

Taranaki By-Products
Monitoring Programme
Annual Report
2017-2018

Technical Report 2018-70

ISSN: 1178-1467 (Online)

Document: 2122945 (Word)

Document: 2136809 (Pdf)

Taranaki Regional Council

Private Bag 713

STRATFORD

March 2019

Executive summary

Taranaki By-Products Ltd (TBP) operates an animal rendering operation located on Kohiti Road at Okaiawa, in the Inaha catchment. Two rendering plants operate on the site: an inedibles plant owned by TBP, and a food grade plant owned by Taranaki Bio-Extracts Ltd (TBE). A trucking firm, Jackson Transport Ltd (JTL), owned by TBP, also operates from the site.

This report for the period July 2017 to June 2018 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company'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 the Company's activities.

Taranaki By-Products Ltd holds 12 resource consents, which include a total of 143 conditions setting out the requirements that they must satisfy. TBP holds two consents to allow it to take and use water, one consent for placing structures in a water course, one consent to realign a water course, two consents to discharge emissions into air at the site, four consents to discharge to the Inaha Stream and a tributary, and two consents to discharge to land.

During the monitoring period, Taranaki By-Products Ltd demonstrated an overall good level of environmental performance.

Monitoring was carried out by both the Council and TBP. TBP monitors water abstraction rates, wastewater volumes and composition, effluent loading on irrigation areas, biofilter performance and weather conditions. The Council undertakes inspections of the plant site, irrigation and burial areas; water quality and biological monitoring of the Inaha Stream and its tributaries, riparian management, groundwater surveys, and facilitates community and hapu engagement meetings.

The Council's monitoring programme for the year under review included 10 inspections, 147 water samples collected for physicochemical analysis, two biomonitoring surveys of receiving waters and odour surveys. In addition the Council also undertook continuous monitoring in the Inaha Stream and its tributaries relating to temperature and flow.

TBP have also demonstrated a high level of commitment in regard to addressing environmental matters related to their operation, with various mitigation measures either planned or underway.

Some minor performance non-compliances occurred including over abstraction of surface water on one occasion and a drop in dissolved oxygen concentration within pond six.

Effects associated with the exercise of consents remain largely unchanged, with three of ten groundwater monitoring wells currently above 50 g/m³ NNN. Surface water monitoring of the Western tributary indicated that this water body is still affected by discharges to land. Sewage fungus was observed in the fire/duck pond which may indicate a slight enrichment. However, the corresponding bio-monitoring indicated no evidence of any impact on the fresh water communities of the Inaha Stream and associated tributaries.

Reported paddock loading information indicated no paddock received over the consented application loading maximum of 300 kg N/ha of wastewater.

Emissions to air from rendering operations continued to draw complaints from the public this period. 10 complaints from the public were received this period. Of the ten complaints received, six were found to be the result of noticeable odour, while four did not find any odour. Three of the six were attributed to mechanical failures at the plant site, which were rectified, the rest were related to pond odour.

TBP demonstrated an overall good level of environmental and a high level of administrative performance with their resource consents during the 2017-2018 monitoring period

For reference, in the 2017-2018 year, consent holders were found to achieve a high level of environmental performance and compliance for 76% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 20% 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 in the year under review.

This report includes recommendations for the 2018-2019 year.

Table of contents

	Page	
1	Introduction	1
1.1	Compliance monitoring programme reports and the Resource Management Act 1991	1
1.1.1	Introduction	1
1.1.2	Structure of this report	1
1.1.3	The Resource Management Act 1991 and monitoring	1
1.1.4	Evaluation of environmental and administrative performance	2
1.2	Process description	3
1.2.1	Wastewater treatment system	4
1.2.2	Bio-extracts plant	5
1.2.3	Odour management	5
1.3	Resource consents	6
1.3.1	Water abstraction permits	7
1.3.2	Water discharge permit	8
1.3.3	Air discharge permit	10
1.3.4	Discharges of waste to land	11
1.3.5	Waste burial	13
1.3.6	Landuse permits	13
1.4	Monitoring programme-water	14
1.4.1	Introduction	14
1.4.2	Programme liaison and management	15
1.4.3	Site inspections	15
1.4.4	Water take	15
1.4.5	Chemical sampling	15
1.4.6	Biomonitoring surveys	16
1.5	Monitoring programme-air	22
1.5.1	Introduction	22
1.5.2	Programme liaison and management	22
1.5.3	Site inspections	22
1.5.4	Monitoring by Taranaki By-Products	22
2	Results	23
2.1	Water	23
2.1.1	Inspections	23

2.2	Water abstraction	23
2.2.1	Surface water abstraction-Inaha Stream	23
2.2.2	Groundwater abstraction	24
2.3	Discharges of wastewater	25
2.3.1	Pond six sampling	25
2.3.2	Cooling water analysis	28
2.3.3	Stormwater analysis	28
2.3.4	Inaha tributary at TBP site	29
2.4	Results of receiving environment monitoring	30
2.4.1	Inaha Stream flow	30
2.4.2	Inaha Stream temperatures	31
2.4.3	Water chemistry	32
2.4.3.1	Inaha Stream	32
2.4.3.2	Northern Tributary	36
2.4.3.3	Western Tributary	37
2.4.4	Irrigation and groundwater monitoring	39
2.4.4.1	Irrigation area and system	40
2.4.4.2	Groundwater monitoring of irrigation areas	42
2.4.5	Solid waste burial	54
2.4.6	Biological monitoring	55
2.5	Air	58
2.5.1	Inspections	58
2.6	Provision of reports management plans and certifications	62
2.6.1	Air discharge certification	63
2.7	Investigations, interventions, and incidents	65
3	Discussion	68
3.1	Discussion of site performance	68
3.2	Environmental effects of exercise of consents	69
3.3	Evaluation of performance	71
3.4	Recommendations from the 2016-2017 Annual Report	84
3.5	Alterations to monitoring programmes for 2018-2019	85
4	Recommendations	86
	Glossary of common terms and abbreviations	87
	Bibliography and references	89

Appendix I Resource consents held by Taranaki By-Products Ltd

Appendix II Biomonitoring reports

Appendix III Air audit report 2017

Appendix IV TBP paddock numbers

List of tables

Table 1	Summary of the resource consents held by TBP	7
Table 2	TBP plant site point source sample key	16
Table 3	Inaha Stream and associated tributaries sampling points	16
Table 4	Surface water and groundwater monitoring analytes	21
Table 5	Pond 6 (IND004004) effluent monitoring 2017-2018	27
Table 6	Cooling water discharge IND002004	28
Table 7	Stormwater analysis STW001075	28
Table 8	IND001015 Inaha tributary at TBP site	29
Table 9	Inaha Stream surface water analysis October and December 2017	33
Table 10	Inaha Stream surface water March and June 2018	34
Table 11	Northern tributary 2017-2018 monitoring (INH000397)	37
Table 12	Surface water monitoring of the Western tributary 2017 (October and December 2017)	38
Table 13	Surface water monitoring of the Western tributary 2018 (March and June 2018)	39
Table 14	INH000440 (Western Tributary) 2017-2018 monitoring period	39
Table 15	Irrigation area monitoring well/location data	42
Table 16	GND1054 2017-2018	44
Table 17	GND1056 2017-2018	45
Table 18	GND1057 2017-2018	46
Table 19	GND1058 Te Kopanga Spring 2017-2018	47
Table 20	GND1346 2017-2018	48
Table 21	GND1347 2017-2018	49
Table 22	GND1348 2017-2018	50
Table 23	GND1349 2017-2018	51
Table 24	GND2225 2017-2018	52
Table 25	GND2226 2017-2018	53
Table 26	Burial pit monitoring 2017-2018	54
Table 27	Summary of discharge consents held by TBP	55

Table 28	Bio-monitoring locations related to TBP in the 2017-2018 monitoring period	56
Table 29	Macroinvertebrate community health based on MCI ranges	56
Table 30	Requirements for reports and plans imposed by consent	62
Table 31	Summary of performance for consent 2049-4	71
Table 32	Summary of performance for consent 2050-4	72
Table 33	Summary of performance for consent 2051-4	73
Table 34	Summary of performance for consent 5426-1	73
Table 35	Summary of performance for consent 4058-4	74
Table 36	Summary of performance for consent 3941-2	75
Table 37	Summary of performance for consent 5495-1	77
Table 38	Summary of performance for consent 6431-1	78
Table 39	Summary of performance for consent 7234-1	79
Table 40	Summary of performance for consent 7329-1	79
Table 41	Summary of performance for consent 9756-1	80
Table 42	Summary of performance for consent 10054-1	81
Table 43	Consent compliance table TBP 2017-2018	82
Table 44	Evaluation of environmental performance over time	83

List of figures

Figure 1	Taranaki By-Products and Taranaki Bio-Extracts aerial view	4
Figure 2	TBP plant site monitoring point source	18
Figure 3	Inaha Stream and associated tributaries sampling locations	19
Figure 4	TBP groundwater monitoring well locations	20
Figure 5	Consent 2051-4 abstraction data 2017-2018	24
Figure 6	Daily groundwater abstraction volumes consent 9756-1 2017-2018	25
Figure 7	Hydrograph of Inaha Stream flow and pond 6 discharge 2017-2018	30
Figure 8	Temperature of the cooling water discharge 2017-2018	31
Figure 9	Inaha Stream temperature increase post discharge 2017-2018	32
Figure 10	Wastewater and fertiliser application by paddock for comparison with previous years loading	42
Figure 11	NNN concentrations GND1054 January 2000-July 2018	44
Figure 12	NNN concentrations GND1056 February 2000-July 2018	45
Figure 13	NNN concentrations GND1057 February 2000 - July 2018	46
Figure 14	GND1058 Te Kopanga Spring 2017-2018	47
Figure 15	NNN January 2005 - September 2018	48

Figure 16	NNN concentration GND1347 January 2005- September 2018	49
Figure 17	NNN concentration GND1348 January 2005- August 2018	50
Figure 18	NNN concentrations GND1349 January 2005 - August 2018	51
Figure 19	NNN concentrations GND2225 October 2011- August 2018	52
Figure 20	NNN concentration GND2226 October 2011-August 2018	53
Figure 21	Bio-monitoring sites in relation to TBP	57

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 2017 to June 2018 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Taranaki By-Products Ltd (TBP). TBP operates an animal rendering facility situated on Kohiti Road at Okaiawa, in the Inaha catchment.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by TBP that relate to abstractions and discharges of water within the Inaha catchment, and the air discharge permit held by TBP to cover emissions to air from the site.

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 the Company's use of water, land and air, and is the 26th combined annual report by the Council for the Company.

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;
- the resource consents held by the Company in the Inaha catchment;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted in the Company's site/catchment.

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 2018-2019 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 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 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 2017-2018 year, consent holders were found to achieve a high level of environmental performance and compliance for 76% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 20% of the consents, a good level of environmental performance and compliance was achieved.

1.2 Process description

The TBP plant on Kohiti Road, Okaiawa is the major animal rendering plant in Taranaki. It was established in 1936, about 60 persons are employed. Raw material comes largely from meat and poultry processing plants in the central and southern North Island. TBP also runs a dead stock collection service in Taranaki and adjacent regions. Transport of raw materials to and products from the site is undertaken by a trucking firm that operates from the site, Jackson Transport Ltd, also owned by TBP.

The site is located beside the Inaha Stream in mid-catchment, about 13 km from the sea, and less than 1 km from Okaiawa, a village of about 50 dwellings. Intensive pastoral farming, mainly dairy, occurs around the site (Photo 1).

Inedible products are manufactured, including meat and bone, poultry, feather, and blood meals, as well as tallow and chicken oil. There are three separate processing lines, a mixed abattoir material line (processing beef and mutton, hard and soft offal, and fallen stock), a poultry line (processing soft poultry offal and feathers), and a blood line. The plant is able to process up to 26 t/h of raw material, this includes 18 t/h through the mixed abattoir material line and 6-8 t/h through the poultry feather and offal line. Up to 100,000 L/day of blood can be processed.

The plant operates 24 hours/day, seven days/week throughout the year, with weekly maintenance shutdowns on Sunday/Monday. There is some seasonal variation in beef offal processing, the peak occurring between January and May, being earlier in dry seasons, when the availability of stock feed is reduced. Processing of fallen stock peaks in July and August, during the calving season. Poultry processing

is relatively steady throughout the year, with a slight increase before Christmas and over the summer months. Poultry, originally planned to be phased out in the 2015-16 monitoring year, has been retained by the facility. However the collection and processing of poultry is limited to deliveries from within the Taranaki region.



Figure 1 Taranaki By-Products and Taranaki Bio-Extracts aerial view

Animal rendering is essentially a two stage process, involving separation of fat and drying of the residual solids. The TBP process is largely continuous low temperature (below 100° C) dry rendering with mechanical de-watering by screw press, and some thermal de-watering. Indirect (Rotadisc) steam-heated driers are employed. The dried product is milled, sieved and stored in bulk.

The mechanical de-watering of the raw material creates large quantities of stickwater, essentially the pressed-out meat juices. Waste heat exchangers dry the stickwater under vacuum to a stage where it can be incorporated back into the meal product. Washings and waste products from the stickwater system have been registered as a fertiliser (Zeal Grow) and are applied to an adjacent dairy farm owned by TBP. Solid wastes are buried in a designated area on the farm. Recent developments within the facility have reduced the output of the registered fertiliser Zeal Grow.

1.2.1 Wastewater treatment system

Wastewater from TBP's plant comprises equipment and floor washings, condensates from treatment of gas emissions, and blood decanter liquids. There is potential for stickwater and blood losses to be put through the treatment system.

The wastewater treatment system comprises a contra-shear screen, a dissolved air flotation (DAF) unit, three anaerobic ponds (ponds 1-3), an aeration pond (pond 4), a settling pond (pond 5), and a large aerobic pond (pond 6).

All wastewater from the plant (except condensate wastewater from the waste heat exchanger) is pumped through the rotary screen, then a 100 m³/h DAF unit to which flocculent is added to assist in recovery of solids. The wastewater then moves sequentially through ponds 1 to 3, with a total volume of about 15,000 m³, where anaerobic activity breaks it down. The condensate wastewater from the plant is pumped directly

to pond 1. Ponds 1 and 2, on the northern side of the plant, may be operated in parallel, depending on loadings. The wastewater from pond 2 enters wet well pump station 1, from where it is pumped to pond 3, at a higher level on the southern side of the plant.

From pond 3, the wastewater discharges to an aerated lagoon (pond 4) with a volume of 8,000 m³. Aerators of about 315 kW total capacity assist in the reduction of biochemical oxygen demand (BOD) and of ammonia concentration. The wastewater finally passes, via a small settling pond (5), into a large aerobic pond (6), with an area of 1.04 ha and a nominal volume of 30,000 m³, with four brush aerators each of 17.5 kW capacity. The purpose of the aerobic pond is to allow further treatment of the effluent, and to provide for storage of treated wastewater. Pond 6 is also used as a source of scrubbing water in the odour control system.

The treated wastewater is discharged either to the Inaha Stream directly or to adjacent land by spray irrigation. This 'dual' wastewater disposal system addresses the limited capacity of the Inaha Stream to assimilate the treated wastewater, while promoting grass growth for dairy production on land that is well suited to irrigation. The total area utilised for irrigation increased from 269 ha in 2011-2012 to 291 ha in 2012-2013. This was further extended in the 2015-2016 monitoring year to a total area of 340 ha.

1.2.2 Bio-extracts plant

In April 2003, an edible (food grade) tallow and gelatine bone chip recovery plant was commissioned adjacent to the existing rendering plant at Okaiawa. A new company, Taranaki Bio Extracts Ltd (TBE), was established for the venture that is owned by TBP and Riverlands Eltham Ltd in equal partnership.

The TBE operation involves the processing of boning-room waste that has been separated from other raw offal at meat processing plants. The rendering and drying is carried out at lower temperatures than at the inedibles plant, resulting in less odour generation and heat emission. Certain utilities are shared between the two plants, including the steam generators and the wastewater treatment plant. The bio-filters used to be shared by both plants, but now they have been separated.

1.2.3 Odour management

The rendering operations have potential to generate offensive odour. Sources include the raw materials, rendering processes, wastewater treatment and disposal systems, odour control system, and solid waste burial areas. The generation of odour is controlled through the quality and preservation of raw materials, design and operation of the rendering processes, maintenance of the buildings, treatment of odorous emissions, and management of the wastewater treatment, disposal systems and burial areas.

Odour extraction, cooling and biofilters are the main components of the odour control systems that are operated at the TBP and TBE plants. There are four extraction systems, one each for concentrated odour sources in the two plants, and two independent factory building air systems (FA1 and FA2) at the TBP plant to capture fugitive emissions that are not collected by the concentrated sources (CS) biofilter.

Concentrated odorous gases from the TBP bovine, poultry and feather rendering (but not blood) lines are collected at source, then cooled and scrubbed in two water spray condenser towers before being discharged to the biofilter. Hot exhaust gases, from pre-cookers and driers, are passed through three waste heat evaporators to concentrate stick liquor, then a vertical condenser, before going to the spray towers with the other concentrated emissions.

The FA1 ventilation system extracts air from above the mixed abattoir and poultry rendering lines in the northern part of the TBP building. The FA2 system collects air from the dead stock pre-breaker, blood drying processes within the blood room, meal mill exhausts and the poultry dryer room, in the southern part of the building, and passes the air through a wet scrubber.

At the TBE plant, humid odorous air streams from the concentrated sources are extracted, and cooled and scrubbed, before being ducted to the CS biofilter. TBE building air is vented directly to atmosphere as it contains no significant odour.

There are three biofilter systems, comprising two factory air biofilters, and a concentrated sources biofilter. FA1 biofilter is of coarse bark set in the ground, with three parallel zones that are each 30 m x 40 m x 1.5 m (total volume of 5,400 m³). FA2 biofilter is also formed of coarse bark, set above ground over pea gravel with two zones 25 m x 30 m x 1 m (1,500 m³). The CS biofilter has two parallel beds 25 m x 20 m x 0.7 m (700 m³) of coarse bark overlaid with fine bark compost. The locations of the biofilters are given in Figure 1, labelled BF1 and BF2.

The CS biofilter was repaired in November 2010, when two sides of both beds were replaced. Bed 3 of FA1 biofilter was reconstructed between July and December 2011, improving the pipework for air distribution and for drainage of liquids. The remainder of FA1 biofilter was reconstructed between October 2012 and April 2013, the corrosion-prone corrugated iron manifolds being replaced with concrete pipes, and bark replacement being delayed by problems with supply.

Upon upgrade of FA1 biofilter, the concentrated sources air flow from the TBP plant was redirected to it temporarily, reducing heat load on the designated CS biofilter, now dedicated to the TBE plant. At the end of the 2012-2013 review period, construction began on the fourth zone for FA1 biofilter, intended to receive the TBP plant concentrated sources (CS) streams.

The CS biofilter was completed and operational prior to Christmas in 2013, and presently both TBE and TBP have independent biofilters.

Engineering certification, as part of TBP's consent to emit emission and odour to the air, TBP must receive certification from a suitably qualified independent person that the works, processes and equipment relevant to all discharges to air from the site are operational in accordance with good engineering practice. In the previous monitoring year TBP engaged Golder Associates to undertake the certification of the process. This is the third time this certification of apparatus associated with odour control has been undertaken by Golder Associates. The next audit is due in the 2019 monitoring period.

The most recent assessment was undertaken in the 2016-2017 monitoring period and can be referenced in the bibliography of this report.

1.3 Resource consents

A summary of the consents held by TBP in relation to activities at its Okaiawa plant is given in Table 1 below, and the consents are discussed in Sections 1.3.1 to 1.3.6. A copy of each of the consents can be found in Appendix I. These summaries of consent conditions may not reflect the full requirements of each condition. The consent conditions in full can be found in the resource consents which are appended to this report.

Table 1 Summary of the resource consents held by TBP

Consent number	Purpose	Volume	Next review date	Expiry date
2049-4	Discharge treated wastewater to Inaha Stream	940 m ³ /day	2017	2019
2050-4	Discharge cooling/backwash water to Inaha Stream	2,160 m ³ /day	2017	2019
2051-4	Take from Inaha Stream	2,160 m ³ /day (50L/s)	2017	2019
3941-2	Discharge treated wastewater to land and air	1,400 m ³ /day	2014	2019
4058-4	Discharge emissions to air from rendering operations		2015	2024
5426-1	Discharge stormwater to Inaha tributary	1,025 L/s	2017	2019
5495-1	Discharge meat wastes by burial into land	200 tonne/day	2017	2019
6431-1	Place culverts in Inaha Stream		2017	2023
7234-1	Disturb to realign Inaha Stream		2017	2023
7329-1	Discharge sediment during Inaha Stream realignment		2017	2023
9756-1	Take groundwater	22.8 L/s (1,970 m ³ /day)	2017	2029
10054-1	Discharge emissions to air from burning		2017	2029

In addition, TBP holds consents **2446** and **3117** to discharge untreated farm dairy effluent by irrigation to land. Consent 2446 was exercised until the 2004-2005 dairy season, when dairy operations were consolidated at a new shed on Kohiti Road from which wastewater is transferred to the treatment system for the nearby rendering operations. Consent **3117** now applies to a small shed used for sick cows on Katotauru Road.

1.3.1 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.

TBP holds two water permits that provide for abstraction of water, one from the Inaha Stream and one from groundwater.

Surface water extraction

TBP holds water permit **2051-4** to cover the abstraction of up to 50 L/s of water from the Inaha Stream for a rendering operation. This permit was issued by the Council on 31 May 1999 under Section 87(d) of the RMA. It is due to expire on 1 June 2019.

There are five conditions imposed on consent 2051-4.

- Condition 1 requires the means of taking water to be satisfactory to Council.
- Condition 2 imposes a minimum flow of 25 L/s be maintained in the stream.
- Condition 3 requires installation of a measuring device and records to be kept of daily abstraction.
- Condition 4 requires the flow of the Inaha Stream to be measured and recorded.
- Condition 5 sets out provision for review of the consent.

Condition 4 was changed on 21 January 2015 to remove the requirement to install a flow recorder, but preserve the requirement to visually record the stream height daily, and keep records of the flows within the Inaha Stream.

Groundwater extraction

TBP holds water permit **9756-1** to cover the take and use of groundwater for industrial water supply. This permit was issued by the Council on 3 February 2014 under Section 87(d) of the RMA. It is due to expire on 1 June 2029.

There are 12 conditions imposed on consent 9756-1.

- Condition 1 imposes a limit on maximum abstraction rate.
- Condition 2 requires the bore to be permanently labelled for identification.
- Conditions 3 and 6 address water level monitoring.
- Conditions 4 and 5 address metering and logging of water use, and certification.
- Condition 7 deals with the telemetry of monitoring data to Council.
- Conditions 8 and 9 relate to access to and failure of monitoring equipment.
- Condition 10 requires adoption of the best practicable option.
- Conditions 11 and 12 relate to lapse and review of consent.

The application was discretionary under rule 50 of the regional freshwater water plan (RFPW). As the effects of the activity were assessed as no more than minor and nobody was adversely affected the application was processed on a non-notified basis.

1.3.2 Water discharge permit

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.

TBP holds four discharge permits that provide for discharge to surface water, one of wastewater, one of cooling water, and two of stormwater.

Wastewater discharge consent

TBP holds water discharge permit **2049-4** to cover discharge of up to 940 m³/day of treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream. This permit was issued by the Council on 31 May 1999 under Section 87(e) of the RMA. It is due to expire on 1 June 2019.

The consent was changed on 4 October 2006, following a review of conditions invoked by Council to deal with adverse effects resulting from exercise of the consent, and an application by TBP to include provision for farm dairy wastewater.

There are 19 special conditions imposed on consent 2049-4.

- Conditions 1 and 2 relate to the location and area of the mixing zone.
- Condition 3 relates to the point of discharge into the Inaha Stream.
- Condition 4 requires the consent holder to give notice of changes in process which may affect the nature of the discharge.
- Condition 5 requires the consent holder to monitor consent conditions as deemed reasonably necessary by Council.
- Condition 6 sets a minimum dilution rate on the discharge.
- Condition 7 prohibits the discharge of stickwater, and deals with increase in dairy herd size.
- Condition 8 requires cessation of discharge into the stream at the specified minimum flow rate.

- Condition 9 prohibits the discharge from giving rise to specific adverse effects in the receiving waters.
- Condition 10 sets a limit on the level of ammonia in the receiving waters.
- Condition 11 requires controls on discharge and records of discharge rate.
- Condition 12 requires the consent holder to maintain a stream flow gauge.
- Conditions 13 and 14 relate to the requirement for a wastewater disposal management plan.
- Conditions 15 and 16 require notice of changes to the management plan, provide for review of the plan, and require a designated manager of the wastewater system.
- Condition 17 requires the wastewater management plan be adhered to, and that site staff are trained in implementation and advised of any changes to the plan.
- Condition 18 relates to a consent holder donation to Taranaki Tree Trust and commitment to riparian planting.
- Condition 19 is a provision for review of consent conditions.

Cooling water discharge

TBP holds water discharge permit **2050-4** to cover discharge of up to 2,160 m³/day of cooling water and backwash water into the Inaha Stream. This permit was issued by the Council on 31 May 1999 under Section 87(e) of the RMA. It is due to expire on 1 June 2019.

There are 7 special conditions imposed on consent 2050-4.

- Condition 1 requires the consent holder to monitor consent conditions as deemed reasonable and necessary by Council.
- Condition 2 prohibits the increase in concentration of pollutants in the discharge.
- Conditions 3 and 4 place a temperature and suspended solids limit on the cooling water discharge.
- Condition 5 prohibits specific adverse effects in the receiving waters of the Inaha Stream.
- Condition 6 requires the consent holder to measure and keep record of discharge temperature, to make available on request.
- Condition 7 sets out provision for review of the consent.

Stormwater discharge

TBP plant site

TBP holds water discharge permit **5426-1** to cover discharge of up to 1,095 L/s of stormwater into an unnamed tributary of the Inaha Stream. This permit was issued by the Council on 31 May 1999 under Section 87(e) of the RMA. It is due to expire on 1 June 2019.

There are five special conditions imposed on consent 5426-1.

- Condition 1 requires the consent holder to give notice of changes in process which may alter the nature of the discharge.
- Condition 2 sets chemical limits on the discharge.
- Condition 3 prohibits specific adverse effects in the receiving waters of the Inaha Stream.
- Condition 4 requires the consent holder to provide Council with a contingency plan.
- Condition 5 sets out provision for review of the consent.

Consideration of the application

1 June 1999 was the last time consents **2049, 2050, 2051** and **5426** were renewed. An application may be processed as non-notified if (section 94(2)), the activity is a discretionary activity and:

- a. The consent authority is satisfied that the adverse effect on the environment of the activity for which consent is sought will be minor; and
- b. Written approval has been obtained from every person whom the consent authority is satisfied may be adversely affected by the granting of the resource consent unless the authority considers it is unreasonable in the circumstances to require the obtaining of every such approval.

If the recommended special conditions (at the time) for each of the resource consents contained in the report were complied with, it was anticipated that the environmental effects of the activities will be minor, thus satisfying section 94 (2)(a).

The applicant undertook consultation with affected parties to the application and had gained written approval of all affected parties which were as follows:

- Ngati Manuhiakia Hapu; and
- Fish and Game New Zealand (Taranaki Region)

As such these applications were processed on a non-notified basis pursuant to section 94(2) of the RMA

Land re-contouring

TBP holds water discharge permit **7329-1** to cover the discharge of stormwater and sediment into the Inaha Stream from earthworks associated with the re-contouring of land and the re-alignment of a section of the Inaha Stream. This permit was issued by the Council on 30 June 2008 under Section 87(e) of the RMA. It is due to expire on 1 June 2023.

There are 10 conditions imposed under consent 7329-1.

- Condition 1 requires the consent to be exercised in accordance with documentation submitted.
- Conditions 2 and 3 limit the area and volume of soil disturbed.
- Conditions 4 and 5 address sediment control measures and mitigation of effects in the stream.
- Condition 6 requires notification and a programme of works.
- Condition 7 deals with stabilisation of completed earthwork areas.
- Condition 8 lays down procedure in case an archaeological site is encountered.
- Conditions 9 and 10 relate to lapse and review of consent.

1.3.3 Air discharge permit

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.

TBP holds two discharge permits that provide for emissions to air, one from rendering operations and one from burning waste wooden material.

Air discharge rendering operations

TBP holds discharge permit **4058-4** to cover the discharge to air of emissions from rendering operations and associated processes including wastewater treatment and burial of material. This permit was issued by the Council under Section 87(e) of the RMA on 11 October 2011. It expires on 1 June 2024,

There are 12 special conditions imposed on consent 4058-4.

- Condition 1 requires the consent holder to adopt the best practicable option to minimise adverse effects of the discharge on the environment.
- Condition 2 prohibits offensive or objectionable odour beyond the property boundaries at any time, and Condition 3 defines such odour.

- Condition 4 requires the employment of a suitable person to ensure compliance with consent conditions.
- Condition 5 prohibits fish processing.
- Condition 6 requires certification of the works, processes and equipment by a suitable independent engineer biennially.
- Conditions 7 to 9 relate to an Air Discharge Management Plan.
- Condition 10 deals with dust.
- Condition 11 deals with community consultation.
- Condition 12 is a review condition, applicable in June 2013 and biennially thereafter.

Considerations of the application

The application for the renewal of consent **4058** was publically notified on the 16 October 1999. Three submissions were received.

After two successful pre-hearings and a request for further information to the applicant, which resulted in a letter setting out matters agreed between all parties. The submitters withdrew their request to be heard on the 20 June 2000.

As a process, the Hearing, which was scheduled for 21 June 2000 was cancelled.

Air discharge pallet burning

TBP holds discharge permit **10054-1** to cover the discharge to air of emissions from the burning of pallets, paper and cardboard. This permit was issued by the Council under Section 87(e) of the RMA on 21 January 2015. It expires on 1 June 2029.

There are nine special conditions imposed on consent 10054-1.

- Condition 1 requires the consent holder to adopt best practicable options to minimise adverse effects of discharge on the environment.
- Condition 2 restricts the type of material combusted.
- Condition 3 prohibits objectionable or offensive odour beyond the property boundaries.
- Condition 4 requires burning to be supervised at all times.
- Conditions 5 to 7 deal with dust and other contaminants.
- Conditions 8 and 9 relate to lapse and review of consent.

1.3.4 Discharges of waste 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.

TBP holds two discharge permits that provide for disposal of untreated farm dairy effluent on land. TBP also holds one discharge permit for wastewater to land.

Discharge permit **2446-2** to cover the discharge of untreated farm dairy effluent by honey wagon onto and into land was issued by the Council on 18 November 2004 under Section 87(e) of the RMA. It is due to expire on 1 December 2023.

Discharge permit **3117-2** to cover the discharge of untreated farm dairy effluent by spray irrigation onto and into land was issued by the Council on 13 July 2004 under Section 87(e) of the RMA. It is due to expire on 1 December 2023.

The two consents have essentially the same nine conditions, relating to volume, location, control of effects, system maintenance, and review of conditions. Consents 2446-2 and 3117-2 provide for up to 1,000 and 250 cows, respectively.

Consent 2446-2 is no longer exercised, but has been retained by TBP in case it is needed in future. Consent 3117-2 applies to a small shed used for sick cows on Katotauru Road.

Spray irrigation

TBP holds discharge permit **3941-2** to cover the discharge of up to 1,400 m³/day of treated wastewater by irrigation onto and into land. This permit was issued by the Council on 15 December 1999 under Section 87(e) of the RMA. It is due to expire on 1 June 2019.

The consent was changed on 21 December 2005, following a review of conditions invoked by Council to deal with adverse effects resulting from exercise of the consent, and an application by TBP to extend the irrigation area and include the discharge of farm dairy effluent. The consent was changed again on 9 November 2009 to allow a further extension of the irrigation area.

- Condition 1 outlines the authorised area for the discharge.
- Condition 2 outlines the requirement to provide a spray irrigation management plan and specific matters it must address.
- Condition 3 requires adherence to the plan and states that consent conditions prevail over any contradictory aspects.
- Condition 4 provides for review of the management plan.
- Condition 5 requires a designated manager to implement the management plan.
- Condition 6 requires adoption of the best practicable option to deal with adverse effects, with particular reference to minimisation of nitrogen in the effluent.
- Condition 7 requires notification to Council when irrigation is not possible and discharge to the stream will cause dilution limits to be exceeded.
- Condition 8 places a minimum limit on the level of dissolved oxygen in the discharge.
- Conditions 9 and 10 stipulate there shall be no objectionable odour or spray drift as a result of irrigation.
- Condition 11 limits the sodium adsorption ratio in the wastewater.
- Condition 12 prohibits ponding of wastewater or direct discharge.
- Conditions 13 and 14 specify the area of the irrigation spray zone and limit the rate of nitrogen loading.
- Condition 15 requires the consent holder to investigate and report on options for reducing ammonia concentrations in wastewater prior to discharge.
- Conditions 16 and 17 restrict the average application rate and specify the return period between effluent applications.
- Conditions 18 and 19 require the consent holder to monitor groundwater bores and to monitor consent activities deemed necessary by Council.
- Condition 20 relates to liaison meetings with interested submitters to the consent, and condition 21 addresses notification of Ngati Manuhiakai hapu of discharges to the Inaha Stream.
- Condition 22 relates to mitigating effects in the case of contamination of groundwater.
- Condition 23 allows for the consent holder to apply for change of conditions.
- Conditions 24, 25 and 26 all set out provisions for review of specific conditions and the consent in general.

Consideration of the application

The consent **3941** was last renewed 1 December 1999. In order for this to occur the application was publically advertised (notified) on the 16 October 1999 and two submissions were received.

After a successful pre-hearing meeting and subsequent discussion which allowed the submitters matters to be addressed, the submitters withdrew their submissions. The consent was then processed.

1.3.5 Waste burial

TBP holds two discharge permits that provide for burial of wastes into land.

TBP holds water discharge permit **5495-1** to cover discharge of up to 200 tonnes/day of wastes from meat rendering operations by burial into land in the vicinity of the Inaha Stream.

This permit was issued by the Council on 30 March 2000 under Section 87(e) of the RMA. It is due to expire on 1 June 2019.

There are 18 conditions imposed on consent 5495-1.

- Condition 1 requires the consent holder to provide a waste burial management plan addressing specific matters.
- Conditions 2, 3 and 4 relate to the implementation and exercise of the management plan and provide for a review with notice from either party.
- Condition 5 prohibits disposal pits from intercepting shallow groundwater.
- Conditions 6 and 7 relate to the construction of the disposal pits and Condition 8 requires inspection by Council prior to disposal.
- Condition 9 relates to the timing of conditions 1-4.
- Condition 10 imposes a time limit on the covering of discharged material.
- Conditions 11 and 12 impose a certain quality of cover material and suitable stormwater contouring.
- Condition 13 requires the disposal site be reinstated satisfactorily.
- Conditions 14 and 15 prohibit irrigation of effluent onto disposal area or direct discharge of contaminants to surface water.
- Condition 16 requires a minimum of eight monitoring bores to monitor groundwater quality.
- Condition 17 allows the consent holder to apply for change to consent conditions.
- Condition 18 sets out provision for review of the consent.

Consideration of the application

The conclusion of the consenting process indicated the following. The requirements of non-notification had been satisfied and it was considered that if the consent were granted subject to conditions, then the activity would be carried out with negligible environmental effects. It was therefore proposed that the non-notified application be approved.

1.3.6 Landuse permits

Stream culverts

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.

TBP holds land use permit **6431-1** to erect and maintain two culverts in the Inaha Stream for farm access. This permit was issued by the Council on 4 October 2004 under Section 87(e) of the RMA. It is due to expire on 1 June 2023.

There are 12 conditions imposed on consent 6431-1.

- Conditions 1 and 2 require the consent holder to adopt best practicable option to minimise adverse environmental effects and establishes that consent conditions prevail over conflicting information.
- Condition 3 requires notice of initial construction and subsequent maintenance of the culverts.
- Condition 4 stipulates dates within which maintenance must occur.
- Conditions 5 and 6 require the consent holder to minimise adverse effects on the water quality and riverbed disturbance.
- Condition 7 requires removal and reinstatement of area when structures are no longer needed.
- Condition 8 prohibits the structure from preventing fish passage.
- Conditions 9 and 10 set out requirements for the establishment and maintenance of fenced riparian margins.
- Condition 11 specifies the placement of culverts and structures to prevent erosion.
- Condition 12 relates to lapse of consent.
- Condition 13 provides for review of consent conditions.

Stream diversion

Section 13(2)(b) of the RMA stipulates that no person may disturb, remove, damage, or destroy any plant or part of any plant or habitats of any such plants or of animals in, or under, or over the bed of any lake or river, unless the activity is expressly allowed for by a resource consent, or rule in a regional plan and in any relevant proposed regional plan.

TBP holds land use permit **7234-1** to realign a section of approximately 350 m of the Inaha Stream for land improvement purposes. This permit was issued by the Council on 12 March 2008 under Section 87(a) of the RMA. It is due to expire on 1 June 2023.

There are 11 conditions imposed on consent 7234-1.

- Condition 1 requires the consent to be exercised in accordance with documentation submitted.
- Conditions 2 and 4 relate to notification and timing of works.
- Condition 3 specifies the construction of a rock wall for bank protection.
- Conditions 5 and 6 address the control and mitigation of riverbed disturbance and sediment effects.
- Conditions 7 and 8 address the removal of fish from the old channel and future fish passage.
- Condition 9 prohibits the burial of the removed vegetation near the stream.
- Conditions 10 and 11 relate to lapse and review of consent.

This summary of consent conditions may not reflect the full requirements of each condition. The consent conditions in full can be found in the resource consents which are appended to this report.

1.4 Monitoring programme-water

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 TBP site consisted of five primary components.

1.4.2 Programme liaison and management

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

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- in 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 TBP site was visited 10 times during the monitoring period, further inspections were also undertaken when required. With regard to consents for the abstraction of or discharge to water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the Company were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

1.4.4 Water take

The water take is checked during site inspections. A rating curve for the stage board at Kohiti Road has been developed and maintained by the Council and updates provided to TBP since April 2001.

1.4.5 Chemical sampling

Compliance sampling is undertaken by the Council to assess the TBP's discharges to receiving waters. TBP operates a dual wastewater disposal system. The system discharges wastewater from the final (aerobic pond) pond 6 (Table 2 and Figure 2). The pond 6 discharge is either directly to the Inaha Stream under a 300:1 dilution ratio, when flow rates are appropriate as defined by consent, or through land application. The land application is undertaken through the use of travelling irrigators, on to and into TBP's irrigation area (Figure 3). Land application occurs mainly in the summer months when the flow rates within the Inaha Stream are insufficient to meet the consent 300:1 dilution rate.

In terms of monitoring of the dual wastewater system, the main focus of the sampling undertaken by the Council is to assess the likely effects associated with exercise of this system across the discharge mediums of surface water and soil/groundwater.

Surface water sampling focuses on sampling the Inaha Stream and associated tributaries (Northern and Western) (Table 3 and Figure 3) to firstly assess the likely effects of the discharge on the Inaha Stream when the site is discharging. Secondly, it is undertaken when TBP is discharging to land to assess the likely contribution from the irrigation areas' discharge to the groundwater (Figure 4) which may result in surface water interaction. Surface water analytes are provided in Table 4.

In terms of the irrigation areas, the Council sampled groundwater monitoring bores to assess the likely effects of the wastewater discharge on the groundwater. Groundwater analytes are provided in Table 4.

The site also operates a waste burial area, whereby if mechanical breakdown of the plant results in unprocessable product, this material may be buried in a specific consented area. As a result the Council monitors the burial pit monitoring wells to assess the likely effects of the process (Figure 4).

In addition, three temperature recorders (one installed in the cooling water tributary and the others upstream and downstream of the confluence of the Inaha Stream and its tributary) were run continuously and downloaded as required. TBP took responsibility for this monitoring in July 2010, and forwarded the data to Council monthly. The responsibility was returned to the Council in September 2013, at the request of TBP.

1.4.6 Biomonitoring surveys

Two surveys of biological communities at up to eight sites in the Inaha Stream and a major tributary were scheduled each year. These surveys assessed the effects of TBP's discharges (point source discharges and any diffuse source discharges as a result of spray irrigation) on benthic invertebrate communities of the stream. These surveys are further discussed in Section 2.4.6.

Table 2 TBP plant site point source sample key

Site	Description	Map reference, NZTM		Site code
		Easting	Northing	
A	Aerobic pond effluent	1703086	5623907	IND004004
B	Cooling water discharge	1702015	5623991	IND002004
C	Stormwater, firewater, coolant and groundwater seepage from reservoir	1701968	5624052	IND001014
D	Stormwater, firewater, coolant and groundwater seepage to Inaha	1701894	5624084	IND001015
E	No 1 stormwater: main reception, garage and yard to firewater reservoir	1702022	5623983	STW001075

Table 3 Inaha Stream and associated tributaries sampling points

Site	Description	Map reference, NZTM		Site code
		Easting	Northing	
1	Ahipaipa Road	1703013	5625271	INH000334
3	Bridge, 420 m u/s Kohiti Road	1702138	5624345	INH000348
4	Unnamed northern tributary at Inaha confluence	1701947	5624362	INH000397
5	Kohiti Road	1701874	5624322	INH000400
6	110 m d/s cooling water discharge and 30 m d/s pond 6 discharge	1701861	5623980	INH000408
7	500 m d/s pond waste discharge	1702021	5623745	INH000420
8	Normanby Road bridge, 1,450 m d/s discharges	1701650	5623262	INH000430
9a	Unnamed western tributary, 3,500 m u/s Inaha confluence	1701109	5625496	INH000433

Site	Description	Map reference, NZTM		Site code
		Easting	Northing	
9	Unnamed western tributary 2,550 m u/s Inaha confluence	1700816	5624558	INH000435
9b	Unnamed western tributary ~2,000 m u/s Inaha confluence	1700818	5624175	
9c	Unnamed western tributary ~1,450 m u/s Inaha confluence	1701183	5623577	
9d	Unnamed western tributary ~900 m u/s Inaha confluence	1701013	5623963	
10	Unnamed western tributary 250 m u/s Inaha confluence	1701518	5623227	INH000440
11	State Highway 45	1700393	5620330	INH000470



Figure 2 TBP plant site monitoring point source

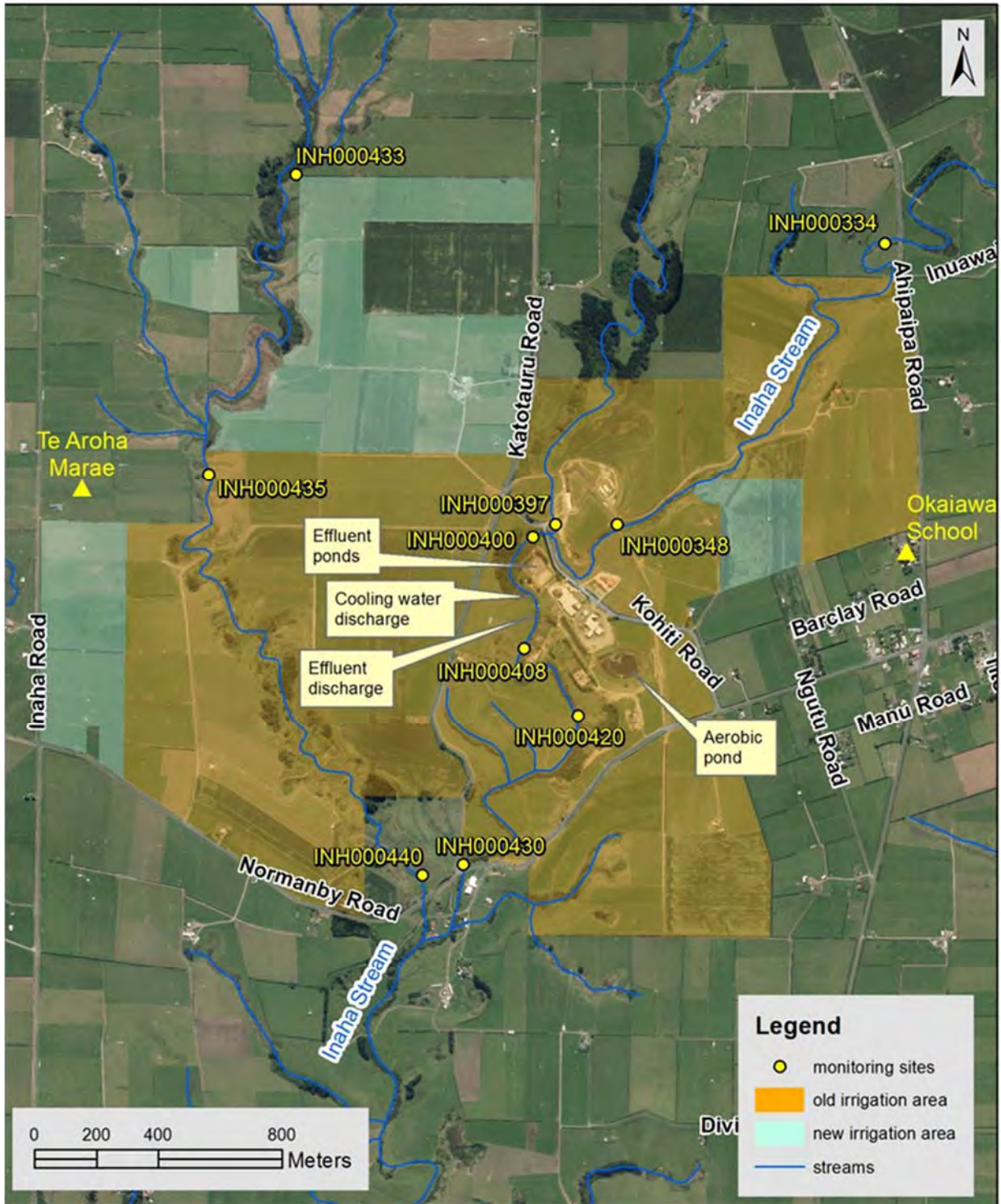


Figure 3 Inaha Stream and associated tributaries sampling locations

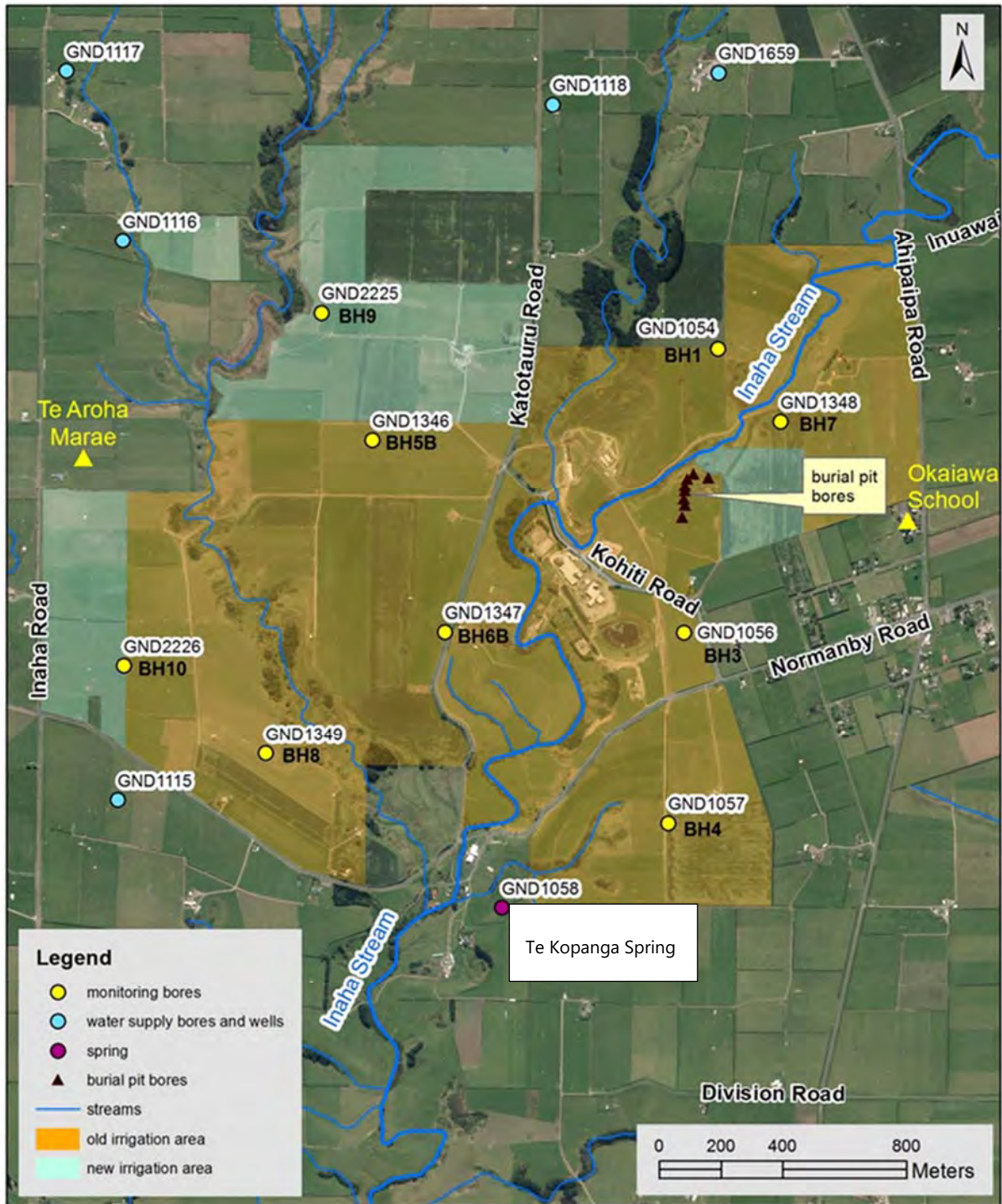


Figure 4 TBP groundwater monitoring well locations

Table 4 Surface water and groundwater monitoring analytes

Parameter	Description	Units
BOD	Biochemical oxygen demand 5day	g/m ³
CL	Chloride	g/m ³
CONDY	Conductivity @ 20°C	mS/m@20°C
DO	Dissolved Oxygen	g/m ³
DRP	Dissolved reactive phosphorus	g/m ³ P
FC	Faecal Coliforms	/100ml
NH ₃	Un-ionised ammonia	g/m ³
NH ₄	Ammoniacal nitrogen	g/m ³ N
NNN	Nitrite/nitrate nitrogen	g/m ³ N
NO ₂	Nitrite nitrogen	g/m ³ N
NO ₃	Nitrate nitrogen	g/m ³ N
PERSAT	Dissolved Oxygen Saturation %	%
pH	pH	pH
TEMP	Temperature	°C
TURBY	Turbidity	NTU
BODCF	Bioch.Ox.Demand,5day,flt;Ninh	g/m ³
FLOW	Flow	m ³ /s
LEVEL	Water Level	m
ALKT	Alkalinity Total	g/m ³ CaCO ₃
CA	Calcium	g/m ³
COD	Chemical Oxygen Demand	g/m ³
HCO ₃	Bicarbonate	g/m ³ HCO ₃
K	Potassium	g/m ³
KAR	Potassium Adsorption Ratio	None
MG	Magnesium	g/m ³
NA	Sodium	g/m ³
SAR	Sodium Adsorption Ratio	None
SO ₄	Sulphate	g/m ³
SS	Suspended solids	g/m ³
ST	Sulphide Total	g/m ³
TG	Total grease	g/m ³
TN	Total nitrogen	g/m ³ N
TP	Total phosphorus	g/m ³ P
O&G	Oil and Grease	g/m ³

1.5 Monitoring programme-air

1.5.1 Introduction

The air quality monitoring programme for the TBP site consisted of three primary components.

