Trade Waste Bylaw) and implement a Diatomix process in Pond 2, which will hopefully reduce phosphorus, nitrogen and algae levels.

3.2 Environmental effects of exercise of consents

No impacts of the discharge were recorded on the physical and chemical quality of the Patea River during the late summer low flow survey. Localised and moderate increases in nutrients were recorded downstream of the rock riprap outfall, mitigated to a certain extent by the effluent quality which was of a good standard at the time of the survey. Some discolouration of the receiving water occurred downstream of the discharge, but this did not extend beyond the permitted mixing zone.

The late summer macroinvertebrate survey showed significant impacts of the discharge beyond the permitted mixing zone under low flow conditions. On the other hand, no significant heterotrophic growths were found on the substrate of the riverbed and all effluent metal concentrations were low with levels unlikely to cause problems to the biota. Benthic periphyton cover continues to be recorded at two sites in the Patea River downstream of the discharge over spring to late summer in recent receiving water surveys. This data will contribute to the evaluation of options for future upgrades to the WWTP.

Three additional seasonal receiving water monitoring surveys found compliance with conditions of the consent, with the exception of turbidity which was over the 50% increase permitted by consent conditions on one occasion.

3.3 Evaluation of performance

A tabular summary of SDC's compliance record for the year under review is set out in Table 8.

Table 8 Summary of performance for consent 0196-4

Purpose: To discharge treated wastewater from the Stratford Wastewater Treatment Plant into the Patea River		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adopt best practicable option	Inspection and chemical sampling	Yes
2. Limits on the discharge volume	Inspection, records	Yes
3. Requirements of Inflow and Infiltration Reduction programme	Inspection, liaison with consent holder	Yes
4. Requirements of Management Plan	Inspection, liaison with consent holder	Yes
5. Aerobic conditions to be maintained in ponds	Inspection and chemical sampling	Yes
6. Trade wastes connections	Liaison with consent holder	Yes
7. Limits on receiving water effects	Inspection and chemical and biological sampling	No – biological monitoring shows impact downstream
8. Limits on turbidity	Chemical sampling	Mostly – 3 out of 4 surveys compliant
9. Monitoring provisions	Monitoring undertaken	Yes
10. Requirements for nutrient monitoring	Chemical sampling	Yes
11. Limits on unionised ammonia and filtered BOD in receiving waters	Chemical sampling	Yes
12. Issues and Options report provided to Council before 30 June 2015	Report provided	Yes
Overall assessment of consent compliance and environmental performance in respect of this consent		Good
Overall assessment of administrative performance in respect of this consent		High

Table 9 Evaluation of environmental performance over time

Year	High	Good	Improvement req	Poor
2010	-	1	-	-
2011	-	1	-	-
2012	-	1	-	-
2013	-	1	-	-
2014	-	1	-	-
2015	-	1	-	-
2016	-	1	-	-
2017	-	1	-	-
2018	-	1	-	-
Totals	0	9	0	0

During the year, SDC demonstrated an 'improvement required' level of environmental and a high level of administrative performance with the resource consents as defined in Section 1.1.4. As noted above, SDC are actively pursuing options for reducing the effects of the discharge from the WWTP upon the Patea River.

3.4 Recommendations from the 2017-2018 Annual Report

In the 2017-2018 Annual Report, it was recommended:

1. THAT in the first instance, monitoring of consented activities at Stratford WWTP in the 2018-2019 year continue at the same level as in 2017-2018.
2. THAT an additional spring biomonitoring survey be included into the monitoring programme to better assess the impacts of the Stratford WWTP discharge on the Patea River.
3. THAT should there be issues with environmental or administrative performance in 2018-2019, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

The first two recommendations were implemented, while additional monitoring was not considered necessary as per recommendation three.

3.5 Alterations to monitoring programmes for 2019-2020

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account:

- the extent of information already made available through monitoring or other means to date;
- its relevance under the RMA;
- the Council's obligations to monitor consented activities and their effects under the RMA;
- the record of administrative and environmental performances of the consent holder; and
- reporting 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 exercising resource consents.

It is proposed that for 2019-2020 that the monitoring programme remains unchanged from that of 2018-2019. Additional monitoring may be undertaken if required by conditions in the renewed consent if it is granted during 2019-2020.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2019-2020.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities at Stratford WWTP in the 2019-2020 year continue at the same level as in 2018-2019.
2. THAT should there be issues with environmental or administrative performance in 2019-2020, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

Glossary of common terms and abbreviations

The following abbreviations and terms may be 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.
BODCF	Carbonaceous biochemical oxygen demand of a filtered sample.
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.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 25°C and expressed in mS/m.
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
E.coli	<i>Escherichia coli</i> , an indicator of the presence of pathological micro-organisms,
FC	Faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m ³	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
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.
Incident Register	The Incident Register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m ²	Square Metres.
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).
NNN	Nitrate-Nitrite nitrogen.
NO ₃ ⁻	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NO ₂ ⁻	Nitrite, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
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 including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
WWTP	Wastewater Treatment Plant.
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 a Science Services Manager.