1.5.2 Programme liaison and management

This part of the monitoring programme was combined with that for the water monitoring programme, and involved discussion and liaison with TBP staff, both on site during regular inspections and at the Regional Council's and TBP's offices.

1.5.3 Site inspections

The TBP site was inspected on 10 occasions during the 2017-2018 monitoring period as part of the annual monitoring programme. An additional number of inspections were undertaken in response to complaints received-this is addressed further in Section 2.5.1 and 2.7.

The main points of interest were plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, and noxious or offensive emissions.

As far as was practicable, inspections in relation to air emissions were integrated with inspections undertaken for other purposes for example water monitoring or in response to complaints. A list of incidents which led to complaints is summarised in Section 2.7 of this report.

1.5.4 Monitoring by Taranaki By-Products

From 2 February 2012, TBP was required, under the new air discharge permit 4058-4 to operate in accordance with an Air Discharge Management Plan. In respect of monitoring, the Plan included the production of a daily activities log, the requirement to conduct ambient odour surveys, and maintenance of a register of complaints. The monitoring components of the Plan had been in place for several years.

The daily activities log presents a checklist of operational monitoring items that must be recorded on a routine daily basis, such as climatic data, condition of the wastewater and odour treatment systems, cleaning and maintenance of plant, and various process records such as temperature in the driers and blood coagulator.

The results of biofilter and weather monitoring, and comment from the daily activities log on events affecting environment quality, were forwarded to the Council on a monthly basis. Odour survey reports and the complaints register are made available during site inspections.

2 Results

2.1 Water

2.1.1 Inspections

Compliance monitoring inspections were undertaken at approximately monthly intervals throughout the monitoring period. Inspections pertaining to water-related matters were undertaken in conjunction with air quality inspections (Section 2.5.1).

A total of 10 routine inspections were undertaken during the 2017-2018 year. Council holds a record of detailed inspection notes which are available by request. Additional inspections were carried out in response to public complaints as they arose. Inspections were also carried out at the times of effluent and receiving water chemistry monitoring. During or immediately after each inspection, an officer of the Council made contact with a TBP representative to discuss the findings.

During inspections particular attention was given to the following items:

- rendering processes;
- air emission control systems;
- load-in and load-out areas;
- workshops;
- truck depot;
- chemical and oil/fuel storage areas;
- stormwater system;
- wastewater treatment system;
- land irrigation system;
- waste burial areas.

2.2 Water abstraction

In the previous monitoring period all water for processing at TBP's in-edibles rendering plant was drawn from the Inaha Stream at a point beside the plant under consent 2051-4. Water for the adjacent edibles plant, and potable water for both plants, came from Waimate West rural water supply.

In February 2014, following surface water quality problems experienced with new high pressure boilers and with other processes, TBP started to use groundwater taken under consent 9756-1 from a 151.2 m bore that had been sunk beside the old cowshed on Katotauru Road, about 800 m north-west of the in-edibles plant.

2.2.1 Surface water abstraction-Inaha Stream

The water take from the Inaha Stream resulted in no compliance issues with regard to the maintenance of the minimum flow (25 L/s downstream of the abstraction point) required under special condition 2 of consent 2051-4. However, on one occasion the maximum abstraction rate was exceeded.

In terms of the abstraction rate and specifically the limit of the abstraction rate, whereby consent 2051-4 allows for maximum daily abstraction rate of 2,160 m³ /day or 25 L/s on average, and an instantaneous maximum of 50 L/s. TBP continuously operate one of two pumps rated at 33 and 25 L/s, with the larger pump as the primary supply.

Under the Resource Management Regulations 2010 (Measurement and Reporting of Water Takes), TBP has been required since 10 November 2012 to take continuous measurements and keep daily records of volume

taken, and thereafter supply, by 31 July each year, the record of the preceding 1 July to 30 June period. TBP installed a flow measurement and recording system as required. Verification of the accuracy of the system was carried out by an approved certifier.

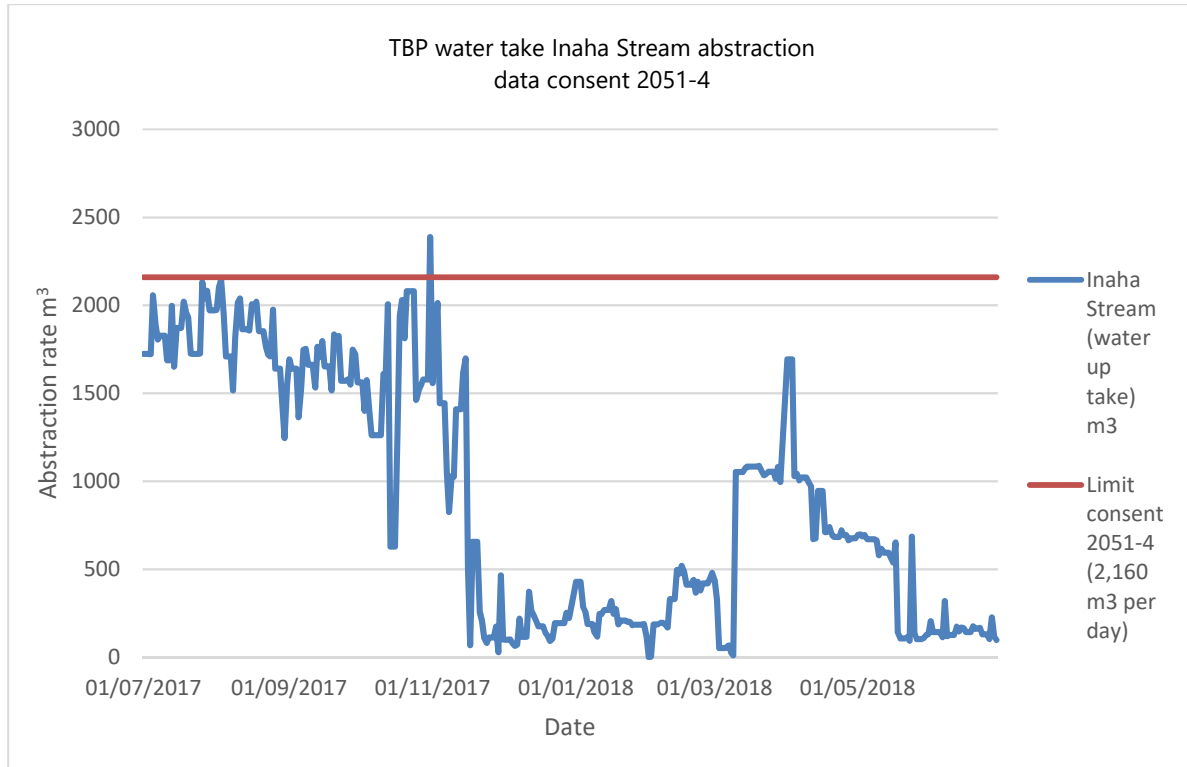


Figure 5 Consent 2051-4 abstraction data 2017-2018

The records provided by TBP (Figure 5) indicated that the consented abstraction daily maximum of 2,160m³ was complied with for the majority of the 2017-2018 monitoring period. On one occasion, 31 October 2017, the maximum abstraction rate was exceeded with an extraction of 2,388 m³, this was an exceedance of 228 m³.

2.2.2 Groundwater abstraction

Consent 9756-1 allows groundwater abstraction at a rate not exceeding 22.8 L/s (1,970 m³/day). The consent was first exercised in February 2014, before the required installation of a flow measurement, recording and telemetry system, for which abatement and infringement notices were issued at the time. Telemetry to Council's computer system was established on 27 March 2014. Verification of the accuracy of the measurement system was undertaken by an approved certifier. The telemetered record for the period ending 30 June 2016 is presented in the following Figure 6.

The total groundwater abstraction volume over this monitoring year (2017-2018) was 537,725 m³ and this equated to a daily average of 1,473 m³/ day. The consent limit as shown in Figure 6 is for a maximum daily abstraction rate of 1,970 m³ /day. Compliance was achieved.

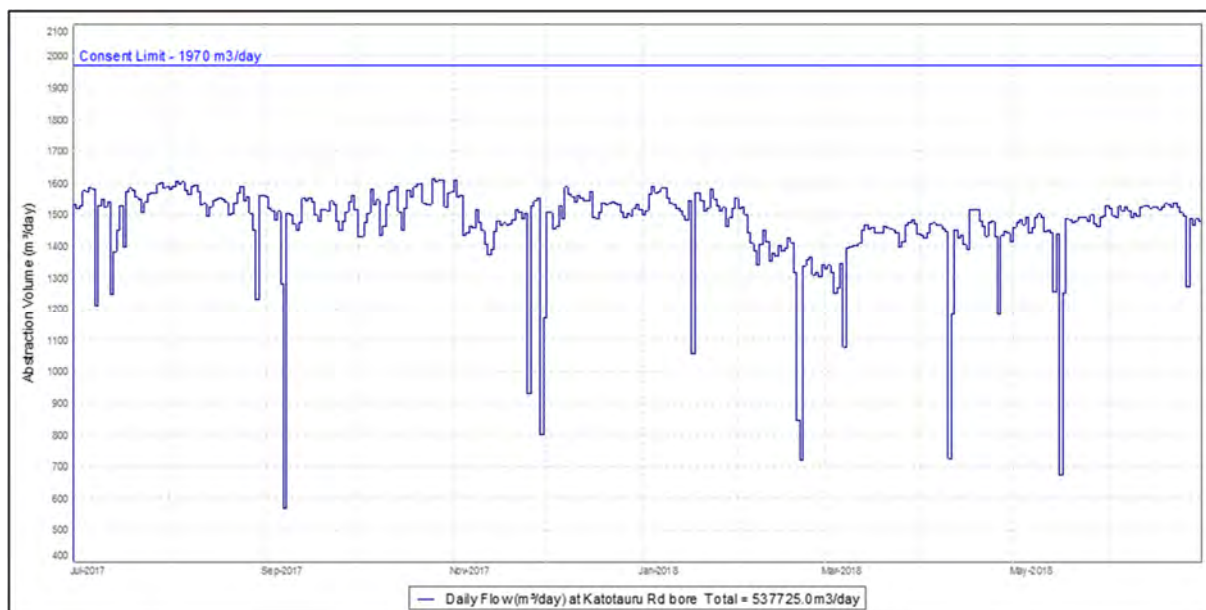


Figure 6 Daily groundwater abstraction volumes consent 9756-1 2017-2018

2.3 Discharges of wastewater

2.3.1 Pond six sampling

TBP hold consent 3941-2; to discharge up to 1,400 m³/ day of treated wastewater from a rendering operation and from a farm dairy onto and into land, in the vicinity of the Inaha Stream and its tributaries. It contains specific conditions with regard to the concentration of dissolved oxygen within this wastewater as well as the sodium absorption ratio (SAR). These conditions state that the level of dissolved oxygen within the wastewater should be above 1.0 g/m³ at all times and that the SAR of the wastewater should not exceed 15.

The following Table 5 contains the analysis of the four samples of pond 6, collected and analysed by the Council in the 2017-2018 monitoring period.

- Dissolved oxygen concentrations were found to be above the requisite 1.0g/m³ on three of the four samples analysed this period. The one occasion when the concentration was below the prescribed limit of 1.0 g/m³ was on the 14 December 2017 with a value of 0.96 g/m³, note this is 0.04 g/m³ below their requirement. It is also noteworthy to mention that the discharge at that time (December 2017) would have been specifically to land. Thus any affect would have been less than minor, as the fluid would be irrigated to land which would likely aerate the fluid before soil contact.
- Sodium absorption ratio (SAR) analysis indicated compliance with the consent condition of being below 15 SAR across the four samples analysed this period, which ranged from 6.75-10.24 SAR.
- Potassium absorption ratio (KAR) ranged from 2.78-4.0 g/m³ in the four monitoring rounds undertaken.
- Bicarbonate (HCO₃) ranged 112-340 g/m³ HCO₃.
- Temperature of pond 6 ranged from 20-30 °C this monitoring period.
- Alkalinity ranged from 92-279 g/m³ CaCO₃.
- Biological oxygen demand (BOD) of the wastewater ranged from 50-98 g/m³ this period.
- Filter carbonaceous (dissolved) biological oxygen demand (BODCF) ranged <2-41 g/m³ this period.
- Calcium in the wastewater range 17-30 g/m³ this period.

- Chloride indicated a slight increase in values throughout the period, from 194-230 g/m³.
- Chemical oxygen demand (COD) of the wastewater indicated a range of 320-540 g/m³ this period.
- Conductivity of the wastewater ranged 196-242 mS/m@20°C.
- Dissolved reactive phosphate (DRP) ranged 32-50 g/m³ P.
- E-coli analysis of the wastewater indicated a range in the four samples collected of 500-3,250 /100 ml.
- Potassium (K) ranged 113-142 g/m³.
- Magnesium (Mg) ranged 8.5-13.3 g/m³.
- Sodium (Na) ranged 177-210 g/m³ this period.
- Ammonia (NH₄) ranged 73-122 g/m³, whilst the corresponding un-ionised ammonia (NH₃) ranged 0.2-7-74 g/m³. The two higher results in this period corresponded to an elevated pH and in the warmer months of the year (December and March).
- Nitrate (NO₃) ranged 5.9-75 g/m³ N this period, whilst nitrite (NO₂) ranged 33-100 g/m³ N. Nitrate was the dominant of the two species at the beginning of the period, prior to nitrite dominating the subsequent three rounds of sampling.
- Oil and grease results were undertaken on three occasions, with two of the three results observed to be below the limit of detection <0.5 g/m³. The final round indicated a value of 9 g/m³.
- pH values ranged from 6.8-7.8 pH this period, the higher values were found in the summer months.
- Sulphate (SO₄) indicated a range of 108-200 g/m³ this period.
- Suspended solids results (SS) ranged from 160-340 g/m³ this period.
- Total sulphide (TS) analysis was undertaken on two occasions this period, both results were below the limit of detection (LOD).
- Three results of total grease (TG) were reported this period, ranging from <5-10 g/m³.
- Total nitrogen (TN) in the wastewater ranged from 159-260 g/m³ N.
- Total phosphate (TP) analysis indicated a range of 35-49 g/m³ P.
- Turbidity analysis of the wastewater from pond six indicated a range of 82-330 NTU this period.
- A singular result of total kjeldahl nitrogen (TKN) was reported this period, with value of 132 g/m³.

Table 5 Pond 6 (IND004004) effluent monitoring 2017-2018

Parameter	HCO ₃	KAR	SAR	DO	FLOW	PERSAT	TEMP	ALKT	BOD	BODCF	CA	CL	COD	CONDY	DRP	ECOL	K
Collected	g/m ³ HCO ₃	None	None	g/m ³	m ³ /s	%	°C	g/m ³ CaCO ₃	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	mS/m @20°C	g/m ³ P	/100ml	g/m ³
11 Oct 2017	112.2	2.78	6.75	1.81	DS	19.8	20	92	70	33	30.2	194	410	196	38.2	3250	124
14 Dec 2017	340.4	3.16	9.07	0.96	0	12.6	30.7	279	98	41	17.9	218	320	217	32	2490	116
21 Mar 2018	301.3	3.27	10.24	4.6	0	0.36	29.7	247	83	20	17.3	212	430	198	42.7	1850	113
12 Jun 2018	168	4	8.9	2.08	DS	23.2	20.1	138	50	< 2	24	230	540	242	50	500	142
Parameter	MG	NA	NH ₄	NH ₃	NO ₃	NNN	NO ₂	O&G	PH	SO ₄	SS	ST	TG	TN	TP	TURBY	TKN
Unit	g/m ³	g/m ³	g/m ³ N	g/m ³	g/m ³ N	g/m ³ N	g/m ³ N	g/m ³	pH	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³ N	g/m ³ P	NTU	g/m ³
11 Oct 2017	13.3	177	73.2	0.22	75	108	33	<0.5	6.8	108	300	<0.05	10	201	43.8	330	NR
14 Dec 2017	10.6	196	122	7.74	21.9	79.6	57.7	NR	7.8	128	170	NR	6	204	35.4	98	NR
21 Mar 2018	8.5	208	86.7	2.63	5.9	46.2	40.3	<0.5	7.5	114	160	NR	<5	159	49.7	82	NR
12 Jun 2018	10.6	210	111	0.33	26	125	100	9	6.9	200	340	< 0.002	NR	260	45	146	132

NR= No result.

Please refer to Table 4 for analyte acronyms.

2.3.2 Cooling water analysis

The cooling water discharge (to the firewater pond) was sampled on four occasions in this monitoring period (Table 6). The results indicated the following:

- The temperature of the cooling water discharge ranged 20-44.9 °C this period.
- The biological oxygen demand (BOD) of the cooling water ranged from 1-4.0 g/m³ this period.
- Conductivity analysis indicated a steady range this period, 26.5-30.4 mS/m @20°C.
- Ammonia analysis of the cooling water ranged 0.98-1.95 g/m³ N this period.
- pH analysis of the cooling water was found to be close to neutral, with a range of 7.1-7.4 pH.
- Turbidity analysis of the cooling water ranged from 4.5-16 NTU.

Table 6 Cooling water discharge IND002004

Parameter	TEMP	BOD	CONDY	NH ₄	PH	TURBY
Collected	°C	g/m ³	mS/m@20°C	g/m ³ N	pH	NTU
11 Oct 2017	34.1	2.3	29.9	1.86	7.3	8.3
14 Dec 2017	30.5	1	26.5	1.05	7.1	16
21 Mar 2018	44.9	2.7	30.4	1.95	7.3	5.2
12 Jun 2018	20	4	29.7	0.98	7.4	4.5

2.3.3 Stormwater analysis

Stormwater from the main yard, garage and raw material reception area, flow via a drain, from Kohiti Road in the firewater pond (monitoring location STW01075). The Council sampled this location four times during this monitoring period. The results of the sampling are provided in the following Table 7.

Table 7 Stormwater analysis STW001075

Parameter	TEMP	BOD	CONDY	ECOL	NH ₄	O&G	PH	SS	TURBY
Unit	°C	g/m ³	mS/m@20°C	/100ml	g/m ³ N	g/m ³	pH	g/m ³	NTU
11 Oct 2017	13.9	10	46.2	21400	1.19	10.5	6.8	17	8.1
14 Dec 2017	16.6	200	72.9	>242000	6.07	6.5	7	67	37
21 Mar 2018	19.3	51	91.4	>24200	9.11	0.7	7.2	18	8.7
12 Jun 2018	15.8	< 2	87	200000	1.22	NR	7.2	< 3	2.8

Consent 5426-1 places the following limits on the stormwater quality.

- pH between 6-9 pH.
- Suspended solids below 100g/m³.
- Oil and grease below 15 g/m³.

The resultant analysis indicated no exceedances with respect to consent conditions. Additional analytes indicated the following.

- E-Coli was recently added to the monitoring programme and all four results indicated significantly elevated E-Coli within the sample location.
- Ammonia results indicated a range of 1.19-6.07 g/m³ N this period in the four samples analysed.

- Biological oxygen demand (BOD) ranged <2-200 g/m³.

2.3.4 Inaha tributary at TBP site

The Council also collected samples from the tributary which runs through the firewater pond. The aim of this sampling exercise was to ascertain the combined discharges of the stormwater and the cooling water, as well as any seepage which may occur from the ring drain around the final pond 6. The sample location is IND001015, the resultant analysis is presented in Table 8.

Table 8 IND001015 Inaha tributary at TBP site

Parameter	NH ₃	NO ₃	DO	PERSAT	TEMP	ALKT	BOD	CL	TURBY
Unit	g/m ³	g/m ³	g/m ³	%	°C	g/m ³ CaCO ₃	g/m ³	g/m ³	NTU
11 Oct 2017	0.0074	NR	6.67	67.7	15.9	73	3.3	33.1	10
14 Dec 2017	0.0408	NR	7.44	92.8	26.3	110	7.7	39	8.3
21 Mar 2018	0.0159	NR	5.23	61.3	23.9	78	0.6	35.6	2.1
12 Jun 2018	0.02	1.54	6.81	68.2	14.7	104	< 2	95	15.2
Parameter	CONDY	DRP	ECOL	NH ₄	NNN	NO ₂	O&G	pH	SS
Unit	mS/m@20°C	g/m ³ P	/100ml	g/m ³ N	g/m ³ N	g/m ³	g/m ³	pH	g/m ³
11 Oct 2017	28.2	0.1	10,500	1.06	4.73	NR	<0.5	7.3	12
14 Dec 2017	33.6	0.004	72,700	1.72	2.39	NR	1.5	7.5	16
21 Mar 2018	44.2	0.12	1,170	0.999	1.76	NR	<0.5	7.4	5
12 Jun 2018	59.2	0.051	3,700	2.4	1.62	0.08	< 4	7.5	17

NR= no result.

- Dissolved oxygen ranged 5.23-7.44 g/m³ this period, whilst the corresponding percentage saturation ranged 61.3-92.8 %.
- Temperature of tributary ranged 14.7-26.3°C this period.
- Alkalinity of the tributary ranged 73-110 g/m³ CaCO₃.
- Biological oxygen demand (BOD) ranged from 0.6-7.7 g/m³.
- Chloride ranged 33-95 g/m³.
- Turbidity ranged 2.1-15.2 NTU this period.
- Conductivity ranged 28.2-59.2 across the four samples collected this period.
- Dissolved reactive phosphorus (DRP) indicated low concentrations, ranging 0.004-0.12 g/m³ P.
- E-coli analysis indicated a range of 1,170-72700 /100ml. With the most elevated result observed in the December sample round.
- Ammonia analysis (NH₄) ranged 0.99-2.4 g/m³ N this period.
- Nitrite/nitrate (NNN) nitrogen analysis indicated a range of 1.62-4.73 g/m³ N.
- Oil and grease returned one measurable concentration this period, 1.5 g/m³, in December 2017. The remaining three samples were a below the limit of detection (LOD).
- pH analysis indicated consistent results across the four sample this period, ranging 7.3-7.5 pH.
- Suspended solid concentrations ranged 5-17 g/m³ this period.

2.4 Results of receiving environment monitoring

2.4.1 Inaha Stream flow

The flow rate of Inaha Stream is measured for the purpose of managing the dilution of TBP's treated wastewater in the stream, and also the rate of abstraction. A water level staff gauge is installed at Kohiti Road Bridge, about 300 m upstream of the TBP discharge point. Stream flow rate is calculated from a rating curve developed from manual stream gaugings taken at the staff gauge site. The Council undertook two stream gaugings in the 2017-2018 reporting period.

TBP has regularly recorded staff gauge readings since May 2008. Previously, readings were taken less frequently, usually when wastewater was discharging to the stream, and during Council inspections.

The hydrograph for 2017-2018 period, drawn from the staff gauge readings at Kohiti Road is provided in the following Figure 7, included to this graph is a plot of the rate of the wastewater discharge to the stream, as measured at the v-notch weir at the outlet of Pond 6.

Special condition 6 on consent 2049 requires that minimum dilution rate of 1:300 for effluent discharged to the stream be maintained at all times, and special condition 8 requires that the discharge cease when flows in the stream, as measured at Kohiti Road Bridge, decrease to below 100 L/s. Special condition 2 on consent 2051 requires that a minimum flow of 25 L/s be maintained in the stream at the point of abstraction.

The results from the monitoring of wastewater and receiving water discharge rates by TBP show that the limit on the minimum dilution rate of 300:1 fold was achieved for the whole of the 2017-2018 period.

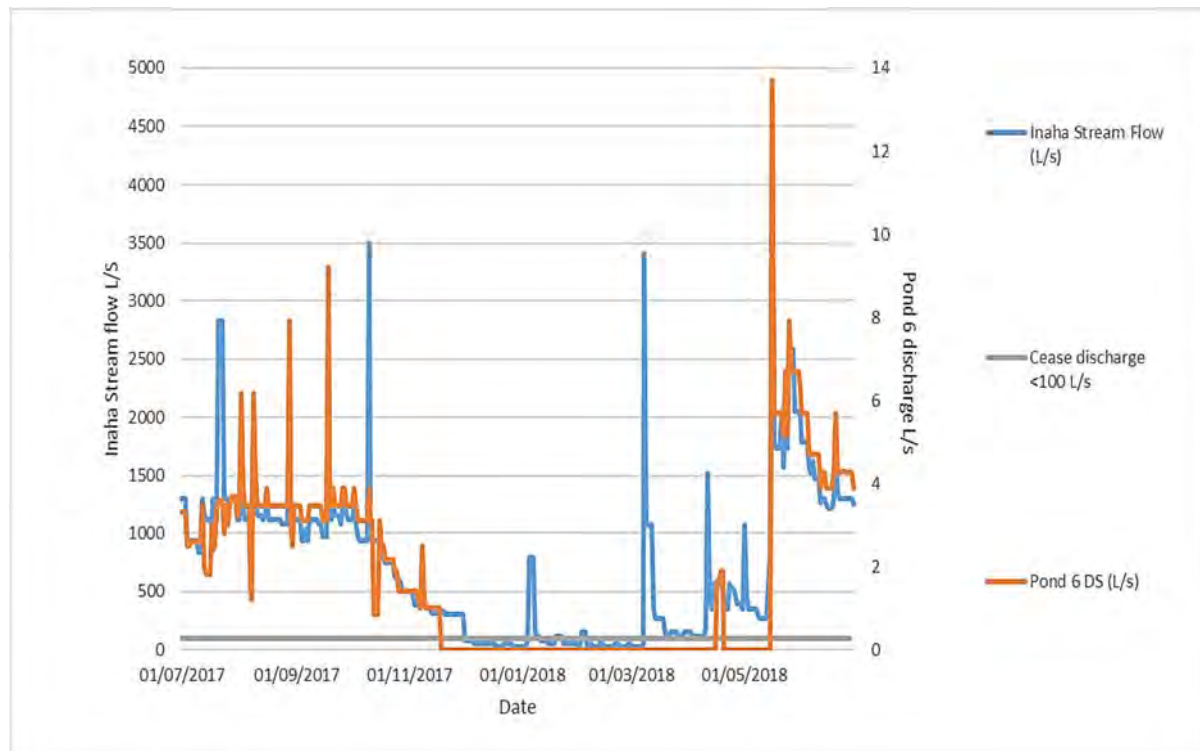


Figure 7 Hydrograph of Inaha Stream flow and pond 6 discharge 2017-2018

2.4.2 Inaha Stream temperatures

In-stream temperature recorders were operated throughout the monitoring period. These monitors are located within the unnamed tributary which receives the cooling water discharge and in the Inaha Stream upstream of the confluence with the tributary, and downstream of the confluence at the end of the mixing zone. In September 2013, the Council took over the temperature monitoring from TBP, at TBP's request.

The record over the 2017-2018 monitoring period for the temperature of cooling water discharged, and the increase in Inaha Stream temperature, is given in Figure 8 and Figure 9. The error on the cooling water temperature is ± 0.2 °C, and the error on the in-stream temperature increase is ± 0.4 °C.

For background, special condition 3 on consent 2050 requires that the temperature of the cooling water discharge must not exceed 35 °C. In this monitoring period (Figure 8) the limit was not exceeded, marking the fifth year TBP has been in compliance with this cooling water temperature condition.

Special condition 9 (c) on consent 2049 and special condition 5 (g) on consent 2050 require that there be no more than a 3.0 °C temperature differential in the receiving waters below the mixing zone as a result of the wastewater and cooling water discharges, respectively. Results presented in Figure 9 indicate compliance with this condition.

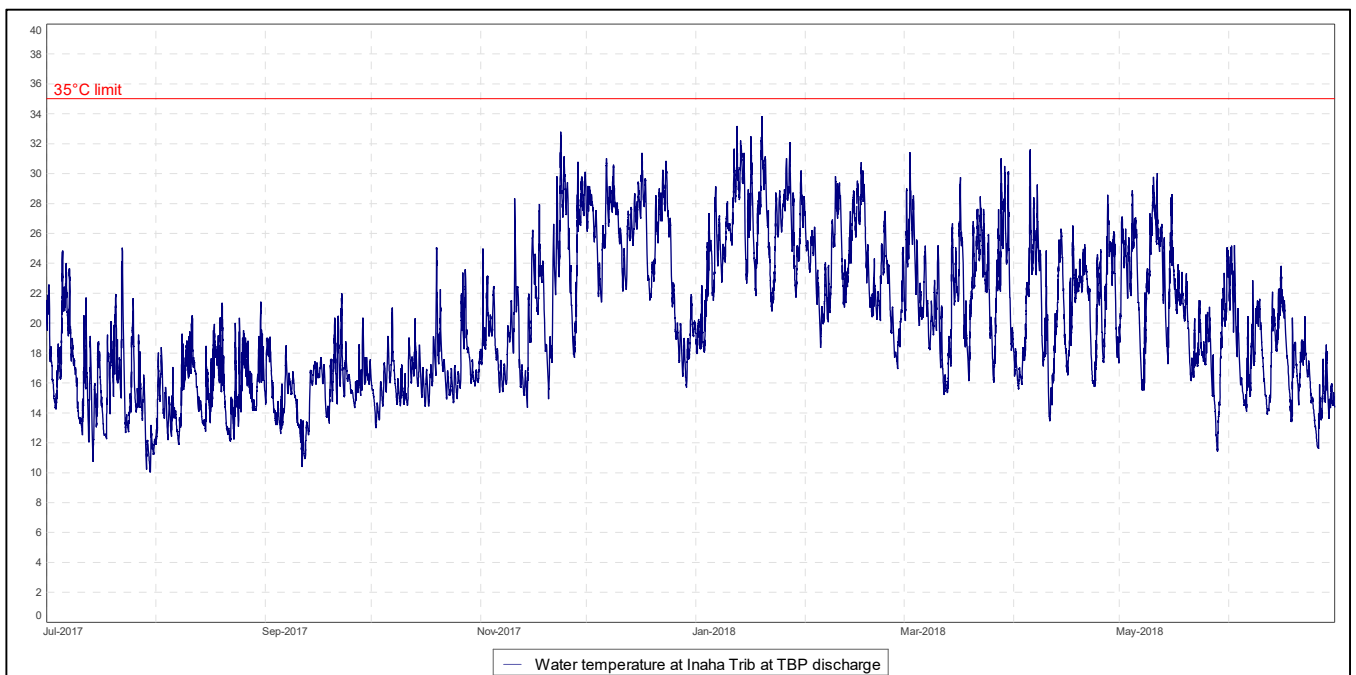


Figure 8 Temperature of the cooling water discharge 2017-2018

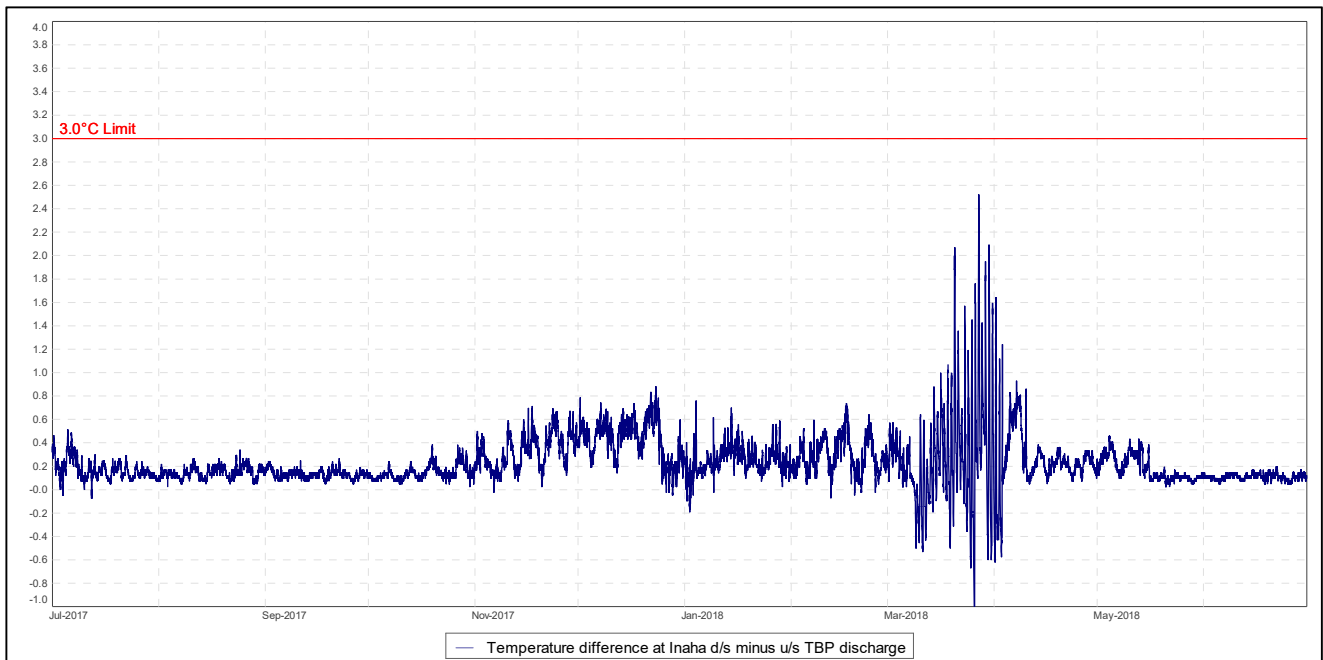


Figure 9 Inaha Stream temperature increase post discharge 2017-2018

2.4.3 Water chemistry

2.4.3.1 Inaha Stream

Surface water analysis is undertaken of the Inaha Stream and associated northern and western tributaries. In this monitoring period four rounds of surface water sampling were undertaken. These rounds were conducted on the following dates: 11 October 2017, 14 December 2017, 21 March 2018 and 12 June 2018.

On two occasions, 11 October 2017 and 12 June 2018, the facility was actively discharging pond 6 effluent at a 1:300 dilution rate, which is a consented discharge. These two sampling rounds stand to attest the effect of the discharge on the receiving waters of the Inaha Stream.

The other two sampling rounds, undertaken 14 December 2017 and 21 March 2018, were carried out when the facility was discharging to land only. TBP's dual wastewater disposal system compliments the TRC requirement to maximise application to land and not water, and also when flow conditions in the Inaha Stream prevent the prescribed 1:300 dilution rate. The sampling rounds undertaken when the facility is not actively discharging to land seek to assess for any likely contribution from the land applications of wastewater to surface water via groundwater.

The following two tables (Tables 9 and 10) represent the four sampling rounds undertaken on the main stem of the Inaha Stream in the 2017-2018 monitoring period. The corresponding analysis of the northern and western tributaries are presented further along in this section and will be discussed separately.

Please note for a graphical presentation of the sampling locations please refer to Figure 3.

Table 9 Inaha Stream surface water analysis October and December 2017

	Parameter	DO	PERSAT	TEMP	BOD	BODCF	CL	CONDY	DRP
Site	Collected/Unit	g/m ³	%	°C	g/m ³	g/m ³	g/m ³	mS/m@20C	g/m ³ P
Surface water 1									
INH000334	11 Oct 2017	10.03	96	13	2.4		22.8	18.9	0.048
INH000348	11 Oct 2017	10.4	99.5	13.1	2.5		24.5	19.9	0.041
INH000400	11 Oct 2017	10.33	98.7	13.1	2.2	<0.5	26.9	21.2	0.042
INH000408	11 Oct 2017	10.29	98.9	13.4	2	<0.5	27.7	21.6	0.061
INH000420	11 Oct 2017	10.34	99.4	13.5	2.1	<0.5	27.7	21.7	0.08
INH000430	11 Oct 2017	10.36	101	14.1	2.5	<0.5	28.2	21.9	0.072
INH000470	11 Oct 2017	9.9	96.8	14.4	2.5		33.1	25	0.075
	Parameter	ECOL	NH ₄	NH ₃	NNN	NO ₃	NO ₂	pH	TURBY
Site	Collected/Unit	/100ml	g/m ³ N	g/m ³	g/m ³ N	g/m ³ N	g/m ³ N	pH	NTU
INH000334	11 Oct 2017	10,500	0.048	0.00034	3.43			7.4	17
INH000348	11 Oct 2017	9,210	0.072	0.00065	3.65			7.5	13
INH000400	11 Oct 2017	8,160	0.069	0.00062	3.72	3.70	0.024	7.5	12
INH000408	11 Oct 2017	9,210	0.118	0.00109	3.83	3.79	0.038	7.5	17
INH000420	11 Oct 2017	6,490	0.149	0.00174	4.03	3.97	0.056	7.6	13
INH000430	11 Oct 2017	5,170	0.129	0.00157	3.9	3.85	0.055	7.6	14
INH000470	11 Oct 2017	3,450	0.122	0.00152	4.63			7.6	13
	Parameter	DO	PERSAT	TEMP	BOD	BODCF	CL	CONDY	DRP
Site	Collected/Unit	g/m ³	%	°C	g/m ³	g/m ³	g/m ³	mS/m@20C	g/m ³ P
Surface water 2									
INH000334	14 Dec 2017	9.9	106.1	18.2	1		28.4	21.4	0.038
INH000348	14 Dec 2017	10.01	106.9	19	1		29.7	23.3	0.033
INH000400	14 Dec 2017	10.06	108.9	19.2	0.8	0.7	32	24.4	0.028
INH000408	14 Dec 2017	9.9	109.9	20	1.8	0.8	32.3	25.7	0.03
INH000420	14 Dec 2017	10.09	112.3	20.3	1.8	0.8	33.5	25.7	0.03
INH000430	14 Dec 2017	10.29	119	22.2	1.6	0.8	34.6	26.2	0.032
INH000470	14 Dec 2017	9.23	103.8	20.9	1.3		45.5	32	0.039
	Parameter	ECOL	NH ₄	NH ₃	NNN	NO ₃	NO ₂	pH	TURBY
Site	Collected/Unit	/100ml	g/m ³ N	g/m ³	g/m ³ N	g/m ³ N	g/m ³ N	pH	NTU
INH000334	14 Dec 2017	1,850	<0.003	0.00004	1.89			7.8	2.9
INH000348	14 Dec 2017	882	0.009	0.00049	3.03			8.1	2.8
INH000400	14 Dec 2017	1,080	0.009	0.01065	1.83	1.82	0.006	8.1	3.4
INH000408	14 Dec 2017	5,480	0.196	0.00903	3.39	3.37	0.025	8	5.8
INH000420	14 Dec 2017	3,650	0.137	0.01	3.45	3.42	0.033	8.2	3.8
INH000430	14 Dec 2017	2,360	0.067	0.0127	3.6	3.56	0.037	8.6	2.7
INH000470	14 Dec 2017	1,350	0.028	0.00138	4.8			8	7

Table 10 Inaha Stream surface water March and June 2018

	Parameter	DO	PERSAT	TEMP	BOD	BODCF	CL	CONDY	DRP
Site	Collected/Unit	g/m ³	%	°C	g/m ³	g/m ³	g/m ³	mS/m@20C	g/m ³ P
Surface water 3									
INH000334	21 Mar 2018	9.12	92.2	16.4	1		22.3	17.4	0.043
INH000348	21 Mar 2018	9.61	97.6	16.7	1.1		23.3	18.1	0.042
INH000400	21 Mar 2018	9.69	98.8	16.9	0.9	<0.5	24.1	18.9	0.044
INH000408	21 Mar 2018	9.54	98.9	17.7	1	<0.5	25.1	19.5	0.048
INH000420	21 Mar 2018	9.76	101.3	17.9	1	<0.5	25.1	19.4	0.051
INH000430	21 Mar 2018	9.7	101.8	18.3	1.4	<0.5	25.2	19.6	0.057
INH000470	21 Mar 2018	9.56	100.4	18.5	1.4		31.8	23.4	0.068
	Parameter	ECOL	NH ₄	NH ₃	NNN	NO ₃	NO ₂	pH	TURBY
Site	Collected/Unit	/100ml	g/m ³ N	g/m ³	g/m ³ N	g/m ³ N	g/m ³ N	pH	NTU
INH000334	21 Mar 2018	384	0.011	0.00016	2.94			7.6	5.6
INH000348	21 Mar 2018	441	0.012	0.00022	3.13			7.7	6.8
INH000400	21 Mar 2018	404	0.015	0.00035	2.96	2.95	0.006	7.8	5.3
INH000408	21 Mar 2018	432	0.1	0.00249	3.47	3.46	0.012	7.8	8
INH000420	21 Mar 2018	309	0.077	0.00244	3.23	3.22	0.013	7.9	8.5
INH000430	21 Mar 2018	243	0.055	0.00224	3.13	3.12	0.015	8	7.9
INH000470	21 Mar 2018	594	0.056	0.00185	3.34			7.9	5.3
	Parameter	DO	PERSAT	TEMP	BOD	BODCF	CL	CONDY	DRP
Site	Collected/Unit	g/m ³	%	°C	g/m ³	g/m ³	g/m ³	mS/m@20C	g/m ³ P
Surface water 4									
INH000334	12 Jun 2018	10.65	102	11.9	< 2		25	22.9	0.017
INH000348	12 Jun 2018	10.81	101.7	12	< 2		26	23.5	0.018
INH000400	12 Jun 2018	10.73	100.9	12	< 2	< 2	28	24.8	0.019
INH000408	12 Jun 2018	10.67	106.6	12.2	< 2	< 2	29	25.3	0.038
INH000420	12 Jun 2018	10.56	100	12.1	< 2	< 2	29	26	0.113
INH000430	12 Jun 2018	10.62	100.8	12.2	< 2	< 2	30	26	0.111
INH000470	12 Jun 2018	10.37	97.9	12.2	3		34	28.2	0.093
	Parameter	ECOL	NH ₄	NH ₃	NNN	NO ₃	NO ₂	pH	TURBY
Site	Collected/Unit	/100ml	g/m ³ N	g/m ³	g/m ³ N	g/m ³ N	g/m ³ N	pH	NTU
INH000334	12 Jun 2018	220	0.01	< 0.010	4.2	4.2	0.011	7.6	7.5
INH000348	12 Jun 2018	170	0.015	< 0.010	4.4	4.4	0.01	7.7	6.2
INH000400	12 Jun 2018	250	0.011	< 0.010	4.4	4.4	0.011	7.5	7.9
INH000408	12 Jun 2018	250	0.083	< 0.010	4.6	4.6	0.056	7.6	8.5
INH000420	12 Jun 2018	190	0.27	0.017	4.8	4.6	0.21	7.7	7.8
INH000430	12 Jun 2018	240	0.22	< 0.010	4.8	4.6	0.194	7.5	7
INH000470	12 Jun 2018	220	0.118	< 0.010	5.2	5	0.138	7.3	10.4

TBP holds discharge consent 2049. This consent allows for the discharge of treated wastewater from TBP's rendering plant to the Inaha Stream. It places specific limits on the combined effect of all discharges from the plant on dissolved oxygen, BOD, total ammonia and pH levels on the receiving waters in the stream, beyond the boundary of a 30 m mixing zone.

The specific limits are as follows: Consent 2049-4 Condition 9.

The discharge (in conjunction with any other discharges pertaining to the same property), shall not cause, or give rise to any of the following effects, at any point in the receiving waters below the mixing zone:

- a. a fall of more than 0.5 pH units;
- b. an increase in filtered carbonaceous biochemical oxygen demand to above 2.0 g/m³;
- c. a temperature rise of more than 3.0°C
- d. a reduction in the dissolved oxygen concentration to below 80% saturation concentration;
- e. the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
- f. any conspicuous change in colour or visual clarity;
- g. any emission of objectionable odour;
- h. the rendering of freshwater unsuitable for consumption by farm animals;
- i. any significant adverse effects on aquatic life, habitats or ecology; and
- j. any visible bacterial and/ or fungal growths in the receiving waters

The effect that the discharge has on the receiving environment is a function of the relative flow rates of the stream and effluent, the strength of the effluent, and the quality of the stream above the discharge point.

Results for individual parameters of concern are discussed separately below.

Dissolved oxygen

Consent 2049 requires that the discharge shall not reduce the concentration of dissolved oxygen (DO) of the receiving water to below 80% of saturation concentration, that is, about 6-9 g/m³ in the case of Inaha Stream, depending on the stream temperature. This limit is set for the protection of fish populations. Sampling runs were timed to take place when dissolved oxygen concentration is at its lowest, in early to mid-morning.

DO was monitored on all four occasions in the 2017-2018 monitoring year, the results were in compliance with the limit on all four occasions.

Monitoring in recent years has shown that, during lower flows, there tends to be a slight increase in dissolved oxygen between Ahipaipa Road and Kohiti Road (between sites INH000334 and INH000400), and a slight decrease below the rendering plants at the second and third sites downstream, 500 m downstream and at Normanby Road. During winter and spring flows, when TBP wastewater is being discharged, there tends to be a slight decrease at the first site downstream.

Biochemical oxygen demand

Consent 2049 requires that the discharge shall not raise the filtered carbonaceous biochemical oxygen demand (BODCF) above 2 g/m³ in the receiving waters of the stream. This limit is set to control excessive bacterial or fungal slime growths. The Council monitored for both total and filtered on four occasions in 2017-2018. Total BOD is also monitored to assess the potential for dissolved oxygen sag.

The limit was complied with on each monitoring occasion; the maximum downstream filtered BODCF value was 0.8 g/m³ and ranged from 0.7 g/m³ to 0.8 g/m³. The highest readings were recorded during December 2017.

BOD determinations with and without nitrifier inhibition (carbonaceous and total BOD) showed that oxygen demand exerted by TBP's effluent was largely nitrogenous. This is supported by the observed conversion of ammonia to nitrate (nitrification) and concurrent slight DO sag in the stream, and is consistent with the discharge of wastewater containing active nitrifying bacteria together with a significant amount of ammonia.

Total ammonia and pH

Consent 2049 requires that the discharge shall not raise the total ammonia concentration (reported as NH_4) in the receiving water above 1.5 g/m^3 if the pH of the receiving water is below 7.75, or above 0.7 g/m^3 if the pH lies between 7.75 and 8.0, or above 0.4 g/m^3 if the pH is above 8.0. The permit also requires that the discharge not cause a fall of more than 0.5 pH units in the receiving water. These limits are set for the protection of fish populations.

During the monitoring period of 2017-2018, there was no exceedance with the ammonia values when compared to the pH level. Of note, the site was only discharging during two of the four monitoring rounds. The highest value of NH_4 was observed in the June 2018 sample, at location INH000420 with a value of $0.27 \text{ g/m}^3 \text{ N}$, with a pH of 7.7 and an NH_3 result of 0.017 g/m^3 .

Tributaries of the Inaha Stream

Physico-chemical monitoring of the two tributaries (the northern and western tributaries) which run through irrigated areas on the western side of Inaha Stream were carried out to determine the effects of wastewater irrigation. The locations and descriptions of the monitoring sites are given in Figure 3 and Table 3 respectively.

The water quality of the two tributaries have a higher conductivity than the main stem, reflecting the closer proximity of their catchment to the sea but also potentially reflecting activities within the sub-catchments. Nitrate concentration is the factor most likely to be affected by irrigation.

2.4.3.2 Northern Tributary

The northern tributary joins the Inaha Stream immediately above Kohiti Road. It runs a distance of about 0.64 km through the Kohiti block of TBP's farm, about 0.42 km adjacent to potentially irrigated areas. The tributary is monitored at its confluence with the main stream at Site 4/INH000397. The analysis of the samples collected in this monitoring period are provided in Table 11.

Analysis of the northern tributary showed a slight decrease from the maximum nitrate/nitrite concentrations observed in the previous monitoring period, $4.61 \text{ g/m}^3 \text{ N}$ (NNN) which was recorded in August 2017. In this period the most elevated result was observed in June 2018 with a value of $4.3 \text{ g/m}^3 \text{ N}$ (NNN).

Table 11 Northern tributary 2017-2018 monitoring (INH000397)

Parameter	DO	PERSAT	TEMP	BOD	CL	CONDY	TURBY	pH
Collected/Unit	g/m ³	%	°C	g/m ³	g/m ³	mS/m@20°C	NTU	pH
11 Oct 2017	9.88	94.6	13.2	2.2	32.9	26.3	14	7.4
14 Dec 2017	9.44	98.2	16.7	0.9	38.5	29.5	5.8	7.7
21 Mar 2018	8.55	87.2	16.9	0.8	37.8	28	1.9	7.5
12 Jun 2018	10.26	97.6	11.9	< 2	35	29.8	6.5	7.5
Parameter	DRP	ECOL	NH ₄	NH ₃	NNN	NO ₃	NO ₂	
Collected/Unit	g/m ³ P	/100ml	g/m ³ N	g/m ³	g/m ³ N	g/m ³ N	g/m ³ N	
11 Oct 2017	0.061	6,490	0.13	0.00094	4.08	NR	NR	
14 Dec 2017	0.03	1,400	<0.003	0.00003	2.98	NR	NR	
21 Mar 2018	0.044	364	0.043	0.00051	1.96	NR	NR	
12 Jun 2018	0.017	700	0.029	< 0.010	4.3	4.3	0.013	

2.4.3.3 Western Tributary

The western tributary joins the Inaha Stream immediately below Normanby Road. It runs a distance of about 3.5 km through land that is irrigated on both sides with TBP wastewater. The distance of the stream in its valley to the irrigated areas on the plateau above is about 50 to 100 m.

The tributary is monitored at three points: INH000433 which is above the TBP farm; INH000435 which was the original upstream site is situated 2.5 km above the Inaha confluence, before the irrigation area was extended; and INH000440 which is the final site on the Western tributary. This is located immediately above Normanby Road, about 0.22 km above the confluence with the main stem of Inaha Stream.

In this monitoring period the main stem of the western tributary (which includes three monitoring sites: INH000433/435 and 440) was monitored on four occasions at the same time as the Inaha Stream was sampled (Tables 12 and 13).

INH000440, which is the lowest site on the western tributary, was monitored on seven additional occasions. The rationale for the increase in monitoring of this location is specifically related to a continued elevation of nitrate/nitrite nitrogen (NNN) observed specifically at the lower of the three sites. For comparison, the most elevated concentration of NNN observed in the monitoring of site INH000440 in the previous monitoring period (2016-2017) was 8.2 g/m³ N, while in the 2015-2016 period it was observed at 13 g/m³ N. This period NNN was observed to peak at 12.8 g/m³ N, 26 February 2018 (Table 14). There was also one standalone result found in the previous monitoring period, of 24 g/m³ N (NNN) recorded on the 10 February 2017.

Table 12 Surface water monitoring of the Western tributary 2017 (October and December 2017)

SW1	Parameter	DO	PERSAT	TEMP	BOD	CL	CONDY	DRP	
Site	Collected/Unit	g/m ³	%	°C	g/m ³	g/m ³	mS/m@20°C	g/m ³ P	
INH000433	11 Oct 2017	9.4	91.1	13	1.5	33.7	25.3	0.021	
INH000435	11 Oct 2017	9.46	92.1	14	0.6	39.5	29.3	0.014	
INH000440	11 Oct 2017	10.16	99.7	14.3	0.6	43.7	31.9	0.014	
SW1	Parameter	ECOL	NH ₄	NH ₃	NNN	NO ₃	NO ₂	pH	TURBY
Site	Collected/Unit	/100ml	g/m ³ N	g/m ³	g/m ³ N	g/m ³ N	g/m ³ N	pH	NTU
INH000433	11 Oct 2017	24,300	0.012	0.00011	2.67	NR	NR	7.5	15
INH000435	11 Oct 2017	2,140	0.054	0.00041	5.52	NR	NR	7.4	4.9
INH000440	11 Oct 2017	1,090	0.032	0.0004	7.26	NR	NR	7.6	1.7
SW2	Parameter	DO	PERSAT	TEMP	BOD	CL	CONDY	DRP	
Site	Collected/Unit	g/m ³	%	°C	g/m ³	g/m ³	mS/m@20°C	g/m ³ P	
INH000433	14 Dec 2017	8.36	86.1	16.2	0.9	38.9	29.8	0.017	
INH000435	14 Dec 2017	9.8	88.9	18.9	0.9	45	33.6	0.017	
INH000440	14 Dec 2017	10.31	112	19	1	54.6	39.8	0.013	
SW2	Parameter	ECOL	NH ₄	NH ₃	NNN	NO ₃	NO ₂	pH	TURBY
Site	Collected/Unit	/100ml	g/m ³ N	g/m ³	g/m ³ N	g/m ³ N	g/m ³ N	pH	NTU
INH000433	14 Dec 2017	987	0.018	0.00026	2.36	NR	NR	7.6	16
INH000435	14 Dec 2017	529	0.022	0.00048	4.98	NR	NR	7.7	6
INH000440	14 Dec 2017	830	0.014	0.00075	10.7	NR	NR	8.1	3.7

The cause of this elevated peak was unknown, and follow up analysis undertaken 28 February 2017 recorded a value of 10.7 g/m³ N (NNN).

In this monitoring period the analysis indicated a general increase in conductivity, chloride and nitrate/nitrite nitrogen (NNN) concentrations from top to the bottom of the monitoring locations (moving down stream). This effect was generally more pronounced when the facility was discharging to land only, which was during two of the four monitoring runs, December 2017 and March 2018. This also when the stream flow is at its lowest.

Table 13 Surface water monitoring of the Western tributary 2018 (March and June 2018)

SW3	Parameter	DO	PERSAT	TEMP	BOD	CL	CONDY	DRP	
Site	Collected/Unit	g/m ³	%	°C	g/m ³	g/m ³	mS/m@20°C	g/m ³ P	
INH000433	21 Mar 2018	6.4	65.1	16.7	0.7	44.7	31.6	0.014	
INH000435	21 Mar 2018	8.09	83.5	17.4	1.1	56	37.2	0.017	
INH000440	21 Mar 2018	7.74	78.8	16.9	3.2	70.3	28.6	0.012	
SW3	Parameter	ECOL	NH ₄	NH ₃	NNN	NO ₃	NO ₂	pH	TURBY
Site	Collected/Unit	/100ml	g/m ³ N	g/m ³	g/m ³ N	g/m ³ N	g/m ³ N	pH	NTU
INH000433	21 Mar 2018	203	0.007	0.00007	0.97	NR	NR	7.4	12
INH000435	21 Mar 2018	609	0.03	0.00047	4.55	NR	NR	7.6	6.3
INH000440	21 Mar 2018	295	0.017	0.00025	10.8	NR	NR	7.6	5.1
SW4	Parameter	DO	PERSAT	TEMP	BOD	CL	CONDY	DRP	
Site	Collected/Unit	g/m ³	%	°C	g/m ³	g/m ³	mS/m@20°C	g/m ³ P	
INH000433	12 Jun 2018	9.82	92.8	12	< 2	40	32.6	0.008	
INH000435	12 Jun 2018	9.8	92.1	11.6	< 2	45	35.2	0.011	
INH000440	12 Jun 2018	10.32	96.7	11.7	< 2	49	37.8	0.013	
SW4	Parameter	ECOL	NH ₄	NH ₃	NNN	NO ₃	NO ₂	pH	TURBY
Site	Collected/Unit	/100ml	g/m ³ N	g/m ³	g/m ³ N	g/m ³ N	g/m ³ N	pH	NTU
INH000433	12 Jun 2018	230	< 0.010	< 0.010	3.8	3.8	0.004	7.6	6.6
INH000435	12 Jun 2018	90	0.23	< 0.010	6.1	5.9	0.128	7.4	2.9
INH000440	12 Jun 2018	140	0.153	< 0.010	8.2	8.1	0.128	7.5	12.9

Table 14 INH000440 (Western Tributary) 2017-2018 monitoring period

	Parameter	TEMP	CL	CONDY	NH ₄	NNN	pH	TURBY
Site	Collected/ Unit	°C	g/m ³	mS/m@20°C	g/m ³ N	g/m ³ N	pH	NTU
INH000440	05 Sep 2017	11.5	47	33.8	0.01	8.18	7.7	NR
INH000440	15 Nov 2017	16.3	47.6	36.4	0.02	9.06	8.1	NR
INH000440	19 Dec 2017	NR	55.5	40	NR	10.7	7.9	6.1
INH000440	26 Feb 2018	16.3	71.5	46.9	0.008	12.8	7.4	1.4
INH000440	03 May 2018	11.6	58.5	38.8	0.026	7.89	7.6	7.2
INH000440	22 May 2018	11.9	49.5	32.6	0.047	5.38	7.5	16
INH000440	11 Jun 2018	10.6	46	37.3	0.057	7.9	7.5	4.8

2.4.4 Irrigation and groundwater monitoring

TBP holds consent 3941-2; this consent allows for the discharge of up to 1,400 m³/day of treated wastewater from their rendering operation onto and into the land in the vicinity of the Inaha Stream and its tributaries.

The wastewater is monitored by both TBP and the Council. TBP measures and records wastewater volumes discharged on each paddock daily, and analyses nitrogen constituents of the wastewater at approximately weekly intervals. Some soil testing has been carried out.

Monitoring by the Council included the following. Inspection of the irrigation areas, effluent analysis, chemical and biological surveys of the Inaha Stream, sampling from the groundwater bores installed around the irrigation areas and of a spring situated near an irrigation area that is used to supply several households.

2.4.4.1 Irrigation area and system

The spray irrigation system employs low-medium pressure travelling irrigators with a 30 m or 50 m swath. Use of a 'Rotorainer' irrigator with a 100 m boom, that requires less maintenance, commenced in May 2008. A second Rotorainer was employed from January 2009.

The area irrigated has progressively increased, as TBP has purchased or leased more land around the rendering plants. Prior to 2006, irrigation occurred on four blocks, three owned by TBP on Kohiti Road (38.83 ha), Normanby Road (37.95 ha) and Katotauru Road (20.15 ha), and a block owned by Mr and Mrs Shearer on Katotauru Road (19.27 ha).

An extension followed the change of consent 3941 in December 2005, which provided for two additional blocks to be irrigated, one leased on Katotauru/Normanby Roads (about 110 ha), the other purchased on Ahipaipa Road (about 48 ha). The blocks were developed in stages by re-fencing and reticulation in 2006 and 2007.

TBP bought or leased further parcels adjacent to the existing irrigation areas, and in November 2009 was granted a change of consent 3941-2 to provide for irrigation on them. Part of this additional land, adjacent to the Katotauru Road block, 17.4 ha area in total, was irrigated from December 2009. Irrigation of "Maori Trust land", 20.6 ha in area beside Upper Inaha Road, started in December 2010. A further area of about 19.1 ha, in the "Kingi Block" to the north, that spans the Inaha Stream tributary between Katotauru and Upper Inaha Roads, was reticulated in December 2010 and irrigated from October 2011, after a groundwater monitoring bore (BH9) was installed down-gradient.

Previous monitoring year's loading (2016-2017)

In the 2016-2017 monitoring period the TBP site had 329.50 hectares available for discharges of wastewater and or fertiliser/ Zealgrow. In that period they discharged a combined (wastewater and fertiliser) application of 32,042 kg of nitrogen. This was a combined total application of 97 kg N/ha.

However as the paddocks were of various sizes and are limited to 300 kg N/ha (note the 200 kg N/ha paddocks was not utilised during the 2016-2017 monitoring year by TBP) in terms of applications of wastewater. The overall compliance with respect to loadings of wastewater in terms of nitrogen is as follows.

The highest recorded application of wastewater was to paddock 23, which received a total of 264 kg N/ha in the 2016-2017 monitoring year. This was compliant with the stated maximum for wastewater application which is limited strictly to 300 kg N/ha per year, as per consent 3941-2.

Paddock 23 did not receive any additional fertiliser (Zealgrow) this monitoring year. The highest volume of fertiliser applied to land was found to be 61 kg N/ha in paddock 7, this had a combined total of 163 kg N/ha.

Current monitoring period loadings

In the current monitoring period the TBP site had 366.25 hectares available for discharges of wastewater and or fertiliser/ Zealgrow, of which they utilised 302.54 hectares. In this period they discharged a combined (wastewater and fertiliser) application of 45,210 kg of nitrogen. This was a combined total application of 149 kg N/ha.

However as the paddocks are of various sizes and are limited to 300 kg N/ha (note only five paddocks within the strict 200 kg N/ha paddocks were utilised this monitoring year by TBP for wastewater, all loadings were below 100 kg N/ Ha) in terms of applications of wastewater. The overall compliance with respect to loadings of wastewater in terms of nitrogen is as follows.

The highest recorded application of wastewater was to paddock 22, which received a total of 295 kg N/ha in the 2017-2018 monitoring year. This was compliant with the stated maximum for wastewater application which is limited strictly to 300 kg N/ha per year, as per consent 3941-2.

Paddock 22 did not receive any additional fertiliser (Zealgrow) this monitoring year. The highest volume of fertiliser (Zealgrow) applied to land was found to be 250 kg N/ha in paddock 1, this paddock also did not receive any additional applications of wastewater during this period.

The highest combined application of wastewater and fertiliser was observed to be paddock 31. This paddock received 46 kg N/ha of fertiliser and 260 kg N/ha of wastewater, which was a combined total of 306 kg N/ha. Note that this is not a breach in consent conditions as the loading for wastewater was below 300 kg N/ha.

When compared to the previous monitoring year's total combined loading. In the 2015-2016 there were 11 paddocks with a combined application of greater than 300 kg N/ha per annum, of which five contained more than 500 kg N/ha per annum. By comparison, in the 2016-2017 monitoring period the highest total loading was found to be paddock 23, with 264 kg N/ha.

Total nitrogen sequestered across both application systems (Inaha Stream and wastewater application area) indicated an increase in nitrogen in terms of the applications of wastewater and fertiliser to land in the 2017-2018 monitoring period.

Wastewater to land in the 2016-2017 monitoring period encompassed 27,072 kg N, while in this period it was 33,727 kg N, which is an increase of 6,655 kg N. Fertiliser (Zealgrow) applications to land in the 2016-2017 monitoring period equated to 4,970 kg N for that period, where as in this monitoring period 11,483 kg N was put to land, this is an increase of 4,828 kg N this period.

A graphical comparison of the current year's loadings with the previous years' loadings is provided in the following Figure 10. A map of the paddocks is provided in Appendix IV.

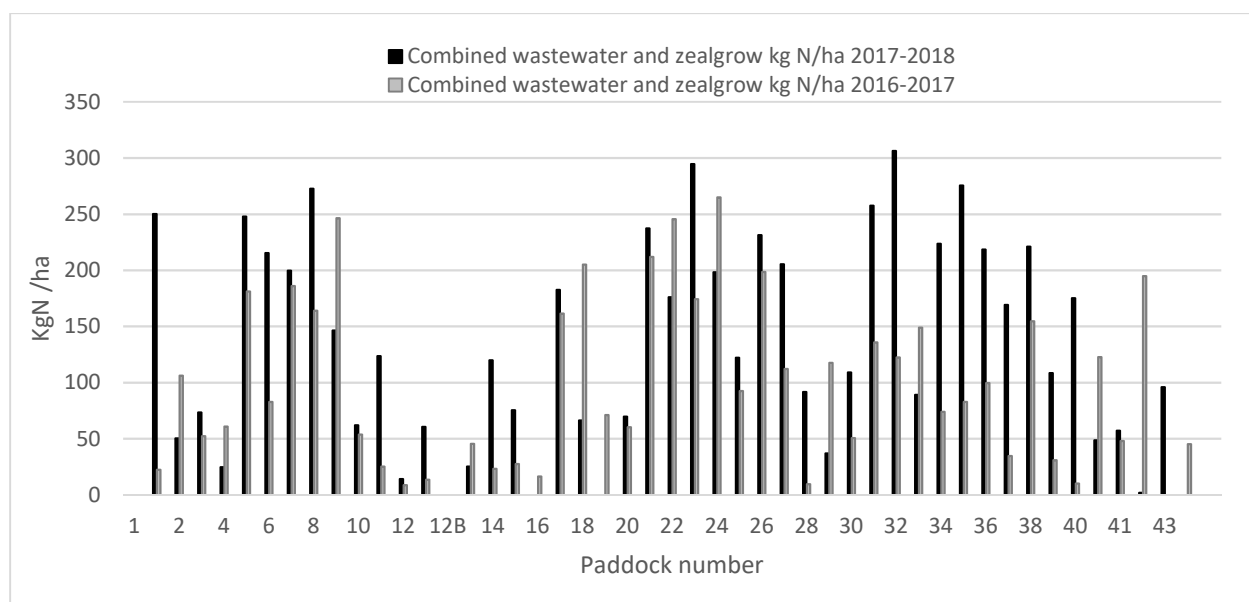


Figure 10 Wastewater and fertiliser application by paddock for comparison with previous years loading

2.4.4.2 Groundwater monitoring of irrigation areas

Groundwater sampling of the irrigation areas commenced in February 2000 and was undertaken on a monthly basis until June 2006, when the frequency was reduced to two-monthly. Initially, four bores on Kohiti and Normanby Road blocks and a spring (Te Kopanga Spring) on Shearers' property were monitored. In September 2001, two bores were commissioned on Katotauru block, four months before irrigation started there. In January 2005, two bores were drilled in proposed new irrigation areas, at least one year before irrigation commenced, and two existing bores were replaced because of access difficulty. In October 2011, two further bores were drilled, at the downslope boundaries of the "Kingi" and Inaha Road blocks at the northern and western extents, respectively, of the irrigation area. The locations of the groundwater monitoring bores and spring are described in Table 15 and shown in Figure 3.

Table 15 Irrigation area monitoring well/location data

Site name	Site code	Depth m	Grid reference, NZMP	
			Easting	Northing
BH1	GND1054	13.5	1702469	5624829
BH3	GND1056	12.8	1702359	5623913
BH4	GND1057	11.0	1702308	5623294
Te Kopanga	GND1058		1701770	5623022
BH5B	GND1346	8.6	1701352	5624536
BH6B	GND1347	12.2	1701586	5623914
BH7	GND1348	13.5	1702671	5624594
BH8	GND1349	13.6	1701013	5623526
BH9	GND2225	11.5	1701186	5624945
BH10	GND2226	10.4	1700548	5623806

Bore 1 and Bore 5 (now obsolete BH5) were installed as control sites, situated at the (then) upslope boundaries of Kohiti and Katotauru blocks, respectively. Bore 5B was placed up-gradient of Bore 5 after a new farm track covered it in September 2004. Bore 2 was on the flat beside an unnamed tributary of Inaha Stream, at the bottom of Kohiti block. Bore 3 is beside Kohiti Road on the south-eastern plateau above TBP's plant. Bore 4 is in the centre of Normanby block. Bore 6 is in a swale beside the road at the downslope boundary of Katotauru block. Bore 6B was emplaced on the flat above Bore 6 after a series of flood events by ponded rainfall and wastewater. Bore 7 is down gradient of the southern side of the Ahipaipa block. Bore 8 is down gradient of the western side of the Katotauru/Normanby Roads block. Bore 9 is down gradient of the eastern side of Kingi block. Bore 10 is down gradient of the "Maori Trustee" block beside Upper Inaha Road.

Background

Monitoring of the irrigation area is undertaken to assess for the effects of the land based applications of wastewater through irrigation and injection spreading of fertiliser (Zealgrow). As previously discussed the TBP site operates a dual wastewater disposal system. The disposal of diluted effluent to the Inaha Stream was previously discussed in section 2.4.3.1. In this section the groundwater monitoring of the irrigation area is presented. Specific effects are related to nitrate impacts in the groundwater and the analyte nitrite/nitrate nitrogen (NNN) is the main analyte of concern as it is proposed to be leading to an increase in surface water values, specifically in the western tributary which was discussed in Section 2.4.3.3.

GND1054: The control bore. Table 16 details the results of the bi-monthly irrigation monitoring of this monitoring well. NNN concentrations indicated a reduction from 28 g/m³ N to <10 g/m³ N this period. Long term analysis of this location (since January 2000) is provided below in Figure 11. In comparison to the long term record, recent analysis has indicated a decrease in NNN concentrations since the peak observed in July and August 2017. Temperature, chloride, conductivity and pH all remained quite stable this period. Paddock 3 where the bore is located received a combined application of 73 kg N/ha this period. A map of the paddocks is provided in Appendix IV.

Table 16 GND1054 2017-2018

GND1054	Site	GND1054	GND1054	GND1054	GND1054	GND1054	GND1054
Parameter	Collected	05/09/2017	15/11/2017	19/12/2017	26/02/2018	03/05/2018	11/06/2018
Bicarbonate	g/m ³ HCO ₃		53.7				
Level bgl	m	6.72	7.1	7.55	8.27	8.66	7.01
Temperature	°C	13.8	14.2	14.2	14.3	14.1	14
Alkalinity	g/m ³ CaCO ₃		44				
Calcium	g/m ³		18.5				
Chloride	g/m ³	48.4	43.6	44.5	44.1	43.2	43
Chemical oxygen demand	g/m ³		<5				
Conductivity	mS/m@20°C	29.2	29.1	28.9	29.1	29.1	32.6
E-Coli	/100ml					<1	< 10
Potassium	g/m ³		2.8				
Magnesium	g/m ³		9.6				
Sodium	g/m ³		26.6				
Ammonia	g/m ³ N	0.008	0.007	0.008	0.015	<0.003	< 0.010
Nitrite/nitrate Nitrogen	g/m ³ N	28.4	5.98	5.94	5.98	6.76	7.4
pH	pH	6.6	6.4	6.4	6.4	6.5	6.6
Sulphate	g/m ³		15.8				

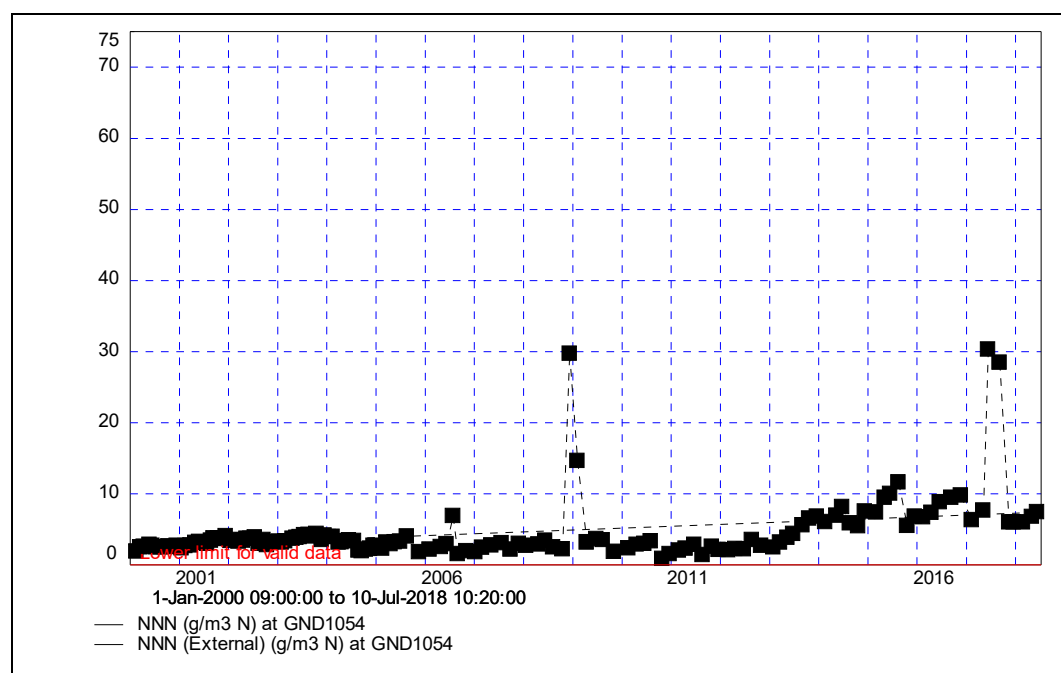


Figure 11 NNN concentrations GND1054 January 2000-July 2018

GND1056: Borehole 3, located to the south of the TBP plant within paddock 12. NNN concentrations indicated a reducing concentration this period, reducing from a maximum of 13.8 g/m³ N to a sub 10 g/m³ N reading of 4.5 g/m³ N by the end of the monitoring period. When compared to the long term record of analysis of this monitoring location (Figure 12), this monitoring location continues to denote a reducing concentration of NNN. Paddock 18, which is located directly next to paddock 12 (where the bore is located) did not receive any applications of wastewater or fertiliser this period, while paddock 12 (including 12A, 12B and 12) received a combined loading of 97 kg N/ha. A map of the paddocks is provided in Appendix IV.

Table 17 GND1056 2017-2018

GND1056	Site	GND1056	GND1056	GND1056	GND1056	GND1056	GND1056
Parameter	Unit/Collected	05/09/2017	15/11/2017	19/12/2017	26/02/2018	03/05/2018	11/06/2018
Bicarbonate	g/m ³ HCO ₃		59.8				
Level bgl	m	6.96	7.3	8.13	9.26		9.59
Temperature	°C	14.3	14.6	14.9	14.8	14.6	14.3
Alkalinity	g/m ³ CaCO ₃		49				
Calcium	g/m ³		11.6				
Chloride	g/m ³	53	42.3	48.8	45.5	42.9	42
Chemical oxygen demand	g/m ³		<5				
Conductivity	mS/m@20°C	34.7	27.5	28.8	28.2	26.9	29.2
E-Coli	/100ml					6	3
Potassium	g/m ³		3				
Magnesium	g/m ³		6.2				
Sodium	g/m ³		39				
Ammonia	g/m ³ N	<0.003	0.009	<0.003	<0.003	0.012	< 0.010
Nitrite/nitrate Nitrogen	g/m ³ N	13.8	3.31	6.96	5.18	4.49	4.5
pH	pH	6.6	6.5	6.3	6.4	6.4	7
Sulphate	g/m ³		10.2				

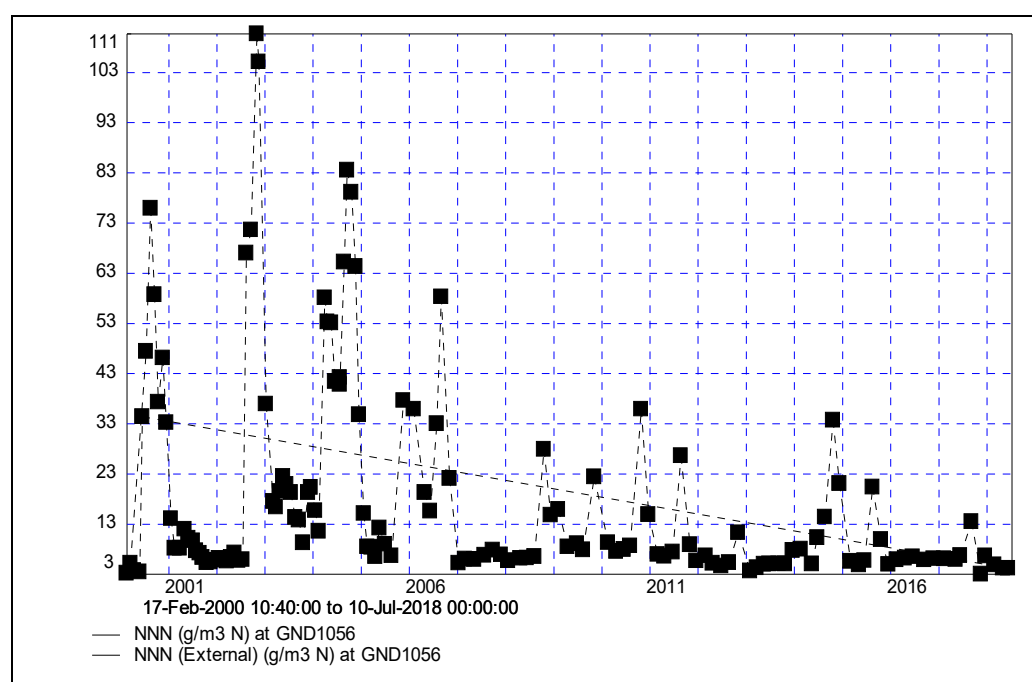


Figure 12 NNN concentrations GND1056 February 2000-July 2018

GND1057: Borehole 4. Located on the edge of paddocks 17 and 13. These two paddocks are part of the southernmost irrigation areas on the eastern side of the Inaha Stream, which also comprises paddocks 14, 15 and 16. NNN concentrations (Table 18) ranged between 13-25 g/m³ N this period, this was slightly more elevated than the range in the previous period 10-17 g/m³ N. When compared to the long term record (Figure 13) the current analysis indicated a peak concentration not observed at this source since January 2012. Paddock loading indicated paddocks 13 and 17 received a combined loading of 119 g/m³ and 66 g/m³ N respectively. A map of the paddocks is provided in Appendix IV.

Table 18 GND1057 2017-2018

GND1057	Site	GND1057	GND1057	GND1057	GND1057	GND1057	GND1057
Parameter	Unit/Collected	05/09/2017	15/11/2017	19/12/2017	26/02/2018	03/05/2018	11/06/2018
Bicarbonate	g/m ³ HCO ₃		48.8				
Level bgl	m	4.91	5.63	6.16	6.92	7.25	5.74
Temperature	°C	14.5	14.6	14.5	14.3	14.5	14.3
Alkalinity	g/m ³ CaCO ₃		40				
Calcium	g/m ³		19.8				
Chloride	g/m ³	55.2	51.8	63.4	71.2	58	58
Chemical oxygen demand	g/m ³		<5				
Conductivity	mS/m@20°C	38.1	40.9	47	43.7	39	44.7
E-Coli	/100ml					<1	4
Potassium	g/m ³		4.1				
Magnesium	g/m ³		12.1				
Sodium	g/m ³		45.5				
Ammonia	g/m ³ N	<0.003	0.014	<0.003	<0.003	0.013	< 0.010
Nitrite/nitrate Nitrogen	g/m ³ N	13	19.9	25.5	19.5	14.2	17.4
pH	pH	6.6	6.3	6.2	6.3	6.4	6.6
Sulphate	g/m ³		12.9				

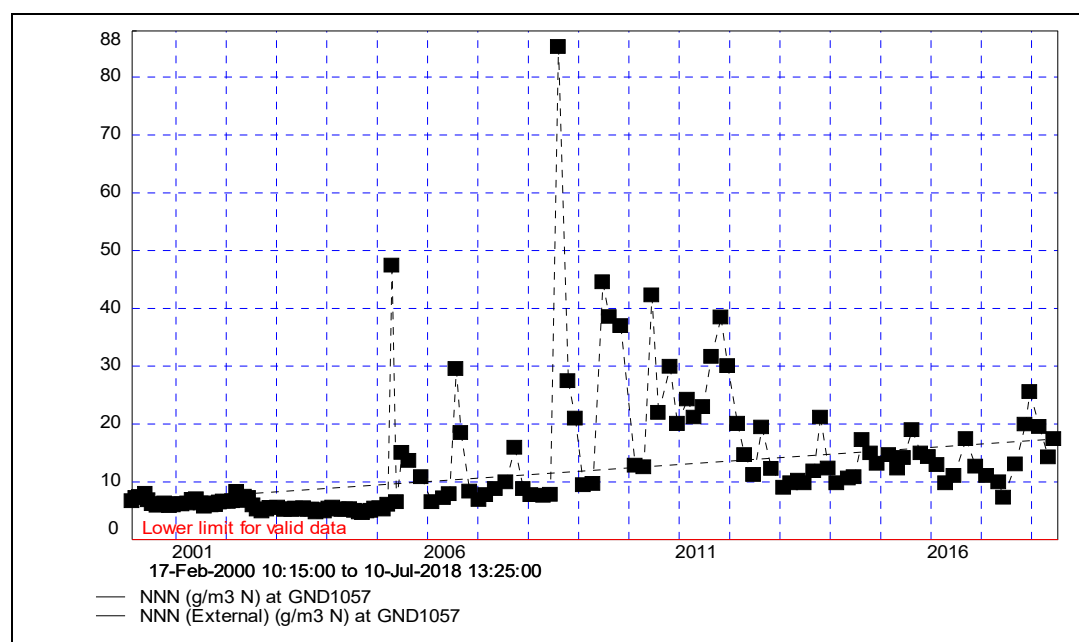


Figure 13 NNN concentrations GND1057 February 2000 - July 2018

GND1058: This monitoring location is known as Te Kopanga Spring, it holds a special place with the Ngati Manuhiakai Hapu. This spring source also supplies local residents with a source of fresh water. Monitoring of this source is undertaken to assess for effects which may be attributed to activities of wastewater and fertiliser discharge to land in the vicinity of the spring source. Monitoring this period (Table 19) indicated a decreasing concentration of NNN throughout the period, from 7.27 g/m³ N to 5.4 g/m³ N at the end of the monitoring period. When compared to the long term record (Figure 14) it can be discerned that peak nitrate was observed in the 2015-2016 monitoring period, 17 August 2015 with a value of 7.7 g/m³ N (NNN). Paddock loading in the immediate vicinity of the spring source indicated paddocks 16 and 17 received a wastewater application of 182 kg N/ha for paddock 16 and 66 kg N/ha for paddock 17. No fertiliser (Zealgrow) was discharged this period.

Table 19 GND1058 Te Kopanga Spring 2017-2018

GND1058	Site	GND1058	GND1058	GND1058	GND1058	GND1058	GND1058
Parameter	Unit/Collected	05/09/2017	15/11/2017	19/12/2017	26/02/2018	03/05/2018	11/06/2018
Bicarbonate	g/m ³ HCO ₃		50				
Level bgl	m						
Temperature	°C	14.6	14.2	17.5	15.1	15	14.3
Alkalinity	g/m ³ CaCO ₃		41				
Calcium	g/m ³		20.9				
Chloride	g/m ³	73.4	70.6	68.9	65.9	63.3	60
Chemical oxygen demand	g/m ³		<5				
Conductivity	mS/m@20°C	35.2	36	34.7	33.6	32.8	36.2
E-Coli	/100ml					<1	1
Potassium	g/m ³		2.8				
Magnesium	g/m ³		12.8				
Sodium	g/m ³		33				
Ammonia	g/m ³ N	<0.003	0.004	<0.003	0.014	0.011	< 0.010
Nitrite/nitrate Nitrogen	g/m ³ N	7.27	6.6	5.9	5.19	4.9	5.4
pH	pH	6.7	6.5	6.5	6.6	6.6	6.6
Sulphate	g/m ³		10.1				

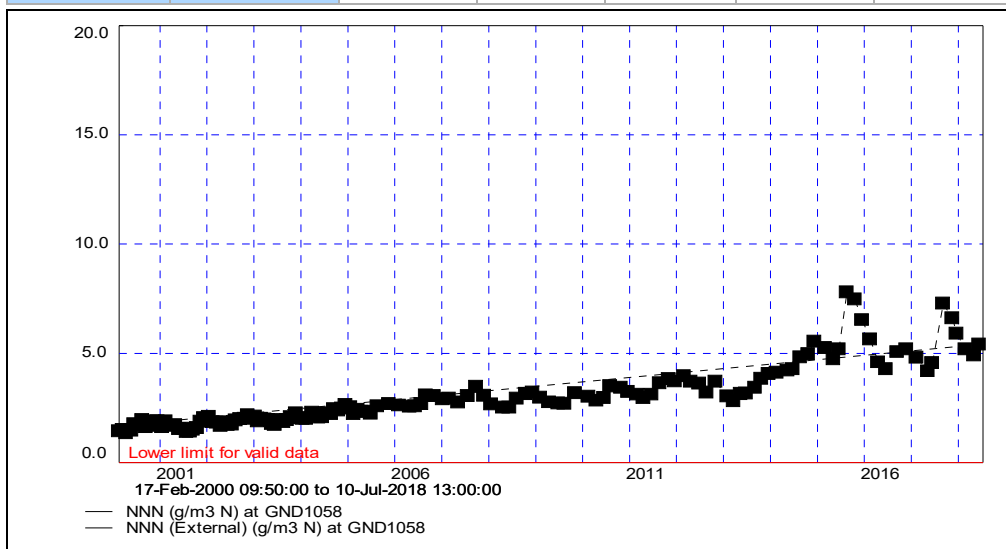


Figure 14 GND1058 Te Kopanga Spring 2017-2018

GND1346: Borehole 5B. This location demonstrates the higher end of the NNN impacts within the groundwater. Located in the centre of the irrigation area. During this period the concentration continued to rise from 78 g/m³ N (NNN) to 81 g/m³ N (NNN). Of note this is the most elevated result for this analyte since February 2012 (Figure 15) at this monitoring location. Paddock loading in the vicinity of this monitoring location indicated paddocks 34 and 35 received applications of wastewater only which were reported as 276 and 219 kg N/ha respectively. No fertiliser was discharged across these two paddocks this period. A map of the paddocks is provided in Appendix IV.

Table 20 GND1346 2017-2018

GND1346	Site	GND1346	GND1346	GND1346	GND1346	GND1346	GND1346
Parameter	Unit/Collected	05/09/2017	15/11/2017	19/12/2017	26/02/2018	03/05/2018	11/06/2018
Bicarbonate	g/m ³ HCO ₃		32.9				
Level bgl	m	3.53	4.61	5.04	5.52	4.38	
Temperature	°C	14.1	14.1	14.2	14.2	14.3	13.9
Alkalinity	g/m ³ CaCO ₃		27				
Calcium	g/m ³		76.9				
Chloride	g/m ³	111	103	104	86.4	99.8	108
Chemical oxygen demand	g/m ³		<5				
Conductivity	mS/m@20°C	95.4	96.6	93.8	83.6	92.8	103.6
E-Coli	/100ml					<1	<10
Potassium	g/m ³		7.9				
Magnesium	g/m ³		34.5				
Sodium	g/m ³		57.3				
Ammonia	g/m ³ N	<0.003	0.012	0.006	<0.003	0.004	<0.010
Nitrite/nitrate Nitrogen	g/m ³ N	78.8	79.5	76	58.2	73.8	81
pH	pH	6.3	6.2	6.1	6.2	6.2	6.5
Sulphate	g/m ³		9.4				

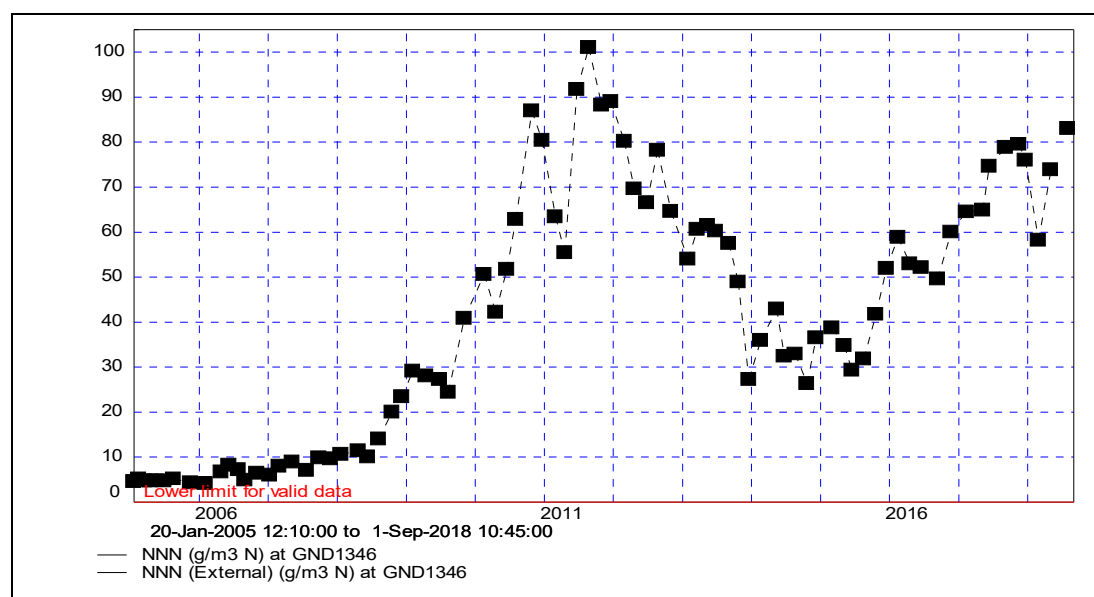


Figure 15 NNN January 2005 - September 2018

GND1347: Borehole 6B. This monitoring well also demonstrates the higher end of nitrogen impacts in groundwater. NNN impacts (Table 21) remained high but fairly consistent this period, demonstrating a slight reduction at the end of the period with value of 56 g/m³ N (NNN). Additional analysis undertaken in the 2018-2019 monitoring period has also been added to the long term analysis (Figure 16). This details that the downward trend appears to be continuing. Of note, the E-coli result recorded in the final monitoring round indicated a measurable result of 140/100ml. This may indicate a damaged well. Follow up analysis will be undertaken and reported in the 2018-2019 monitoring period.

Table 21 GND1347 2017-2018

GND1347	Site	GND1347	GND1347	GND1347	GND1347	GND1347	GND1347
Parameter	Unit/Collected	05/09/2017	15/11/2017	19/12/2017	26/02/2018	03/05/2018	11/06/2018
Bicarbonate	g/m ³ HCO ₃		36.6				
Level bgl	m	6.69	7.48	8.28	9.06	8.79	
Temperature	°C	14.3	14.5	14.5	14.5	14.3	14.1
Alkalinity	g/m ³ CaCO ₃		30				
Calcium	g/m ³		57.1				
Chloride	g/m ³	94	97.6	95.9	99.6	98.2	91
Chemical oxygen demand	g/m ³		<5				
Conductivity	mS/m@20°C	75.7	82	80.9	83.4	82.8	78.7
E-Coli	/100ml					<2	140
Potassium	g/m ³		5.4				
Magnesium	g/m ³		32				
Sodium	g/m ³		55.7				
Ammonia	g/m ³ N	0.003	0.022	0.006	0.011	0.017	< 0.010
Nitrite/nitrate Nitrogen	g/m ³ N	58.3	63.9	61.5	62.5	64.4	56
pH	pH	6.3	6.1	6.1	6.1	6.2	6.5
Sulphate	g/m ³		4				

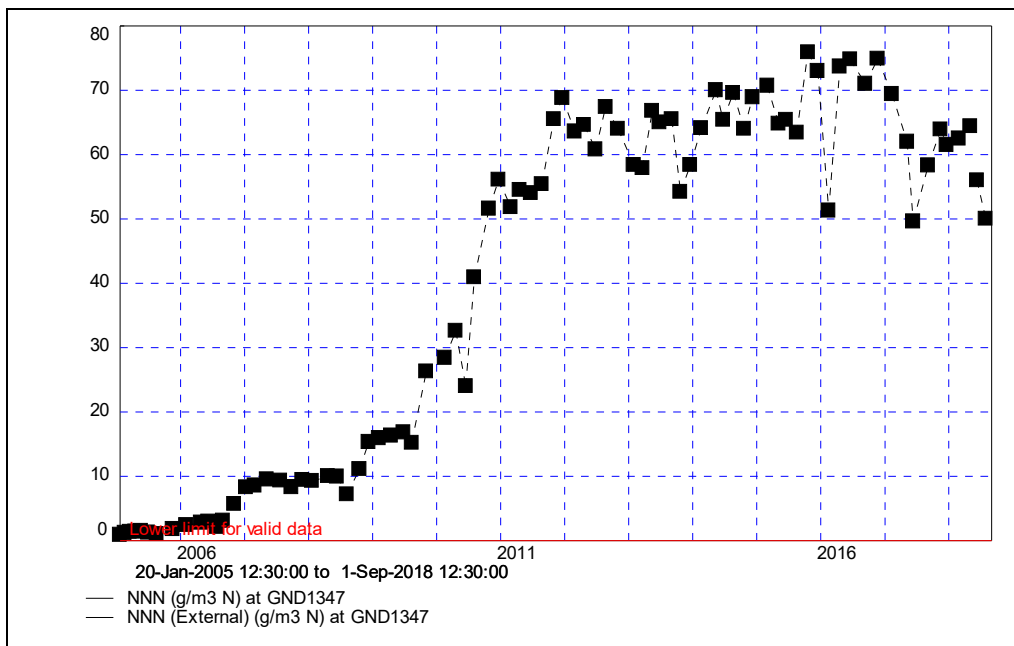


Figure 16 NNN concentration GND1347 January 2005- September 2018

GND1348: Borehole 7. Observations of this monitoring location has detailed a considerable amount of variation in NNN concentrations through time (Figure 17). In this monitoring period (Table 22) the variation was also apparent. NNN concentrations were observed to increase in the summer months at this location and then decrease in the winter, which is in line with when the TBP site is actively discharging to the Inaha Stream (in the winter). Paddock loading in this area showed that paddock nine, which only received wastewater this period, had a loading of 62 kg N/ha. A map of the paddocks is provided in Appendix IV.

Table 22 GND1348 2017-2018

GND1348	Site	GND1348	GND1348	GND1348	GND1348	GND1348	GND1348
Parameter	Unit/Collected	05/09/2017	15/11/2017	19/12/2017	26/02/2018	03/05/2018	11/06/2018
Bicarbonate	g/m ³ HCO ₃		46.4				
Level bgl	m	9.07	9.29	9.83	10.59	11.12	10.39
Temperature	°C	14	14.6	14.9	14.8	14.3	14.2
Alkalinity	g/m ³ CaCO ₃		38				
Calcium	g/m ³		42.8				
Chloride	g/m ³	50.8	73.7	82.7	93.4	72	51
Chemical oxygen demand	g/m ³		<5				
Conductivity	mS/m@20°C	42.7	63.4	74.2	82.5	60.2	44.2
E-Coli	/100ml					<2	< 10
Potassium	g/m ³		6.5				
Magnesium	g/m ³		24.5				
Sodium	g/m ³		45.4				
Ammonia	g/m ³ N	<0.003	0.013	0.007	<0.003	0.007	< 0.010
Nitrite/nitrate Nitrogen	g/m ³ N	27.1	44.8	56.8	64.2	38.9	22
pH	pH	6.6	6.3	6.3	6.3	6.4	6.6
Sulphate	g/m ³		18.1				

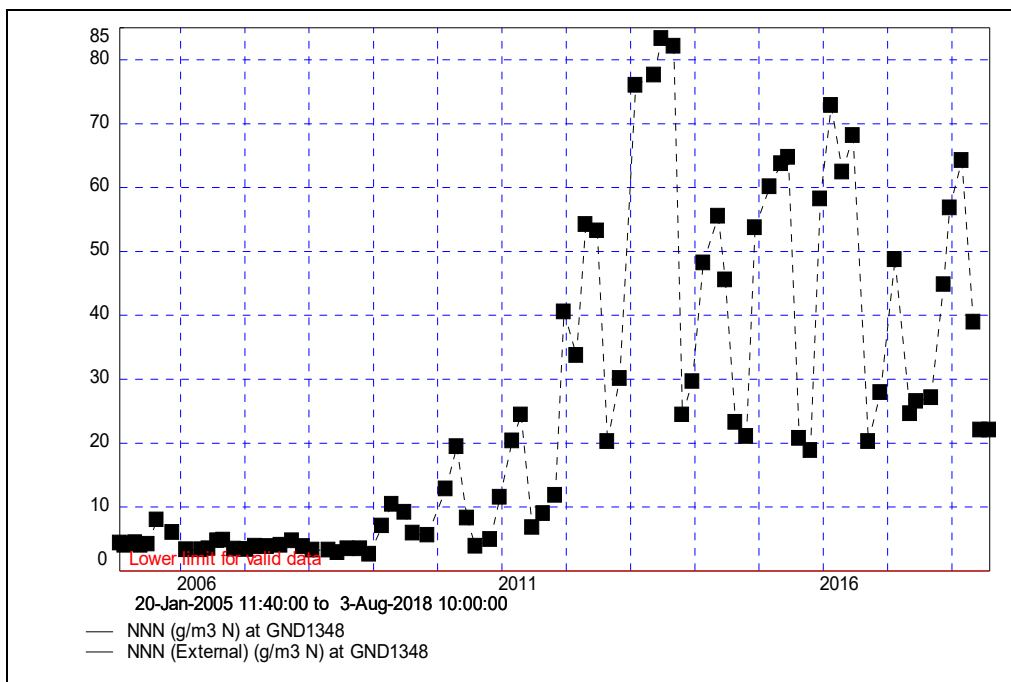


Figure 17 NNN concentration GND1348 January 2005- August 2018

GND1349: Borehole 8 is located on the western side of the Katotauru/Normanby block in paddock 25. NNN concentrations ranged between 24 and 40 g/m³ N during this period, elevated from the previous year (25-35 g/m³ N). The long term record of NNN analysis, as indicated in Figure 18, detailed an increasing concentration of NNN over time. Paddock loading information indicated a loading of 231 kg N/ha this period. A map of the paddocks is provided in Appendix IV.

Table 23 GND1349 2017-2018

GND1349	Site	GND1349	GND1349	GND1349	GND1349	GND1349	GND1349
Parameter	Unit/Collected	05/09/2017	15/11/2017	19/12/2017	26/02/2018	03/05/2018	11/06/2018
Bicarbonate	g/m ³ HCO ₃		78.1				
Level bgl	m	9.13	9.28	9.85	10.67	11.06	10.59
Temperature	°C	14.4	14.5	14.5	14.7	14.5	14.1
Alkalinity	g/m ³ CaCO ₃		64				
Calcium	g/m ³		29.1				
Chloride	g/m ³	44.4	55.3	46.3	45.8	66.9	54
Chemical oxygen demand	g/m ³		<5				
Conductivity	mS/m@20°C	50.7	45.8	45.4	43.6	56.2	58.3
E-Coli	/100ml					16.8	10
Potassium	g/m ³		3.9				
Magnesium	g/m ³		15.9				
Sodium	g/m ³		42				
Ammonia	g/m ³ N	<0.003	0.01	0.005	0.018	0.009	< 0.010
Nitrite/nitrate Nitrogen	g/m ³ N	39.8	23.5	24.9	21.7	29.7	35
pH	pH	6.6	6.3	6.2	6.4	6.3	6.5
Sulphate	g/m ³		13.4				

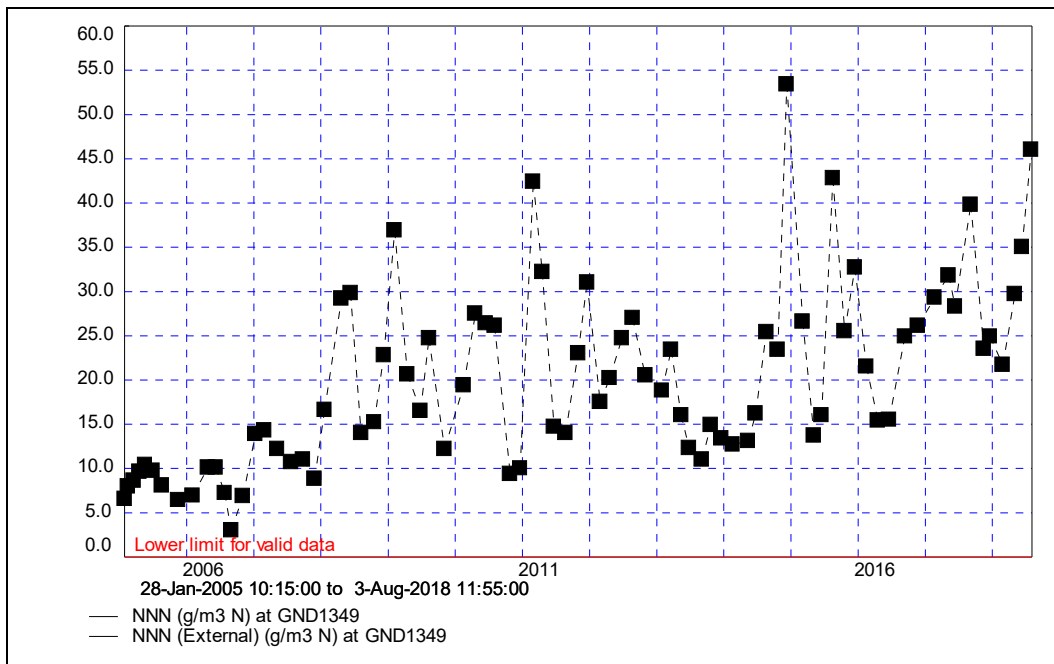


Figure 18 NNN concentrations GND1349 January 2005 - August 2018

GND2225: Borehole 9. This is located down gradient on the eastern side of the Kingi Block, which is listed as paddock 33. NNN concentrations ranged between 29 and 50 g/m³ N during this monitoring period. The long term analysis of NNN (Figure 19) indicated a significant increase in concentration since May 2017. Of note the two E-coli results which returned results may suggest a damaged well. As this area only received wastewater by irrigation it would be unlikely for bacteria to percolate into the groundwater and be reported. Follow up analysis will be undertaken and reported in the 20-18-2019 monitoring period. Paddock loading information indicated that paddock 33 received wastewater only this period with a loading of 223 kg N/ha.