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Appendix I

Resource consent held by Stratford District Council

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

Consent number	Purpose	Granted	Review	Expires
0196-4	To discharge treated wastewater from the Stratford WWTP into the Patea River	November 2013	-	June 2016

Water abstraction permits

Section 14 of the RMA stipulates that no person may take, use, dam or divert any water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or it falls within some particular categories set out in Section 14. Permits authorising the abstraction of water are issued by the Council under Section 87(d) of the RMA.

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. Permits authorising discharges to water are issued by the Council under Section 87(e) of the RMA.

Air discharge permits

Section 15(1)(c) of the RMA stipulates that no person may discharge any contaminant from any industrial or trade premises into air, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Permits authorising discharges to air are issued by the Council under Section 87(e) of the RMA.

Discharges of wastes to land

Sections 15(1)(b) and (d) of the RMA stipulate that no person may discharge any contaminant onto land if it may then enter water, or from any industrial or trade premises onto land under any circumstances, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Permits authorising the discharge of wastes to land are issued by the Council under Section 87(e) of the RMA.

Land use permits

Section 13(1)(a) of the RMA stipulates that no person may in relation to the bed of any lake or river use, erect, reconstruct, place, alter, extend, remove, or demolish any structure or part of any structure in, on, under, or over the bed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Land use permits are issued by the Council under Section 87(a) of the RMA.

Coastal permits

Section 12(1)(b) of the RMA stipulates that no person may erect, reconstruct, place, alter, extend, remove, or demolish any structure that is fixed in, on, under, or over any foreshore or seabed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Coastal permits are issued by the Council under Section 87(c) of the RMA.

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 of the discharge on the environment.
2. The volume of treated wastewater discharge shall not exceed 4,800 cubic metres per day, unless there has been a total of more than 10 mm of rain over the previous three days (as measured by the Taranaki Regional Council rain gauge at Stratford).
3. The consent holder shall implement an inflow and infiltration reduction programme to minimise the stormwater inflow to the ponds. The programme shall include taking all practicable actions to ensure that all unauthorised stormwater connections to the sewage reticulation system are removed and remain disconnected. The consent holder shall report on progress under this condition to the Chief Executive, Taranaki Regional Council, by 30 June each year.
4. The consent holder shall implement and maintain a Management Plan which shall include operating procedures to avoid, remedy or mitigate against potential adverse effects arising from:
 - a) the operation of the wastewater treatment plant;
 - b) the build up of sludge in the ponds; and
 - c) stormwater and groundwater infiltration into the sewerage system.
5. The oxidation ponds shall be maintained in aerobic conditions at all times during daylight hours.
6. The consent holder shall consult with the Taranaki Regional Council prior to accepting new trade wastes, which may contain toxic or hazardous wastes, into the consent holder's wastewater system.
7. After allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 50 metres downstream of the discharge point, 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 the colour or visual clarity;
 - c) any emission of objectionable odour;
 - d) any significant adverse effect on aquatic ecosystems.
8. After allowing for reasonable mixing within a mixing zone extending 50 metres downstream of the discharge point, the discharge shall not give rise to an increase in turbidity of more than 50% (as determined using NTU (nephelometric turbidity units)) in the Patea River.

Consent 0196-4

9. The consent holder shall, in conjunction with the Taranaki Regional Council, undertake chemical, bacteriological and ecological monitoring of the oxidation pond system and Patea River as deemed reasonably necessary by the Chief Executive, Taranaki Regional Council subject to Section 36 of the Resource Management Act 1991. That monitoring shall include wastewater quality monitoring to provide for an assessment of possible further upgrade requirements in relation to potential impacts on the biological communities of the receiving water.
10. The monitoring, evaluation and assessment required by condition 9 shall specifically include monitoring, evaluation and assessment of dissolved reactive phosphorus (DRP) and other nutrient-species.
11. After allowing for reasonable mixing, being a mixing zone extending from the discharge point, to a point 50 metres downstream of the discharge point, the discharge shall not cause the receiving waters of the Patea River to exceed the following concentrations:

Contaminant	Concentration
Unionised ammonia	0.025 gm ⁻³
Filtered carbonaceous BOD ₅	2.0 gm ⁻³

12. Before 30 June 2015 the consent holder shall provide to the Chief Executive, Taranaki Regional Council a report detailing issues and options for the Stratford Wastewater Treatment Plant.

The report shall document the environmental effects of the discharge from the Stratford Wastewater Treatment Plant, and set out the options available to address the effects on the receiving environment resulting from the discharge.

The report shall be to the reasonable satisfaction of the Chief Executive, Taranaki Regional Council and shall, as a minimum, address the following:

- a) the environmental effects of discharge on the Patea River, including water quality, periphyton growth and aquatic biota;
- b) options available for further treatment of wastewater from Stratford, giving particular emphasis to the reduction of nutrients in the discharge; and
- c) detail the: costs; expected levels of reduction in adverse effects; and practical implications of introducing each option to the Stratford wastewater treatment system.

Signed at Stratford on 23 October 2013

For and on behalf of
Taranaki Regional Council

Director-Resource Management