Table 24 GND2225 2017-2018

GND2225	Site	GND2225	GND2225	GND2225	GND2225	GND2225	GND2225
Parameter	Unit/Collected	05/09/2017	15/11/2017	19/12/2017	26/02/2018	03/05/2018	11/06/2018
Bicarbonate	g/m ³ HCO ₃		45.1				
Level bgl	m	5.25	5.82	6.2	6.57	6.25	5.14
Temperature	°C	14.3	14.5	14.7	14.6	14.3	14.1
Alkalinity	g/m ³ CaCO ₃		37				
Calcium	g/m ³		26.6				
Chloride	g/m ³	65.7	52.5	52.2	53.8	57.9	63
Chemical oxygen demand	g/m ³		<5				
Conductivity	mS/m@20°C	53.9	45.9	45	45.7	50.2	66.6
E-Coli	/100ml					58.4	70
Potassium	g/m ³		3.3				
Magnesium	g/m ³		19				
Sodium	g/m ³		35.8				
Ammonia	g/m ³ N	0.008	0.016	0.017	<0.003	0.004	< 0.010
Nitrite/nitrate Nitrogen	g/m ³ N	38.1	32.3	50.5	29.1	34.8	50
pH	pH	6.4	6.3	6.2	6.3	6.3	6.7
Sulphate	g/m ³		7.7				

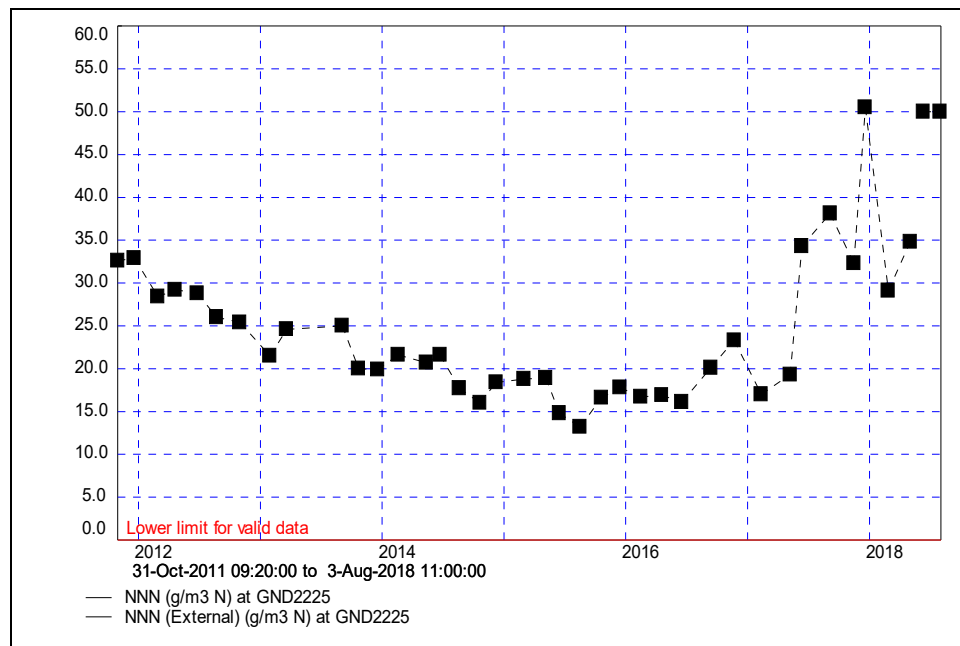


Figure 19 NNN concentrations GND2225 October 2011- August 2018

GND2226: Borehole 10 is located on the edge of the 200 m buffer zone along Normanby and the Inaha Roads. Long term NNN monitoring of this location for NNN (Figure 20) indicated that the concentration continues to increase. During this monitoring period the highest NNN value to date for this monitoring location was recorded at 91 g/m³ N (NNN). Chloride analysis was also the highest value in this data set with a value of 148 g/m³. Paddock 29, where the bore is located, was reported to have received a total combined loading rate of wastewater and fertiliser of 109 kg N/ha this period. A map of the paddocks is provided in Appendix IV.

Table 25 GND2226 2017-2018

GND2226	Site	GND2226	GND2226	GND2226	GND2226	GND2226	GND2226
Parameter	Unit/Collected	05/09/2017	15/11/2017	19/12/2017	26/02/2018	03/05/2018	11/06/2018
Bicarbonate	g/m ³ HCO ₃		34.2				
Level bgl	m	4.01	5.12	6.2	7.55	7.3	5.93
Temperature	°C	14.3	15	14.7	14.4	14.3	14.1
Alkalinity	g/m ³ CaCO ₃		28				
Calcium	g/m ³		83.3				
Chloride	g/m ³	136	142	52.2	148	143	144
Chemical oxygen demand	g/m ³		<5				
Conductivity	mS/m@20°C	104	111	45	115	111	117.9
E-Coli	/100ml					<1	10
Potassium	g/m ³		5.6				
Magnesium	g/m ³		46.9				
Sodium	g/m ³		63.5				
Ammonia	g/m ³ N	0.006	0.006	0.017	<0.003	<0.003	< 0.010
Nitrite/nitrate Nitrogen	g/m ³ N	81.1	83.2	50.5	91	84.7	84
pH	pH	6.3	6.1	6.2	6.1	6.1	6.6
Sulphate	g/m ³		4.3				

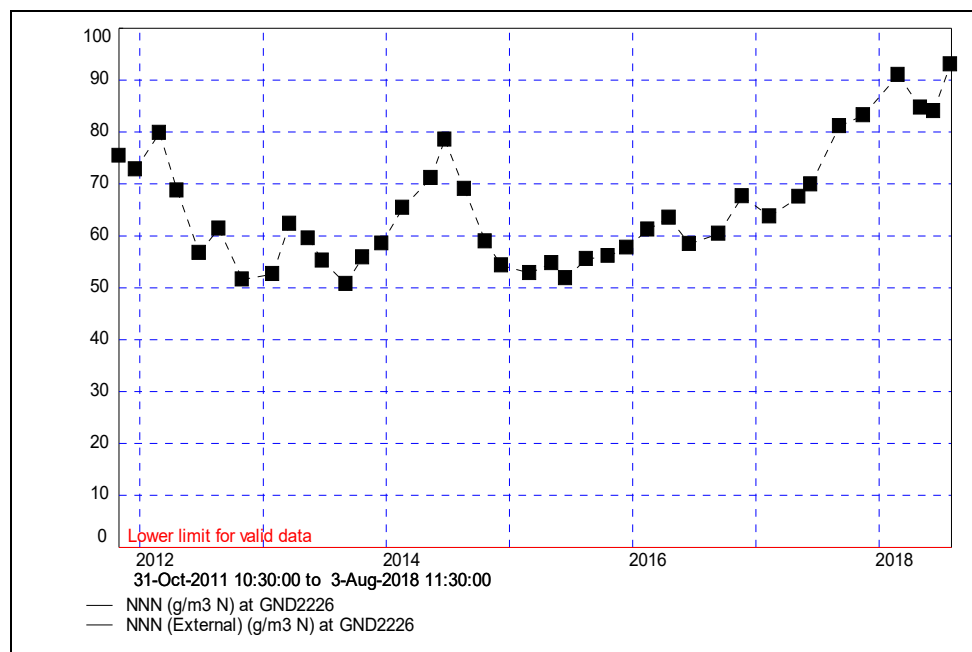


Figure 20 NNN concentration GND2226 October 2011-August 2018

Irrigation area groundwater monitoring discussion

Three groundwater monitoring wells currently remain above 50 g/m³ N (NNN). These elevated results are a function of the long term usage and over usage of the irrigation areas with applications of wastewater and fertiliser (Zealgrow).

2.4.5 Solid waste burial

Solid waste burial is undertaken under consent 5495-1. Specifically, condition 15 states the following:

The exercise of the consent shall not lead, or be liable to lead, to a direct discharge of contaminates to a surface water body.

The burial pits were utilised this period on one occasion for the burial of sand trap waste.

In this monitoring period there was no physical observation or chemical analysis result in the surface water sampling of the Inaha Stream, (Site INH000348, and Section 2.4.3). Groundwater monitoring (Table 26) indicated elevated ammonia and chemical oxygen demand in two of the groundwater bores located around the burial pit (GND1066/69). It has been requested that TBP maintain close attention to this area and they are meeting this request.

In future, additional mitigation may be required in this specific area. The consent 5495-1 is up for renewal in the 2018-2019 monitoring year and the renewal process will seek to mitigate the elevated ammonia and chemical oxygen demand in the close proximity to the pits by reviewing all available options and best practicable options.

Table 26 Burial pit monitoring 2017-2018

Burial Pit	Parameter	LEVEL	TEMP	COD	CONDY	NH4	NNN	pH	
Site	Collected/Unit	M bgl	°C	g/m3	mS/m@20C	g/m3 N	g/m3 N	pH	
Round 1									
GND1063	23 Aug 2017	6.33	14.2	5	43.9	<0.003	16.8	6.2	
GND1066	23 Aug 2017	5.52	15.7	9	102	22.3	36.5	6.2	
GND1067	23 Aug 2017	5.38	15.5	11	76.3	0.142	18.1	6.2	
GND1069	23 Aug 2017	4.08	14.7	26	172	61.7	15.4	6.7	
GND2506	28 Aug 2017	4.08	14.7	16	54.7	0.087	25.4	6.4	
Round 2									
GND1063	16 Nov 2017	6.73	14.4	<5	41.5	<0.003	15.1	6.2	
GND1066	16 Nov 2017	5.67	15.1	26	198	110	29.4	6.7	
GND1067	16 Nov 2017	5.62	15.2	<5	66.2	0.069	19.1	6.1	
GND1069	16 Nov 2017	5.57	15.5	64	294	206	0.02	6.7	
GND2506	16 Nov 2017	4.43	14.2	<5	67.3	0.081	20.9	6.3	
Round 3									
GND1063	27 Feb 2018	8.4	14.4	<5	37.2	0.015	15.4	6.3	
GND1066	27 Feb 2018	5.97	15	34	229	116	18	6.7	
GND1067	27 Feb 2018	Dry							
GND1069	27 Feb 2018	6.3	15.6	38	290	202	0.11	6.9	
GND2506	27 Feb 2018	5.83	14.7	13	70.6	<0.003	17.7	6.2	
Round 4									
GND1063	30 May 2018	8.68	14.2	<5	35.5	0.039	15.1	6.4	

Burial Pit	Parameter	LEVEL	TEMP	COD	CONDY	NH4	NNN	pH
Site	Collected/Unit	M bgl	°C	g/m3	mS/m@20C	g/m3 N	g/m3 N	pH
GND1066	30 May 2018	5.85	14.4	35	231	97.4	33.3	6.9
GND1067	30 May 2018	5.45	14.3	7	51	0.27	5.73	6.4
GND1069	30 May 2018	5.19	14.7	33	209	61	90.4	6.6
GND2506	30 May 2018	4.63	15	15	69.4	0.044	20.8	6.6

2.4.6 Biological monitoring

TBP holds a number of consents for discharges to land and to water associated with the operation of a rendering plant and a neighbouring farm owned and operated by the Company. The discharge consents most relevant to this biomonitoring survey are summarised in the following Table 27.

Table 27 Summary of discharge consents held by TBP

Consent no.	Purpose
2049-4	To discharge up to 940 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream
2050-4	To discharge up to 2,160 cubic metres/day of cooling water and backwash water from a rendering operation into an unnamed tributary of the Inaha Stream
3941-2	To discharge up to 1,400 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy via spray irrigation onto and into land, and to discharge emissions into the air, in the vicinity of the Inaha Stream and its tributaries between 1700909E-5625245N, 1700631E-5625092N and 1700921E-5625046N
5426-1	To discharge up 1,095 litres/second of stormwater from an animal rendering site into an unnamed tributary of the Inaha Stream

Biomonitoring has been undertaken at some sites in relation to the discharges from the rendering plant and associated activities since the mid-1980s. Some of the sites used for the biomonitoring of these discharges have changed over time and these changes have been documented in previous reports (Jansma, 2012 a, b, c).

Methods

The biomonitoring surveys were undertaken at eight sites on 31 October 2017 and 8 February 2018 (Figure 21). Five of the eight sites surveyed were in the Inaha Stream and the remaining sites were in an unnamed tributary of the Inaha Stream. The locations of sampling sites in relation to the discharges from the rendering plant are discussed below.

Site U (INH000334) was established in the 2003-2004 monitoring period as an appropriate control site on the Inaha Stream above the rendering plant discharges and irrigation areas. Site 1 (INH000400) is located upstream of the wastewater and cooling water discharge points but downstream of part of the treated wastewater irrigation area. Sites 2d and 3 (INH000420 and INH000430) are located downstream of these two discharges and above the confluence with the unnamed tributary of the Inaha Stream which drains land upon which wastewater is irrigated.

The area of land authorised to be irrigated onto under consent 3941-2 has increased on several occasions since the consent was granted in December 1999. Sites UT, MT and DT (INH000433, INH000435 and INH000440) were established to monitor the effects of the expanded irrigation area on an unnamed tributary of the Inaha Stream. Site UT was established as a 'control site' for the expanded irrigation area.

Site MT is located within the authorised irrigation area and site DT is situated downstream of the irrigation area but upstream of the unnamed tributary's confluence with the Inaha Stream.

Site 4 (INH000450) on the Inaha Stream is situated approximately 100 metres downstream of the convergence point between the Inaha Stream and the unnamed tributary.

Table 28 Bio-monitoring locations related to TBP in the 2017-2018 monitoring period

Stream	Site No.	Site code	Location	Sampling method used
Inaha Stream	U	INH000334	Upstream of irrigation area, near Ahipaipa Road	Streambed kick
	1	INH000400	Upstream of treatment ponds, Kohiti Road	Streambed kick
	2d	INH000420	500 m downstream of cooling water discharge	Streambed kick
	3	INH000430	Upstream of Normanby Road	Streambed kick
	4	INH000450	100 m downstream of 'irrigation' tributary confluence	Streambed kick
Unnamed tributary of Inaha Stream	UT	INH000433	Upstream of irrigation area	Vegetation sweep
	MT	INH000435	Middle site within the new irrigation area	Kick/sweep
	DT	INH000440	50m upstream Normanby Road	Streambed kick

Two different sampling techniques were used to collect streambed macroinvertebrates in this survey. The Council's standard '400ml kick-sampling' technique was used at sites U, 1, 2d, 3,4 and DT and the 'vegetation sweep' technique was used at site UT. A combination of these two techniques was used at site MT (Table 28). The 'kick-sampling' and 'vegetation sweep' techniques are very similar to Protocol C1 (hard-bottomed, semi-quantitative) and C2 (soft-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 NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark *et al.* 2001). Macroinvertebrate taxa found in each sample were recorded based on the abundance categories in Table 29 .

Table 29 Macroinvertebrate community health based on MCI ranges

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

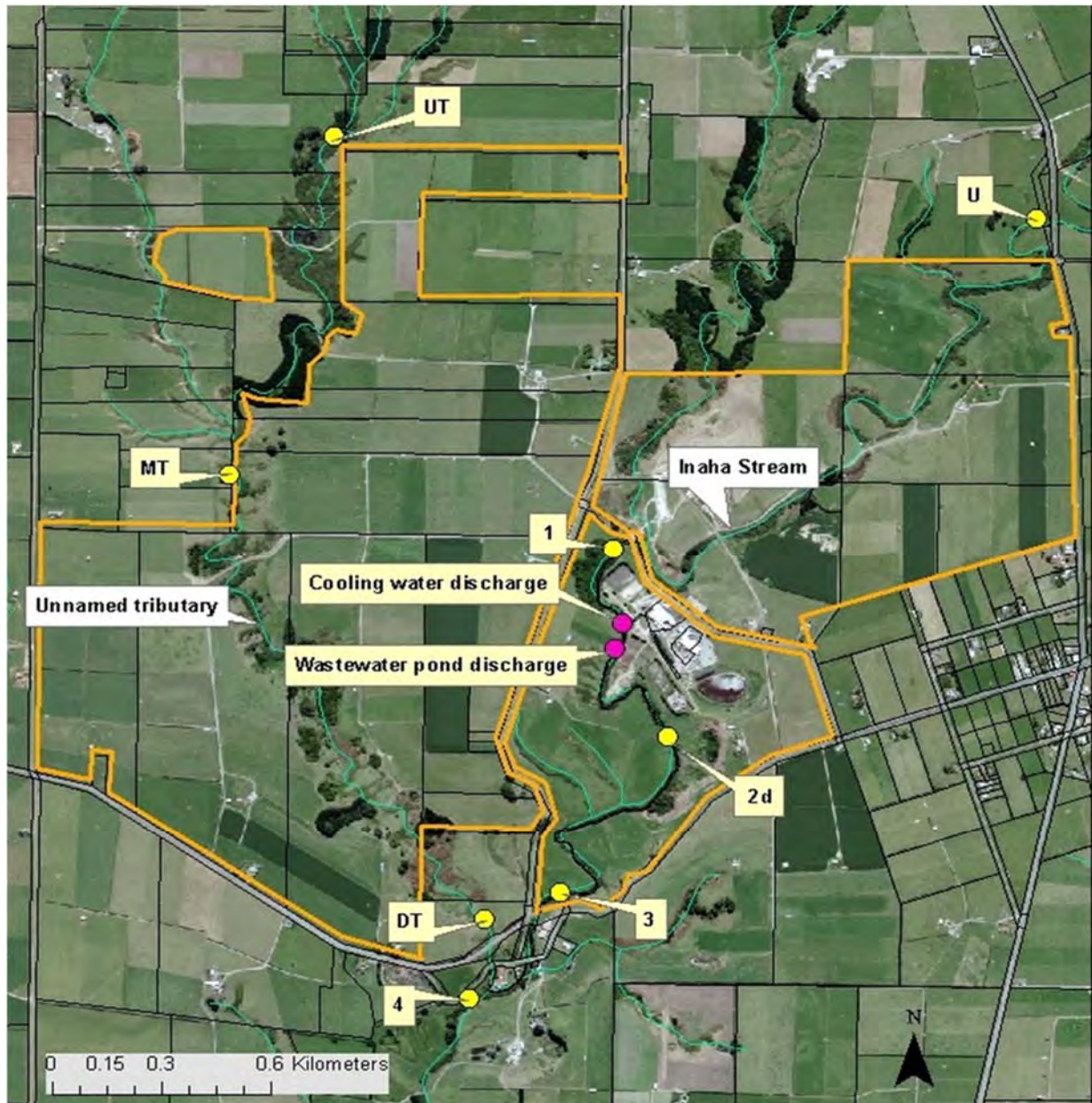


Figure 21 Bio-monitoring sites in relation to TBP

A semi-quantitative MCI value (SQMCI_s) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCI_s is not multiplied by a scaling factor of 20, therefore SQMCI_s values range from 1 to 10, while MCI values range from 20 to 200.

Where necessary, sub-samples of algal and detrital material taken from the macroinvertebrate samples were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ('undesirable biological growths') at a microscopic level. The presence of these organisms is an indicator of organic enrichment within a stream. Such heterotrophic growths have been recorded on numerous past occasions at sites downstream of the TBP plant as a result of organic nutrient enrichment from the wastewater discharge.

Summary of results from the spring bio-monitoring survey-October 2017

No 'heterotrophic growths' were recorded at any sites monitored in this survey, which was indicative of reasonably good preceding water quality. The presence of heterotrophic growths on the bed of the Inaha Stream was last recorded in the spring 2009 survey, and this shows improved management of the wastewater discharge since that time.

Overall, there was no evidence that discharges from TBP have impacted on the freshwater macroinvertebrate communities present in the Inaha Stream.

Summary of results from the late summer bio-monitoring survey-February 2018

Overall, there was no evidence that discharges from TBP have impacted on the freshwater macroinvertebrate communities present in the Inaha Stream.

2.5 Air

2.5.1 Inspections

19 July 2017

At the time of inspection the following was observed. The wind was variable in strength at a low velocity from the east. An odour survey identified essentially constant 'factory/cooking/pond' type odours along Katotauru Road, which was down wind of plant. The odour survey did not find any odours as far as Inaha Road. Typical strong/intense sulphur type pond odours were noticed around ponds 1 and 2. The cover of the ponds (the pond crust) was observed to be complete across both ponds, however there were bubbles discharging through the crust. No irrigation was occurring at the time of inspection. Pond 6 was discharging at the time and the dilution factors were being achieved. The northern factory wall around the tanks and tallow plant had been removed and TBP were continuing to process product at a rate of approximately 150 tons per day. The volumes were expected to increase in the coming months. No recent burial of product had occurred. The stormwater catchments around the site were inspected and found to be clean. Paunch product was stored outside the load-in doors, and the factory doors were closed when deliveries were not occurring.

3 August 2017

At the time of the inspection the following was observed. The plant had been experiencing power supply issues over recent days, as such, at the time only some of the plant machinery could be operated at any one time. At the time no irrigation was occurring as pond six was discharging to the receiving waters of the Inaha Stream, which was observed to be in high flow. At the time a 1:600 dilution ratio was being achieved. No harmful effects were observed below the discharge point, no fugitive discharges to the stream were observed.

On observation of the fire pond a green coloured discharge was entering through a stormwater drain. The liquid was traced back to the boiler area. A drain at the bio-extracts side of the plant had been blocked with fat which had caused the boiler blowdown water to travel overland rather than be conveyed to pond 1. Staff agreed to clear the blockage.

11 October 2017

During the inspection the following was observed. Sampling of discharges and receiving waters was undertaken during the inspection. The receiving waters were found in high flow and were noted as turbid throughout the length of the sites influence. Dilution factors were being achieved at the time of inspection. The main factory doors were open throughout the inspection, however no traffic movements were occurring at the time. As a process an issue was raised with the Environmental Manager whom agreed to inform the Operations Supervisor of the requirement to ensure doors remained closed when not in use. Steam

emissions were observed to be escaping the right load-in door and the factory odour was prevalent around the area of the load in area. At the time no cooking of product was occurring though fallen stock were present in the left load-in bay. Paunch product was stored outside, there was very little odour from the stockpile upon observation. At the time the fire pit was not in use though materials were awaiting incineration, these appeared compliant with consented allowance for burning on site. The biofilter was observed and leachate had been directed to pond 3 and the ring drain was effective at conveying it. No irrigators were operating at the time of inspection due to ground saturation.

8 December 2017

At the time of the inspection strong pond odours were noted along Kohiti Road, these were identified as intermittent factory/cooking odours at the corner of Kohiti and Normanby Road. Biofilters were observed and were found to be under maintenance, with some of them having their bark replaced. The pipe join for TBP main extraction line was proposed to be resealed as discussed by the site manager. No fugitive discharges into the Inaha Stream were found and the stream was clear throughout the length of the site. Ponds 1-3 had complete cover, though bubbles were discharging through the crust in pond 1. Pond 4 had 5 aerators operating and the D.O was 1.02 mg/L O₂, though the probe was dirty.

At the time pond 6 was not discharging, as the flows in the Inaha Stream were too low. The Inaha Stream discharge had been ceased until autumn conditions bring the flows up to complaint standards to allow for discharge. No irrigators were operating at the time of inspection. No recent burial of product had occurred. At the time the site was busy as production had been high lately. Farm dairy effluent (FDE) areas satisfactory. No incidents were reported.

14 December 2017

During the inspection the following was noted. Two travelling irrigators were in operation. As a result no ponding or runoff had occurred and all receiving pasture appeared healthy. Both factories appeared busy and both were in operation. At the time works were continuing on the TBE extraction system, though the join in TBP extraction pipe had been resealed. Both TBE biofilters had been renewed and works had also occurred on the newest TBP biofilter. Strong musty/earthy odours were noticed around this area while inspecting, with visible emissions discharging across all beds from the biofilters.

At the main load in area paunch and fallen stock were stored outside the load-in doors and the doors were closed when not in use. The wastewater system was observed and pond 6 was not discharging. Discussions were held regarding the latest flow ratings and further gauging were to occur. The main water take from Inaha Stream was observed and one pump was in operation. The fire pit was not in use. The anaerobic ponds were observed of have good cover. Ponds four had five aerators in operation. No recent burial of product had occurred. Farm effluent areas were found to be satisfactory. No incidents were reported. No fugitive discharges to water found and samples were taken during the inspection, no adverse effects were observed within the receiving waters.

25 January 2018

During the inspection the following was observed. Odour surveys were undertaken beyond the site boundary and found constant noticeable site odours along Normanby Road, which is downwind of the plant. For brief periods the odour was considered putrid, at other times it was considered to be a cooking/biofilter type odour.

Observations of operations undertaken before entering site found the load-in doors were constantly open, although no deliveries were occurring at the time. Also the access door on the left load-in sliding door was missing, upon arrival staff undertook to close all doors. After discussion with the environmental manager staff undertook to reattach the missing access door. At the time no paunch was stored outside but a large pile was observed inside the room with the missing door. At the time a blood delivery was occurring, and

the surrounding area was clear of spills and the equipment was clean, also the blood room doors were closed.

The water take from Inaha was observed to be measuring 7.5 m³/hr, the intake was clear and one pump was operating. The Inaha Stream was running clear throughout the length of the site. No fugitive inputs sighted, although the fire pond had a slight green tinge but the discharge appeared clear. At the time pond 6 was not discharging and it had 5 aerators in operation. Pond 4 had 7 aerators in operation and the surface foam was present. Ponds 1-3 had complete covers, and no bubbles were discharging through pond 1, the crust appeared dry.

Observed a large pile of sump cleanings stored adjacent to pond 1 which are to be buried in the near future. No recent burial of product had occurred. A new concrete pipe was being delivered at the time for the TBE concentrated sources line. Both scrubbers were operational. A new line will be installed across the fire-pond. Bark had been delivered and was on site for the TBP concentrated sources biofilter and this was expected to be added by the end of next week. At the time the fire pit was not in use, though untreated timber and green waste were awaiting incineration. FDE remains irrigated with wastewater, both FDE collection areas were found to be satisfactory. No irrigators were operating during the inspection. No incidents were reported.

21 March 2018

During the inspection the following was observed. Odour surveys which were undertaken beyond the site boundary found noticeable typical 'load-in' and 'pond 1' type odours along Kohiti and Normanby Roads. The odour was at times very strong around the load-in area within the site boundary. A front end loader was working to move materials around. When this machine was not in use and no deliveries were occurring the doors were predominantly closed. The factory walls appeared in good repair. No delivered materials were stored outside and the paunch bunker was empty. Blood was present in the bund at the load-in system but no distinct odour was present. Pond 1 was active and bubbles were discharging through the crust which had a wet appearance. On observation ponds 1-3 had good cover. Pond 4 had 7 aerators in operation and pond 6 had 5 aerators in operation. At the time no discharge to the Inaha was occurring from pond 6. The stormwater discharge into the fire-pond was clear, and the fire pond appeared to have a mineral surface sheen and lots of algae was present at the outlet end. No adverse effects were observed in the Inaha Stream downstream of the fire-pond input.

One water take pump was operating at the time of inspection, +/- 45 m³/hr. A water take from the unnamed tributary, used for farm purposes, was found to be filled with gravel and sediment during recent storms and works will need to occur to make it operational again. Fire pit not in use. Visible emissions were discharging through the biofilters, typical bark/musty odours present down-wind. TBE plant upgrades were continuing. The FDE collection areas were found to be satisfactory. No recent burial of product had occurred and no excavated pits were observed on-site. No irrigation was occurring at the time of inspection. No incidents were reported. Samples of discharges and receiving waters were collected during the inspection.

26 April 2018

During the inspection the following was observed. Odour surveys were undertaken downwind of the site and found intermittent and distinct factory/pond odours at the corners of Kohiti and Normanby Roads as well as Ngutu and Normanby Roads. Very strong pond odours were present along Kohiti Road when directly down-wind of ponds 1 and 2.

No objectionable visible emissions were found. Burial of sand trap cleaning had occurred and a notification via e-mail had been received concerning the process. The pit had been filled back in. Recent cleanings were stored adjacent to pond 1 and all leachate appeared to be entering the pond. Ponds 1 and 2 had complete crusting, some bubbles were observed to be discharging through the wet areas around the inlet of pond 1.

Pond 3 had a complete cover, though the grass looked quite dead on the first half of the pond. Pond 4 had 6 aerators operating and pond 6 had 5 aerators in operation. No discharge from pond 6 was occurring though during a recent prolonged period of heavy rain it was reported that pond 6 did discharge to surface water briefly. No product was stored outside and the load-in catchment was tidy. The doors were shut when not in use. The blood load-in area was also tidy. One water take was in operation at a rate 29 m³/hr.

The discharge from the fire pond was clear and no adverse effects were observed within the receiving waters at the time of inspection. The fire pit was not in use at the time. The biofilter had typical odours and all ducting appeared in good repair. Fresh bark was on-site and it will be applied to one bed. Recent works had occurred to unblock an air extraction pipe as it was blocked with meal. Developments were continuing with the TBE site. FDE sumps were viewed and found to be satisfactory. The irrigation areas were coping well with applications of wastewater, no ponding or surface run-off was occurring and all pasture appeared healthy. Stickwater was also being applied, though no odour was noted downwind of application area.

8 June 2018

During the inspection the following was noted. Odour surveys were undertaken down-wind of plant, they found strong and constant putrid odours along Katotauru Road. The odour was typical in nature of ponds 1 and 2. The crusts across both ponds were intact but were wet looking and bubbles were discharging through across all areas.

Discussions were held with the site management regarding the odour. They outlined that due to issues with commissioning new processes at the TBE plant, concentrated stickwater was discharged into the pond on more than one occasion, which had caused the ponds to be very active recently. Pond 3 had good cover, pond 4 had 6 aerators in operation. The dissolved oxygen meter was due for a clean as it was not reading accurately. Pond 6 had 4 aerators in operation. The discharge from pond 6 was flowing at 2.5 L/S, and the Inaha Stream was flowing at 3.44 as defined the staff gauge at the Kohiti Road Bridge. Dilution factors were being achieved at the time of inspection.

The water take was operating through the use of a submersible pump, the meter for logging the take data was not operating. This issue was raised with site management who agreed to immediately look into the issue. The fire pit was not in use at the time, only acceptable materials were present in the pile to be burnt.

Visible emissions were observed discharging from all biofilters, they smelt like typical earthy/barky odours. The load-in doors remained closed when not in use, and a pile of paunch was stored outside the room. No other product was stored outside. The blood load-in area and bund were found to be clean, and the blood room doors were closed. The discharge from the fire-pond appeared clear and no adverse effects were observed within the receiving waters. Upon inspection it was found that a travelling irrigator was in operation in paddock 8. No ponding or run-off was occurring, and the receiving pasture appeared healthy. FDE collection areas were satisfactory at both dairy sheds. No recent burial of product has occurred. No incidents were reported.

12 June 2018

The following was noted during the inspection. Odour surveys were undertaken beyond the site boundary, these identified strong, putrid, odours which were attributed to ponds 1 and 2 along Katotauru Road. The ponds were inspected and found to have a wet looking crust across both ponds, and bubbles were discharging through the crust.

Pond 6 had 5 aerators in operation and was discharging at 12 cm. The staff gauge was 3.44, dilution factors were being achieved and the D.O was 2.08 g /m³. The Inaha Stream gauging rating table and v-notch calculation sheet was supplied to the site Environmental Manager. Pond 4 had 6 aerators in operation, though the corresponding D.O was low at 0.5 g/m³. The plant manager was informed of the low D.O.

The load-in area was clear of stored product and paunch bin was empty. The load-in doors were closed when not in use, and the stormwater catchment was clear of spilled material. The blood load-in area had spilled product inside the bund, though no odour was noted at the time. The stormwater discharge to the fire-pond was clear, however the pond had a turbid appearance.

Sewage fungus was present in the pond in the outlet culvert and on some vegetation around the outlet indicating nutrients had entered the pond. However, no sewage fungus was found in the receiving waters downstream of the fire-pond input. At the time the fire pit was not in use. The biofilter had visible emissions discharging across all beds. The concentrated sources for TBE and TBP were found to be discharging the most emissions. These were described as earthy musty odours and found directly downwind. They were not noticeable beyond the site boundary due to the strength of the pond odours.

The piping and ducting which runs across the stream appeared in good repair. At the time a travelling irrigator was operating in paddock 26. No ponding or run-off was occurring at the time of inspection. No recent burial of product had occurred. FDE collection areas were satisfactory. No incidents were reported.

Management outlined the recent investigation into the water take meter had found that the pump was cavitating, so not actually taking water from the stream, the meter was reportedly functioning correctly. Water samples were collected during the inspection.

2.6 Provision of reports management plans and certifications

Reports and plans

TBP is required to provide to the Council various management plans, contingency procedures, certifications and monitoring reports under five consents, as summarised in the following Table 30.

Table 30 Requirements for reports and plans imposed by consent

Requirement	Consent Number (and Condition Numbers)	Dates(s) required	Compliance achieved
Emissions to air			
Certification that works, processes and equipment are operated according to good engineering practice	4058-4 (6)	Biennially from 30 April 2013	Certification received 01 May 2017
Air discharge management plan	4058-4 (7)(9)	2 February 2012, annual review by 31 May, including contingency procedures	Initial plan received 3 July 2012. Annual review received 06 June 2018
Monthly report under section 3.2 of management plan on daily activities log, weather, biofilter performance	4058-4 (7)	Monthly	Reports received, late on the odd occasion
Wastewater to Inaha Stream			
Wastewater disposal management plan	2049-4 (13)(15)	31 December 2000, annual review from 31 May 2007	Plan received and approved Dec 2000. Annual review received 28 May 2018

Requirement	Consent Number (and Condition Numbers)	Dates(s) required	Compliance achieved
Monthly report under section 5.2 of management plan on wastewater characteristics, flows and irrigated areas	2049-4 (13)(15)	Monthly	Reports received, late on the odd occasion
Wastewater to Inaha Stream			
Spray irrigation management plan	3941-2 (1)(3)	31 December 2000 annual review from 31 May 2006	Plan received and approved Dec. 2000. Annual review received 22 May 2018
Annual report under section 4.3 of management plan on wastewater characteristics, flows and irrigated areas	3941-2 (1)(3)	Annually	Nitrogen budget supplied monthly
Burial pits			
(Solid) Waste burial management plan	5495-1 (1)(3)	1 November 2000, subject to review on two months' notice	Plan received and approved Oct. 2000. Review received 2 May 2014
Stormwater to Inaha Stream			
Contingency plan for spillage or accidental discharge	5426-1 (4)	31 August 1999	Plan received and approved Nov 2000. Review received 28 May 2014

Management plans (4) are required for the disposal of wastewater to the Inaha Stream, to land by spray irrigation, for the burial of solid wastes, and for the discharge of emissions to air. TBP is required to undertake an annual review of both wastewater management plans and the air management plan, the reviewed plans are to be provided by 31 May each year.

Certification by a suitably qualified independent person that the works, processes and equipment relevant to all discharges to air from the site are operating in accordance with good engineering practice is required biennially. Contingency plans (2) are required that address situations which could result in a discharge to air of odorous emissions that are offensive or objectionable beyond the boundary of the site, and spillage or accidental discharge to the stormwater catchment.

Monthly monitoring reports are required from TBP under the wastewater management plan on various aspects of wastewater quality and disposal, and under the air consent/management plan about weather and biofilter performance. An annual report is required under the spray irrigation management plan.

The required management and contingency plans and certification were all produced in 2000, except the air management plan, which was not required until 2012. For the period from 2000-2001 to 2008-2009, none of the required revision or certification documents were received by Council. The TBE plant was constructed in the interim. It is noted that annual reviews of plans have only been required since wastewater and air discharge consents were changed in 2005 and 2007, respectively upon consent reviews invoked by Council.

2.6.1 Air discharge certification

The third biennial engineering practice audit under permit 4058-4, in respect of the works, processes and equipment relevant to all discharges to air from the site, was undertaken by Golder Associates air quality

engineers on 16th and 17th March 2017. The audit focussed on aspects that contribute to the status of existing 'engineering practice':

- Physical condition of equipment: the state of odour control components, including consideration of materials used for construction.
- Instrumentation review: the accuracy of selected instrumentation and the adequacy of instrument for monitoring the odour control system.
- Design aspects: the current engineering design with respect to the air extraction, air cooling and biofilter systems.

The conclusions and recommendations from the report are provided below; the full report can be found in the previous monitoring years' report: Technical Report 2017-13, which is referenced in the rear of this report.

The existing biofilters and extraction systems are generally working effectively. However, some design and remedial measures are recommended as follows:

- The TBP concentrated source biofilter design is effective but requires deeper coverage of the inlet manifold and improved sealing against air leakage along the western border of the bed (opposite the inlet manifold).
- Measures are required to reduce the extent of air channelling that is currently occurring in the TBP concentrated source biofilter, including investigating air leaks around the Novaflow pipe lateral connections to the main concrete manifold, the addition of bark to cover the inlet manifold and improve the sealing of the western wall of the bed.
- The FA1 biofilter design is appropriate for a building air treatment system. However, given its increasingly important role for treating humid fugitive process emissions it may in time be necessary to consider sealing its western side. Currently this does not appear to be causing an issue, however some further investigations are recommended for the FA1 biofilter. This includes an assessment of pressure drops across the media and the internal condition of inlet manifold and air distribution laterals.
- The geotextile within FA2 biofilter could well be causing its high inlet air duct pressure and it should be removed. Additionally this bed needs additional bark material along its southern side to avoid untreated air by-passing the media and also to lower the bed's air loading rate.
- The TBE biofilter's bark requires replacement/remediation and that a low fraction (< 10 vol.%) of loamy soil is incorporated into any new bark to ensure effective odour removal at air loading rates that could approach 30 m³air/hr/m³ media following an upgrade to the concentrated sources Point Source Extraction System (PSES).
- Testing of the TBE biofilter media for size distribution to help establish what fraction of existing media to retain and remix with new bark.
- Upgrading the PSES for concentrated sources is recommended in preference to employing building air extraction at TBE. An optimised configuration of the Duskie and new concentrated source fans should be based on their respective fan specifications and a system curve.
- Ventilation of the TBE raw material bin room to the TBE biofilter is recommended. However, the optimal approach achieving this requires more detailed design consideration than provided in this report (e.g., a dedicated duct connecting down-stream of the scrubber or connecting to the existing concentrated sources dust).
- For all site biofilters, install water tube manometers or tubing that allows for checks upon the media air pressure drop within the biofilter beds.

- The existing cooling systems continue to achieve inlet airstreams to the biofilters that are normally 40°C or lower, which represents good practice. However, installation of new gauges for monitoring the pond water temperature changes across the TBP and TBE scrubber systems will help monitor the ability of the ponds evaporative cooling capacity to meet the required cooling duty that the concentrated sources PSESs require.

The audit undertaken by Golder Associates in March of 2017 concluded that the associated equipment, including ducts, fans, cooling systems and biofilters, continue to be maintained and operated in a sound engineering state.

TBP, post the audit have undertaken to achieve all proposed recommendations for the biofilters, these proposed recommendations have, for the most part, been implemented throughout this monitoring period.

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

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

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

In the 2017-2018 period, the Council was 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.

[22 October 2017 09:30 am](#)

[IN/35295](#)

A complaint was received regarding an objectionable odour discharging beyond the boundary of a site used for rendering by-products.

Odour surveys found light and intermittent factory and pond type odours were briefly present. Complainant outlined that the odour was strong at around 09:20 but was short lived. Further odour surveys undertaken at 12:20 found similar odours with similar frequency and intensity.

[09 November 2017 06:45 am](#)

[IN/35345](#)

A complaint was received regarding objectionable odour discharging beyond the boundary of a site used for rendering by-products.

Odour surveys undertaken in response to a complaint received at 06:45 regarding an objectionable odour. Surveys found a noticeable plant odour which was present around the Okaiawa Township. Locations varied with wind direction, plume width extended quite some distance, the odour was considered distinct and constant.

Observations of factory operations found staff were proactively managing the load-in doors between deliveries at the main factory. Works occurring on the TBE doors. Strong pond odours present along Kohiti Road. Discussion held with site manager who outlined that the scrubber water intake had been blocked causing the pump motor to cut-out, and was likely the cause of the odour, the scrubber intake was subsequently unblocked by staff.

02 December 2017 11:57 am

IN/35470

A complaint was received regarding odour being emitted from TBP, Kohiti Road, Okaiawa.

An inspection was undertaken in response to two independent complaints of odour within the Okaiawa township. The inspection found that odour was intermittent at the time of the inspection and if it had been consistent it would have been considered objectionable. The intermittent nature of the odour appeared to be due to the swirling and shifting wind conditions.

An inspection of the facility found that there had been a mechanical failure at the TBE plant resulting in extra product being processed by the TBP facility. Although the product was kept within a storage facility with doors closed, these doors were required to be opened during the operation to allow trucks to enter.

It was anticipated that the excess product would be processed overnight thus reducing the odour emitted from the facility. The complainants advised that the odour was very strong and. No communication was made with either complainant by TBP to explain or advise them of potential odour.

08 December 2017 06:10 pm

IN/35558

A complaint was received concerning an offensive rendering plant odour on Tempsky road, Okaiawa.

An odour survey was undertaken on Tempsky road, no odour was detected down wind or up wind of rendering plant facility.

No further action was taken.

09 December 2019 01:30 pm

IN/35559

A complaint was received concerning a rendering plant odour on Kohiti road, Okaiawa.

An inspection was undertaken which involved an odour survey. No rendering plant odour was detected at time on inspection. No further action taken.

10 December 2017 03:30 pm

IN/35560

Complaint was received concerning a rendering plant odour on Manu road, Okaiawa.

An inspection was undertaken which involved an odour survey on Manu road, down wind and up wind of rendering plant. No rendering plant odour was detected at the time of inspection. No further action taken.

12 December 2017 08:04 am

IN/35512

An odour complaint was received regarding TBP at Manu Road, Okaiawa.

No odour found at time of inspection.

06 April 2018 04:50 pm

IN/35937

A complaint was received regarding odours being emitted from the TBP processing facility, Kohiti Road, Okaiawa.

An inspection was undertaken following a complaint from a member of the public regarding odour being discharged beyond the boundary of the site in breach of resource consent conditions.

Odour surveys were undertaken on dusk. A North-West light breeze was blowing at the time with approximately 1/8th cloud cover and 15°C. An odour was detected off-site near the Okaiawa township which was best described as the 'cooking' type odour from the plant.

An odour survey about this location found that the odour was approximately a two on the odour scale. The odour was found to be intermittent and shifting due to the light wind and slight changes in direction.

The odour may have been considered objectionable if it was prolonged and consistent in nature which was not the case on this inspection. The plant manager was notified of the complaint. He advised that the plant had experienced problems with the vacuum pump which had resulted in the loss of negative pressure within the buildings at the facility. The required repairs had been made and the plant was now operating as designed, however odour would have discharged from the facility while the repairs were being undertaken. At the time of the inspection it was found that the site was compliant with resource consent 4058-4.

08 April 2018 11:16 am

IN/35938

A complaint was received regarding odour being emitted beyond the boundary of the property from TBP, Kohiti Road, Okaiawa.

An inspection was undertaken in response to an odour complaint from a member of the public. An inspection was undertaken with the wind blowing in moderate strength from the north-west. Inspection found that some odour was detected about the facility with slight odours detected in the Kohiti Road / Normanby Road areas. These odours were deemed to be slight and well within resource consent limits. No odour was detected within the Okaiawa Township.

28 June 2018 05:20 am

IN/36526

A complaint was received regarding objectionable odour discharging beyond the boundary of a by-products rendering facility at Okaiawa.

Odour surveys undertaken in response to a complaint received regarding objectionable odour discharging beyond the site boundary. No odours attributable to site activities were found at the complainant's property, the complainant outlined that the odour was very strong for half an hour around 17:00. Odour surveys undertaken along the Normanby Road corridor found putrid odours attributed to the wastewater ponds when directly downwind of the ponds.

3 Discussion

3.1 Discussion of site performance

TBP provide an important service to the meat and poultry industry in Taranaki and the lower North Island by the production of products from the by-products of these industries such as offal, feather and fallen stock.

Site compliance performance will be discussed by item.

Water abstraction in terms of surface water abstraction from the Inaha Stream. On one occasion, 31 October 2017, the maximum abstraction rate was exceeded with an extraction of 2,388 m³, this was an exceedance of 228 m³. The abstraction of groundwater was undertaken this period and compliance was achieved.

Discharges to the Inaha Stream were as follows. The discharge of treated wastewater to the Inaha Stream was undertaken this period. TBP were in compliance with the consented dilution rate of 1:300 for the whole of the time they were discharging to the Inaha Stream. The temperature differential for the discharge of cooling water/ backwash water were maintained this period. There was no exceedance with the total river temperature, post discharge, it remained below the consented maximum of 35°C. Also there was no thermal increase of the discharge on the receiving waters of the Inaha Stream greater than or equal to 3°C.

Monitoring of pond six indicated that dissolved oxygen concentrations were found to above the requisite 1.0g/m³ on three of the four samples analysed this period. The one occasion when the concentration was below the prescribed limit of 1.0 g/m³ was on the 14 December 2017 with a value of 0.96 g/m³, note this is 0.04 g/m³ below their requirement. It is also noteworthy to mention that the discharge, at that time (December 2017) would have been specifically to land.

In terms of the discharges to the Inaha Stream, these occurred on 190 days throughout year, which is a decrease from the previous period where by the site discharged on 191 days¹ to the Inaha Stream.

Records provided by TBP, in terms of applications of wastewater to land, indicated that the highest recorded application of wastewater was to paddock 22, which received a total of 295 kg N/ha in the 2017-2018 monitoring year. This was compliant with the stated maximum for wastewater application which is limited strictly to 300 kg N/ha per year, as per consent 3941-2.

Paddock 22 did not receive any additional fertiliser (Zealgrow) this monitoring year. The highest volume of fertiliser (Zealgrow) applied to land was found to be 250 kg N/ha in paddock 1, this paddock also did not receive any additional applications of wastewater this period.

The highest combined application of wastewater and fertiliser was observed to be paddock 31. This paddock received 46 kg N/ha of fertiliser and 260 kg N/ha of wastewater, which was a combined total of 306 kg N/ha. Note that this is not a breach in consent conditions as the loading for wastewater was below 300 kg N/ha.

Wastewater to land in the 2016-2017 monitoring period encompassed 27,072 kg N, while in this period it was 33,727 kg N, which is an increase of 6,655 kg N. Fertiliser (Zealgrow) applications to land in the 2016-2017 monitoring period equated to 4,970 kg N for that period, where as in this monitoring period, 11,483 kg N was put to land, this was an increase of 4,828 kg N this period.

¹ Please note that a calculation error was reported in the 2016-2017 report for discharges to the Inaha Stream, where by it stated that discharges occurred to the Inaha Stream on only 83 days, this was incorrect. The true number was 191 days of discharge to the Inaha Stream in the 2016-2017 monitoring period.

Discharges to air from the burning of pallets, paper and cardboard was undertaken this period. Although the investigating officer did not observe the burning occurring. Observations indicated that the area appeared well managed and that only prescribed materials were in the burn piles throughout the year.

Emissions to air from rendering operations continued to draw complaints from the public this period. Ten complaints from the public were received this period. Of the ten complaints received and engaged, six were found to be the result of noticeable odour, while four did not find any odour. Of the six which found noticeable odour, three were attributed to mechanical failures at the plant site, which were rectified. These were related to process changes which were at the time, being undertaken at the TBE plant to upgrade the odour extraction system. These upgrades were recommended in the recent (March 2017) Golder Associates audit of odour control systems. In the upcoming monitoring period the audit of odour control systems will be undertaken again.

The community liaison meeting was held at the Okaiawa Rugby club on the 7 March 2018. Minutes of the meeting were taken and provided to TBP staff whom shared them amongst attendees. The discussions held at the liaison meeting indicated that the performance of the company in terms emissions to air was improving, however, continual progress is required. There was also a request to undertake two community engagement meetings in the upcoming monitoring period. One was proposed to be held in November 2018 at the beginning of the summer, and the second to be held in March 2019 to discuss the Company's summer performance.

A meeting was held with Ngati Manuhiakai Hapu on two occasions this period, one was held on the 14 April 2018 at Te Aroha Marae, and the follow up was undertaken on the 9 June 2018, held at Ranagatapu Marae. Matters discussed included the effects of the current resource consents (six consents) which are up for renewal in June 2019.

3.2 Environmental effects of exercise of consents

Environmental effects associated with the exercise of consents held by TBP will be discussed on a system basis.

Monitoring of the abstraction of surface water from the Inaha Stream, whereby a brief exceedance in daily maximums was reported, indicated no adverse effects as a process of this exceedance, however consented maximums should be adhered to. Groundwater abstraction was undertaken without issue.

Monitoring of cooling waters indicated negligible effects as process of this discharge. However, visual observations of sewage fungus at certain locations within the duck pond/fire pond indicated that some nutrients may be making their way to this pond, most likely entrained in the stormwater system. During an inspection a fat blockage of a drain was identified to have prevented boiler blow down water from flowing to pond 1, whereby it had travelled overland into the fire/ duck pond. Inaha Stream monitoring indicated that the fungus was contained within the fire pond and was not observed on the main stem of the Inaha Stream.

Discharges of wastewater to the Inaha Stream was undertaken this period. Surface water analysis was undertaken on four occasions, of which on two occasions the facility was actively discharging to the Inaha Stream. The resultant analysis indicated that during the discharge sample runs a slight increase in NNN was reported. Conversely, the increase in NNN was more pronounced during the summer months when the facility was not discharging to the Inaha Stream, coupled with low flows in the stream.

Dissolved oxygen concentrations were within compliance standards across the surface water monitoring of the Inaha Stream this period, with no result below the prescribed standard of 80% saturation as required by consent.

Monitoring of dissolved oxygen levels within pond six indicated that on one occasion of four, the concentration of dissolved oxygen was below the consented requirement of 1.0 g/m³ with value of 0.96 g/m³. While this was 0.04 g/m³ below the set limit, the likely effect would have been minimal. At the time the facility would have been discharging to land only, through travelling irrigator, thus the fluid would have been aerated prior to land application.

Monitoring of the irrigation area's groundwater indicated that currently three groundwater monitoring wells remain above 50 g/m³ N (NNN). These elevated results are a function of long term usage and over usage of the irrigation areas with applications of wastewater and fertiliser (Zealgrow). An effect that TBP are working to mitigate.

Surface water monitoring of the Western tributary indicated that during the summer months especially, the NNN effect of groundwater egress to this water body can increase the concentration of NNN from 1.0 to 10 g/m³ N as it travels down the length of the unnamed tributary. This is proposed to be an effect of groundwater through flow into the western tributary, from the elevated groundwater concentrations identified in the irrigation area monitoring.

This effect is most pronounced during the summer low flows. In this monitoring period the most elevated value for this parameter reported a value of 12.8 g/m³ N in February 2018, noting this is the third highest reading for this parameter in the data set which has been monitored since 2004.

Monitoring of Te Kopanga Spring, located at the Shearer residence, indicated the third highest value for this monitoring location with a value of 7.27 g /m³ N (NNN) in September 2017. The Council will continue to monitor this location. TBP have been made aware of this slowly elevating concentration and will regard it moving forward with reduced applications of wastewater and fertiliser.

The Council biologist whom undertook the biological monitoring of the Inaha Stream on two occasions this period indicated the following:

Overall, there was no evidence that discharges from TBP had impacted on the freshwater macroinvertebrate communities present in the Inaha Stream.

Air related environmental effects appeared to be the process of two elements this period, one being equipment malfunction and the second being related to pond odour. Stickwater was reported (June 2018) to have been discharged into the pond system on a couple of occasions due to malfunctions within the TBE plant. This is not permitted under consent 2049-4 as this may adversely affect the pond systems denitrifying capacity. It is also vastly odorous with an elevated biological oxygen demand exerted by this fluid, as such it is only discharged to land via an injection spreader which negates the odour of the fluid, however it conversely leads to elevated nitrogen levels within the groundwater as the injection by-passes the soil/vegetation interface.

Continual improvement is required with respect to emissions to air and TBP have taken on and implemented biennial audit recommendations from the 2017 audit. Community engagement also recognised the improvements which have been made. In the upcoming monitoring period the audit will occur again.

Groundwater monitoring of the burial pits has indicated significantly elevated ammonia in close proximity to the burial pits, a watch is held over the Inaha Stream and nothing adverse has been detected in the corresponding surface water analysis. The burial pits were utilised on one occasion this period to bury sand trap waste. In the upcoming consent renewal process further options for disposal will be explored.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 31-42.

Table 31 Summary of performance for consent 2049-4

Purpose: To discharge treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream (2049-4)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Mixing zone 30 m downstream of discharge	Site inspection and monitoring results	Yes
2. Boundaries of mixing zone to be determined by Council	Site inspection	N/A
3. Point of discharge to enter channel directly to ensure mixing	Site inspection	Yes
4. Advise Council before making changes to alter nature of discharge	Site inspection, monitoring results and liaison	Yes
5. TBP to undertake self-monitoring	Review of monthly monitoring of effluent for nitrogen. Some monitoring in management plan undertaken by Council	Yes
6. Minimum discharge dilution rate	Monitoring results	Yes
7. No discharge of stickwater, and consult with Council before increasing cow herd	Site inspection reported stickwater was discharged into the pond system on more than one occasion (Inspection June 2018)	No
8. Discharge to cease when flows in the Inaha Stream drop below 100 L/s	Monitoring of Kohiti Road flow gauge results	Yes
9. Control on effect of discharge in receiving water	Inspection, chemical sampling and bio-monitoring	Yes
10. Limits on receiving water ammonia concentration	Chemical sampling	Yes
11. Recording and reporting of discharge rate	Inspection and review of records	Yes
12. Inaha Stream flow measurement device	Inspection, gaugings by Council	Yes
13. Provision of wastewater disposal plan	Plan received by Council and approved December 2000	Yes
14. Plan to be implemented	Inspections and liaison and receipt of TBP reports	Yes
15. Optional and annual reviews of wastewater plan	Annual review undertaken by TBP, provided	Yes, review provided 28 May 2018
16. Designated staff member	Part of TBP's Environmental Manager's job description, also Plant and Operations Manager's	Yes

Purpose: To discharge treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream (2049-4)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
17. Training of staff on wastewater disposal	Liaison and inspection	Yes
18. Donation to Taranaki Tree Trust	Confirmation with Council finance department that donation received	Yes
19. Optional review provision	Next review date available June 2017	N/A
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 32 Summary of performance for consent 2050-4

Purpose: To discharge cooling water to Inaha tributary (2050-4)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Activity monitoring by TBP as required	Continuous temperature monitoring taken over by Council in September 2013, at TBP's request	Yes
2. Composition not to be different to Inaha Stream, other than heat and solids	Chemical sampling by Council	Yes
3. Maximum temperature limit on discharge	Continuous temperature recording by Council	Yes
4. Limit on suspended solids in discharge	Sampling by Council	Yes
5. Controls on effect of discharge in receiving water	Continuous temperature monitoring, and chemical and biological sampling, by Council.	Yes
6. Discharge temperature measurement and recording	Monitoring carried out by Council	Yes
7. Optional review provision	Next review date available June 2017	No review required
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 33 Summary of performance for consent 2051-4

Purpose: To take water from the Inaha Stream for a rendering operation (2051-4)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Means of take satisfactory to Council	Inspection and monitoring	Yes
2. Minimum flow of 25 L/s downstream of point of abstraction	Monitoring of flow	Yes
3. Operation of an abstraction measurement device, maintain records	Data provision indicated an exceedance in total daily maximum On one occasion, 31 October 2017, the maximum abstraction rate was exceeded with an extraction of 2,388 m ³ , and this was an exceedance of 228 m ³ .	No
4. Operation of a flow recorder at Kohiti Road, level gauge from Jan 2015	Staff gauge in stream, rated by Council. Daily level record and monthly report by TBP	Yes
5. Report on use of treated wastewater as cooling water by 31 March 2000	Report produced 13 October 2000 and recommendations implemented	N/A
6. Provision for review	Next review date available 1 June 2017	N/A
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 34 Summary of performance for consent 5426-1

Purpose: To discharge stormwater to Inaha tributary (5426-1)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notification prior to changing processes that may significantly alter discharge	Inspection by Council	Yes
2. Limits on discharge composition	Chemical sampling by Council indicated compliance with this consent condition	Yes
3. Controls on effect of discharge in receiving water	Chemical and biological sampling by Council	Yes
4. Provision of spillage contingency plan by 31 August 1999	Plan produced in November 2000	N/A
5. Optional review provision	Next review date available June 2017	No review required
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 35 Summary of performance for consent 4058-4

Purpose: To discharge emissions to air (4058-4)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adopt best practicable option (bpo) to prevent or minimise adverse effects	Checking that standard operating procedures to achieve compliance with consent conditions are followed. Liaison with TBP and inspection by Council. Audit undertaken in March 2017, recommendations to be implemented	No-stickwater discharged to pond system reported in June 2018 inspection
2. No offensive or objectionable odour beyond boundary	Odour surveys undertaken by Council during inspections and by TBP. Further investigations were undertaken in respect of complaints received from the public. Ten odour complaints were received in this monitoring period. Six found noticeable odour. Four found no odour. Of the six which found noticeable odour, three were the result of a mechanical failure. No finding of objectionable odour.	Yes
3. Definition of noxious, offensive or objectionable odour		N/A
4. Designated staff member for emissions management	Part of TBP Environmental Manager's job description. Also Plant and Operations Manager's responsibility	Yes
5. Prohibition of fish rendering	Inspection by Council, no fish rendering undertaken	Yes
6. Certification processes and equipment operated according to good engineering practice biennially from 30 April 2013	Biennial certification by suitably qualified independent person. Undertaken 16 & 17 March 2017. Next audit due 2019.	Yes
7. Preparation of Air Discharge Management Plan	Submission of Plan, on 3 July 2012, reviewed plan received 06 June 2018	Yes
8. Operation in accordance with Air Discharge Management Plan	Inspection by Council	Yes
9. Annual review of Air Discharge Management Plan by 31 May	Liaison. Reviewed by TBP and submitted to Council 06 June 2018	Yes
10. Limits on dust deposition rate	Inspection	Yes
11. Newsletter production, and community liaison meetings	Newsletter produced. Community liaison meeting held 07 March 2018	Yes

Purpose: To discharge emissions to air (4058-4)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
12. Optional review provision to deal with significant adverse effects	Recent audit undertaken in March 2017. Recommendations to be implemented.	Not required at present, although it is under consideration
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 36 Summary of performance for consent 3941-2

Purpose: To discharge treated wastewater to land (3941-2)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Irrigation to defined area	Inspection by Council	Yes
2. Provision and maintenance of spray irrigation management plan	Plan received by Council and approved in October 2000	Yes
3. Plan to be followed	Liaison, inspection and provision of monitoring reports	Yes
4. Optional, and mandatory annual reviews of management plan	Revision submitted 22 May 2018	Yes
5. Designated staff member	Part of TBP Environmental Manager's job description. Also Plant and Operations Manager's responsibility	Yes
6. Adopt best practicable option to minimise adverse effects, including total nitrogen minimisation	Significant developments planned through filtration, pending	Yes
7. Seek permission for Inaha Stream discharge when cannot irrigate, and Inaha Stream in low flow	Liaison and inspection. Not required this period	N/A
8. Limit on dissolved oxygen in final pond	Chemical sampling of pond 6 indicated compliance with limit on 3 of 4 occasions sampled. December sample indicated a value of 0.96 g/m ³	No
9. No offensive or objectionable odour beyond boundary	Inspection and complaint register	Yes
10. No spray drift beyond boundary	Inspection and complaint register	Yes
11. Limit on sodium absorption ratio	Chemical sampling indicated compliance with this limit	Yes
12. Prohibition of ponding and run-off	Inspection and complaint register	Yes

Purpose: To discharge treated wastewater to land (3941-2)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
13. Spray buffer zones	Inspection and complaint register	Yes
14. Limit on nitrogen application rate	Monitoring by TBP and review of irrigation records. Record also kept of fertiliser application to establish total nitrogen loading	Yes
15. Report on reducing ammonia concentration by 15 December 2000	Report received by Council on 2 April 2001	N/A
16. Limit on application rate	Inspection	Yes
17. Limit on return period	Inspection and provision of records	Yes
18. Installation and maintenance of monitoring bores	Liaison and inspection. Environmental consultant have installed additional bores recently	Yes
19. Baseline and operational monitoring by TBP	Results of wastewater, irrigation and soil monitoring by/for TBP reviewed by Council	Yes
20. Consultation meetings with interested parties	Imposed by review of 21 December 2005. Meeting held at Te Aroha Marae on 14 April 2018 and Ranagatapu Marae 09 June 2018	Yes
21. Notification prior to Inaha discharge	Imposed by review of 21 December 2005. Liaison with TBP and Ngati Manuhiakai	Yes
22. Provisions for contamination of groundwater or water supply	Significant nitrate impacts in groundwater identified and communicated to TBP in previous monitoring periods. Remedial actions undertaken by TBP. Suitably qualified Environmental Consultant engaged and aiding in wastewater management. Ongoing for one year. Still on going.	Remedial actions implemented and under development
23. Optional review provision for operational requirements	Not sought by TBP	N/A
24. Optional review provision upon receipt of ammonia reduction report	The engagement of a suitably qualified environmental consultant will seek to mitigate elevated nitrogen in groundwater	Consultant appointed
25. Optional review provision for nitrogen treatment and disposal	Review not required at this stage, consent set for renewal in 2018-2019 period	Not required
26. Optional review provision for environmental effects	Current proposed plans preferred to the review option. The review option will not be exercised this period	Not required
Overall assessment of consent compliance and environmental performance in respect of this consent		Improvement required
Overall assessment of administrative performance in respect of this consent		High

Table 37 Summary of performance for consent 5495-1

Purpose: To discharge wastes from meat rendering by burial (5495-1)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Provision of waste burial management plan by 1 November 2000	Plan received by Council and approved in October 2000	N/A
2. Waste burial management plan to be followed	Inspection by Council, and review of TBP records	Yes
3. Optional provision for review of waste burial management plan	Not sought by TBP or Council. Revision undertaken by TBP in May 2014	N/A
4. Designated staff member	Part of TBP Environmental Manager's job description. Also Plant and Operations Managers' responsibility	Yes
5. Disposal pits not to intercept groundwater	Inspection by Council	Yes
6. Disposal pits to be constructed as undertaken in consent application	Inspection by Council	Yes
7. Notification of commencement of pit construction outside nominated area	Inspection by Council, no notification received	N/A
8. All constructed disposal pits to be inspected by Council prior to use	Inspection by Council	Yes
9. Conditions 1-4 to apply to new disposal pits	Inspection by Council	Yes
10. Discharged material to be covered within 4 hours	Inspection by Council	Yes
11. Soil cover requirements upon completion of each disposal operation	Inspection by Council	Yes
12. Cover material and surrounding land to be contoured to direct stormwater away	Inspection by Council	Yes
13. Site rehabilitation and pasture re-establishment	Inspection by Council	Yes
14. No irrigation of effluent onto disposal area	Inspection by Council	Yes
15. No direct discharge of contaminants to surface water	Inspection and chemical/biological survey by Council	Yes
16. Installation of monitoring bores	Inspection and sampling by Council. New bore installed 11 May 2015, replacing two bores damaged	Yes
17. Optional review provision for operational requirements	Not sought by TBP	N/A
18. Optional review provision for environmental effects	Due to expire 1 June 2019. Renewal currently on going	Not required
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 38 Summary of performance for consent 6431-1

Purpose: To place culverts in Inaha Stream (6431-1)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adoption of best practicable option to minimise adverse environmental effects	Liaison, and inspection by Council	Yes
2. Consent to be exercised in accordance with documentation submitted	Inspection by Council	N/A
3. Notification prior to commencement and upon completion of works	Liaison with Council. No work undertaken	N/A
4. Subsequent works prohibited between May and October, without permission	Inspection by Council. Permission for dead willow removal given 4 June 2015	Yes
5. Adoption of best practicable option to minimise discharges, bed disturbance and water quality effects	Liaison, inspection and bio-monitoring by Council	Yes
6. Minimisation of bed disturbance	Inspection by Council	Yes
7. Structure removal and area reinstatement upon redundancy		N/A
8. Fish passage not to be restricted	Inspection by Council	Yes
9. Erection of stock-proof riparian fences on consent holders property above Kohiti Road	Implementation of riparian plan RMP938 and inspection by Council	Yes fencing completed June 2009
10. Planting of riparian margins within 4 years from 4 October 2004	Implementation of riparian plan RMP938 and inspection by Council. Some replanting/ blanking undertaken in winter 2011 and 2015	Yes planting completed June 2009
11. Placement of culvert inverters and headwall protection structures	Inspection by Council	Yes
12. Lapse of consent if not exercised	Consent was exercised	N/A
13. Optional review provision for environmental effects	Next review date available 1 June 2017	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		High

Table 39 Summary of performance for consent 7234-1

Purpose: To disturb and realign Inaha Stream (7234-1)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Consent to be exercised in accordance with documentation submitted	Inspection by Council	N/A
2. Notification prior to commencement of works	Notification given 17 March 2008	N/A
3. Placement and design of rock wall for bank protection	Inspection by Council	N/A
4. Works prohibited between May and October, without permission	Inspection by Council	N/A
5. Riverbed disturbance to be minimised	Inspection by Council	N/A
6. Sediment discharge and effects to be minimised	Inspection by Council	N/A
7. Fish salvage from old channel immediately upon diversion	Council carried out fish salvage on 18 April 2008	N/A
8. Fish passage not be obstructed	Inspection by Council	N/A
9. Vegetation removed not to be buried near stream	Inspection by Council	N/A
10. Lapse of consent if not exercised	Consent was exercised	N/A
11. Optional review provision for environmental effects	Next review date available June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Not exercised
Overall assessment of administrative performance in respect of this consent		Not exercised

Table 40 Summary of performance for consent 7329-1

Purpose: To discharge stormwater and sediment from re-contouring land and realigning Inaha Stream (7329-1)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Consent to be exercised in accordance with documentation	Inspection by Council. An erosion and sediment control management plan was provided with the application. (Sediment controls initially inadequate)	N/A
2. Limit on maximum soil area disturbed	Inspection by Council	N/A

Purpose: To discharge stormwater and sediment from re-contouring land and realigning Inaha Stream (7329-1)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
3. Limit on maximum soil volume disturbed	Inspection by Council	N/A
4. Design criteria for run-off sediments traps to be followed	Inspection by Council	N/A
5. Sediment discharge and effects to be minimised	Inspection by Council	N/A
6. Provision of programme of works prior to exercise of consent	An erosion and sediment control management plan was provided with the application	N/A
7. Stabilisation of earthwork areas upon completion of soil disturbance activities	Inspection by Council	N/A
8. Procedure to be followed upon discovery of archaeological site	Liaison with Council (Retrospective)	N/A
9. Lapse of consent if not exercised	Consent was exercised	N/A
10. Optional review provision for environmental effects	Next review date available June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Not exercised
Overall assessment of administrative performance in respect of this consent		Not exercised

Table 41 Summary of performance for consent 9756-1

Purpose: To take and use groundwater for industrial water supply (9756-1)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Limit on maximum take	Water measuring and recording required by consent conditions	Yes
2. Labelling of bore	Inspection by Council	Yes
3. Access to bore for manual measurement of water levels	Inspection by Council	Yes
4. Installation of metering and logging equipment	Inspection by Council and certification under condition 5	Yes
5. Certification of water measuring equipment	Provision of certificate. Supplied 29 May 2014.	Yes
6. Installation of water level measuring equipment	Inspection by Council	Yes

Purpose: To take and use groundwater for industrial water supply (9756-1)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
7. Telemetry of monitoring data to Council	Inspection by Council and receipt of data. Water take from 27 March 2014; water level from 6 June 2014	Yes
8. Access to monitoring equipment	Inspection by Council	Yes
9. Notification of equipment failure	Inspection by Council and checking of records	N/A
10. Adoption of best practicable option	Liaison and inspection	Yes
11. Lapse of consent if not exercised	Consent was exercised	N/A
12. Optional review provision for environmental effects	Next review date available June 2017	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		High

Table 42 Summary of performance for consent 10054-1

Purpose: To discharge emissions into the air from the burning of pallets, paper and cardboard (10054-1)		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adoption of best practicable option to minimise adverse environmental effects	Liaison, and inspection by Council	Yes
2. Restrict on materials combusted	Inspection by Council	Yes
3. Prohibition of objectionable odour	Inspection by Council	Yes
4. Supervision of burning	Inspection by Council	Yes
5. Limit on dust deposition rate	Inspection by Council	N/A
6. Control of airborne dust components and particulate concentration	Inspection by Council	Yes
7. Prohibition of toxic components beyond boundary	Inspection by Council	Yes
8. Lapse of consent if not exercised	Consent was exercised	N/A
9. Optional review provision for environmental effects	Next review date available June 2017, no review required	N/A

Purpose: <i>To discharge emissions into the air from the burning of pallets, paper and cardboard (10054-1)</i>		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 43 Consent compliance table TBP 2017-2018

Consent Number	Description	Environmental compliance	Administrative performance
2051-4	To take water from the Inaha Stream for a rendering operation	Good	High
2049-4	To discharge treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream	Good	High
2050-4	To discharge cooling water to Inaha tributary	High	High
5426-1	To discharge stormwater to Inaha tributary	High	High
4058-4	To discharge emissions to air	Good	High
3941-2	To discharge treated wastewater to land	Improvement required	High
5495-1	To discharge wastes from meat rendering by burial	High	High
6431-1	To place culverts in Inaha Stream	High	High
7234-1	To disturb and realign Inaha Stream	Not exercised	
7239-1	To discharge stormwater and sediment from re-contouring land and realigning Inaha Stream	Not exercised	
9756-1	To take and use groundwater for industrial water supply	High	High
10054-1	To discharge emissions into the air from the burning of pallets, paper and cardboard	High	High

Table 44 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2009-2010	2051-4			1	
	2049-4		1		
	2050-4	1			
	5426-1			1	
	4058-3			1	
	3941-2		1		
	5495-1	1			
	6431-1		1		
	7234-1	1			
	7329-1	1			
2010-2012	2051-4			1	
	2049-4	1			
	2050-4	1			
	5426-1			1	
	4058-3/4			1	
	3941-2		1		
	5495-1	1			
	6431-1		1		
	7234-1	1			
	7239-1	1			
2012-2013	2051-4		1		
	2049-4	1			
	2050-4				1
	5426-1			1	
	4058-4				1
	3941-2			1	
	5495-1		1		
	6431-1		1		
	7234-1	1			
	7239-1	1			
2013-2015	2051-4	1			
	2049-4			1	
	2050-4		1		
	5426-1			1	
	4058-4			1	

Year	Consent no	High	Good	Improvement req	Poor
	3941-2			1	
	5495-1		1		
	6431-1		1		
	9756-1	1			
2015-2016	2051-4		1		
	2049-4		1		
	2050-4	1			
	5426-1	1			
	4058-4			1	
	3941-2			1	
	5495-1		1		
	6431-1	1			
	9756-1	1			
	10054-1		1		
2016-2017	2051-4	1			
	2049-4		1		
	2050-4	1			
	5426-1		1		
	4058-4			1	
	3941-2			1	
	5495-1	1			
	6431-1	1			
	9756-1	1			
	10054-1	1			
Totals		24	17	16	2

During the year, the Company demonstrated a good level of environmental and high level of administrative performance with the resource consents as defined in Section 1.1.4.

3.4 Recommendations from the 2016-2017 Annual Report

In the 2016-2017 Annual Report, it was recommended:

1. THAT in the first instance, monitoring of consented activities at TBP in the 2017-2018 year continues at the same level as in 2016-2017.
2. THAT should there be issues with environmental or administrative performance in 2017-2018, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

3.5 Alterations to monitoring programmes for 2018-2019

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 2018-2019 that monitoring location INH000450 be instilled into the surface water monitoring of the Inaha Stream. This location will test the water quality, post the confluence with the Western tributary on the Inaha Stream, to ascertain for any affect from the elevated nitrogen of the Western tributary surface water on the Inaha Stream.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site(s) 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 2018-2019.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities at TBP in the 2018-2019 year continue at the same level as in 2017-2018 with the inclusion of surface water monitoring site INH000450 to the four monitoring rounds of surface water planned for the upcoming period.
2. Groundwater monitoring well integrity testing should be undertaken to make sure the groundwater is not adversely affected from a compromised monitoring well. Certain wells have reported E-Coli in this monitoring period.
3. THAT should there be issues with environmental or administrative performance in 2017-2018, 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.
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.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
Cu*	Copper.
Cumec	A volumetric measure of flow- 1 cubic metre per second (1 m ³ s ⁻¹).
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
E.coli	Escherichia coli, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100
Fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m ² /day	grams/metre ² /day.
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).
NO ₃	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
Pb*	Lead.
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
PM ₁₀ , PM _{2.5} , PM _{1.0}	Relatively fine airborne particles (less than 10 or 2.5 or 1.0 micrometre diameter, respectively).
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.
UI	Unauthorised Incident.
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.

Bibliography and references

- Golder Associates, 2017: TBP Audit Report-Odour Control System Audit 2017. Report 1530864_7403-003-R-Rev 0.
- Golder Associates, 2015: Site visit report-Consent 4058-4 certification. Golder Project No. 1530864.
- Golder Associates, 2013: Site visit report-Consent 4058-4 certification. Golder Project No. 1378104138.
- Golder Associates, 2010: Evaluation of the air discharge control operations, Golder Document No. 1078104234.
- Stark JD, 1999: An evaluation of TRC's SQMCI biomonitoring index. Cawthron Institute, Nelson. Cawthron Report No 472.
- Stark JD, 1998: SQMCI: a biotic index for freshwater macroinvertebrate coded abundance data. New Zealand Journal of Marine and Freshwater Research 32(1):55-66.
- Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. Water and Soil Miscellaneous Publication No.87.
- Stark, JD and Fowles, C R, 2004: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant using artificial substrate, January to March 2003. TRC report.
- Taranaki Regional Council, 2016: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2015-2016. Technical report 2017-13
- Taranaki Regional Council, 2016: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2015-2016. Technical report 2016-80.
- Taranaki Regional Council, 2015: Taranaki By-Products Ltd Monitoring Programmes Biennial Report 2013-2015. Technical report 2015-65.
- Taranaki Regional Council, 2013: Taranaki By-Products Ltd Monitoring Programmes Biennial Report 2012-2013. Technical report 2013-101.
- Taranaki Regional Council, 2012: Taranaki By-Products Ltd Monitoring Programmes Biennial Report 2010-2012. Technical report 2012-94.
- Taranaki Regional Council, 2010: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2009-2010. Technical report 2010-38.
- Taranaki Regional Council, 2009: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2008-2009. Technical report 2009-108.
- Taranaki Regional Council, 2008: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2007-2008. Technical report 2008-77.
- Taranaki Regional Council, 2007: Taranaki By-Products Ltd Monitoring Programme Triennial Report 2004-2007. Technical Report 2008-08.
- Taranaki Regional Council, 2004: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2003-2004. Technical report 2004-67.
- Taranaki Regional Council, 2003: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2002-2003. Technical report 2003-81.
- Taranaki Regional Council, 2002: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2001-2002. Technical report 2002-73.

- Taranaki Regional Council, 2001: Taranaki By-Products Ltd Monitoring Programmes Annual Report 2000-2001. Technical report 2001-88.
- Taranaki Regional Council, 2000: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1999-2000. Technical report 2000-25.
- Taranaki Regional Council, 1999: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1998-99. Technical report 99-48.
- Taranaki Regional Council, 1998: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1997-98. Technical report 98-87.
- Taranaki Regional Council, 1997: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1996-97. Technical report 97-59.
- Taranaki Regional Council, 1996: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1995-96. Technical report 96-70.
- Taranaki Regional Council, 1995: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1994-95. Technical report 95-38.
- Taranaki Regional Council, 1994: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1993-94. Technical report 94-72.
- Taranaki Regional Council, 1993: Taranaki By-Products Ltd Resource Consents Monitoring Programmes Annual Report 1992-93. Technical report 93-59.

Appendix I

Resource consents held by Taranaki By-Products Ltd

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

Consent number	Purpose	Volume	Next review date	Expiry date
2049-4	Discharge treated wastewater to Inaha Stream	940 m ³ /day	2017	2019
2050-4	Discharge cooling/backwash water to Inaha Stream	2,160 m ³ /day	2017	2019
2051-4	Take from Inaha Stream	2,160 m ³ /day (50L/s)	2017	2019
3941-2	Discharge treated wastewater to land and air	1,400 m ³ /day	2014	2019
4058-4	Discharge emissions to air from rendering operations		2015	2024
5426-1	Discharge stormwater to Inaha tributary	1,025 L/s	2017	2019
5495-1	Discharge meat wastes by burial into land	200 tonne/day	2017	2019
6431-1	Place culverts in Inaha Stream		2017	2023
7234-1	Disturb to realign Inaha Stream		2017	2023
7329-1	Discharge sediment during Inaha Stream realignment		2017	2023
9756-1	Take groundwater	22.8 L/s (1,970 m ³ /day)	2017	2029
10054-1	Discharge emissions to air from burning		2017	2029

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

Name of
Consent Holder: Taranaki By-Products Limited
 P O Box 172
 HAWERA

Change to
Conditions/Review
Completed Date: 4 October 2006 [Granted: 31 May 1999]

Conditions of Consent

Consent Granted: To discharge up to 940 cubic metres/day of treated
 wastewater from a rendering operation and from a farm
 dairy into the Inaha Stream at or about GR: Q21:118-858

Expiry Date: 1 June 2019

Review Date(s): June 2001, June 2003, June 2005, June 2007,
 June 2011, June 2017

Site Location: Kohiti Road, Okaiawa

Legal Description: Lots 1 & 2 DP 6457 Blk IV Waimate SD

Catchment: Inaha

General conditions

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

Special conditions

Special conditions 1 – 5 (unchanged)

1. The mixing zone in each condition of this consent shall extend for a distance of 30 metres downstream of the point of discharge of treated wastewater.
2. The boundaries of the mixing zone and site of discharge shall be as physically determined by the Chief Executive, Taranaki Regional Council.
3. The point of discharge into the Inaha Stream shall be such that the discharge enters directly into a channel of the Inaha Stream in order to ensure that complete mixing occurs.
4. The consent holder shall advise the Taranaki Regional Council prior to making any change in the processes undertaken at the site which could significantly alter the nature of the discharge.
5. The consent holder shall undertake such monitoring of the activities licensed by this consent, as deemed reasonably necessary by the Chief Executive, Taranaki Regional Council, subject to section 35(2)(d) and section 36 of the Resource Management Act 1991. This monitoring information is to be forwarded to the Chief Executive, Taranaki Regional Council, upon request.

Special condition 6 [amended]

6. A minimum dilution rate of 1:300 shall be maintained at the point of discharge to the Inaha Stream at all times.

Special condition 7 [replaced]

7. a) No stick-water shall be discharged under this consent. Stick-water is defined as juices squeezed out of products that are rendered.
- b) This consent allows the discharge of wastewater from up to 1,200 cows. Prior to this number being increased the consent holder must demonstrate, in writing, to the satisfaction of the Chief Executive Officer, Taranaki Regional Council, that the wastewater treatment system can treat the wastewater without breaching condition 9 of this consent.

Special conditions 8- 12 [unchanged]

8. The discharge shall cease when flows decrease in the Inaha Stream, as measured at the Kohiti Road gauging site, to below 100 litres/second.
9. The discharge [in conjunction with any other discharges pertaining to the same property], shall not cause or give rise to any of the following effects, at any point in the receiving waters below the mixing zone:
 - (a) a fall of more than 0.5 pH units;
 - (b) an increase in filtered carbonaceous biochemical oxygen demand [20 degrees Celsius, 5-day test] to above 2.00 gm⁻³;
 - (c) a temperature rise of more than 3.0 degrees Celsius;
 - (d) a reduction in the dissolved oxygen concentration to below 80% of saturation concentration;
 - (e) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
 - (f) any conspicuous change in the colour or visual clarity;
 - (g) any emission of objectionable odour;
 - (h) the rendering of fresh water unsuitable for consumption by farm animals;
 - (i) any significant adverse effects on aquatic life, habitats or ecology;
 - (j) any visible bacterial and/or fungal growths in the receiving water.
10. The discharge, in conjunction with any other discharges pertaining to the same property, shall not raise the total ammonia concentration [expressed as NH₃] in the receiving waters at any point below the mixing zone above 1.5 gm⁻³ if the pH of the receiving water is below 7.75, or above 0.7 gm⁻³ if the pH of the receiving water lies between 7.75 and 8.00, or above 0.4 gm⁻³ if the pH of the receiving water is above 8.00.
11. The consent holder shall install a metal control gate on the discharge outlet, and install and operate a v-notch weir and stage board on the outlet, to the satisfaction of the Chief Executive, Taranaki Regional Council; and shall keep records of the discharge rate during the exercise of this consent; such records to be made available to the Chief Executive, Taranaki Regional Council, upon request.
12. The consent holder shall install and maintain a stage board on the Kohiti Road Bridge and shall gauge the site for the purpose of providing a stream flow monitoring site, to the satisfaction of the Chief Executive, Taranaki Regional Council.

Special condition 13 [amended]

13. The consent holder shall maintain a wastewater disposal management plan [the management plan] for the wastewater treatment system, to the approval of the Chief Executive, Taranaki Regional Council, outlining the management of the system, particularly the use of the spray irrigation system in combination with the pond discharge, which shall demonstrate the ability to comply with consent conditions and shall address the following matters:
- (a) monitoring of the discharge wastewater;
 - (b) monitoring of the receiving water;
 - (c) management of the wastewater treatment system;
 - (d) minimisation of nutrients in the discharge wastewater;
 - (e) treatment and disposal of stickwater;
 - (f) mitigation of the effects of the discharge;
 - (g) guidelines for use of spray irrigation or discharge to surface water; and
 - (h) reporting on the exercise of the consent.

An objective of the plan shall be to minimise discharges to surface water and to maximise discharges to land under consent 3941.

Special condition 14 [unchanged]

14. The consent shall be exercised in accordance with the procedures set out in the wastewater disposal management plan, and the consent holder shall subsequently adhere to and comply with the procedures, requirements, obligations and all other matters specified in the management plan, except by the specific agreement of the Chief Executive, Taranaki Regional Council. In case of any contradiction between the management plan and the conditions of this resource consent, the conditions of this resource consent shall prevail.

Special condition 15 [amended]

15. The consent holder shall advise the Taranaki Regional Council two months prior to any changes being made to the wastewater disposal management plan. Should the Taranaki Regional Council wish to review the wastewater disposal management plan, two months notice shall be provided to the consent holder. The consent holder shall review the plan annually and shall provide the reviewed plan to the Chief Executive, Taranaki Regional Council, by 31 May each year.

Special conditions 16-18 [unchanged]

16. The consent holder shall designate an officer with the necessary qualifications and/or experience to manage the wastewater treatment system.

Consent 2049-4

17. The consent holder shall ensure that:
- (a) the operation of the wastewater treatment system shall be carried out at all times in accordance with the requirements of the wastewater disposal management plan prepared as required in condition (13) above or subsequent version of that document which does not lessen environmental protection standards;
 - (b) all relevant site staff are to be regularly trained on the content and implementation of the wastewater disposal management plan, the maximum period between training sessions being 12 months. New staff are to be trained on recruitment and the training record made available to the Chief Executive, Taranaki Regional Council, upon request; and
 - (c) all relevant site staff are advised immediately of any revision or additions to the wastewater disposal management plan.
18. By the agreement of the consent holder, the consent holder shall mitigate the effects of the discharge by donating annually to the Taranaki Tree Trust \$2100 [goods and services tax exclusive] for the purpose of providing riparian planting and management in the Inaha Stream catchment. The amount shall be adjusted annually according to the consumer price index, or similar index, to account for the effects of inflation.

Special condition 19 [amended]

19. 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 2007, June 2011, and/or June 2017, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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 4 October 2006

For and on behalf of
Taranaki Regional Council

Director-Resource Management

TRK992050

DISCHARGE PERMIT

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

Name of Consent Holder: TARANAKI BY-PRODUCTS LIMITED
PO BOX 172 HAWERA

Renewal Granted Date: 31 May 1999

CONDITIONS OF CONSENT

Consent Granted: TO DISCHARGE UP TO 2,160 CUBIC METRES/DAY OF COOLING WATER AND BACKWASH WATER FROM A RENDERING OPERATION INTO AN UNNAMED TRIBUTARY OF THE INAHA STREAM AT OR ABOUT GR: Q21:118-858

Expiry Date: 1 June 2019

Review Date[s]: June 2001, June 2003, June 2005, June 2011 and June 2017

Site Location: KOHITI ROAD OKAIAWA

Legal Description: LOTS 1 & 2 DP6457 BLK IV WAIMATE SD

Catchment: INAHA 351.000

Tributary: UNNAMED TRIBUTARY

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

TRK992050

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 undertake such monitoring of the activities licensed by this consent, as deemed reasonably necessary by the General Manager, Taranaki Regional Council, subject to section 35(2)(d) and section 36 of the Resource Management Act 1991. This monitoring information is to be forwarded to the General Manager, Taranaki Regional Council, upon request.
2. THAT the discharge shall not contain concentrations of any chemical, biological or physical contaminant [other than heat and suspended solids] greater than those found in the water abstracted from the Inaha Stream.
3. THAT the cooling water discharge to the Inaha Stream shall not exceed 35.0 degrees Celsius in temperature at the point of the discharge to the unnamed tributary of the Inaha Stream.
4. THAT the cooling water discharge to the Inaha Stream shall not contain a concentration of suspended solids in excess of 100 gm⁻³
5. THAT after allowing for a mixing zone of 45 metres extending downstream of the confluence of the unnamed tributary with the Inaha Stream, the discharge [in conjunction with any other discharge pertaining to the same property], shall not give rise to any of the following effects in the receiving waters:
 - (a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended material;
 - (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, habitats or ecology;
 - (f) any visible bacterial and/or fungal growths; and
 - (g) an increase in temperature of more than 3.0 degrees Celsius.
6. THAT the consent holder shall operate and maintain, to the satisfaction of the General Manager, Taranaki Regional Council, a discharge temperature measuring device and shall keep records of the discharge temperature during the exercise of this consent; such records to be made available to the General Manager, Taranaki Regional Council, upon request.

TRK992050

7. 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 2001, June 2003, June 2005, June 2011 and/or June 2017, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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 31 May 1999

For and on behalf of
TARANAKI REGIONAL COUNCIL

DIRECTOR—RESOURCE MANAGEMENT

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

Name of
Consent Holder: Taranaki By-Products Limited
PO Box 172
Hawera 4640

Decision Date
(Change): 21 January 2015

Commencement Date
(Change): 21 January 2015 (Granted: 31 May 1999)

Conditions of Consent

Consent Granted: To take up to 2,160 cubic metres/day (50 litres/second) of water from the Inaha Stream for a rendering operation

Expiry Date: 1 June 2019

Review Date(s): June 2017

Site Location: Kohiti Road, Okaiawa

Legal Description: Lot 3 DP 378038 Lot 2 DP 410593 Lots 2-3 DP 6457
(Site of take)

Grid Reference (NZTM) 1701884E-5624101E

Catchment: Inaha

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

General conditions

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

Special conditions

- 1. That the means of taking water shall be maintained to the satisfaction of the Chief Executive, Taranaki Regional Council.
- 2. That a minimum flow of at least 25 litres/second shall be maintained in the stream at all times downstream of the point of abstraction.
- 3. That the consent holder shall install and operate to the satisfaction of the Chief Executive, Taranaki Regional Council, an abstraction rate measuring device and shall keep records of the dates and daily quantities of water abstracted during the exercise of this consent; such records to be made available to the Chief Executive, Taranaki Regional Council, upon request.
- 4. That the consent holder shall to the satisfaction of the Chief Executive, Taranaki Regional Council, monitor and keep daily records of the flows in the Inaha Stream at the Kohiti Road Bridge; such records to be made available to the Chief Executive, Taranaki Regional Council, upon request.
- 5. 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 2017, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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 21 January 2015

For and on behalf of
Taranaki Regional Council

A D McLay
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: Taranaki By-Products Limited
P O Box 172
HAWERA 4640

Change To Conditions Date: 9 November 2009 [Granted: 15 December 1999]

Conditions of Consent

Consent Granted: To discharge up to 1400 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy via spray irrigation onto and into land, and to discharge emissions into the air, in the vicinity of the Inaha Stream and its tributaries

Expiry Date: 1 June 2019

Review Date(s): June 2011, June 2014, June 2017

Site Location: Kohiti Road, Okaiawa

Legal Description: Existing areas: Lot 1 DP 6457 Pt Sec 93 Blk IV Waimate SD [factory site], Lot 1 DP 378038, Pt Sec 93 Lots 2 & 3 DP 6457 Ngatimanuhiakai 17B2 17A2 17A3 Sec 88 Pt Sec 90 Lot 1 DP 10174 Lot 1 DP 11864 Pt Secs 90 & 94 DP SO219 Pt Sec 8 Sec 9 Pt Sec 154 Pt Sec 87 & Sec 89 Lot 2 DP 10412 Sec 92 Ngatimanuhiakai 3B Pt Sec 149 Ngatimanuhiakai 17B1 Lots 1 & 2 DP 4415 Sec 151 Blk IV Waimate SD

New areas:

Ngatimanuhiakai 3A Blk IV Waimate SD, Ngatimanuhiakai 2A & 2B Blk, Ngatimanuhiakai 4A Blk IV Waimate SD, Ngatimanuhiakai 10A2 Blk IV Waimate SD, Lot 1 DP 5153 Sec 86 Blk Waimate SD, Lot 1 DP 10412 Lot 2 DP 11864 Pt Sec 94 Blk IV Waimate SD, Ngatimanuhiakai 7C1 Blk IV Waimate SD [between the following points; NW (1700589E-5625245N), NE (1700909E-5625245N), SW (1700631E-5625092N), SE (1700921E-5625046N)]

Catchment: Inaha

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

Consent 3941-2

General conditions

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

Special conditions

Condition 1 – new

1. The discharge authorised by this consent shall only occur on the land shown in the map labelled Figure 1 attached.

Conditions 2 to 12 [previously conditions 1 to 11] – unchanged

Management plan

2. Prior to the exercise of the consent, the consent holder shall provide, and subsequently shall maintain, a spray irrigation management plan, to the approval of the Chief Executive, Taranaki Regional Council, outlining the management of the system, which shall demonstrate ability to comply with consent conditions and shall address the following matters:
 - a) designated application areas;
 - b) selection of appropriate irrigation methods for different types of terrain;
 - c) application rate and duration;
 - d) application frequency;
 - e) farm management and operator training;
 - f) soil and herbage management;
 - g) prevention of runoff and ponding;
 - h) minimisation and control of odour effects offsite;
 - i) operational control and maintenance of the spray irrigation system;
 - j) monitoring of the effluent [physicochemical];
 - k) monitoring of soils and herbage [physicochemical];
 - l) monitoring of groundwater beneath the irrigated area [physicochemical];
 - m) monitoring of drainage water downslope of the irrigated area [physicochemical];
 - n) monitoring of Inaha Stream and relevant tributaries;
 - o) remediation measures;
 - p) liaison with submitters to the consent, and interested parties;
 - q) reporting monitoring data;
 - r) procedures for responding to complaints; and
 - s) notification to the Council of non-compliance with the conditions of this consent.

Consent 3941-2

An objective of the plan shall be to maximise discharges to land and to minimise discharges to surface water under consent 2049.

3. The consent shall be exercised in accordance with the procedures set out in the spray irrigation management plan, and the consent holder shall subsequently adhere to and comply with the procedures, requirements, obligations and other matters specified in the management plan, except by the specific agreement of the Chief Executive, Taranaki Regional Council. In case of any contradiction between the management plan and the conditions of this resource consent, the conditions of this resource consent shall prevail.
4. The spray irrigation management plan described in special condition 2 of this consent shall be subject to review upon two months notice by either the consent holder or the Taranaki Regional Council. Further, the consent holder shall review the spray irrigation management plan annually and shall provide the reviewed plan to the Chief Executive, Taranaki Regional Council, by 31 May each year.
5. The consent holder shall designate an officer with the necessary qualifications and/or experience to manage the spray irrigation system. The officer shall be regularly trained on the content and implementation of the spray irrigation management plan, and shall be advised immediately of any revision or additions to the spray irrigation management plan.
6. The consent holder shall at all times adopt the best practicable option or options, as defined in Section 2 of the Resource Management Act 1991, to prevent or minimise the adverse effects of the discharges on the environment. This shall include, but not be limited to the minimisation of total nitrogen concentration in the treated effluent.
7. In circumstances where spray irrigation of wastewater is not possible, and where a dilution rate of 1:200 in the Inaha Stream cannot be maintained, the consent holder shall seek the permission of the Chief Executive, Taranaki Regional Council, prior to discharging wastewater to the Inaha Stream.

Odour and spray effects

8. The level of dissolved oxygen within the wastewater pond from which irrigation water is drawn shall be maintained above 1.0 gm^{-3} at all times.
9. There shall be no offensive or objectionable odour as a result of the irrigation of treated wastewater at or beyond the boundary of the property or properties on which spray irrigation is occurring.
10. There shall be no spray drift as a result of the irrigation of treated wastewater at or beyond the boundary of the property or properties on which spray irrigation is occurring.

Consent 3941-2

Land effects

11. The sodium adsorption ratio [SAR] of the wastewater shall not exceed 15.
12. There shall be no ponding of wastewater, and/or any direct discharge to a watercourse due to the exercise of this consent.

Condition 13 [previously condition 12 - changed]

13. The edge of the spray zone shall be at least:
 - a) 25 metres from the banks of any watercourse;
 - b) 50 metres from any bore, well or spring used for water supply purposes;
 - c) 20 metres from any public road, except as detailed in f) and g) of this condition;
 - d) 20 metres from any property boundary;
 - e) 150 metres from any dwellinghouse or place of public assembly unless the written approval of the occupier has been obtained to allow the discharge at a lesser distance;
 - f) 200 metres from Normanby Road adjacent to the property described as Lots 3 & 4, Pt Lot 1 DP 2707, Lot 1 DP 3731, Blk IV, Waimate SD, unless the written approval of the occupier has been obtained to allow the discharge at a lesser distance; and
 - g) 50 metres from Ahipaipa Road adjacent to the properties described as Pt Lot 1 and Lot 2 DP 3322, Lot 2 DP12129, Blk IV, Waimate SD.

Conditions 14 to 26 [previously conditions 13 to 25] – unchanged

14. The effluent application rate shall not exceed 300 kg nitrogen/hectare/year except on land described as Pt Sec 154 Blk IV Waimate SD, where the effluent application rate shall not exceed 200 kg/nitrogen/hectare/year.
15. The consent holder shall investigate, and report in writing on, options for upgrading the wastewater treatment system to reduce the concentration of ammonia in the wastewater prior to discharge; the report to be received by the Chief Executive, Taranaki Regional Council, not later than twelve months from the date the consent is granted. Any necessary works associated with the report on reduction of ammonia concentrations shall be completed within twelve months after the receipt of the report.
16. The average application rate shall not exceed 5 mm/hour.
17. The return period between applications shall be at least seven days and the application depth shall not exceed 25 mm at each application.

Monitoring and liaison

18. The consent holder shall site, install and maintain to the satisfaction of the Chief Executive, Taranaki Regional Council, a minimum of nine monitoring bores for the purpose of determining groundwater quality in the vicinity of the discharge. The bores are to be sited in the following locations: upslope of the Kohiti Road and Katotauru Road irrigation areas (2), at the southern boundary of the western Normanby Road irrigation area (2), within the Normanby Road, Kohiti Road and Katotauru Road irrigation areas (3), at the southern boundary of the Katotauru irrigation area, and at the southern boundary of the Ahipaipa Road irrigation area. The spring downslope of the Normanby Road irrigation area, and three bores in the vicinity of Inuawai Road shall also be monitored.
19. The consent holder shall undertake such baseline and operational monitoring of the activities licensed by this consent, as deemed reasonably necessary by the Chief Executive, Taranaki Regional Council.
20. The consent holder and staff of the Regional Council shall meet as appropriate, quarterly or at such other frequency as the parties may agree, with representatives of Ngati Manuhiakai Hapu and other interested submitters to the consent, and any other interested party at the discretion of the Chief Executive, Taranaki Regional Council, to discuss any matter relating to the exercise of the resource consent, in order to facilitate ongoing consultation.
21. The consent holder shall, where practicable, advise the Chief Executive, Taranaki Regional Council, and representatives of Ngati Manuhiakai Hapu, prior to discharge to Inaha Stream under consent 2049.

Mitigation

22. Should monitoring of the discharge under conditions 14 and 18 indicate contamination of local groundwater as a result of the exercise of this consent, the consent holder shall:
 - a) undertake appropriate remedial action as soon as practicable as described in the spray irrigation management plan prepared under condition 2, or such action reasonably required by the Chief Executive, Taranaki Regional Council;
 - b) shall review the spray irrigation management plan and incorporate such reasonable modifications as are considered necessary by the Chief Executive, Taranaki Regional Council; and
 - c) where water supplies are significantly affected, immediately provide alternative supplies as reasonably required by the Chief Executive, Taranaki Regional Council.

Review

23. The consent holder may apply to the Council for a change or cancellation of any of the conditions of this consent in accordance with section 127(1)(a) of the Resource Management Act 1991 to take account of operational requirements or the results of monitoring.

Consent 3941-2

24. The Taranaki Regional Council may review conditions 7 and 14 of this consent within two weeks after the completion of works to be investigated under condition 15 of this consent, for the purpose of evaluating the appropriateness of the required dilution rate and application rate, and the effects of the discharge on the Inaha Stream and soil.
25. The Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2001, and/or June 2007, for the purpose of assessing the need to increase the land area for wastewater disposal, reduce nitrogen loading to land and/or increase treatment at the wastewater treatment system to reduce the nitrogen concentration of the effluent.
26. The Taranaki Regional Council may, pursuant to section 128 of the Resource Management Act 1991, review any or all of the conditions of this consent by giving notice of review during June 2001, June 2003, June 2005, June 2007, June 2009, June 2011, June 2014 and/or June 2017, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this consent, which either were not foreseen at the time the application was considered or which it was not appropriate to deal with at that time.

Signed at Stratford on 9 November 2009

For and on behalf of
Taranaki Regional Council

Director-Resource Management

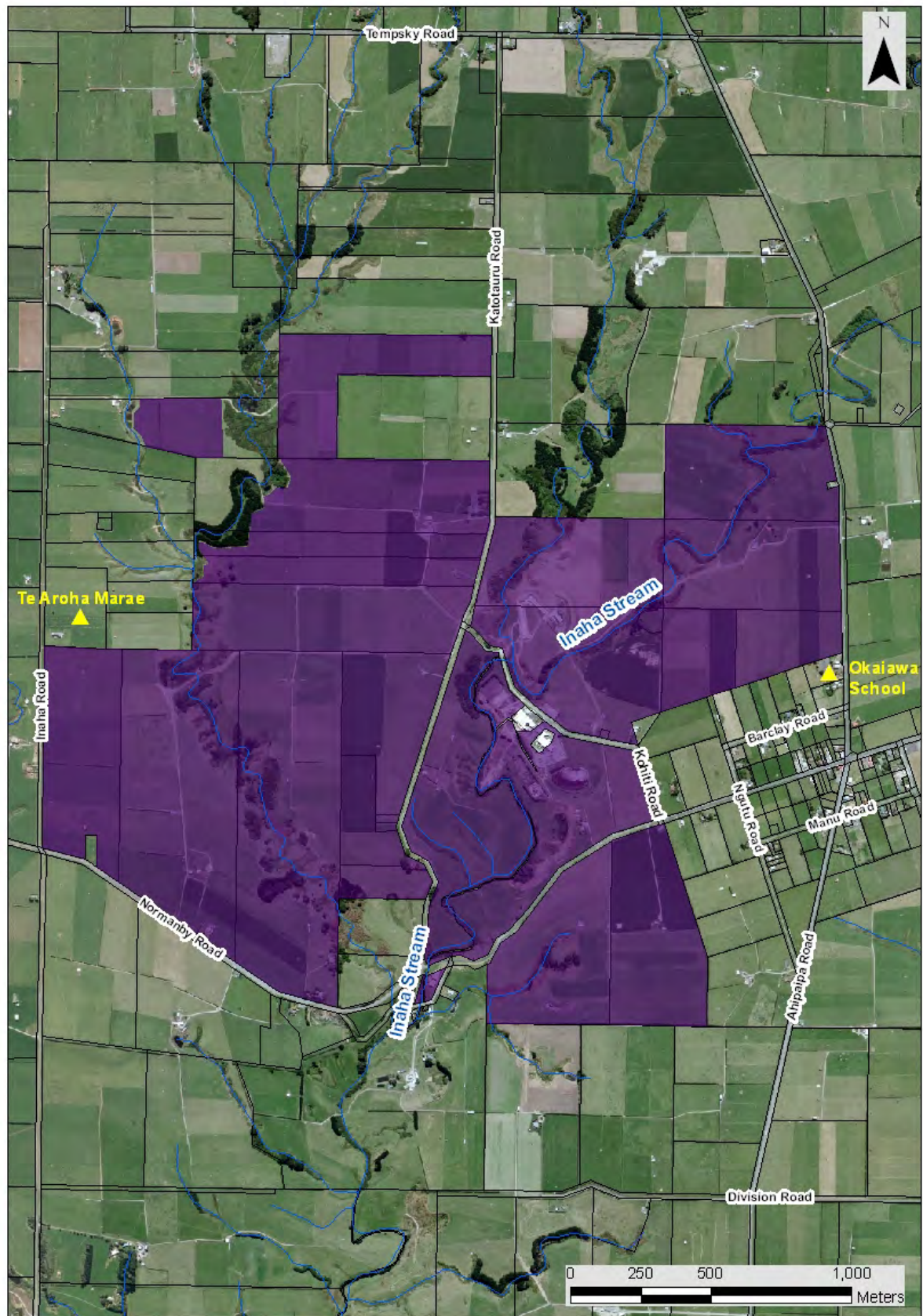


Figure 1 Location of the authorised area to receive wastewater, via spray irrigation, onto and into land

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

Name of
Consent Holder: Taranaki By-Products Limited
P O Box 172
HAWERA 4640

Decision Date: 11 October 2011

Commencement
Date: 11 October 2011

Conditions of Consent

Consent Granted: To discharge emissions into the air from rendering operations and associated processes including wastewater treatment at or about (NZTM) 1701965E-5624119N and burial of material at or about (NZTM) 1702416E-5624339N

Expiry Date: 1 June 2024

Review Date(s): June 2013, June 2015, June 2017,
June 2019, June 2021, June 2023

Site Location: Kohiti Road, Okaiawa

Legal Description: Lot 3 DP 378038 Lot 2 DP 410593 Lots 2-3 DP 6457, Lot 1 DP 6457 Blk IV Waimate SD, Lot 1 DP 410593 [TBE], Lot 1 DP 10174 Lot 1 DP 11864 Sec 88 Pt Sec 90 Blk IV Waimate SD

*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 to section 36 of the Resource Management Act.

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site.
2. The discharge authorised by this consent shall not give rise to an odour at or beyond the boundary of the site that is offensive or objectionable.

Note: With respect to this condition, the consent holder's site is defined as the areas shown in the map attached.

3. For the purposes of condition 2, an odour shall be deemed to be offensive or objectionable if:
 - a. it is held to be so in the opinion of an enforcement officer of the Taranaki Regional Council, having regard to the duration, frequency, intensity and nature of the odour; and/or
 - b. an officer of the Taranaki Regional Council observes that an odour is noticeable, and either it lasts longer than two (2) hours continuously, or it occurs frequently during a single period of more than four (4) hours; and/or
 - c. no less than two individuals from at least two different properties, each declare in writing that an objectionable or offensive odour was detected beyond the boundary of the site, provided the Council is satisfied that the declarations are not vexatious and that the objectionable or offensive odour was emitted from the site at the frequency and duration specified in (b). Each declaration shall be signed and dated and include:
 1. the individuals' names and addresses;
 2. the date and time the objectionable or offensive odour was detected;
 3. details of the duration, frequency, intensity and nature of the odour that cause it to be considered offensive or objectionable;
 4. the location of the individual when it was detected; and
 5. the prevailing weather conditions during the event.
4. The consent holder shall continue to employ a suitably qualified and experienced person in the role of Environmental Manager, whose responsibilities shall include ensuring compliance with the conditions of this consent.
5. No fish or fish parts shall be received or processed on the premises.

Consent 4058-4

6. By 30 April 2013, and every two years thereafter, the consent holder shall provide certification by a suitably qualified independent person that the works, processes and equipment relevant to all discharges to air from the site are operational in accordance with good engineering practice.
7. Before 2 February 2012, the consent holder shall prepare an Air Discharge Management Plan for the site that, to the satisfaction of the Chief Executive of the Taranaki Regional Council, details how discharges to air from the site will be managed to ensure compliance with conditions of this consent. The plan shall include but not necessarily be limited to;
 - a. A description of the air quality objectives sought by the plan;
 - b. The identification of key personnel responsible for managing air discharges and implementing the Management Plan;
 - c. A description of the activities on the site and the main potential sources of odour emissions;
 - d. A description of storage and treatment procedures (including specification of storage times and preservative dosing concentrations) for ensuring that only high quality raw material is processed;
 - e. The identification and description of the odour and dust mitigation measures in place;
 - f. The identification and description of relevant operating procedures and parameters that need to be controlled to minimise emissions;
 - g. A description of contingency procedures for addressing situations, such as equipment failure or spillage of raw material or chemicals, which could result in a discharge to air of odorous emissions that are offensive or objectionable beyond the boundary of the plant;
 - h. A description of monitoring and maintenance procedures for managing the odour mitigation measures including record keeping of control parameters and maintenance checks; and
 - i. Details of staff training proposed to enable staff to appropriately manage the odour mitigation measures.
8. Operations on site shall be undertaken in accordance with the Air Discharge Management Plan, required by condition 7 above.
9. The Air Discharge Management Plan described in special condition 7 of this consent shall be subject to review upon two months notice by either the consent holder or the Taranaki Regional Council. Further, the consent holder shall review the management plan annually and provide the reviewed plan to the Taranaki Regional Council, by 31 May each year.

Consent 4058-4

10. The discharges authorised by this consent shall not give rise to suspended or deposited dust at or beyond the boundary of the site that, in the opinion of at least one enforcement officer of the Taranaki Regional Council, is offensive or objectionable. For the purpose of this condition, discharges in excess of the following limits are deemed to be offensive or objectionable:
 - a. dust deposition rate $0.13 \text{ g/m}^2/\text{day}$; and/or
 - b. suspended dust level 3 mg/m^3 .
11. The consent holder shall consult and inform the local community about activities on the site, specifically those relating to the exercise of this consent, by:
 - a. Four times per year, providing a newsletter to all landowners and/or occupiers of properties within 3 kilometres of the site; and
 - b. Convening a meeting with the Director - Resource Management, Taranaki Regional Council (or their delegate), and the local community annually or at such other frequency as the parties may agree.
12. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2013 and/or every two years thereafter. The purpose of any review would be to ensure 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. When determining if any review is required the Council will take into account any expressed views of the Okaiawa community.

Signed at Stratford on 11 October 2011

For and on behalf of
Taranaki Regional Council

Director-Resource Management

TRK995426

DISCHARGE PERMIT

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

Name of
Consent Holder: TARANAKI BY-PRODUCTS LIMITED
PO BOX 172 HAWERA

Consent
Granted Date: 31 May 1999

CONDITIONS OF CONSENT

Consent Granted: TO DISCHARGE UP TO 1,095 LITRES/SECOND OF
STORMWATER FROM AN ANIMAL RENDERING SITE INTO
AN UNNAMED TRIBUTARY OF THE INAHA STREAM AT OR
ABOUT GR: Q21:119-858, Q21:120-858 AND Q21:121-858

Expiry Date: 1 June 2019

Review Date[s]: June 2001, June 2003, June 2005, June 2011 and June 2017

Site Location: KOHITI ROAD OKAIAWA

Legal Description: LOTS 1 & 2 DP6457 BLK IV WAIMATE SD

Catchment: INAHA 351.000

Tributary: UNNAMED TRIBUTARY

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

TRK995426

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 advise the Taranaki Regional Council prior to making any change in the processes undertaken at the site which could significantly alter the nature of the discharge.
2. THAT the discharge shall not exceed the following parameters:

<u>Component</u>	<u>Concentration</u>
pH range	6-9
oil and grease	15 gm ⁻³
suspended solids	100 gm ⁻³

This condition shall apply prior to the entry of the discharge into the receiving water at designated sampling point[s] approved by the General Manager, Taranaki Regional Council.

3. THAT after allowing for reasonable mixing, within a mixing zone extending 45 metres from the confluence of the unnamed tributary with the Inaha Stream, the discharge [in conjunction with any other discharges pertaining to the same property], shall not give rise to any of the following effects in the receiving waters:
 - (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 freshwater unsuitable for consumption by farm animals;
 - (e) any significant adverse effects on aquatic life, habitats or ecology; and
 - (f) any visible bacterial and/or fungal growths.
4. THAT within three months of the granting of this consent, the consent holder shall prepare a contingency plan outlining measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not licensed by this consent and measures to avoid, remedy or mitigate the environmental effects of such a spillage or discharge.

TRK995426

5. 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 2001, June 2003, June 2005, June 2011 and/or June 2017, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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 31 May 1999

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: Taranaki By-Products Limited
P O Box 172
HAWERA

Change To
Conditions Date: 4 August 2000 [Granted: 30 March 2000]

Conditions of Consent

Consent Granted: To discharge up to 200 tonnes/day of wastes from meat rendering operations by burial into land in the vicinity of the Inaha Stream at or about GR: Q21:121-859

Expiry Date: 1 June 2019

Review Date(s): June 2001, June 2003, June 2005, June 2011, June 2017

Site Location: Kohiti Road, Okaiawa

Legal Description: Lot 1 DP 10174 Lot 1 DP 11864 Sec 88 Pt Sec 90 SO 268
Blk IV Waimate SD

Catchment: Inaha

Consent 5495-1

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

special condition 1 [amended]

1. THAT by 1 November 2000, the consent holder shall provide a waste burial management plan, to the approval of the General Manager, Taranaki Regional Council, outlining the management of the system, which shall demonstrate ability to comply with consent conditions and shall address the following matters:
 - a) nature of wastes discharged;
 - b) discharge control;
 - c) waste cover;
 - d) addition of hydrated lime to stabilise the wastes;
 - e) minimisation and control of odour effects offsite;
 - f) stormwater control;
 - g) leachate management;
 - h) monitoring of groundwater beneath the burial area [physicochemical];
 - i) site re-instatement and after care (including maintaining the integrity of the cover material);
 - j) site contouring;
 - k) reporting monitoring data;
 - l) procedures for responding to complaints; and
 - m) notification to the Council of non-compliance with the conditions of this consent.

special conditions 2-5 [unchanged]

2. THAT the consent shall be exercised in accordance with the procedures set out in the waste burial management plan, and the consent holder shall subsequently adhere to and comply with the procedures, requirements, obligations and other matters specified in the management plan, except by the specific agreement of the General Manager, Taranaki Regional Council. In case of any contradiction between the management plan and the conditions of this resource consent, the conditions of this resource consent shall prevail.
3. THAT the waste burial management plan described in special condition 1 of this consent shall be subject to review upon two months notice by either holder the Taranaki Regional Council.
4. THAT the consent holder shall designate an officer with the necessary qualifications and/or experience to manage the waste burial site. The officer shall be regularly trained on the content and implementation of the burial management plan, and shall be advised immediately of any revision or additions to the burial management plan.

Consent 5495-1

5. THAT the disposal pit[s] shall not intercept shallow groundwater.

special conditions 6 – 7 [amended]

6. THAT the disposal pits shall be constructed when required in general accordance with the information supplied by the applicant in support of application 1084.
7. THAT the consent holder shall notify the Council of the commencement to construct additional disposal pits outside of the disposal area indicated in the map supporting the application.

special condition 8 [unchanged]

8. THAT an officer of the Council is to inspect all constructed disposal pits prior to disposal operations.

special condition 9 [amended]

9. THAT special conditions 1 to 4 shall apply after 1 November 2000 when the disposal pit required by special condition 6 is constructed and also for all subsequent disposal pits.

special conditions 10 – 15 [unchanged]

10. THAT the discharged material shall be covered within a period of four hours or less so as to avoid the generation of offensive offsite odours.
11. THAT at the completion of the disposal operation a low permeability, clean, compacted soil cover with a minimum thickness of 1.0m be placed over the discharged wastes.
12. THAT the cover material and surrounding land shall be contoured such that all stormwater is directed away from the disposal area to the satisfaction of the General Manager, Taranaki Regional Council.
13. THAT the disposal site shall be rehabilitated and pasture re-established to the satisfaction of the General Manager, Taranaki Regional Council.
14. THAT there shall not be any irrigation of effluent under resource consent 3941 or resource consent 2466 onto the disposal area.
15. THAT the exercise of this consent shall not lead, or be liable to lead, to a direct discharge of contaminants to a surface water body.

special condition 16 [amended]

16. THAT the consent holder shall install and maintain, to the satisfaction of the General Manager, Taranaki Regional Council, a minimum of eight monitoring bores for the purpose of determining groundwater quality in the vicinity of the discharge.

Consent 5495-1

special condition 17-18 [unchanged]

17. THAT the consent holder may apply to the Council for a change or cancellation of any of the conditions of this consent in accordance with section 127(1)(a) of the Resource Management Act 1991 to take account of operational requirements or the resources of monitoring.
18. 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 2001, June 2003, June 2005, June 2011 and/or June 2017, 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 was 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 4 August 2000

For and on behalf of
Taranaki Regional Council

Director-Resource Management

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

Name of
Consent Holder: Taranaki By-Products Limited
 P O Box 172
 HAWERA

Consent Granted 4 October 2004
Date:

Conditions of Consent

Consent Granted: To erect, place and maintain two culverts in the Inaha
 Stream for farm access purposes at or about GR:
 Q21:121-860 and Q21:125-863

Expiry Date: 1 June 2023

Review Date(s): June 2011, June 2017

Site Location: Kohiti Road, Hawera

Legal Description: Secs 89 & 90 Blk IV Waimate SD

Catchment: Inaha

General conditions

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

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this resource consent.
2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 3271. In the case of any contradiction between the documentation submitted in support of application 3271 and the conditions of this consent, the conditions of this consent shall prevail.
3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 48 hours prior to the commencement and upon completion of the initial installation and again at least 48 hours prior to and upon completion of any subsequent maintenance works which would involve disturbance of or deposition to the river bed or discharges to water.
4. Once initial work is complete, any further instream works shall take place only between 1 November and 30 April inclusive, except where this requirement is waived in writing by the Chief Executive, Taranaki Regional Council.
5. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.
6. The consent holder shall ensure the area and volume of riverbed disturbance shall, so far as practicable, be minimised and any areas which are disturbed shall, so far as practicable, be reinstated.
7. The structures authorised by this consent shall be removed and the area reinstated, if and when the structures are no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to removal and reinstatement.
8. The structures which are the subject of this consent shall not restrict the passage of fish.

Consent 6431-1

9. The consent holder shall prevent stock at all times from accessing all water bodies, including wetlands, on or bordering the consent holder's property, upstream of Kohete Road bridge, by constructing and maintaining fences or other controls, located to provide for the establishment of riparian margins; such means of prevention to be established within four years of the granting of this consent.
10. The consent holder shall undertake planting and subsequent maintenance of the riparian margins of the water bodies within the fenced or controlled area(s) as required by special condition 9, to the satisfaction of the Chief Executive, Taranaki Regional Council, within four years of the granting of this consent, for the purpose of enhancing water quality and aquatic habitat.
11. The invert of the culverts shall be not less than 50 mm below the bed of the stream. Appropriate headwall structures shall be constructed to protect the intake and outlet of the culverts from erosion.
12. This consent shall lapse on the expiry of five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
13. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2011 and/or June 2017, 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 4 October 2004

For and on behalf of
Taranaki Regional Council

Director-Resource Management

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

Name of
Consent Holder: Taranaki By-Products Limited
P O Box 172
HAWERA

Consent Granted
Date: 12 March 2008

Conditions of Consent

Consent Granted: To realign a section of approximately 350 metres of the
Inaha Stream for land improvement purposes at or about
2612637E-6186381N

Expiry Date: 1 June 2023

Review Date(s): June 2011, June 2017

Site Location: 533 Ahipaipa Road, Okaiawa

Legal Description: Sec 89 Blk IV Waimate SD Lot 2 DP 10412 Pt Sec 87 Blk
IV Waimate SD

Catchment: Inaha

General conditions

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

Special conditions

1. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 4881. In the case of any contradiction between the documentation submitted in support of application 4881 and the conditions of this consent, the conditions of this consent shall prevail.
2. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least seven days prior to the exercise of this consent. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz. Notification by fax or post is acceptable only if the consent holder does not have access to email.
3. A rock wall consisting of interlocking boulders of an average diameter of at least 1 metre shall be constructed on the outside of the bend at the downstream end of the realignment to protect that bank from erosion. The rock wall and bank over this reach shall be no steeper than 2 horizontal to 1 vertical.
4. Any instream works shall take place only between 1 November and 30 April inclusive, except where this requirement is waived in writing by the Chief Executive, Taranaki Regional Council.
5. The consent holder shall ensure that the area and volume of riverbed disturbance shall, so far is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.
6. The consent holder shall take all reasonable steps to:
 - a. minimise the amount of sediment discharged to the stream;
 - b. minimise the amount of sediment that becomes suspended in the stream; and
 - c. mitigate the effects of any sediment in the stream.

Undertaking work in accordance with *Guidelines for Earthworks in the Taranaki region*, by the Taranaki Regional Council, will achieve compliance with this condition.

Consent 7234-1

7. Immediately before water is diverted away from the existing stream channel the consent holder shall ensure that fish are removed from the channel to be dewatered and released to a reach with suitable habitat. Fish to be removed shall be captured using electric fishing, or other accepted fish capture techniques that achieve similar results.
8. The stream realignment shall not obstruct fish passage.
9. Any vegetation removed during the realignment shall not be buried within 25 metres of the Inaha Stream.
10. This consent shall lapse on the expiry of five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
11. 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 2011 and/or June 2017, 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 12 March 2008

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: Taranaki By-Products Limited
P O Box 172
HAWERA

Consent Granted
Date: 30 June 2008

Conditions of Consent

Consent Granted: To discharge stormwater and sediment from earthworks associated with the re-contouring of land and the re-aligning of a section of the Inaha Stream onto and into land and into the Inaha Stream at or about (NZTM) 1702455E-5624812N

Expiry Date: 1 June 2023

Review Date(s): June 2011, June 2017

Site Location: 533 Ahipaipa Road, Okaiawa

Legal Description: Sec 89 & Lot 2 DP 10412 Pt Sec 87 Blk IV Waimate SD

Catchment: Inaha

General conditions

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

Special conditions

1. The exercise of this consent shall be undertaken in accordance with the documentation submitted in support of application 6022. If there is any conflict between the documentation submitted in support of application 6022 and the conditions of this consent, the conditions of this consent shall prevail.
2. The discharge shall not derive from an area of soil disturbance greater than 8 hectares.
3. The discharge shall not derive from a volume of soil disturbance greater than 24, 000 cubic metres.
4. While any area of soil is exposed, all run off from that area shall pass through settlement ponds or sediment traps with a minimum total capacity of 200 cubic metres for every hectare of exposed, unless other sediment control measures that achieve an equivalent standard are agreed to by the Chief Executive of the Taranaki Regional Council.
5. The consent holder shall take all reasonable steps to:
 - a. minimise the amount of sediment discharged to the stream;
 - b. minimise the amount of sediment that becomes suspended in the stream; and
 - c. mitigate the effects of any sediment in the stream.

Subject to condition 2, undertaking work in accordance with *Guidelines for Earthworks in the Taranaki region*, by the Taranaki Regional Council, will achieve compliance with this condition.

6. At least 7 working days prior to the commencement of works the consent holder shall provide the Taranaki Regional Council with a programme for the proposed works, including: a schedule of proposed start dates and an estimation of the duration of the works, and details of the contractor including contact information for the project manager. The programme shall be emailed to worknotification@trc.govt.nz. Notification by fax or post is acceptable if the consent holder does not have access to email.

Consent 7329-1

7. All earthwork areas shall be stabilised vegetatively or otherwise as soon as is practicable immediately following completion of soil disturbance activities.
8. In the event of any archaeological site or koiwi being encountered during the exercise of this consent, activities in the vicinity of the discovery shall cease. The consent holder shall contact the Chief Executive, Taranaki Regional Council, to obtain details of the relevant iwi authority. The consent holder shall then consult with the relevant local iwi, the New Zealand Historic Places Trust and the New Zealand Police and shall not recommence works in the area of the discovery until the relevant Historic Places Trust approvals or other approvals to damage, destroy or modify such sites have been obtained, where necessary.
9. This consent shall lapse five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
10. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2011 and/or June 2017 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 30 June 2008

For and on behalf of
Taranaki Regional Council

Director-Resource Management

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

Name of
Consent Holder: Taranaki By-Products Limited
P O Box 172
HAWERA 4640

Decision Date: 3 February 2014

Commencement Date: 3 February 2014

Conditions of Consent

Consent Granted: To take and use groundwater for industrial water supply purposes

Expiry Date: 1 June 2029

Review Date(s): June 2017, June 2023

Site Location: 179 Katotauru Road, Okaiawa

Legal Description: Ngatimanuhiakai 2B (Site of take & use)

Grid Reference (NZTM) 1701636E-5624804N

Catchment: Inaha

*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 to section 36 of the Resource Management Act 1991.

Special conditions

1. The total volume of water taken from the 'Bore 3' (GND2380) at a rate not exceeding 22.8 litres per second (1,970 cubic metres per day)
2. The bore shall be easily identifiable by a permanent label, which may be welded or engraved on the casing, or on the equivalent fixed part of the well construction or associated building. The bore shall be labelled with the bore number assigned by Taranaki Regional Council - GND2380.
3. The consent holder shall ensure that there is access into the well that enables the manual measurement of static and pumping water levels.
4. Before exercising this consent the consent holder shall install, and thereafter maintain a water meter and a datalogger at the site of taking (or a nearby site in accordance with Regulation 10 of the *Resource Management (Measurement and Reporting of Water Takes) Regulations 2010*. The water meter and datalogger shall be tamper-proof and shall measure and record the rate and volume of water taken to an accuracy of $\pm 5\%$. Records of the date, the time (in New Zealand Standard Time) and the rate and volume of water taken at intervals not exceeding 15 minutes, shall be made available to the Chief Executive, Taranaki Regional Council at all reasonable times.

Note: Water meters and dataloggers must be installed, and regularly maintained, in accordance with manufacturer's specifications in order to ensure that they meet the required accuracy. Even with proper maintenance water meters and dataloggers have a limited lifespan.

5. The consent holder shall provide the Chief Executive, Taranaki Regional Council with a document from a suitably qualified person certifying that water measuring and recording equipment required by the conditions of this consent ('the equipment'):
 - (a) has been installed and/or maintained in accordance with the manufacturer's specifications; and/or
 - (b) has been tested and shown to be operating to an accuracy of $\pm 5\%$.

The documentation shall be provided:

- (i) within 30 days of the installation of a water meter or datalogger;
- (ii) at other times when reasonable notice is given and the Chief Executive, Taranaki Regional Council has reasonable evidence that the equipment may not be functioning as required by this consent; and
- (iii) no less frequently than once every five years.

Consent 9756-1.0

6. Before exercising this consent, the consent holder shall install and subsequently maintain equipment to measure and record the water level within Bore 3 to an accuracy of ± 0.05 metres at intervals not exceeding 15 minutes.
7. The measurements made in accordance with condition 4 and 6 of this consent, shall be transmitted to the Taranaki Regional Council's computer system, in a format to be advised by the Chief Executive, Taranaki Regional Council, to maintain a 'real time' record of the water taken and bore water levels. The records of water taken and the water level within each bore shall:
 - (a) be in a format that, in the opinion of the Chief Executive, Taranaki Regional Council, is suitable for auditing; and
 - (b) specifically record the water taken as 'zero' when no water is taken.
8. The water meter, level monitoring device and datalogger shall be accessible to Taranaki Regional Council officer's at all reasonable times for inspection and/or data retrieval. The data logger shall be designed and installed so that Council officers can readily verify that it is accurately recording the required information.
9. If any measuring or recording equipment breaks down, or for any reason is not operational, the consent holder shall advise the Chief Executive, Taranaki Regional Council immediately. Any repairs or maintenance to this equipment must be undertaken by a suitably qualified person.
10. At all times the consent holder shall adopt the best practicable option (BPO) to prevent or minimise any actual or likely adverse effect on the environment associated with the abstraction of groundwater, including, but not limited to, the efficient and conservative use of water.
11. This consent shall lapse on 31 March 2019, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
12. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2017 and/or June 2023 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 3 February 2014

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: Todd Energy Limited
PO Box 802
New Plymouth 4340

Decision Date
(Change): 24 July 2018

Commencement Date
(Change): 24 July 2018 (Granted Date: 9 December 2014)

Conditions of Consent

Consent Granted: To discharge emissions to air associated with hydrocarbon producing wells at the Mangahewa-G wellsite

Expiry Date: 1 June 2033

Review Date(s): June 2021, June 2027

Site Location: Mangahewa-G wellsite, Otaraoa Road, Tikorangi
(Property owner: FD & KS Wyatt)

Grid Reference (NZTM) 1714150E-5674109N

*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. For the purposes of this consent:
 - (a) 'flaring' means the uncontrolled or partially controlled open air burning of hydrocarbons derived from or entrained in the well stream. 'Flare', as a verb, has the corresponding meaning and, as noun, means the flame produced by flaring.
 - (b) 'incineration' means the controlled, enclosed burning of formation hydrocarbons within a device designed for the purpose. 'Incinerate' has the corresponding meaning.
 - (c) 'Combustion' means burning generally and includes both flaring and incineration as well as other burning such as fuel in machinery.
2. Incineration shall only occur in a device with a minimum chimney height determined by the method detailed in Appendix VIII of the *Regional Air Quality Plan for Taranaki*.
3. Flaring shall only occur over a pit, or within a purpose built flare bin, placed within an area lined with impermeable material that prevents any liquid from leaking through its base or sidewall and discharging to land.
4. Flaring and incineration shall only occur within 20 metres of the location defined by 1714150E-5674109N.
5. Other than in emergencies, the consent holder shall notify the Chief Executive, Taranaki Regional Council, whenever the continuous flaring or incineration of hydrocarbons (other than purge gas) is expected to occur for more than five minutes in duration. Notification shall be no less than 24 hours before the flaring or incineration commences. Notification shall include the consent number and be emailed to worknotification@trc.govt.nz.
6. At least 24 hours before any flaring or incineration, other than in emergencies, the consent holder shall provide notification of the commencement of flaring or incineration to the occupants of all dwellings within 1000 metres of the point of flaring or incineration and all landowners within 200 metres. The consent holder shall include in the notification a 24-hour contact telephone number for a representative of the consent holder, and shall keep and make available to the Chief Executive, Taranaki Regional Council, a record of all queries and complaints received in respect of any combustion activity.
7. No material shall be flared or incinerated, other than those derived from or entrained in the well stream.
8. To the greatest extent possible, all gas that is flared or incinerated must first be treated by effective liquid and solid separation and recovery.

Consent 10021-1.1

9. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or potential effect on the environment arising from any emission to air, including, but not limited to having regard to the prevailing and predicted wind speed and direction at the time of initiation, and throughout, any episode of combustion so as to minimise offsite effects (other than for the maintenance of a pilot flame).
10. There shall be no emission of odour, smoke or dust that is objectionable or offensive beyond the boundary of the property where the wellsite is located.
11. All permanent tanks used as hydrocarbon storage vessels, shall be fitted with vapour recovery systems.
12. The consent holder shall control all emissions of carbon monoxide, nitrogen dioxide, fine particles (PM10) and sulphur dioxide to the atmosphere from the site, in order that the maximum ground level concentration of any of these contaminants arising from the exercise of this consent measured under ambient conditions does not exceed the relevant ambient air quality standard as set out in the Resource Management (National Environmental Standards for Air Quality Regulations, 2004) at or beyond the boundary of the property on which the wellsite is located.
13. The consent holder shall control all emissions of contaminants to the atmosphere from the site, other than those expressly provided for under special condition 12, in order that they do not individually or in combination with other contaminants cause a hazardous, noxious, dangerous, offensive or objectionable effect at a distance greater than 100 metres from the emission source.
14. The consent holder shall make available to the Chief Executive, Taranaki Regional Council, upon request, an analysis of a typical gas and condensate stream from the field, covering sulphur compound content and the content of carbon compounds of structure C6 or higher number of compounds.
15. The consent holder shall record and make available to the Chief Executive, Taranaki Regional Council, a 'combustion log' that includes:
 - (a) the date, time and duration of all flaring or incineration episodes;
 - (b) the zone from which flaring or incineration occurred;
 - (c) the volume of substances flared or incinerated;
 - (d) whether there was smoke at any time during the combustion episode and if there was, the time, duration and cause of each 'smoke event'.
16. This consent shall lapse on 31 December 2019, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

Consent 10021-1.1

17. 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 2021 and/or June 2027, for any of the following purposes:
- (a) dealing with any significant adverse effect on the environment arising from the exercise of the consent which was not foreseen at the time the application was considered or which it was not appropriate to deal with at the time; and/or
 - (b) requiring the consent holder to adopt specific practices in order to achieve the best practicable option to remove or reduce any adverse effect on the environment caused by the discharge; and/or
 - (c) to alter, add or delete limits on mass discharge quantities or discharge or ambient concentrations of any contaminant.

Signed at Stratford on 24 July 2018

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Appendix II

Biomonitoring reports

To Job Manager, Nathan Crook
From Environmental Scientist, Katie Blakemore
Report No KB032
Document 2017859
Date 5 March 2018

Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, October 2017

Introduction

Taranaki By-Products Limited holds a number of consents for discharges to land and to water associated with the operation of a rendering plant and a neighbouring farm owned and operated by the Company. The discharge consents most relevant to this biomonitoring survey are summarised in Table 1 below:

Table 1 Summary of discharge consents held by Taranaki By-Products Limited which are of most relevance to this biological survey.

Consent no.	Purpose
2049-4	To discharge up to 940 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream
2050-4	To discharge up to 2,160 cubic metres/day of cooling water and backwash water from a rendering operation into an unnamed tributary of the Inaha Stream
3941-2	To discharge up to 1400 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy via spray irrigation onto and into land, and to discharge emissions into the air, in the vicinity of the Inaha Stream and its tributaries between 1700909E-5625245N, 1700631E-5625092N and 1700921E-5625046N
5426-1	To discharge up 1,095 litres/second of stormwater from an animal rendering site into an unnamed tributary of the Inaha Stream

Biomonitoring has been undertaken at some sites in relation to the discharges from the rendering plant and associated activities since the mid-1980s. Some of the sites used for the biomonitoring of these discharges have changed over time and these changes have been documented in previous reports (Jansma, 2012 a, b, c).

This spring biological survey was the first of two scheduled in the Inaha Stream catchment in the 2017-2018 monitoring year in relation to discharges from the Taranaki By-Products plant. Results from previous surveys are also referred to in this report (see references).

Methods

This biomonitoring survey was undertaken at eight sites on 31 October 2017 (Table 2 and Figure 1). Five of the eight sites surveyed were in the Inaha Stream and the remaining sites were in an unnamed tributary of the Inaha Stream (Figure 1). The locations of sampling sites in relation to the discharges from the rendering plant are discussed below.

Site U (INH000334) was established in the 2003-2004 monitoring period as an appropriate control site on the Inaha Stream above the rendering plant discharges and irrigation areas. Site 1 (INH000400) is located upstream of the wastewater and cooling water discharge points but downstream of part of the treated wastewater irrigation area. Sites 2d and 3 (INH000420 and INH000430) are located downstream of these two discharges and above the confluence with the unnamed tributary of the Inaha Stream which drains land upon which wastewater is irrigated.

The area of land authorised to be irrigated onto under consent 3941-2 has increased on several occasions since the consent was granted in December 1999. Sites UT, MT and DT (INH000433, INH000435 and INH000440) were established to monitor the effects of the expanded irrigation area on an unnamed tributary of the Inaha Stream. Site UT was established as a 'control site' for the expanded irrigation area. Site MT is located within the authorised irrigation area and site DT is situated downstream of the irrigation area but upstream of the unnamed tributary's confluence with the Inaha Stream.

Site 4 (INH000450) on the Inaha Stream is situated approximately 100 metres downstream of the convergence point between the Inaha Stream and the unnamed tributary.

Table 2 Biomonitoring sites in the Inaha Stream and in an unnamed tributary relating to the Taranaki By-Products plant.

Stream	Site No.	Site code	Location	Sampling method used
Inaha Stream	U	INH000334	Upstream of irrigation area, near Ahipaipa Road	Streambed kick
	1	INH000400	Upstream of treatment ponds, Kohiti Road	Streambed kick
	2d	INH000420	500 m downstream of cooling water discharge	Streambed kick
	3	INH000430	Upstream of Normanby Road	Streambed kick
	4	INH000450	100 m downstream of 'irrigation' tributary confluence	Streambed kick
Unnamed tributary of Inaha Stream	UT	INH000433	Upstream of irrigation area	Vegetation sweep
	MT	INH000435	Middle site within the new irrigation area	Kick/sweep
	DT	INH000440	50m upstream Normanby Road	Streambed kick

Two different sampling techniques were used to collect streambed macroinvertebrates in this survey. The Council's standard '400ml kick-sampling' technique was used at sites U, 1, 2d, 3,4 and DT and the 'vegetation sweep' technique was used at site UT. A combination of these two techniques was used at site MT (Table 2). The 'kick-sampling' and 'vegetation sweep' techniques are very similar to Protocol C1 (hard-bottomed, semi-quantitative) and C2 (soft-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 NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark *et al.* 2001). Macroinvertebrate taxa found in each sample were recorded based on the abundance categories in Table 3.

Table 3 Macroinvertebrate abundance categories

Abundance category	Number of individuals
R (rare)	1-4
C (common)	5-19
A (abundant)	20-99
VA (very abundant)	100-499
XA (extremely abundant)	>499

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. Averaging the scores from a list of taxa taken from one site and multiplying by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value. A difference of 11 units or more in MCI values is considered significantly different (Stark 1998). A gradation of biological water quality conditions based upon MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985; Boothroyd and Stark, 2000) (Table 4).

Table 4 Macroinvertebrate community health based on MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000)

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

A semi-quantitative MCI value (SQMCI_s) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCI_s is not multiplied by a scaling factor of 20, therefore SQMCI_s values range from 1 to 10, while MCI values range from 20 to 200.

Where necessary, sub-samples of algal and detrital material taken from the macroinvertebrate samples were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ('undesirable biological growths') at a microscopic level. The presence of these organisms is an indicator of organic enrichment within a stream. Such heterotrophic growths have been recorded on numerous past occasions at sites downstream of the Taranaki By-Products plant as a result of organic nutrient enrichment from the wastewater discharge.

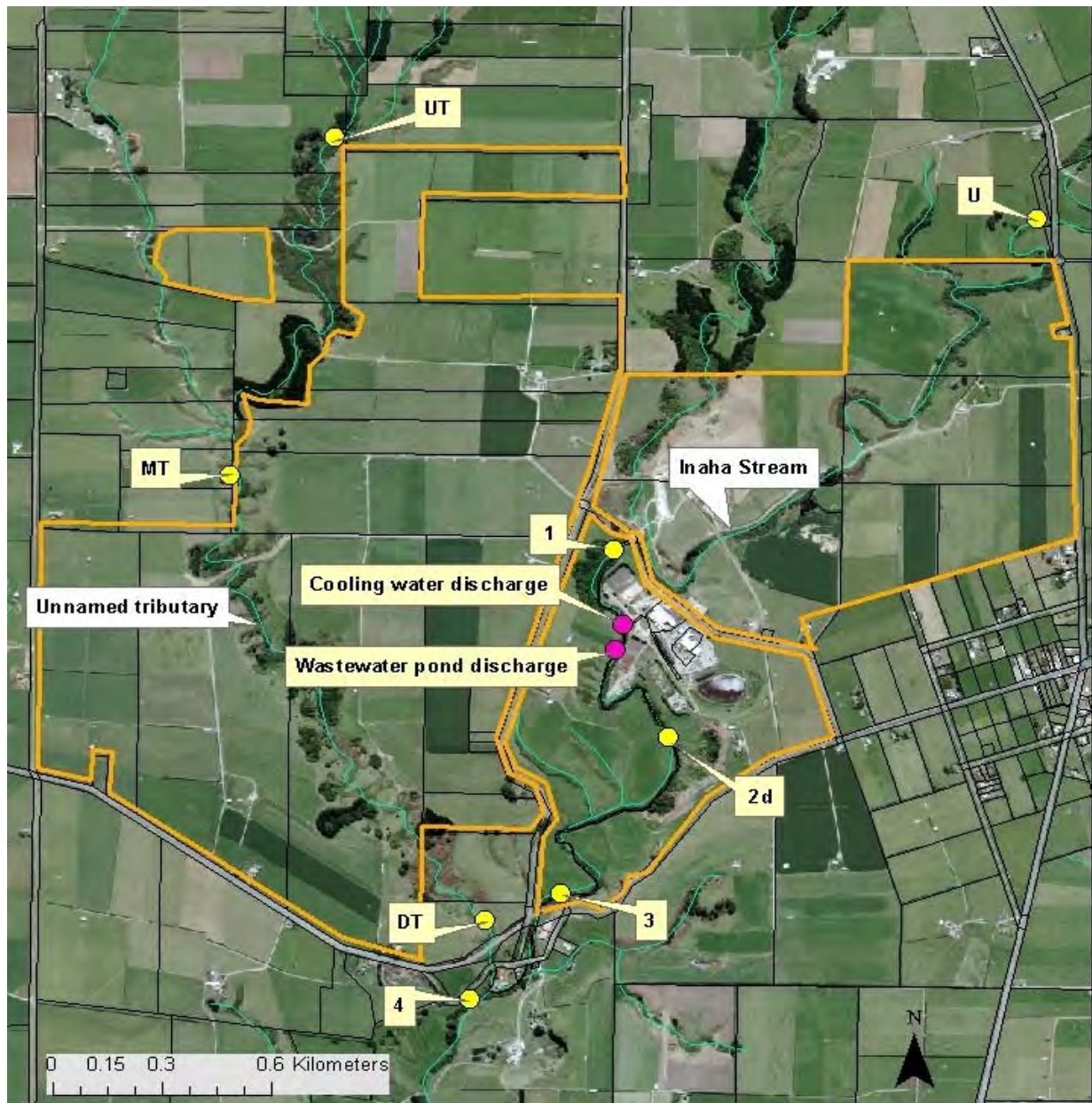


Figure 1 Aerial photo showing biomonitoring sites in the Inaha Stream and an unnamed tributary stream relating to discharges from the Taranaki By-Products plant. The orange line outlines the irrigation areas around the rendering plant.

Results

Site habitat characteristics and hydrology

This October 2017 survey followed a period of 20 days since a fresh in excess of three times median flow in the nearby Waiokura Stream at No. 3 Fairway (the nearest appropriate water level recorder) and 21 days since a fresh in excess of seven times median flow.

The Company's records showed that treated wastewater was discharging to the Inaha stream at the time of this biological survey. Cooling water was discharged to the stream throughout this period. The record shows that the minimum dilution of wastewater of 1:300 that is required under consent 2049-4 was maintained throughout the period.

At all of the Inaha Stream sites (U, 1, 2d, 3 and 4) the flow conditions were moderate and water speeds swift. The flow was clear and grey at site U and cloudy and brown at sites 1, 2d, 3 and 4. Water temperatures in the Inaha Stream ranged between 15.3 °C and 17.8 °C. In the unnamed tributary of the Inaha Stream, there was a moderate, slow flow which was a cloudy brown colour at site UT, and a moderate, steady flow at sites MT and DT, which was clear and uncoloured at site MT and cloudy grey at site DT. The water was very shallow at site DT. Stream temperatures ranged from 15.4 °C to 16.5 °C during this survey.

Excluding site 4, all of the Inaha Stream sites had predominantly cobble and gravel substrates with varying amounts of silt, sand and boulder. A small amount of hard clay was present at sites U and 3 only. The substrate at site 4 was predominantly hard clay and gravel. Substrate in the unnamed tributary of the Inaha Stream comprised predominantly silt and hard clay at site UT. Site UT also recorded some wood/root, sand and fine gravel. Site MT was dominated by silt and wood/root, with some sand gravel cobble and hard clay. Site DT recorded predominantly gravel and hard clay with small amounts of silt, sand and cobbles.

Patchy periphyton mats and patchy filaments were recorded at sites U, 1 and 2d, while no periphyton was recorded at sites 3, patchy mats and no filaments were recorded at site 4. Macrophytes were recorded growing at the edges of the stream at site 2d, while no macrophytes were recorded growing at any other site in the Inaha Stream. Leaves were patchy on the streambed at all sites, while wood was patchy at site 4 only. Site 4 was partially shaded, while all other Inaha Stream sites were unshaded.

In the unnamed tributary of the Inaha Stream, no periphyton mats were recorded at any of the sites, while filamentous periphyton was patchy at sites MT and DT. Moss was patchy and leaves were patchy or widespread at all three sites. Wood was patchy, widespread and absent from the streambed at sites UT, MT and DT respectively. Macrophytes were recorded growing at the edges and on the bed of the stream at all sites. Site UT was completely shaded, site MT was partially shaded and site DT was completely unshaded.

Streambed microflora

A microscopic inspection of material collected from the bed of the Inaha Stream found no evidence of 'heterotrophic growths' (protozoa or fungi) at any of the sites sampled. This was the seventeenth consecutive survey to record a lack of such growths, continuing the improvement following the late summer 2008 and spring 2009 surveys, which both recorded such growths. This is an important result; as such growth is often associated with 'sewage fungus' which is an indication of high levels of organic matter and nutrient enrichment in the stream. Such growths have been recorded on many previous sampling occasions, often in abundance, particularly downstream of the plant discharges at site 2d. The absence of such growths is evidence that the degree of enrichment is not as severe as that recorded previously.

Macroinvertebrate communities

Results of previous macroinvertebrate surveys performed in the Inaha Stream and the unnamed tributary are summarised and presented together with current results in Table 5.

Table 5 Summary of previous numbers of macroinvertebrate taxa and MCI and SQMCI_s values for surveys between September 1987 and March 2017 together with current results recorded in the Inaha Stream and an unnamed tributary in relation to Taranaki By-Products.

	Number of taxa				MCI values			SQMCI _s values			
	No. samples	Range	Median	Current survey	Range	Median	Current Survey	No. of samples	Range	Median	Current survey
U	33	18-34	23	18	83-102	94	94	33	4.3-6.9	5.2	5.8
1	73	12-31	22	23	82-104	95	92	49	3.6-6.3	5.1	5.4
2d	61	10-30	22	17	52-106	81	96	50	1.2-6.5	2.1	4.9
3	74	6-35	21	19	43-102	81	99	50	1.3-6.5	2.7	5.7
4	30	17-31	26	15	77-104	90	87	30	2.0-6.6	4.4	5.3
UT	13	9-23	19	18	64-109	97	81	13	1.6-6.3	5.3	3.7
MT	26	12-29	20	13	70-94	83	89	26	3.1-5.7	4.5	5.1
DT	27	12-25	21	15	80-105	89	95	27	3.5-5.3	4.6	4.7

Table 6 provides a summary of various macroinvertebrate indices within a specific altitudinal band for 'control' sites situated in Taranaki ring plain streams arising outside of Egmont National Park. The full results from this current survey are in Table 7 and Table 8.

Table 6 Range and median number of taxa, MCI values and SQMCI_s scores for 'control' sites (Taranaki ring plain rivers/streams with sources outside Egmont National Park) at altitudes 80-124 m asl (TRC, 2017).

	No. of taxa	MCI value	SQMCI _s value
No. Samples	272	272	216
Range	9-34	64-112	1.3-6.9
Median	22	92	4.8

Table 7 Macroinvertebrate fauna of the Inaha Stream in relation to Taranaki By-Products wastes discharges sampled on 31 October 2017

Taxa List	Site Number		MCI score	U	1	2d	3	4
	Site Code			INH000334	INH000400	INH000420	INH000430	INH000450
	Sample Number			FWB17378	FWB17379	FWB17380	FWB17381	FWB17385
NEMATODA	Nematoda		3	-	-	-	R	-
ANNELIDA (WORMS)	Oligochaeta		1	R	R	C	C	R
	Lumbricidae		5	R	R	-	C	R
MOLLUSCA	<i>Physa</i>		3	-	R	-	R	-
	<i>Potamopyrgus</i>		4	A	VA	C	VA	C
	Sphaeriidae		3	-	R	-	-	-
CRUSTACEA	Isopoda		5	-	R	-	-	-
	<i>Paracalliope</i>		5	R	R	-	-	VA
	Paraleptamphopidae		5	-	C	-	-	-
	Talitridae		5	-	R	-	-	A
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>		7	A	A	C	C	A
	<i>Deleatidium</i>		8	VA	VA	A	VA	-
	<i>Zephlebia group</i>		7	-	-	R	R	A
PLECOPTERA (STONEFLIES)	<i>Zelandobius</i>		5	A	C	R	C	-
COLEOPTERA (BEETLES)	Elmidae		6	A	A	C	A	-
MEGALOPTERA (DOBSONFLIES)	<i>Archichauliodes</i>		7	C	-	R	R	-
TRICHOPTERA (CADDISFLIES)	<i>Hydropsyche (Aoteapsyche)</i>		4	C	C	R	-	R
	<i>Costachorema</i>		7	-	C	C	R	-
	<i>Hydrobiosis</i>		5	C	C	-	C	-
	<i>Hudsonema</i>		6	-	-	-	C	R
	<i>Oxyethira</i>		2	-	-	-	-	R
	<i>Pycnocentria</i>		7	R	R	-	R	-
	<i>Pycnocentrodes</i>		5	VA	VA	A	A	-
	<i>Triplectides</i>		5	-	-	R	-	-
	DIPTERA (TRUE FLIES)	<i>Aphrophila</i>		5	C	-	R	-
<i>Harrisius</i>		6	-	-	-	-	R	
<i>Maoridiamesa</i>		3	R	A	C	-	-	
Orthoclaadiinae		2	A	A	A	C	R	
<i>Polypedilum</i>		3	C	R	R	R	C	
Tanytarsini		3	C	-	-	-	-	
<i>Austrosimulium</i>		3	-	R	R	R	C	
ACARINA (MITES)	Acarina		5	-	R	-	-	R
No of taxa			18	23	17	19	15	
MCI			94	92	96	99	87	
SQMCIs			5.8	5.4	4.9	5.7	5.3	
EPT (taxa)			7	8	8	9	4	
%EPT (taxa)			39	35	47	47	27	
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa				

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

Table 8 Macroinvertebrate fauna of the unnamed tributary of the Inaha Stream in relation to Taranaki By-Products wastes discharges sampled on 31 October 2017

Taxa List	Site Number	MCI score	UT	MT	DT
	Site Code		INH000433	INH000435	INH000440
	Sample Number		FWB17382	FWB17383	FWB17384
NEMATODA	Nematoda	3	R	-	-
ANNELIDA (WORMS)	Oligochaeta	1	VA	-	R
MOLLUSCA	Lymnaeidae	3	-	R	-
	<i>Physa</i>	3	R	R	-
	<i>Potamopyrgus</i>	4	C	A	VA
	Sphaeriidae	3	C	-	-
	Ostracoda	1	A	-	-
CRUSTACEA	<i>Paracalliope</i>	5	VA	VA	VA
	Paraleptamphopidae	5	VA	R	-
	Talitridae	5	C	C	VA
	<i>Paranephrops</i>	5	-	-	R
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	R	A	C
	<i>Zephlebia group</i>	7	A	A	C
COLEOPTERA (BEETLES)	Elmidae	6	-	-	R
TRICHOPTERA (CADDISFLIES)	<i>Costachorema</i>	7	-	-	R
	<i>Hydrobiosis</i>	5	-	R	R
	<i>Polyplectropus</i>	6	C	-	-
	<i>Hudsonema</i>	6	-	-	R
	<i>Triplectides</i>	5	-	R	-
DIPTERA (TRUE FLIES)	<i>Paralimnophila</i>	6	R	-	-
	<i>Maoridiamesa</i>	3	-	-	R
	Orthocladiinae	2	A	R	R
	<i>Polypedilum</i>	3	-	-	C
	Tanypodinae	5	R	-	-
	Ceratopogonidae	3	R	-	-
	<i>Paradixa</i>	4	R	R	-
	<i>Austrosimulium</i>	3	C	A	-
ACARINA (MITES)	Acarina	5	-	-	C
No of taxa			18	13	15
MCI			81	89	95
SQMCIs			3.7	5.1	4.7
EPT (taxa)			3	4	5
%EPT (taxa)			17	31	33
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa	

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

Inaha Stream

Site U

A moderate taxa richness of 18 taxa was found at site U (the 'control' site for the Inaha Stream) at the time of the survey which was five taxa less than the median number recorded for the site (median taxa richness 23; Table 5) and seven taxa fewer than the previous sample (taxa richness 25; Figure 2).

The MCI score of 94 units indicated a community of 'fair' biological health which was equal to the median value calculated from previous surveys at the same site (median MCI score 94 units; Table 5) and was five units higher than the previous survey score (MCI score 89 units; Figure 2). The SQMCI_s score of 5.8 units was slightly higher than both the median value calculated from previous surveys at the same site (median SQMCI_s score 5.2 units; Table 5) and the previous survey score (SQMCI_s score 5.1 units).

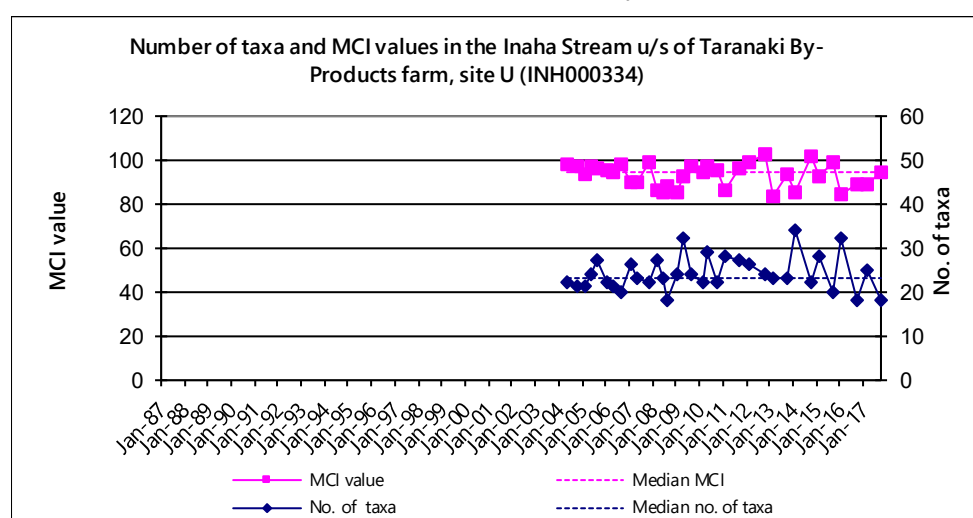


Figure 2 Numbers of macroinvertebrate taxa and MCI values recorded at site U in the Inaha Stream since May 2004

The community was characterised by two 'tolerant' taxa [snail (*Potamopyrgus*) and chironomid midge (*Orthocladiinae*)], four 'moderately sensitive' taxa [mayfly (*Austroclima*), stonefly (*Zelandobius*), elm mid beetles and caddisfly (*Pycnocentroides*)], and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 7).

Site 1

A moderate taxa richness of 23 taxa was found at site 1 at the time of the survey which was one taxon more than the median number recorded for the site (median taxa richness 22; Table 5) and eight taxa less than the previous survey (taxa richness 31; Figure 3).

The MCI score of 92 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 95 units; Table 5) or to the previous survey score (MCI score 85 units; Figure 3). The SQMCI_s score of 5.4 units was similar to the median value calculated from previous surveys at the same site (median SQMCI_s score 5.1 units; Table 5) and the previous survey score (SQMCI_s score 5.5 units).

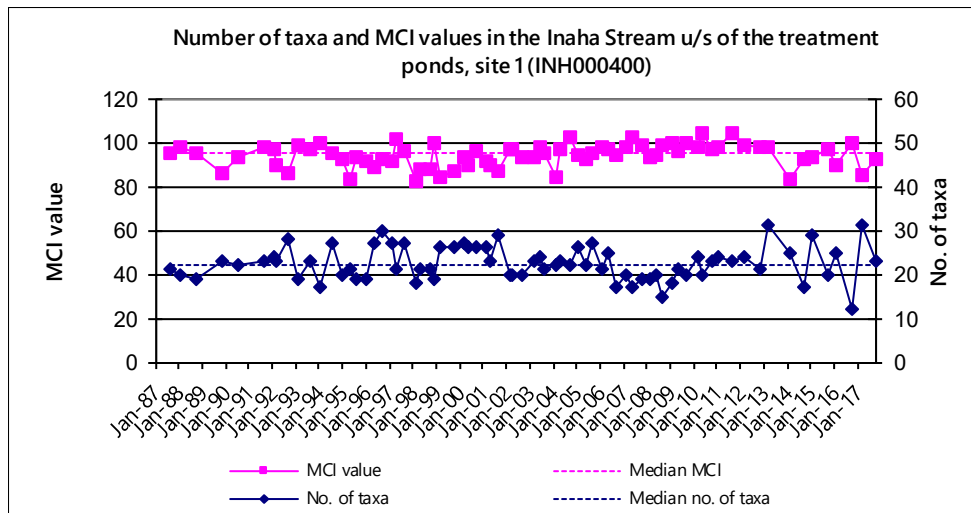


Figure 3 Numbers of macroinvertebrate taxa and MCI values recorded at site 1 in the Inaha Stream since September 1987

The community was characterised by three 'tolerant' taxa [snail (*Potamopyrgus*) and chironomid midges (Orthoclaadiinae) and (*Maoridiamesa*)], three 'moderately sensitive' taxa [mayfly (*Austroclima*), elmid beetles and caddisfly (*Pycnocentroides*)], and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 7).

Site 2d

A moderate macroinvertebrate community richness of 17 taxa was found at site 2d at the time of the survey which was five taxa less than the median number recorded for the site (median taxa richness 22; Table 5) and two taxa less than that recorded by the previous survey (19 taxa, Figure 4).

The MCI score of 96 units indicated a community of 'fair' biological health which was significantly (Stark, 1998) higher than the median value calculated from previous surveys at the same site (median MCI score 81 units; Table 5) and was slightly lower than the previous survey score (MCI score 102 units; Figure 4). The SQMCI_s score of 4.9 units was significantly higher than the median value calculated from previous surveys at the same site (median SQMCI_s score 2.1 units; Table 5) and significantly lower than the previous survey score (SQMCI_s score 6.2 units).

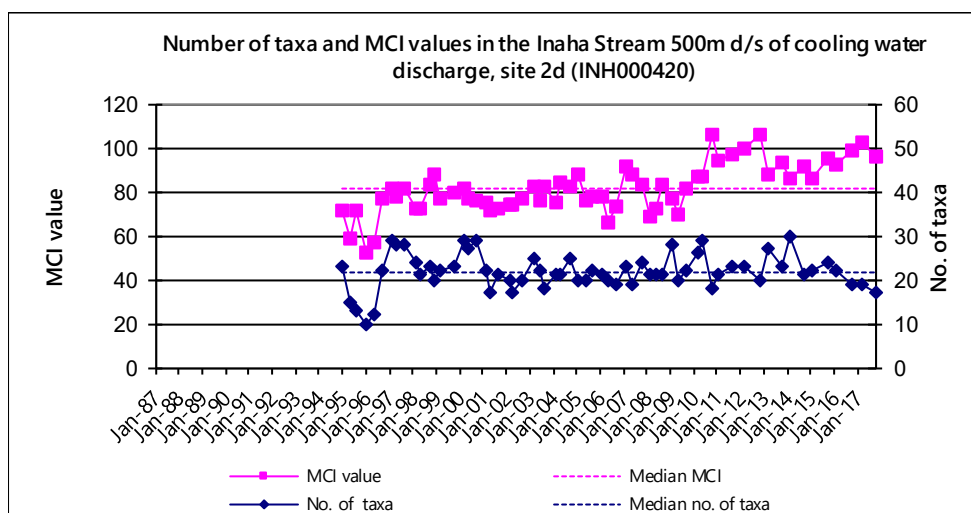


Figure 4 Numbers of taxa and MCI values recorded at site 2d in the Inaha Stream since 1995

The community was characterised by one 'tolerant' taxon [orthoclad midges], one 'moderately sensitive' taxon [caddisfly (*Pycnocentroides*)], and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 7).

Site 3

A moderate taxa richness of 19 taxa was found at site 3 at the time of the survey which was two taxa less than both the median number recorded for the site (median taxa richness 21; Table 5) and the richness recorded in the previous survey (taxa richness 21; Figure 5).

The MCI score of 99 units indicated a community of 'fair' biological health which was significantly higher (Stark, 1998) than the median value calculated from previous surveys at the same site (median MCI score 81 units; Table 5) and slightly lower than the previous survey score (MCI score 102 units; Figure 5). The SQMCI₅ score of 5.7 units was significantly higher (Stark 1998) than the median value calculated from previous surveys at the same site (median SQMCI₅ score 2.7 units; Table 5) and slightly lower than the previous survey score (SQMCI₅ score 6.5 units).

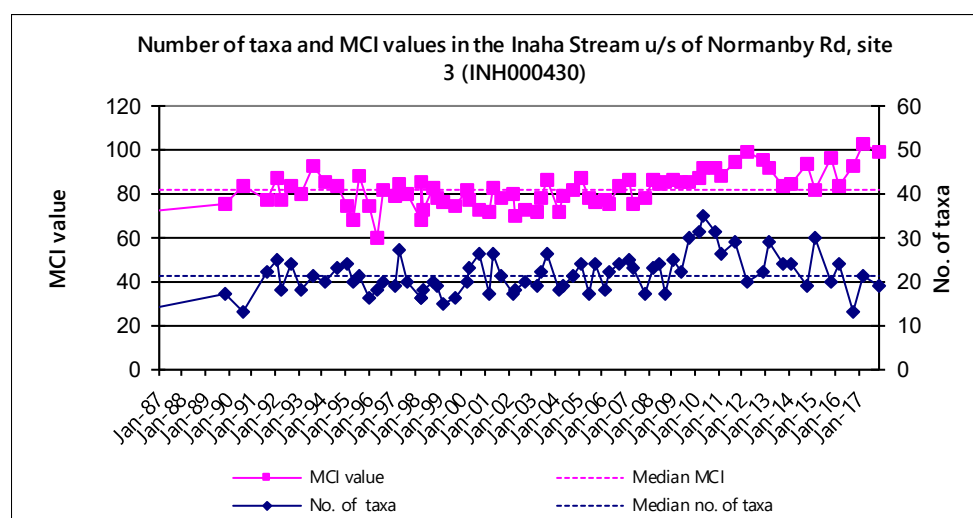


Figure 5 Numbers of taxa and MCI values recorded at site 3 in the Inaha Stream since 1989

The community was characterised by one 'tolerant' taxon [snail (*Potamopyrgus*)], two 'moderately sensitive' taxa [elmid beetles and caddisfly (*Pycnocentroides*)] and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 7).

Site 4

A moderate macroinvertebrate community richness of 15 taxa was found at site 4 at the time of the survey which was 11 taxa less than the median number recorded for the site (median taxa richness 26; Table 5) and lower than the previous survey (taxa richness 24; Figure 6).

The MCI score of 81 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 90 units; Table 5), although was lower than that recorded by the previous survey (MCI score 87 units; Figure 6). The SQMCI₅ score of 5.3 units was slightly higher than the median value calculated from previous surveys at the same site (median SQMCI₅ score 4.4 units; Table 5) and the previous survey score (SQMCI₅ score 4.9 units).

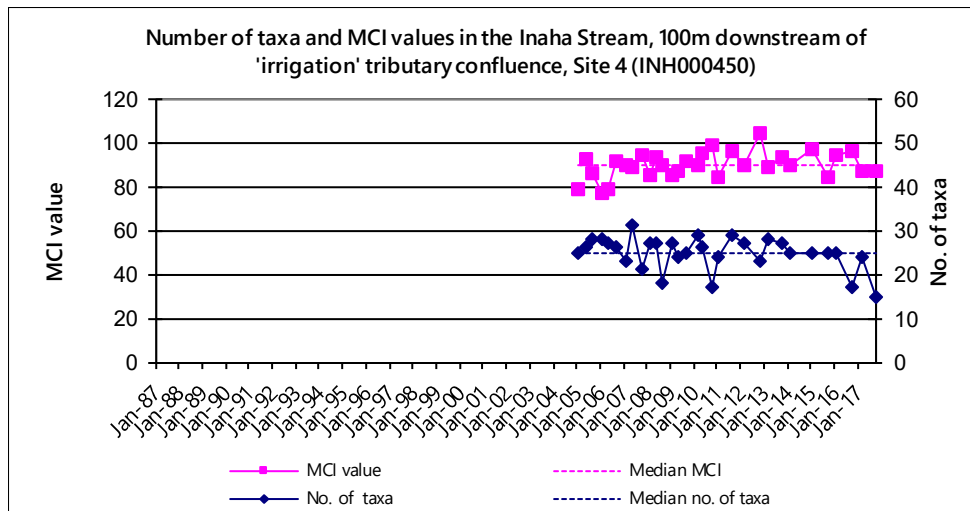


Figure 6 Numbers of taxa and MCI values recorded at site 4 in the Inaha Stream

The community was characterised by four 'moderately sensitive' taxa [mayflies (*Austroclima*) and (*Zephlebia* group) and amphipods (*Paracalliope*) and (*Talitridae*)] (Table 7).

Unnamed tributary of the Inaha Stream

Site UT

A moderate macroinvertebrate community richness of eighteen taxa was found at site UT (the 'control' site for the unnamed tributary of the Inaha Stream) at the time of the survey. This was one taxon less than the median richness recorded for the site (median taxa richness 19, Table 5) and nine taxa more than that recorded in the previous survey (Figure 7).

The MCI score of 81 units indicated a community of 'fair' biological health which was significantly lower (Stark, 1998) than the median value calculated from previous surveys at the same site (median MCI score 97 units; Table 5) and significantly (Stark, 1998) higher than the previous survey score (MCI score 64 units; Figure 7). The SQMCI₅ score of 3.7 units was significantly lower (Stark 1998) than the median value calculated from previous surveys at the same site (median SQMCI₅ score 5.3 units; Table 5) and was significantly higher (Stark 1998) than the previous survey score (SQMCI₅ score 1.6 units).

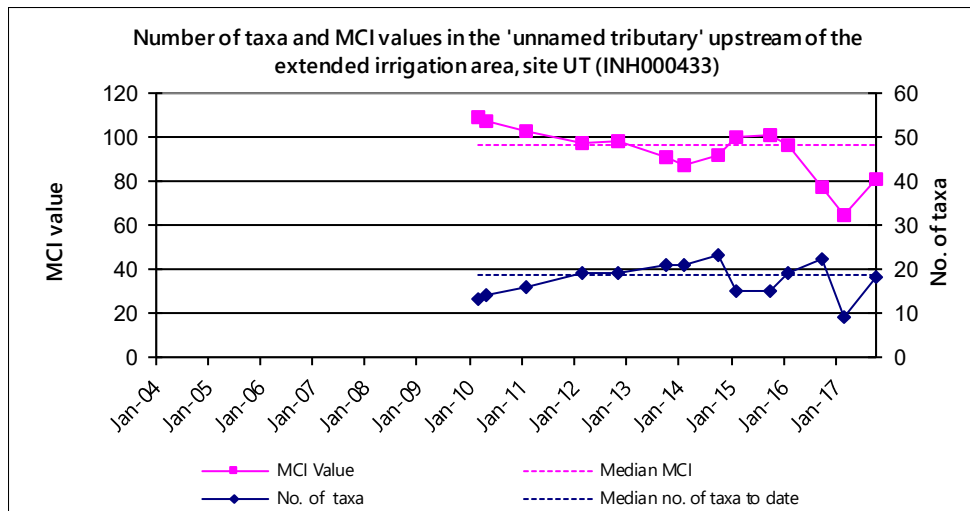


Figure 7 Numbers of taxa and MCI values recorded at site UT in the unnamed tributary of the Inaha Stream since 2004

The community was characterised by three 'tolerant' taxa [oligochaete worms, midge larvae (*Orthoclaadiinae*) and seed shrimp (*Ostracoda*)] and three 'moderately sensitive' taxa [*Paracalliope* and (*Paraleptamphopidae*) and mayfly (*Zephlebia* group)] (Table 8).

Site MT

A low macroinvertebrate community richness of 13 taxa was recorded at site MT which was seven taxa fewer than the median number recorded for the site (median taxa richness 20; Table 5) and six taxa fewer than the previous survey (taxa richness 19; Figure 8).

The MCI score of 89 units indicated a community of 'fair' biological health, which was slightly higher than both the median value calculated from previous surveys at the same site (median MCI score 83 units; Table 5) and the previous survey score (MCI score 84 units; Figure 8). The SQMCI₅ score of 5.1 units was slightly higher than both the median value calculated from previous surveys at the same site (median SQMCI₅ score 4.5 units; Table 5) and the previous survey score (SQMCI₅ score 4.7 units).

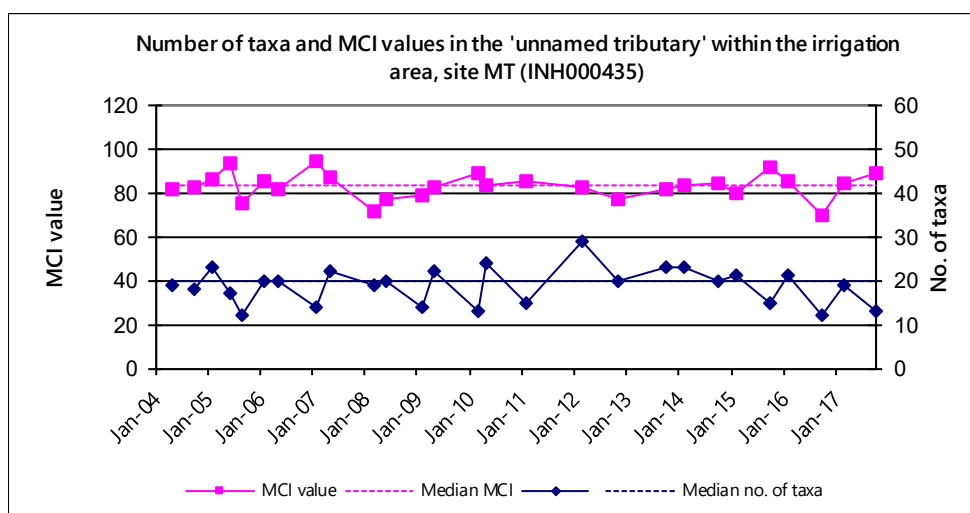


Figure 8 Numbers of taxa and MCI values recorded at site MT in the unnamed tributary of the Inaha Stream since 2004

The community was characterised by two 'tolerant' taxa [snail (*Potamopyrgus*) and sandfly larvae (*Austrosimulium*)] and three 'moderately sensitive' taxa [mayflies (*Austroclima*) and (*Zephlebia* group) and amphipod (*Paracalliope*)] (Table 8).

Site DT

A moderately low macroinvertebrate community richness of 15 taxa was recorded at site DT which was six taxa less than the median number recorded for the site (median taxa richness 21; Table 5) and three taxa less than that recorded by the previous survey (taxa richness 18; Figure 9).

The MCI score of 95 units indicated a community of 'fair' biological health which was slightly higher than the median value calculated from previous surveys at the same site (Table 5) and not significantly different (Stark, 1998) to the previous survey score (MCI score 89 units; Figure 9). The SQMCI_S score of 4.7 units was slightly higher than the median value calculated from previous surveys at the same site (median SQMCI_S score 4.6 units; Table 5) and slightly lower than the previous survey score (SQMCI_S score 5.2 units).

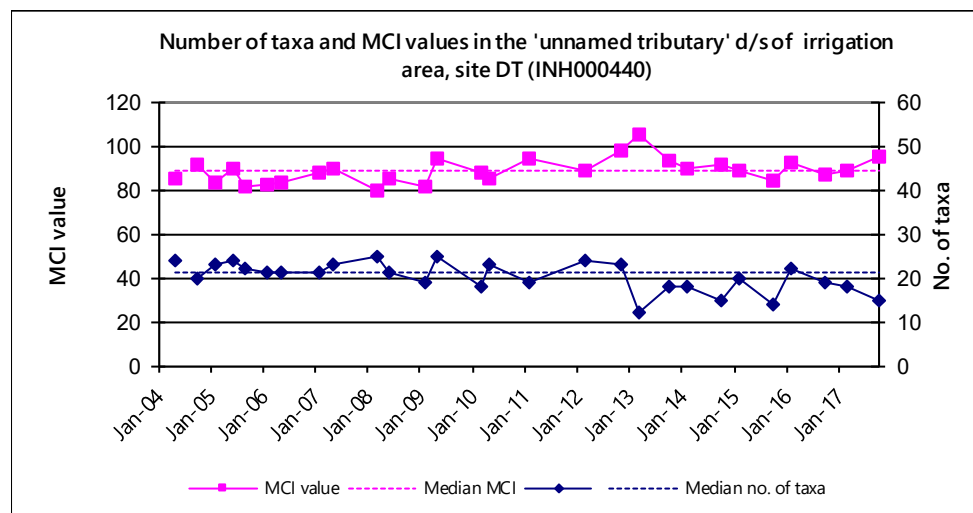


Figure 9 Numbers of taxa and MCI values recorded at site DT in the unnamed tributary of the Inaha Stream since 2004

The community was characterised by one 'tolerant' taxon [snail (*Potamopyrgus*)] and two 'moderately sensitive' taxa [amphipods (*Paracalliope*) and (Talitridae)] (Table 8).

Discussion and conclusions

In the past, heterotrophic growths such as 'sewage fungus' have occurred in the Inaha Stream downstream of the rendering plant which were most likely the result of the discharges from the plant. However, no 'heterotrophic growths' were recorded at any sites monitored in this survey, which was indicative of reasonably good preceding water quality. The presence of heterotrophic growths on the bed of the Inaha Stream was last recorded in the spring 2009 survey, and this shows an improved management of the wastewater discharge since that time.

Inaha Stream

There were no substantial differences between site U (the 'control' site) and site 1 for MCI or SQMCI_S scores; however taxa richness was slightly higher at site 1. These results indicate that leaching of nutrients into the Inaha Stream from the north-eastern block of land under irrigation (Figure 1) was unlikely to be affecting the health of the macroinvertebrate communities present in the Inaha Stream at the time of the survey.

MCI scores were similar between sites, with the exception of the score at site 4 which had a significantly lower score than site 3. SQMCI_S scores were also similar between sites, again with one exception, site 2d, which was significantly lower than the score at site U. When compared to the previous (March 2017) survey results, MCI scores did not change significantly for any site and SQMCI_S scores changed significantly only for site 2d, which decreased between the two surveys. Taxa richnesses were lower than the previous survey

for all sites. Both MCI and SQMCI_s scores were significantly higher than median scores for sites 2d and 3, while SQMCI_s score was significantly higher than the median score at site 4. All other sites recorded MCI and SQMCI_s scores similar to their respective medians.

In the previous spring (October 2016) survey the MCI recorded by site U was significantly (Stark, 1998) lower than that recorded at site 1, however no other significant differences between sites were recorded. Taxa richnesses were moderately low at sites 1 and 3 and moderate at the remaining three sites. SQMCI_s scores were similar between sites U, 1 and 2d but substantially lower at sites 3 and 4. This was attributed mainly to a significant increase in one 'tolerant' taxon (oligochaete worms) and a significant decrease of three to four 'sensitive' taxa. It was postulated that wastewater discharges from Taranaki By-Products that were discharging at the time of the spring survey might have negatively affected the macroinvertebrate communities present in the Inaha Stream at site 3 and 4, as indicated by the SQMCI_s results for these sites. However, the MCI scores for these sites did not support this, and as such, it was difficult to deduce whether the reduced SQMCI_s scores at sites 3 and 4 was due to the discharge, or related to habitat variation. It was suggested a discharge may be occurring between sites 2d and 3, and consideration should be given to increasing the monitoring of this reach. The most recent previous (March 2017) survey and the current survey results show no significant differences in MCI and SQMCI_s scores between sites 2d and 3, and the decrease in scores at site 4 is thought to be mainly habitat related. If a return to more 'unhealthy' conditions were to be recorded at sites 3 and 4 then it would again be recommended that consideration be given to increasing the monitoring of this reach.

On examination of all of the Inaha Stream sites, the trends suggests improvements began to appear in 2009 (Figure 10 and Figure 11) but since 2012 large fluctuations in macroinvertebrate indices have occurred. The best result for this type of survey is that MCI scores and SQMCI_s scores in the Inaha Stream are not significantly different to each other within each survey. Occasionally differences in habitat between sites can result in different scores, although this can often be explained when the community assemblage is assessed. The SQMCI_s is more sensitive to changes in habitat, and this is evident in Figure 10. Figure 10 shows SQMCI_s scores were generally similar between sites.

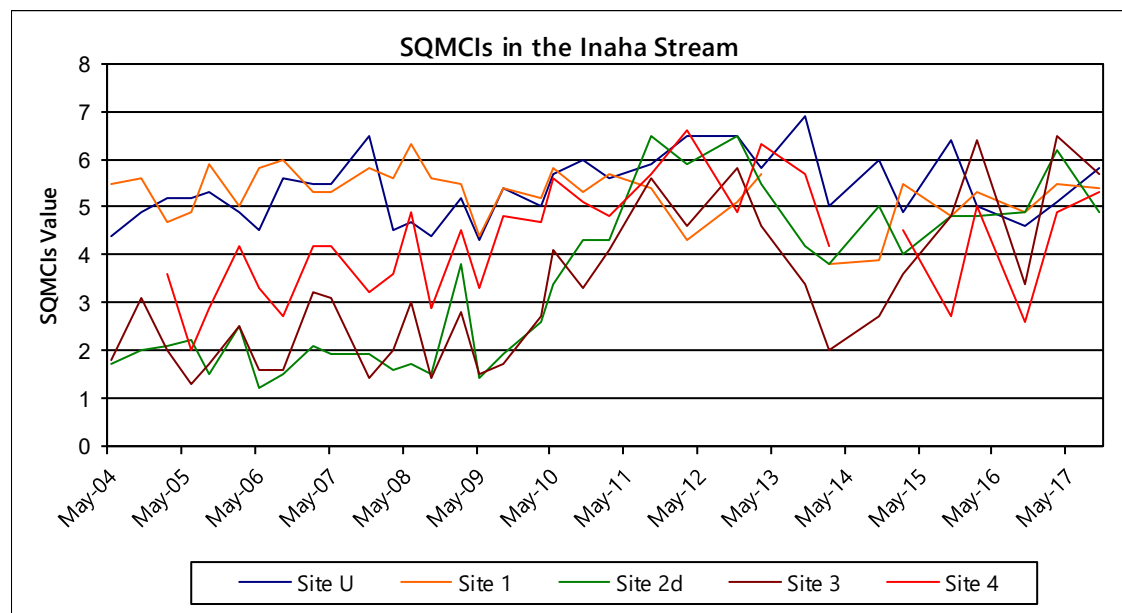


Figure 10 SQMCI_s values for the Inaha Stream sampled in relation to Taranaki By-Products discharges since May 2004

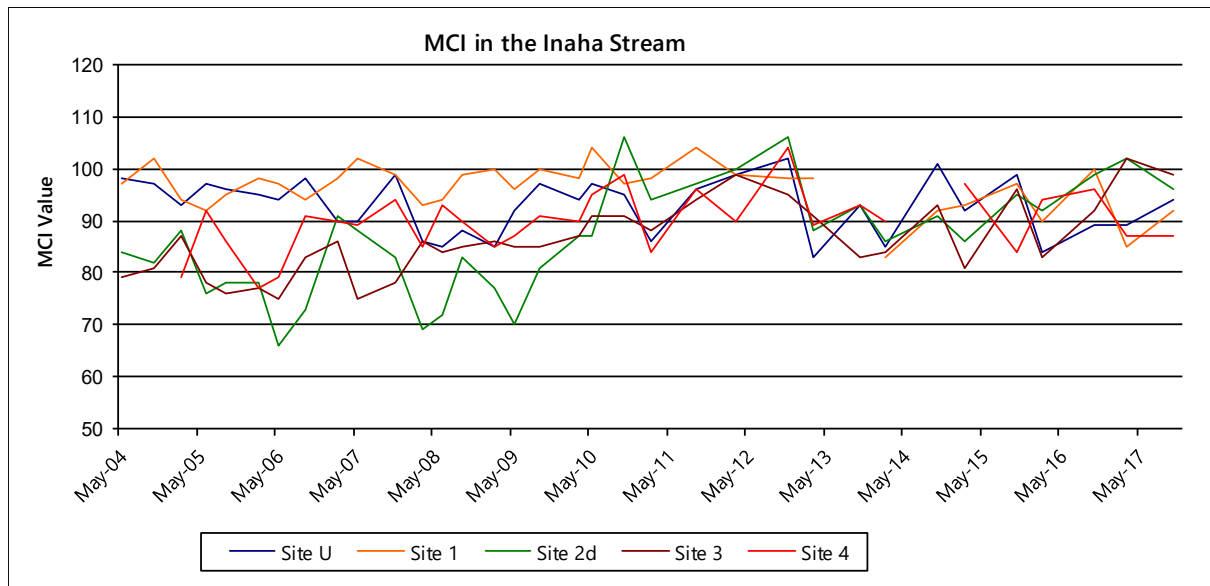


Figure 11 MCI values for the Inaha Stream sampled in relation to Taranaki By-Products discharges since May 2004

Unnamed tributary of the Inaha Stream

The upstream 'control' site UT recorded a slightly higher taxa richness, lower MCI score and significantly lower SQMCI_s score compared with the two downstream sites. The 'control' site UT had 3 and 5 taxa more than that recorded at the 'potentially impacted' sites MT and DT respectively. The MCI score (81 units) recorded at site UT was a non-significant (Stark, 1998) 8 units and a significant (Stark 1998) 14 units lower than sites MT and DT respectively. The SQMCI_s score of 3.7 was a significant (Stark 1998) 1.4 units lower than that recorded by site MT and 1.0 units lower than that recorded by site DT. The MCI and SQMCI_s scores at site UT both recorded a significant improvement from that recorded in the previous (March 2017) survey (both of which were the lowest recorded score for that site). Despite this recovery, site UT recorded substantially lower macroinvertebrate indices than those recorded by comparative sites in the Taranaki ringplain (Table 6). In contrast, sites MT and DT recorded taxa richnesses and MCI and SQMCI_s scores similar to those recorded by comparative sites in the Taranaki ring plain (Table 6).

The MCI scores recorded at all three sites in the unnamed tributary were indicative of 'fair' macroinvertebrate health. The MCI score recorded at site UT was well below the median value for this site, while the scores at sites MT and DT were similar to their median values respectively. Community composition varied between sites, with only one of the abundant taxa common to all three sites. The differences in macroinvertebrate community composition between sites reflected differences in the instream habitat, with proportions of roots and/or fine sediment and instream macrophytes varying at all three sites. Poor habitat quality at site UT can explain the low macroinvertebrate indices recorded at this site at the time of the survey. Overall the MCI and SQMCI_s scores recorded in the unnamed tributary of the Inaha Stream indicated no affect on the macroinvertebrate communities in the unnamed tributary of the Inaha Stream as a result of irrigation to land by Taranaki By-Products.

Summary

The Councils 'kick-sampling' and 'vegetation sweep' techniques (and a combination of the two) were used at eight sites to collect streambed macroinvertebrates from the Inaha Stream and an unnamed tributary, to assess whether discharges (via point source and irrigation to land) from Taranaki By-Products Limited's rendering plant had had any adverse effects on the macroinvertebrate communities of the streams. Samples were processed to provide number of taxa (richness), MCI and SQMCI_s scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI₅ takes into account taxa abundances as well as sensitivity to pollution. Significant differences in either the MCI or the SQMCI₅ between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

On 31 October 2017, a spring macroinvertebrate survey was performed at five sites in the Inaha Stream and at three sites in an unnamed tributary of the Inaha Stream in relation to discharges by Taranaki By-Products. Taxa richnesses were generally similar to the median values calculated from all previous surveys.

MCI scores showed that macroinvertebrate communities were in 'fair' health in the Inaha Stream. MCI scores were similar between sites, with the exception of site 4, which had a score significantly lower (Stark 1998) than site 3 (but not significantly different to any other site). This difference is likely a reflection of habitat differences between the sites, in particular to the increase in fine substrate (namely sand) at site 4. SQMCI₅ scores recorded at the sites were generally similar, although site 2d recorded a score substantially lower than site U.

In the previous spring survey (October 2016) it was thought that wastewater discharges from Taranaki By-Products may have negatively affected the macroinvertebrate communities present in the Inaha Stream at site 3 and 4, as indicated by the SQMCI₅ results. However, the MCI scores for these sites did not support this, and as such, it was difficult to conclude whether the reduced SQMCI₅ scores at sites 3 and 4 was due to a discharge or related to habitat variation. It was acknowledged that the results suggested that there may have been a discharge occurring between sites 2d and 3, and it was recommended consideration be given to increasing the monitoring of this reach. In both the preceding summer (March 2017) and current surveys, there were no significant differences in MCI and SQMCI₅ scores between sites 2d and 3, and the decrease in scores at site 4 is thought to be mainly habitat related. If a return to more 'unhealthy' conditions were to be recorded at sites 3 and 4 then it would again be recommended that consideration be given to increasing the monitoring of this reach.

The unnamed tributary of the Inaha Stream recorded MCI scores reflective of 'fair' stream health. MCI increased in a downstream direction, while SQMCI₅ scores were significantly higher at sites MT and DT compared to site UT. Both the MCI and SQMCI₅ scores recorded at all three sites were similar to or higher than medians for each site, and previous survey results. The current survey results indicate no significant negative impact to the macroinvertebrate communities present in the unnamed tributary of the Inaha Stream from irrigation to land by Taranaki By-Products.

No 'heterotrophic growths' were recorded at any sites monitored in this survey, which was indicative of reasonably good preceding water quality. The presence of heterotrophic growths on the bed of the Inaha Stream was last recorded in the spring 2009 survey, and this shows improved management of the wastewater discharge since that time.

Overall, there was no evidence that discharges from Taranaki By-Products have impacted on the freshwater macroinvertebrate communities present in the Inaha Stream.

References

- Colgan, B, 2003: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, June 2003. TRC report BC012.
- Dunning KJ, 2001: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2001. TRC report KD78.
- Dunning KJ, 2002a: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2002. TRC report KD108.
- Dunning KJ, 2002b: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, April 2002. TRC report KD109.
- Dunning KJ, 2002c: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2002. TRC report KD132.
- Fowles CR and Colgan BG, 2004: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, May 2004. TRC report CF339.
- Fowles CR and Colgan BG, 2005: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, October 2004. TRC report CF352.
- Fowles CR and Jansma B, 2008a: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, November 2007. TRC report CF468.
- Fowles CR and Jansma B, 2008b: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, March 2008. TRC report CF469.
- Fowles CR and Jansma B, 2008c: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, June 2008. TRC report CF470.
- Fowles CR and Jansma B, 2008: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2008. TRC report CF471.
- Fowles CR and Moore SC, 2004: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2004. TRC report CF327.
- Fowles CR and Stark JD, 2004: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant using artificial substrates January to March 2003. TRC report.
- Hickey CW and Vickers ML, 1994: Toxicity of ammonia to nine native New Zealand freshwater invertebrate species. *Archives of Environmental Contamination and Toxicology* 26: 292-298.
- Hope KJ, 2005: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, June 2005. TRC report KH043.
- Hope KJ, 2007: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2006. TRC report KH087.
- Hope KJ, 2007: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, May 2006. TRC report KH088.
- Jansma B, 2008: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, September 2006. TRC report BJ033.
- Jansma B, 2008: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2007. TRC report BJ034.

- Jansma B, 2009: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2009. TRC report BJ086.
- Jansma B, 2009: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, May 2009. TRC report BJ087.
- Jansma B, 2010: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, September 2009. TRC report BJ094.
- Jansma B, 2010: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2010. TRC report BJ095.
- Jansma B, 2010: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, May 2010. TRC report BJ096.
- Jansma B, 2012 (a): Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2010. TRC report BJ168.
- Jansma B, 2012(b): Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2011. TRC report BJ169.
- Jansma B, 2012(c): Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, September 2011. TRC report BJ170.
- Jansma B and Smith K, 2013. Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, November 2012. TRC report BJ211.
- Jansma B, 2013. Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2013. TRC report BJ212.
- McWilliam H, 2001a: Biomonitoring of the Inaha Stream above and below the Taranaki By- Products plant, September 2000. TRC report HM234.
- McWilliam H, 2001b: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2001. TRC report HM247.
- McWilliam H, 2001c: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, May 2001. TRC report HM248.
- Moore S, 2003: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2003. TRC report SM577.
- Moore S, 2003: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, August 2003. TRC report SM588.
- Smith K, 2012: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2012. TRC report KS008.
- Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. *Water and Soil* Miscellaneous Publication No. 87.
- Stark JD, 1998: SQMCI: a biotic index for freshwater macroinvertebrate coded abundance data. *New Zealand Journal of Marine and Freshwater Research* 32(1): 55-66.
- Stark JD, 1999: An evaluation of TRC's SQMCI biomonitoring index. Cawthron Institute, Nelson. Cawthron Report No. 472.
- Stark JD, Boothroyd IKG, Harding JS, Maxted JR, Scarsbrook MR, 2001: Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report

- No. 1. Prepared for the Ministry for the Environment. Sustainable Management Fund Project No. 5103. 57p.
- Stark JD and Fowles CR, 2009: Relationships between MCI, site altitude, and distance from source for Taranaki ring plain stream. Prepared for Taranaki Regional Council. Stark Environmental Report No. 2009-01. 47p.
- Stark JD and Maxted JR, 2004. Macroinvertebrate community indices for Auckland's soft-bottomed streams and applications to SOE reporting. Prepared for Auckland Regional Council. Cawthron Report No. 970. Cawthron Institute, Nelson. ARC Technical Publication 303. 59p.
- Stark JD and Maxted JR, 2007. A biotic index for New Zealand's soft bottomed streams. *New Zealand Journal of Marine and Freshwater Research* 41(1).
- Stark JD and Maxted JR, 2007a. A user guide for the macroinvertebrate community index. Cawthron Institute, Nelson. Cawthron Report No. 1166.
- Sutherland DL and Thomas B, 2015: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2015. TRC report DS024.
- Sutherland DL, 2015: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, February 2015. TRC report DS025.
- Thomas B, 2013: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2013. TRC report BT010.
- Thomas B, 2014: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, February 2014. TRC report BT042.
- Thomas B, 2016: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2015. TRC report BT049.
- Thomas B, 2016: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, February 2016. TRC report BT060.
- Thomas B, 2016: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2016. TRC report BT064.
- Thomas B, 2017. Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, March 2017. TRC report BT077.
- TRC, 2015: Some statistics from the Taranaki Regional Council database (Esam) of freshwater macroinvertebrate surveys performed during the period from January 1980 to 30 September 2017. Technical Report 2014-105.
- Winterbourn MJ, Gregson KLD, Dolphin CH, 2006. Guide to the aquatic insects of New Zealand. [4th edition]. *Bulletin of the Entomological Society of New Zealand* 14, 108p.

To Job Manager, Nathan Crook
From Environmental Scientist, Katie Blakemore
Report No KB049
Document 2058613
Date 23 May 2018

Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2018

Introduction

Taranaki By-Products Limited holds a number of consents for discharges to land and to water associated with the operation of a rendering plant and a neighbouring farm owned and operated by the Company. The discharge consents most relevant to this biomonitoring survey are summarised in Table 1 below:

Table 1 Summary of discharge consents held by Taranaki By-Products Limited which are of most relevance to this biological survey

Consent no.	Purpose
2049-4	To discharge up to 940 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream
2050-4	To discharge up to 2,160 cubic metres/day of cooling water and backwash water from a rendering operation into an unnamed tributary of the Inaha Stream
3941-2	To discharge up to 1400 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy via spray irrigation onto and into land, and to discharge emissions into the air, in the vicinity of the Inaha Stream and its tributaries between 1700909E-5625245N, 1700631E-5625092N and 1700921E-5625046N
5426-1	To discharge up 1,095 litres/second of stormwater from an animal rendering site into an unnamed tributary of the Inaha Stream

Biomonitoring has been undertaken at some sites in relation to the discharges from the rendering plant and associated activities since the mid-1980s. Some of the sites used for the biomonitoring of these discharges have changed over time and these changes have been documented in previous reports (Jansma, 2012 a, b, c).

This spring biological survey was the second of two scheduled in the Inaha Stream catchment in the 2017-2018 monitoring year in relation to discharges from the Taranaki By-Products plant. Results from previous surveys are also referred to in this report (see references).

Methods

This biomonitoring survey was undertaken at eight sites on 27 February 2018 (Table 2 and Figure 1). Five of the eight sites surveyed were in the Inaha Stream and the remaining sites were in an unnamed tributary of the Inaha Stream (Figure 1). The locations of sampling sites in relation to the discharges from the rendering plant are discussed below.

Site U (INH000334) was established in the 2003-2004 monitoring period as an appropriate control site on the Inaha Stream above the rendering plant discharges and irrigation areas. Site 1 (INH000400) is located upstream of the wastewater and cooling water discharge points but downstream of part of the treated wastewater irrigation area. Sites 2d and 3 (INH000420 and INH000430) are located downstream of these two discharges and above the confluence with the unnamed tributary of the Inaha Stream which drains land upon which wastewater is irrigated.

The area of land authorised to be irrigated onto under consent 3941-2 has increased on several occasions since the consent was granted in December 1999. Sites UT, MT and DT (INH000433, INH000435 and INH000440) were established to monitor the effects of the expanded irrigation area on an unnamed tributary of the Inaha Stream. Site UT was established as a 'control site' for the expanded irrigation area. Site MT is located within the authorised irrigation area and site DT is situated downstream of the irrigation area but upstream of the unnamed tributary's confluence with the Inaha Stream.

Site 4 (INH000450) on the Inaha Stream is situated approximately 100 metres downstream of the convergence point between the Inaha Stream and the unnamed tributary.

Table 2 Biomonitoring sites in the Inaha Stream and in an unnamed tributary relating to the Taranaki By-Products plant

Stream	Site No.	Site code	Location	Sampling method used
Inaha Stream	U	INH000334	Upstream of irrigation area, near Ahipaipa Road	Streambed kick
	1	INH000400	Upstream of treatment ponds, Kohiti Road	Streambed kick
	2d	INH000420	500 m downstream of cooling water discharge	Streambed kick
	3	INH000430	Upstream of Normanby Road	Streambed kick
	4	INH000450	100 m downstream of 'irrigation' tributary confluence	Streambed kick
Unnamed tributary of Inaha Stream	UT	INH000433	Upstream of irrigation area	Kick/sweep
	MT	INH000435	Middle site within the new irrigation area	Kick/sweep
	DT	INH000440	50m upstream Normanby Road	Vegetation sweep

Two different sampling techniques were used to collect streambed macroinvertebrates in this survey. The Council's standard '400ml kick-sampling' technique was used at sites U, 1, 2d, 3 and 4 and the 'vegetation sweep' technique was used at site DT. A combination of these two techniques was used at sites UT and MT (Table 2). The 'kick-sampling' and 'vegetation sweep' techniques are very similar to Protocol C1 (hard-bottomed, semi-quantitative) and C2 (soft-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 and ethanol for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark *et al.* 2001). Macroinvertebrate taxa found in each sample were recorded based on the abundance categories in Table 3.

Table 3 Macroinvertebrate abundance categories

Abundance category	Number of individuals
R (rare)	1-4
C (common)	5-19
A (abundant)	20-99
VA (very abundant)	100-499
XA (extremely abundant)	>499

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. Averaging the scores from a list of taxa taken from one site and multiplying by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value. A difference of 11 units or more in MCI values is considered significantly different (Stark 1998). A gradation of biological water quality conditions based upon MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985; Boothroyd and Stark, 2000) (Table 4).

Table 4 Macroinvertebrate community health based on MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000)

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

A semi-quantitative MCI value (SQMCI_s) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCI_s is not multiplied by a scaling factor of 20, therefore SQMCI_s values range from 1 to 10, while MCI values range from 20 to 200.

Where necessary, sub-samples of algal and detrital material taken from the macroinvertebrate samples were scanned under 40-400x magnification to determine the presence or absence of any mats, plumes or dense growths of bacteria, fungi or protozoa ('undesirable biological growths') at a microscopic level. The presence of these organisms is an indicator of organic enrichment within a stream. Such heterotrophic growths have been recorded on numerous past occasions at sites downstream of the Taranaki By-Products plant as a result of organic nutrient enrichment from the wastewater discharge.

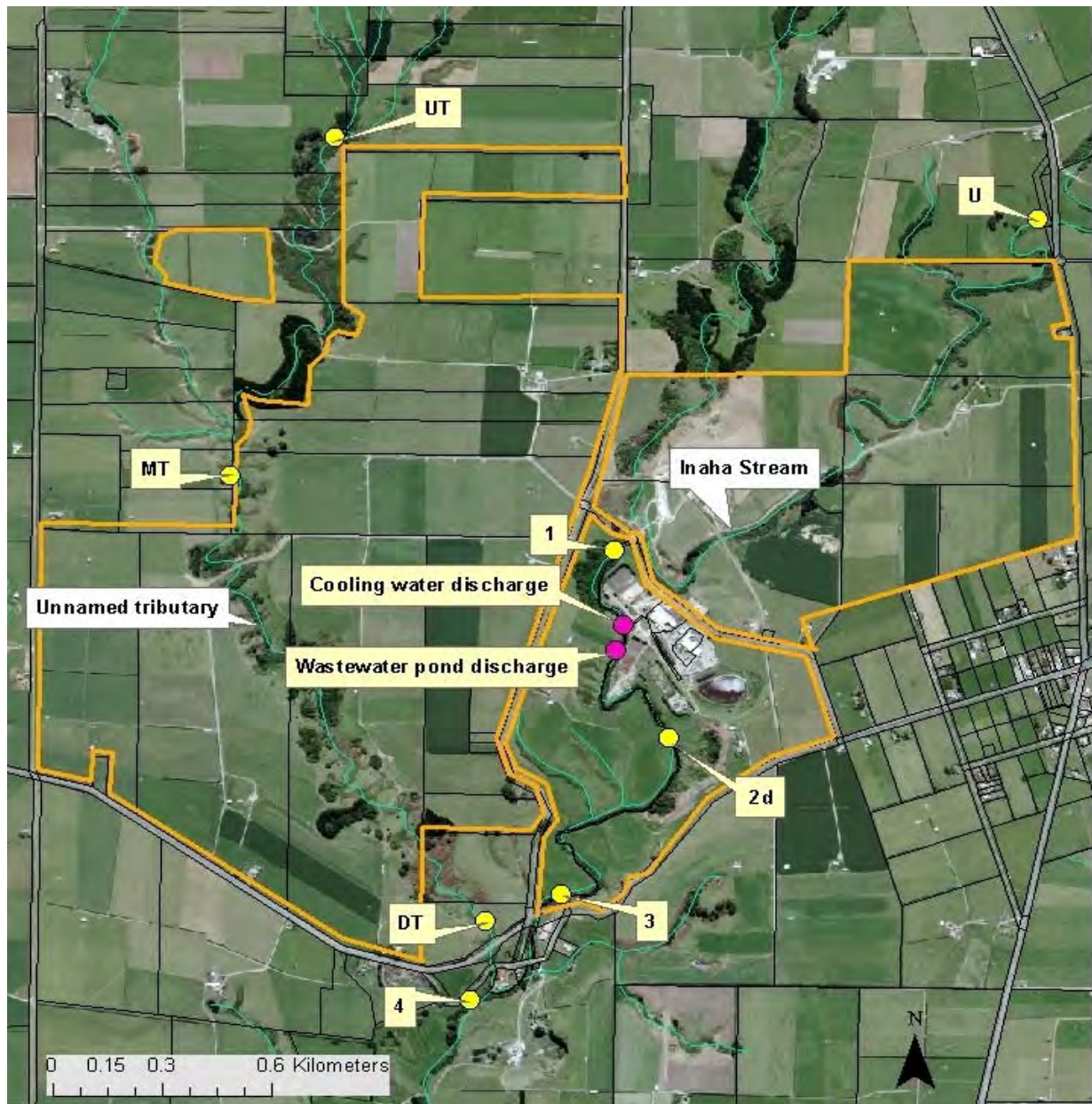


Figure 1 Aerial photo showing biomonitoring sites in the Inaha Stream and an unnamed tributary stream relating to discharges from the Taranaki By-Products plant. The orange line outlines the irrigation areas around the rendering plant

Results

Site habitat characteristics and hydrology

This February 2018 survey followed a period of 101 days since a fresh in excess of three times median flow in the nearby Waiokura Stream at No. 3 Fairway (the nearest appropriate water level recorder) and 140 days since a fresh in excess of seven times median flow. Flows had been largely stable with only three small freshes recorded since the previous survey in October 2017.

The Company's records showed that treated wastewater was not discharging to the Inaha stream at the time of this biological survey, with a period of cessation beginning on 20 November 2017. Cooling water was discharged to the stream throughout this period. The record shows that the minimum dilution of wastewater of 1:300 that is required under consent 2049-4 was maintained throughout the period.

At all of the Inaha Stream sites (U, 1, 2d, 3 and 4) the flow conditions were low. Water speeds were swift at sites U, 2d and 3, and steady at sites 1 and 4. The flow was clear and uncoloured at sites U, 1, 2d and 3, and cloudy grey at site 4. Water temperatures in the Inaha Stream ranged between 14.9 °C and 16.7 °C. In the unnamed tributary of the Inaha Stream, Site UT had a very low, very slow/still flow which was cloudy grey. Sites MT and DT had a low, slow flow which was a cloudy grey at site MT and clear and uncoloured at site DT. The water was very shallow and almost stagnant at site UT. Stream temperatures ranged from 14.7 °C to 16.2 °C during this survey.

All of the Inaha Stream sites had predominantly cobble and gravel substrates with varying amounts of silt, sand and boulder present. Substrate in the unnamed tributary of the Inaha Stream comprised predominantly silt with some wood/root at site UT. Site MT was dominated by silt and hard clay, with some boulder and hard clay. Site DT recorded predominantly gravel and hard clay with small amounts of silt, sand and cobbles.

Patchy periphyton mats and widespread filaments were recorded at sites U and 1, while patchy mats and patchy filaments were recorded at sites 2d and slippery mats and patchy filaments were recorded at site 4. Macrophytes were recorded growing at the edges of the stream at sites 2d and 3, while no macrophytes were recorded growing at any other site in the Inaha Stream. Leaves were patchy on the streambed at all sites except site 3. Site 4 was partially shaded, while all other Inaha Stream sites were unshaded.

In the unnamed tributary of the Inaha Stream, no periphyton mats were recorded at any of the sites, while filamentous periphyton was patchy at site MT only. Leaves were widespread on the streambed at sites UT and MT, and absent at site DT, while wood was patchy on the streambed at site UT only. Macrophytes were recorded growing on the bed of the stream at all sites. Site UT was completely shaded, site MT was partially shaded and site DT was completely unshaded.

Streambed microflora

A microscopic inspection of material collected from the bed of the Inaha Stream found no evidence of 'heterotrophic growths' (protozoa or fungi) at any of the sites sampled. This was the eighteenth consecutive survey to record a lack of such growths, continuing the improvement following the late summer 2008 and spring 2009 surveys, which both recorded such growths. This is an important result; as such growth is often associated with 'sewage fungus' which is an indication of high levels of organic matter and nutrient enrichment in the stream. Such growths have been recorded on many previous sampling occasions, often in abundance, particularly downstream of the plant discharges at site 2d. The absence of such growths is evidence that the degree of enrichment is not as severe as that recorded previously.

Macroinvertebrate communities

Results of previous macroinvertebrate surveys performed in the Inaha Stream and the unnamed tributary are summarised and presented together with current results in Table 5.

Table 5 Summary of previous numbers of macroinvertebrate taxa and MCI and SQMCI_s values for surveys between September 1987 and October 2017 together with current results recorded in the Inaha Stream and an unnamed tributary in relation to Taranaki By-Products

	Number of taxa				MCI values			SQMCI _s values			
	No. samples	Range	Median	Current survey	Range	Median	Current Survey	No. of samples	Range	Median	Current survey
U	34	18-34	23	21	83-102	94	81	34	4.3-6.9	5.3	3.8
1	74	12-31	22	20	82-104	95	90	50	3.6-6.3	5.1	4.6
2d	62	10-30	22	17	52-106	81	94	51	1.2-6.5	2.1	4.9

	Number of taxa				MCI values			SQMCI _s values			
	No. samples	Range	Median	Current survey	Range	Median	Current Survey	No. of samples	Range	Median	Current survey
3	75	6-35	21	17	43-102	81	89	51	1.3-6.5	2.7	6.0
4	31	15-31	25	22	77-104	90	92	31	2.0-6.6	4.5	5.6
UT	14	9-23	19	14	64-109	97	83	14	1.6-6.3	5.3	1.7
MT	27	12-29	20	16	70-94	83	74	27	3.1-5.7	4.5	3.9
DT	28	12-25	21	13	80-105	89	100	28	3.5-5.3	4.6	5.4

Table 6 provides a summary of various macroinvertebrate indices within a specific altitudinal band for 'control' sites situated in Taranaki ring plain streams arising outside of Egmont National Park. The full results from this current survey are presented in Table 7 and Table 8.

Table 6 Range and median number of taxa, MCI values and SQMCI_s scores for 'control' sites (Taranaki ring plain rivers/streams with sources outside Egmont National Park) at altitudes 80-124 m asl (TRC, 2017)

	No. of taxa	MCI value	SQMCI _s value
No. Samples	272	272	216
Range	9-34	64-112	1.3-6.9
Median	22	92	4.8

Table 7 Macroinvertebrate fauna of the Inaha Stream in relation to Taranaki By-Products wastes discharges sampled on 27 February 2018

Taxa List	Site Number	MCI score	U	1	2d	3	4	
	Site Code		INH000334	INH000400	INH000420	INH000430	INH000450	
	Sample Number		FWB18072	FWB18073	FWB18074	FWB18075	FWB18079	
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	-	-	-	-	R	
NEMERTEA	Nemertea	3	R	-	-	-	R	
ANNELIDA (WORMS)	Oligochaeta	1	A	C	A	C	A	
	Lumbricidae	5	-	-	-	R	-	
HIRUDINEA (LEECHES)	Hirudinea	3	-	-	-	-	R	
MOLLUSCA	<i>Latia</i>	5	-	R	-	-	-	
	<i>Potamopyrgus</i>	4	A	XA	VA	A	VA	
CRUSTACEA	Ostracoda	1	R	R	A	C	C	
	<i>Paracalliope</i>	5	VA	R	-	-	R	
	<i>Phreatogammarus</i>	5	-	-	-	R	-	
	Talitridae	5	-	-	-	-	R	
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	C	VA	VA	VA	C	
	<i>Deleatidium</i>	8	C	A	A	XA	VA	
	<i>Zephlebia group</i>	7	-	-	-	R	C	
COLEOPTERA (BEETLES)	Elmidae	6	A	A	A	A	VA	
MEGALOPTERA (DOBSONFLIES)	<i>Archichauliodes</i>	7	C	C	A	C	C	
TRICHOPTERA (CADDISFLIES)	<i>Hydropsyche (Aoteapsyche)</i>	4	A	VA	VA	XA	C	
	<i>Hydrobiosis</i>	5	C	C	R	R	R	
	<i>Hydropsyche (Orthopsyche)</i>	9	-	-	-	-	R	
	<i>Psilochorema</i>	6	-	R	-	-	-	
	<i>Oecetis</i>	4	-	-	-	-	R	
	<i>Olinga</i>	9	-	-	R	-	-	
	<i>Oxyethira</i>	2	C	-	-	-	-	
	<i>Paroxyethira</i>	2	R	-	-	-	-	
	<i>Pycnocentria</i>	7	R	R	-	-	-	
	<i>Pycnocentroides</i>	5	A	VA	XA	A	C	
	<i>Triplectides</i>	5	-	-	-	-	C	
	DIPTERA (TRUE FLIES)	<i>Aphrophila</i>	5	-	-	C	-	-
		Eriopterini	5	-	-	-	-	R
<i>Chironomus</i>		1	-	-	-	-	R	
<i>Harrisius</i>		6	-	-	R	-	-	
<i>Maoridiamesa</i>		3	-	R	-	-	-	
Orthocladiinae		2	VA	C	C	C	-	
<i>Polypedilum</i>		3	R	R	R	R	-	
Tanytarsini		3	C	C	R	C	-	
Ephydriidae		4	R	-	-	-	-	
Muscidae		3	C	-	-	-	R	
<i>Austrosimulium</i>		3	R	R	-	R	-	
Tanyderidae		4	-	-	R	-	-	
ACARINA (MITES)		Acarina	5	-	R	-	-	
No of taxa			21	20	17	17	22	
MCI			81	90	94	89	92	
SQMCIs			3.8	4.6	4.9	6.0	5.6	
EPT (taxa)			6	7	6	6	9	
%EPT (taxa)			29	35	35	35	41	
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa				

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

Table 8 Macroinvertebrate fauna of the unnamed tributary of the Inaha Stream in relation to Taranaki By-Products wastes discharges sampled on 27 February 2018

Taxa List	Site Number	MCI score	UT	MT	DT
	Site Code		INH000433	INH000435	INH000440
	Sample Number		FWB18076	FWB18077	FWB18078
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	R	C	R
ANNELIDA (WORMS)	Oligochaeta	1	XA	A	C
MOLLUSCA	<i>Physa</i>	3	R	R	-
	<i>Potamopyrgus</i>	4	C	VA	A
CRUSTACEA	Sphaeriidae	3	XA	-	-
	Ostracoda	1	XA	A	-
	<i>Paracalliope</i>	5	-	VA	C
	Talitridae	5	R	C	A
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	-	-	A
	<i>Deleatidium</i>	8	R	-	-
	<i>Zephlebia group</i>	7	R	R	A
ODONATA (DRAGONFLIES)	<i>Xanthocnemis</i>	4	-	R	R
COLEOPTERA (BEETLES)	Elmidae	6	-	-	R
	Hydrophilidae	5	R	-	-
TRICHOPTERA (CADDISFLIES)	<i>Hydropsyche (Aoteapsyche)</i>	4	-	R	R
	<i>Hydrobiosis</i>	5	-	-	R
	<i>Hydropsyche (Orthopsyche)</i>	9	-	-	R
	<i>Polypectropus</i>	6	-	C	-
	<i>Oxyethira</i>	2	-	C	-
	<i>Triplectides</i>	5	-	C	-
DIPTERA (TRUE FLIES)	<i>Paralimnophila</i>	6	R	-	-
	<i>Chironomus</i>	1	-	C	-
	Tanypodinae	5	R	R	-
	Tanytarsini	3	-	R	-
	Culicidae	3	C	-	-
ACARINA (MITES)	<i>Paradixa</i>	4	R	-	-
	Acarina	5	-	-	R
No of taxa			14	16	13
MCI			83	74	100
SQMCIs			1.7	3.9	5.4
EPT (taxa)			2	4	5
%EPT (taxa)			14	25	38
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa	

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

Inaha Stream

Site U

A moderate taxa richness of 21 taxa was found at site U (the 'control' site for the Inaha Stream) at the time of the survey which was two taxa less than the median number recorded for the site (median taxa richness 23; Table 5) and three taxa more than the previous sample (taxa richness 18; Figure 2).

The MCI score of 81 units indicated a community of 'fair' biological health, which was significantly lower (Stark 1998) than the median value calculated from previous surveys at the same site (median MCI score 94 units; Table 5) and the previous survey score (MCI score 94 units; Figure 2). The SQMCI_s score of 3.8 units was significantly lower (Stark 1998) than both the median value calculated from previous surveys at the same site (median SQMCI_s score 5.3 units; Table 5) and the previous survey score (SQMCI_s score 5.8 units). Both the MCI and SQMCI_s scores recorded in the current survey are the lowest recorded at this site to date (Table 5).

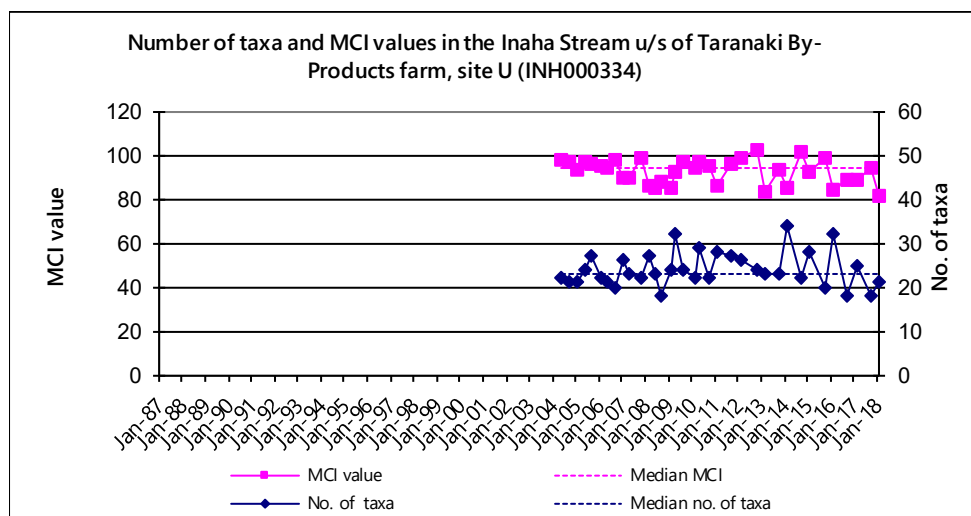


Figure 2 Numbers of macroinvertebrate taxa and MCI values recorded at site U in the Inaha Stream since May 2004

The community was characterised by four 'tolerant' taxa [oligochaete worms, snail (*Potamopyrgus*), caddisfly (*Hydropsyche* – formerly *Aoteapsyche*) and chironomid midge (Orthoclaadiinae)] and three 'moderately sensitive' taxa [amphipod (*Paracalliope*), elmid beetles and caddisfly (*Pycnocentroides*)] (Table 7).

Site 1

A moderate taxa richness of 20 taxa was found at site 1 at the time of this survey which was two taxa less than the median number recorded for the site (median taxa richness 22; Table 5) and three taxa less than the previous survey (taxa richness 23; Figure 3).

The MCI score of 90 units indicated a community of 'fair' biological health, which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 95 units; Table 5) or to the previous survey score (MCI score 92 units; Figure 3). The SQMCI_s score of 4.6 units was similar to the median value calculated from previous surveys at the same site (median SQMCI_s score 5.1 units; Table 5) and the previous survey score (SQMCI_s score 5.4 units).

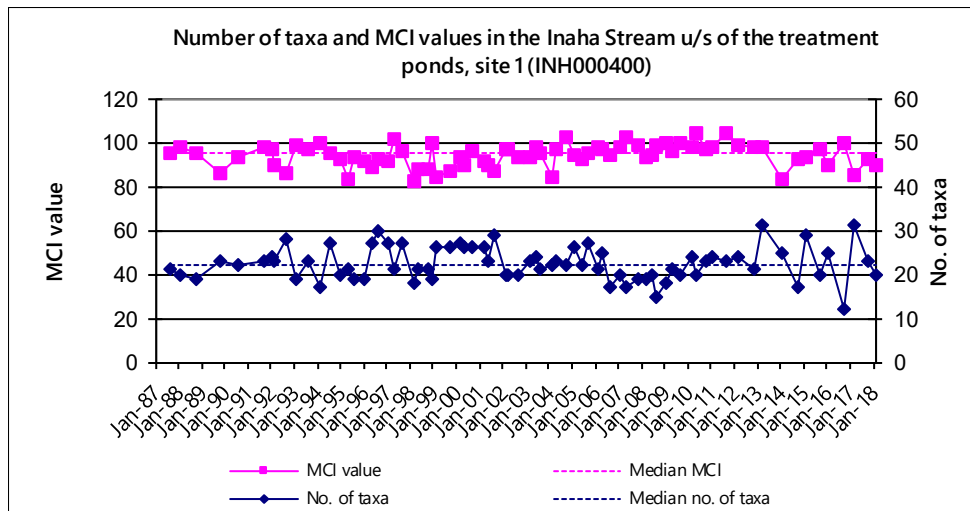


Figure 3 Numbers of macroinvertebrate taxa and MCI values recorded at site 1 in the Inaha Stream since September 1987

The community was characterised by two 'tolerant' taxa [snail (*Potamopyrgus*) and caddisfly (*Hydropsyche* - formerly *Aoteapsyche*)], three 'moderately sensitive' taxa [mayfly (*Austroclima*), elmid beetles and caddisfly (*Pycnocentroides*)], and one 'highly sensitive' taxon [mayfly (*Deleatidium*) (Table 7).

Site 2d

A moderate macroinvertebrate community richness of 17 taxa was found at site 2d at the time of this survey, which was five taxa less than the median number recorded for the site (median taxa richness 22; Table 5) and equal to that recorded by the previous survey (17 taxa, Figure 4).

The MCI score of 94 units indicated a community of 'fair' biological health, which was significantly (Stark, 1998) higher than the median value calculated from previous surveys at the same site (median MCI score 81 units; Table 5) but was slightly lower than the previous survey score (MCI score 96 units; Figure 4). The SQMCI_s score of 4.9 units was significantly higher than the median value calculated from previous surveys at the same site (median SQMCI_s score 2.1 units; Table 5) and equal to the previous survey score (SQMCI_s score 4.9 units).

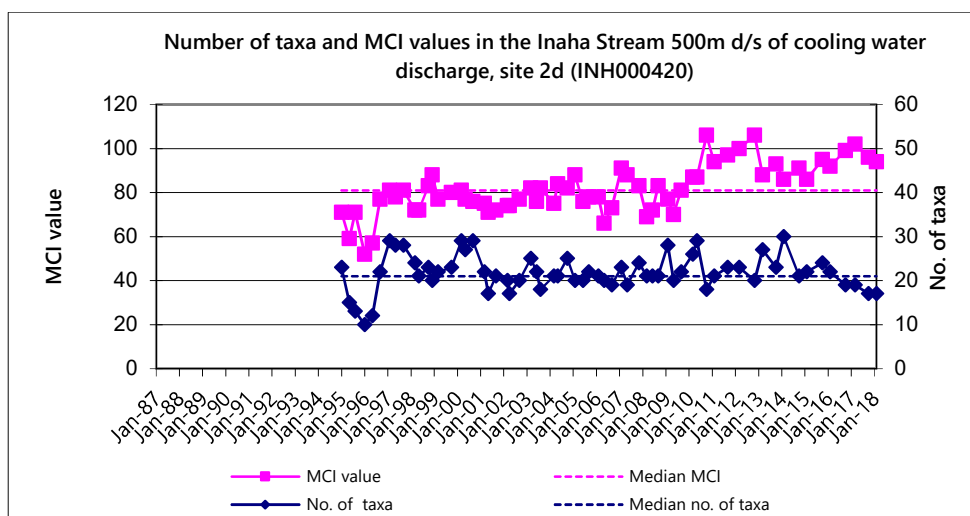


Figure 4 Numbers of taxa and MCI values recorded at site 2d in the Inaha Stream since 1995

The community was characterised by four 'tolerant' taxa [oligochaete worms, snail (*Potamopyrgus*), seed shrimp (Ostracoda) and caddisfly (*Hydropsyche* – formerly *Aoteapsyche*)], four 'moderately sensitive' taxa [mayfly (*Austroclima*), elmid beetle, toe biter (*Archichauliodes*) and caddisfly (*Pycnocentroides*)], and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 7).

Site 3

A moderate taxa richness of 17 taxa was found at site 3 at the time of the survey, which was four taxa less than the median number recorded for the site (median taxa richness 21; Table 5) and two taxa less than the richness recorded in the previous survey (taxa richness 19; Figure 5).

The MCI score of 89 units indicated a community of 'fair' biological health, which was slightly higher than the median value calculated from previous surveys at the same site (median MCI score 81 units; Table 5) but slightly lower than the previous survey score (MCI score 99 units; Figure 5). The SQMCI_s score of 6.0 units was significantly higher (Stark 1998) than the median value calculated from previous surveys at the same site (median SQMCI_s score 2.7 units; Table 5) and slightly higher than the previous survey score (SQMCI_s score 5.7 units).

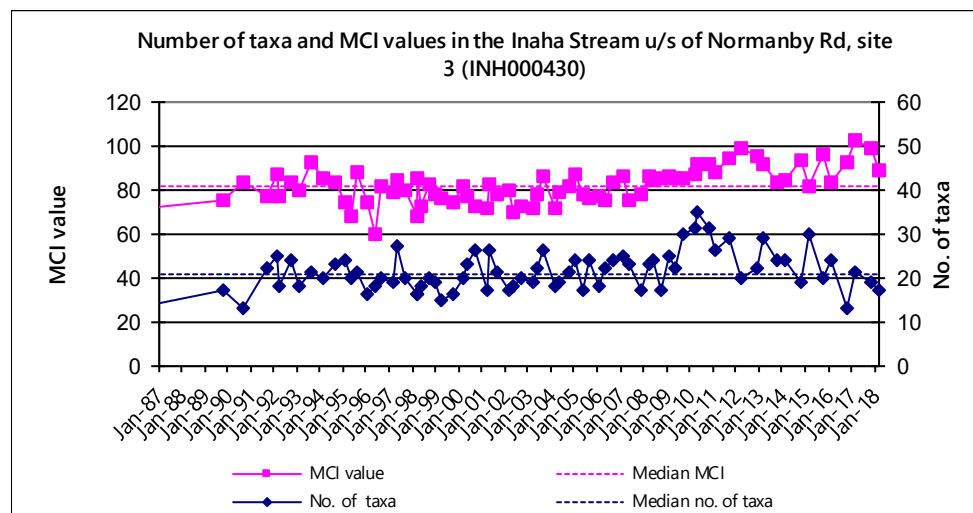


Figure 5 Numbers of taxa and MCI values recorded at site 3 in the Inaha Stream since 1989

The community was characterised by two 'tolerant' taxa [snail (*Potamopyrgus*) and caddisfly (*Hydropsyche* – formerly *Aoteapsyche*)], three 'moderately sensitive' taxa [mayfly (*Austroclima*), elmid beetles and caddisfly (*Pycnocentroides*)] and one 'highly sensitive' taxon [mayfly (*Deleatidium*)] (Table 7).

Site 4

A moderate macroinvertebrate community richness of 22 taxa was found at site 4 at the time of the survey which was three taxa less than the median number recorded for the site (median taxa richness 25; Table 5) but seven taxa more than the previous survey (taxa richness 15; Figure 6).

The MCI score of 92 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the median value calculated from previous surveys at the same site (median MCI score 90 units; Table 5), although it was significantly higher than that recorded by the previous survey (MCI score 81 units; Figure 6). The SQMCI_s score of 5.6 units was significantly higher than the median value calculated from previous surveys at the same site (median SQMCI_s score 4.5 units; Table 5) and slightly higher than the previous survey score (SQMCI_s score 5.3 units).

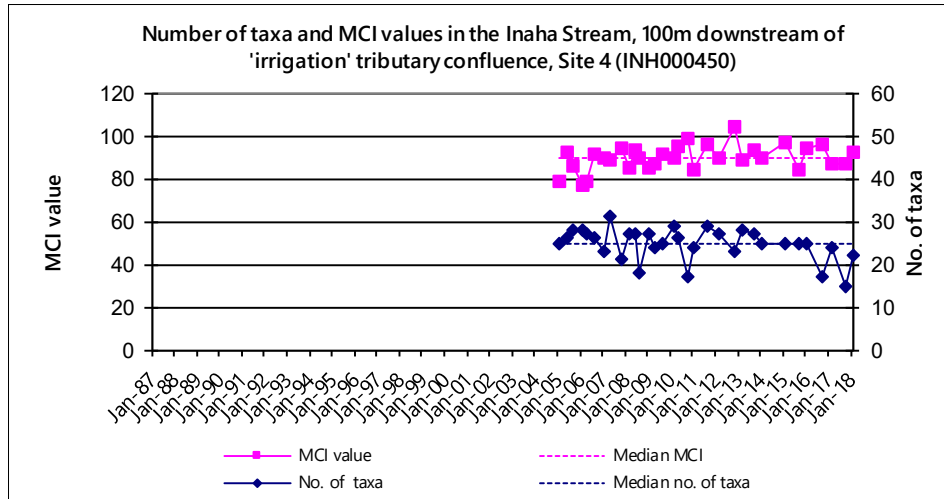


Figure 6 Numbers of taxa and MCI values recorded at site 4 in the Inaha Stream

The community was characterised by two 'tolerant' taxa [oligochaete worms and snail (*Potamopyrgus*)], one 'moderately sensitive' taxon [elmid beetles] and one 'highly sensitive taxon [mayfly (*Deleatidium*)] (Table 7).

Unnamed tributary of the Inaha Stream

Site UT

A moderately low macroinvertebrate community richness of 14 taxa was found at site UT (the 'control' site for the unnamed tributary of the Inaha Stream) at the time of the survey. This was five taxa less than the median richness recorded for the site (median taxa richness 19, Table 5) and four taxa less than that recorded in the previous survey (18 taxa, Figure 7).

The MCI score of 83 units indicated a community of 'fair' biological health, which was significantly lower (Stark, 1998) than the median value calculated from previous surveys at the same site (median MCI score 97 units; Table 5) but similar to the previous survey score (MCI score 81 units; Figure 7). The SQMCI₅ score of 1.7 units was significantly lower (Stark 1998) than the median value calculated from previous surveys at the same site (median SQMCI₅ score 5.3 units; Table 5) and the previous survey score (SQMCI₅ score 3.7 units).

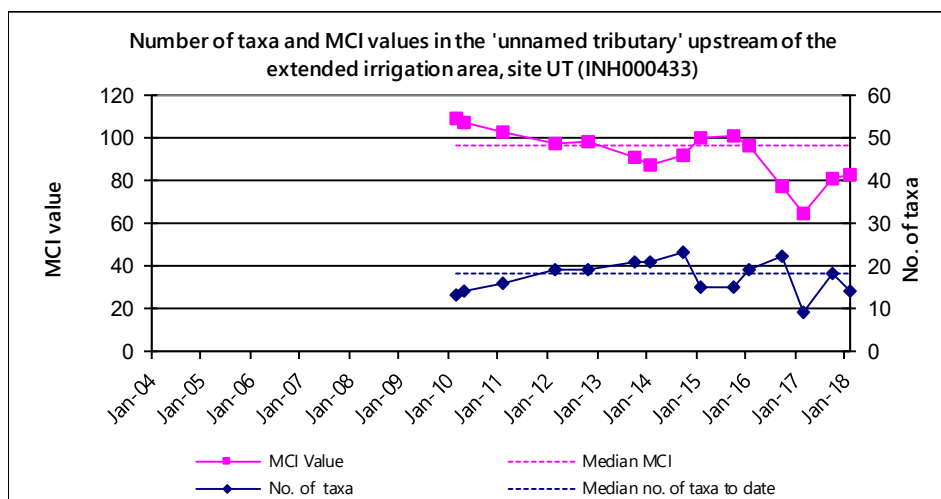


Figure 7 Numbers of taxa and MCI values recorded at site UT in the unnamed tributary of the Inaha Stream since 2004

The community was characterised by three 'tolerant' taxa [oligochaete worms, pea clams (*Sphaeriidae*) and seed shrimp (*Ostracoda*)] (Table 8).

Site MT

A moderate macroinvertebrate community richness of 16 taxa was recorded at site MT, which was four taxa fewer than the median number recorded for the site (median taxa richness 20; Table 5) and three taxa more than the previous survey (taxa richness 13; Figure 8).

The MCI score of 74 units indicated a community of 'poor' biological health, being slightly lower than the median value calculated from previous surveys at the same site (median MCI score 83 units; Table 5) and significantly lower (Stark 1998) than the previous survey score (MCI score 89 units; Figure 8). The SQMCI_s score of 3.9 units was slightly lower than the median value calculated from previous surveys at the same site (median SQMCI_s score 4.5 units; Table 5) and significantly lower (Stark 1998) than the previous survey score (SQMCI_s score 5.1 units).

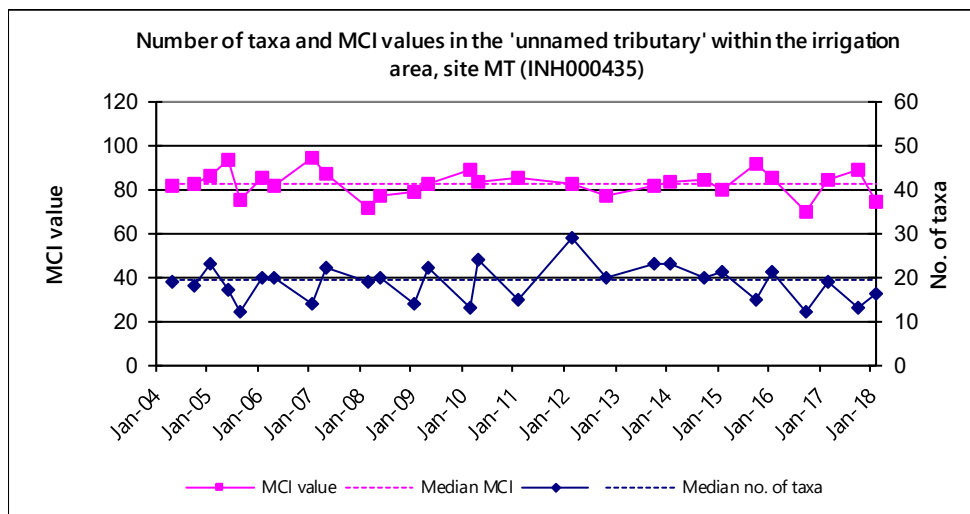


Figure 8 Numbers of taxa and MCI values recorded at site MT in the unnamed tributary of the Inaha Stream since 2004

The community was characterised by three 'tolerant' taxa [oligochaete worms, snail (*Potamopyrgus*) and seed shrimp (*Ostracoda*)] and one 'moderately sensitive' taxon [amphipod (*Paracalliope*)] (Table 8).

Site DT

A moderately low macroinvertebrate community richness of 13 taxa was recorded at site DT which was eight taxa less than the median number recorded for the site (median taxa richness 21; Table 5) and two taxa less than that recorded by the previous survey (taxa richness 15; Figure 9).

The MCI score of 100 units indicated a community of 'good' biological health, and was significantly higher (Stark 1998) than the median value calculated from previous surveys at the same site (89 units Table 5) but not significantly different (Stark, 1998) to the previous survey score (MCI score 95 units; Figure 9). The SQMCI_s score of 5.4 units was slightly higher than both the median value calculated from previous surveys at the same site (median SQMCI_s score 4.6 units; Table 5) and the previous survey score (SQMCI_s score 4.7 units). This SQMCI_s score was the highest recorded to date at this site (Table 5).

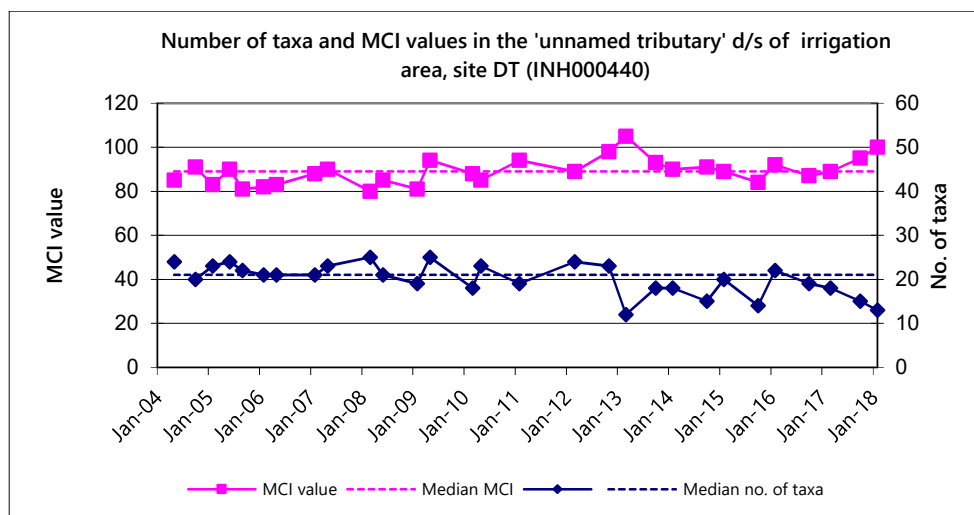


Figure 9 Numbers of taxa and MCI values recorded at site DT in the unnamed tributary of the Inaha Stream since 2004

The community was characterised by one 'tolerant' taxon [snail (*Potamopyrgus*)] and three 'moderately sensitive' taxa [amphipod (Talitridae) and mayflies (*Austroclima*) and (*Zephlebia* group)] (Table 8).

Discussion and conclusions

In the past, heterotrophic growths such as 'sewage fungus' have occurred in the Inaha Stream downstream of the rendering plant which were most likely the result of the discharges from the plant. However, no 'heterotrophic growths' were recorded at any sites monitored in this survey, which was indicative of reasonably good preceding water quality. The presence of heterotrophic growths on the bed of the Inaha Stream was last recorded in the spring 2009 survey, and this shows an improved management of the wastewater discharge since that time.

Inaha Stream

Slightly higher MCI and SQMCI_S scores were recorded at site 1 compared to site U; however taxa richness was slightly lower at site 1. These results indicate that leaching of nutrients into the Inaha Stream from the north-eastern block of land under irrigation (Figure 1) was unlikely to be affecting the health of the macroinvertebrate communities present in the Inaha Stream at the time of the survey.

MCI scores were similar between sites, with the exception of the score at site U which had a significantly lower score than site 2d and site 4. SQMCI_S scores were also similar between sites, again with the exceptions of site U, which was significantly lower than the score at sites 2d, 3 or 4, and site 3, which was significantly higher than sites U, 1 and 2d. When compared to the previous (October 2017) survey results, MCI scores decreased significantly for site U and increased significantly for site 4, and SQMCI_S scores changed significantly only for site U which decreased between the two surveys. Taxa richnesses were similar to the previous survey for all sites. Both MCI and SQMCI_S scores were significantly lower than median scores for site U and significantly higher than median scores for site 2d and 3. The SQMCI_S score was significantly higher than the median score at sites 3 and 4. All other sites recorded MCI and SQMCI_S scores similar to their respective medians.

In the October 2016 survey the MCI recorded by site U was significantly (Stark, 1998) lower than that recorded at site 1, however no other significant differences between sites were recorded. Taxa richnesses were moderately low at sites 1 and 3 and moderate at the remaining three sites. SQMCI_S scores were similar between sites U, 1 and 2d but substantially lower at sites 3 and 4. This was attributed mainly to a significant increase in one 'tolerant' taxon (oligochaete worms) and a significant decrease of three to four 'sensitive'

taxa. It was postulated that wastewater discharges from Taranaki By-Products that were discharging at the time of the spring survey might have negatively affected the macroinvertebrate communities present in the Inaha Stream at site 3 and 4, as indicated by the SQMCI₅ results for these sites. However, the MCI scores for these sites did not support this, and as such, it was difficult to deduce whether the reduced SQMCI₅ scores at sites 3 and 4 was due to the discharge, or related to habitat variation. It was suggested a discharge may be occurring between sites 2d and 3, and consideration should be given to increasing the monitoring of this reach. The two intervening surveys show no significant differences in MCI and SQMCI₅ scores between sites 2d and 3, and the decrease in scores at site 4 is thought to be mainly habitat related. The current survey was inconclusive, recording a significant decrease in MCI score but a significant increase in SQMCI₅ score between sites 2d and 3. If a return to more 'unhealthy' conditions were to be recorded at sites 3 and 4 then it would again be recommended that consideration be given to increasing the monitoring of this reach.

On examination of all of the Inaha Stream sites, the trends suggests improvements began to appear in 2009 (Figure 10 and Figure 11) but since 2012 large fluctuations in macroinvertebrate indices have occurred. These fluctuations coincide with willow removal in April 2011, which may contribute to increased seasonal variation, via decreasing the amount of shading received by the stream. This in turn causes increased water temperatures and increased periphyton growth, both of which typically peak over the warmer summer months and can alter the macroinvertebrate community assemblage. The best result for this type of survey is that MCI scores and SQMCI₅ scores in the Inaha Stream are not significantly different to each other within each survey. Occasionally differences in habitat between sites can result in different scores, although this can often be explained when the community assemblage is assessed. The SQMCI₅ is more sensitive to changes in habitat, and this is evident in Figure 10. Figure 10 shows SQMCI₅ scores were generally similar between sites.

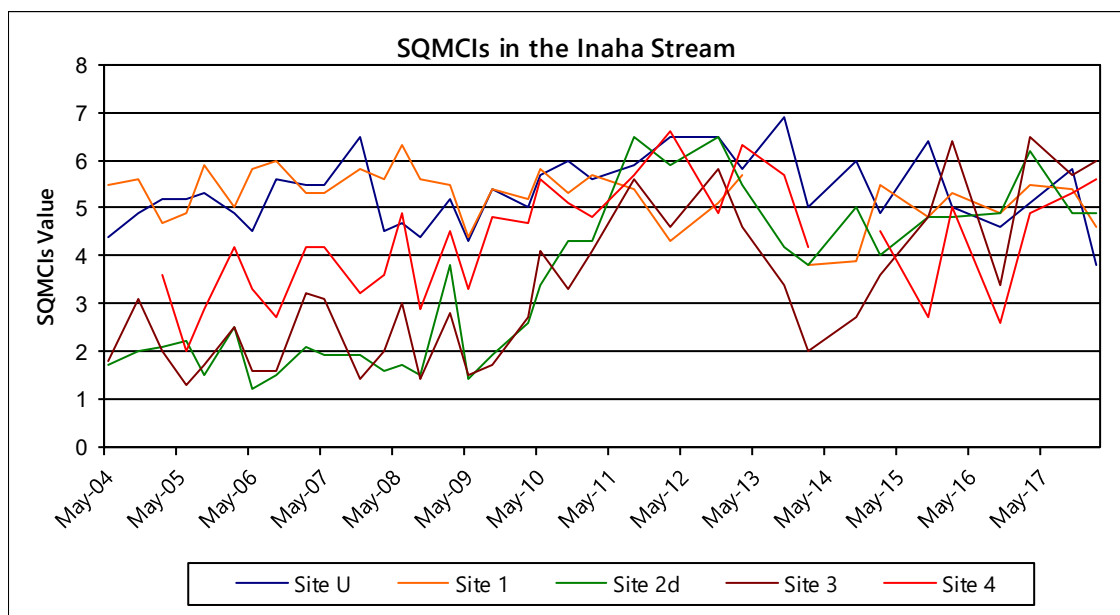


Figure 10 SQMCI₅ values for the Inaha Stream sampled in relation to Taranaki By-Products discharges since May 2004

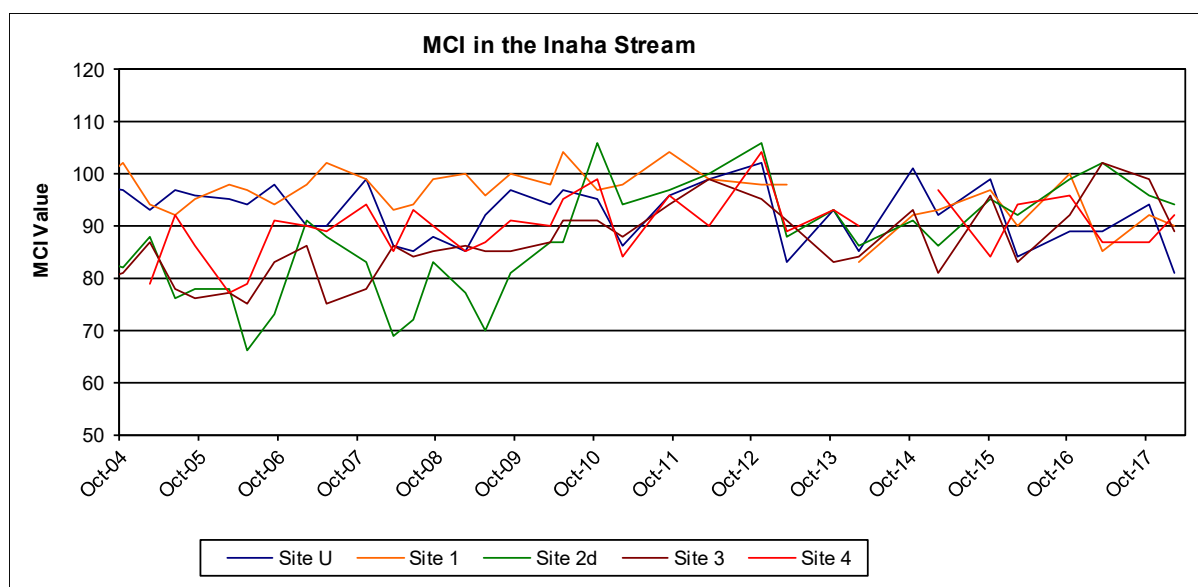


Figure 11 MCI values for the Inaha Stream sampled in relation to Taranaki By-Products discharges since May 2004

Unnamed tributary of the Inaha Stream

The upstream 'control' site UT recorded a similar taxa richness and significantly lower SQMCI₅ score compared with the two downstream sites. The MCI score (83 units) recorded at site UT was a non-significant (Stark, 1998) 9 units higher and a significant (Stark 1998) 17 units lower than sites MT and DT respectively, while the SQMCI₅ score of 1.7 was a significant (Stark 1998) 2.2 and 3.7 units lower than that recorded at sites MT and DT respectively. The MCI score remained similar to the previous survey, which was a significant improvement from the March 2017 survey (which recorded the lowest score at this site to date). In contrast, the SQMCI₅ score at site UT recorded a significant decrease from that recorded in the previous (October 2017) survey, to a score only 0.1 unit higher than recorded in the March 2017 survey, which was again the lowest recorded score for this site to date. This score was substantially lower than those recorded by comparative sites in the Taranaki ringplain (Table 6). Both the current survey and the March 2017 survey were conducted under summer low flow conditions, where a dirty pool of stagnant water was sampled. These poor habitat conditions are most likely the cause of the poor SQMCI₅ scores. Taxa richnesses at all sites were substantially lower than those recorded by comparative sites in the Taranaki ringplain and historic medians for the respective sites (Table 5, Table 6). Site MT also recorded MCI and SQMCI₅ scores significantly lower than comparative sites in the Taranaki ringplain, while site DT recorded scores that were similar to those recorded by comparative sites in the Taranaki ring plain (Table 6).

The MCI scores recorded at sites UT, MT and DT in the unnamed tributary were indicative of 'fair', 'poor' and 'good' macroinvertebrate health respectively. The MCI score recorded at site UT was well below the median value for this site, while the scores at site MT was similar to the median value and site DT was significantly higher than the median value. Community composition varied between sites, with no taxon being abundant at all three sites. The differences in macroinvertebrate community composition between sites reflected differences in the instream habitat, with proportions of roots and/or fine sediment and instream macrophytes varying at all three sites. Poor habitat quality at site UT can explain the low macroinvertebrate indices recorded at this site at the time of the survey. Overall the MCI and SQMCI₅ scores recorded in the unnamed tributary of the Inaha Stream indicated no effect on the macroinvertebrate communities in the unnamed tributary of the Inaha Stream as a result of irrigation to land by Taranaki By-Products.

Summary

The Councils 'kick-sampling' and 'vegetation sweep' techniques (and a combination of the two) were used at eight sites to collect streambed macroinvertebrates from the Inaha Stream and an unnamed tributary, to assess whether discharges (via point source and irrigation to land) from Taranaki By-Products Limited's rendering plant had had any adverse effects on the macroinvertebrate communities of the streams. Samples were processed to provide number of taxa (richness), MCI and SQMCI₅ scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI₅ takes into account taxa abundances as well as sensitivity to pollution. Significant differences in either the MCI or the SQMCI₅ between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

On 27 February 2018, a summer macroinvertebrate survey was performed at five sites in the Inaha Stream and at three sites in an unnamed tributary of the Inaha Stream in relation to discharges by Taranaki By-Products. Taxa richnesses were generally similar to the median values calculated from all previous surveys.

MCI scores showed that macroinvertebrate communities were in 'fair' health in the Inaha Stream. MCI scores were generally similar between sites, with the lowest score recorded at the upstream 'control' site U. This score was significantly lower than sites 2d and 4 only. This difference is likely a reflection of habitat differences between the sites. SQMCI₅ scores recorded at the sites were generally similar, with the exception of site U which recorded a score significantly lower than sites 2d, 3 and 4, and site 3, which recorded a score significantly higher than sites U, 1 and 2d.

In the October 2016 survey it was thought that wastewater discharges from Taranaki By-Products may have negatively affected the macroinvertebrate communities present in the Inaha Stream at site 3 and 4, as indicated by the SQMCI₅ results. However, the MCI scores for these sites did not support this, and as such, it was difficult to conclude whether the reduced SQMCI₅ scores at sites 3 and 4 were due to a discharge or related to habitat variation. It was acknowledged that the results suggested that there may have been a discharge occurring between sites 2d and 3, and it was recommended that consideration be given to increasing the monitoring of this reach. In the two subsequent surveys there were no significant differences in MCI and SQMCI₅ scores between sites 2d and 3, and the decrease in scores at site 4 is thought to be mainly habitat related. The current survey recorded mixed results, with a significant decrease in MCI and a significant increase in MCI between sites 2d and 3. If a return to more 'unhealthy' conditions were to be recorded at sites 3 and 4 then it would again be recommended that consideration be given to increasing the monitoring of this reach.

The unnamed tributary of the Inaha Stream recorded MCI scores that varied substantially between sites. The MCI score was significantly higher at site DT compared to sites UT and MT, while SQMCI₅ scores increased significantly in a downstream direction. Both the MCI and SQMCI₅ scores recorded at site UT were significantly lower than historic medians, and the SQMCI₅ was significantly lower than the preceding survey. This can be explained by the habitat quality at site UT; as was the case in the March 2016 survey (which also recorded poor results at this site) there was no flow and a pool of dirty stagnant water was sampled. MCI and SQMCI₅ scores at sites MT and DT were similar to or higher than medians for the respective sites and the previous survey results. The current survey results indicate no significant negative impact on the macroinvertebrate communities present in the unnamed tributary of the Inaha Stream from irrigation to land by Taranaki By-Products.

No 'heterotrophic growths' were recorded at any sites monitored in this survey, which was indicative of reasonably good preceding water quality. The presence of heterotrophic growths on the bed of the Inaha Stream was last recorded in the spring 2009 survey, and this shows improved management of the wastewater discharge since that time.

Overall, there was no evidence that discharges from Taranaki By-Products have impacted on the freshwater macroinvertebrate communities present in the Inaha Stream.

References

- Blakemore KS, 2018: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okiawa, October 2017. TRC report KB032.
- Colgan, B, 2003: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, June 2003. TRC report BC012.
- Dunning KJ, 2001: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2001. TRC report KD78.
- Dunning KJ, 2002a: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2002. TRC report KD108.
- Dunning KJ, 2002b: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, April 2002. TRC report KD109.
- Dunning KJ, 2002c: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2002. TRC report KD132.
- Fowles CR and Colgan BG, 2004: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, May 2004. TRC report CF339.
- Fowles CR and Colgan BG, 2005: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, October 2004. TRC report CF352.
- Fowles CR and Jansma B, 2008a: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, November 2007. TRC report CF468.
- Fowles CR and Jansma B, 2008b: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, March 2008. TRC report CF469.
- Fowles CR and Jansma B, 2008c: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, June 2008. TRC report CF470.
- Fowles CR and Jansma B, 2008: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, September 2008. TRC report CF471.
- Fowles CR and Moore SC, 2004: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2004. TRC report CF327.
- Fowles CR and Stark JD, 2004: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant using artificial substrates January to March 2003. TRC report.
- Hickey CW and Vickers ML, 1994: Toxicity of ammonia to nine native New Zealand freshwater invertebrate species. *Archives of Environmental Contamination and Toxicology* 26: 292-298.
- Hope KJ, 2005: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, June 2005. TRC report KH043.
- Hope KJ, 2007: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2006. TRC report KH087.
- Hope KJ, 2007: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, May 2006. TRC report KH088.

- Jansma B, 2008: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, September 2006. TRC report BJ033.
- Jansma B, 2008: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2007. TRC report BJ034.
- Jansma B, 2009: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2009. TRC report BJ086.
- Jansma B, 2009: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, May 2009. TRC report BJ087.
- Jansma B, 2010: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, September 2009. TRC report BJ094.
- Jansma B, 2010: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2010. TRC report BJ095.
- Jansma B, 2010: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, May 2010. TRC report BJ096.
- Jansma B, 2012 (a): Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2010. TRC report BJ168.
- Jansma B, 2012(b): Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, February 2011. TRC report BJ169.
- Jansma B, 2012(c): Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, September 2011. TRC report BJ170.
- Jansma B and Smith K, 2013. Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, November 2012. TRC report BJ211.
- Jansma B, 2013. Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2013. TRC report BJ212.
- McWilliam H, 2001a: Biomonitoring of the Inaha Stream above and below the Taranaki By- Products plant, September 2000. TRC report HM234.
- McWilliam H, 2001b: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2001. TRC report HM247.
- McWilliam H, 2001c: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, May 2001. TRC report HM248.
- Moore S, 2003: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, March 2003. TRC report SM577.
- Moore S, 2003: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, August 2003. TRC report SM588.
- Smith K, 2012: Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2012. TRC report KS008.
- Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. *Water and Soil* Miscellaneous Publication No. 87.
- Stark JD, 1998: SQMCI: a biotic index for freshwater macroinvertebrate coded abundance data. *New Zealand Journal of Marine and Freshwater Research* 32(1): 55-66.

- Stark JD, 1999: An evaluation of TRC's SQMCI biomonitoring index. Cawthron Institute, Nelson. Cawthron Report No. 472.
- Stark JD, Boothroyd IKG, Harding JS, Maxted JR, Scarsbrook MR, 2001: Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for the Ministry for the Environment. Sustainable Management Fund Project No. 5103. 57p.
- Stark JD and Fowles CR, 2009: Relationships between MCI, site altitude, and distance from source for Taranaki ring plain stream. Prepared for Taranaki Regional Council. Stark Environmental Report No. 2009-01. 47p.
- Stark JD and Maxted JR, 2004. Macroinvertebrate community indices for Auckland's soft-bottomed streams and applications to SOE reporting. Prepared for Auckland Regional Council. Cawthron Report No. 970. Cawthron Institute, Nelson. ARC Technical Publication 303. 59p.
- Stark JD and Maxted JR, 2007. A biotic index for New Zealand's soft bottomed streams. New Zealand Journal of Marine and Freshwater Research 41(1).
- Stark JD and Maxted JR, 2007a. A user guide for the macroinvertebrate community index. Cawthron Institute, Nelson. Cawthron Report No. 1166.
- Sutherland DL and Thomas B, 2015: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2015. TRC report DS024.
- Sutherland DL, 2015: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, February 2015. TRC report DS025.
- Thomas B, 2013: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2013. TRC report BT010.
- Thomas B, 2014: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, February 2014. TRC report BT042.
- Thomas B, 2016: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2015. TRC report BT049.
- Thomas B, 2016: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, February 2016. TRC report BT060.
- Thomas B, 2016: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, October 2016. TRC report BT064.
- Thomas B, 2017: Biomonitoring of the Inaha Stream above and below the Taranaki By-Products plant, Okaiawa, March 2017. TRC report BT077.
- TRC, 2015: Some statistics from the Taranaki Regional Council database (Esam) of freshwater macroinvertebrate surveys performed during the period from January 1980 to 30 September 2017. Technical Report 2014-105.
- Winterbourn MJ, Gregson KLD, Dolphin CH, 2006. Guide to the aquatic insects of New Zealand. [4th edition]. Bulletin of the Entomological Society of New Zealand 14, 108p.

Appendix III

Air audit report 2017

2 July 2013

Project No. 1378104138_002_LR_Rev0

Bevan Chapman
Taranaki By-Products Limited
PO Box 172
Hawera 4640

SITE VISIT REPORT - CONSENT 4058-4 CERTIFICATION

Dear Bevan,

This letter¹ provides the results of the audit by Golder Associates (NZ) Limited (Golder) of 'engineering practice' with respect to the odour control systems that are operated at the Taranaki By-Products Limited (TBL) and Taranaki Bio-Extracts Limited (TBE) sites, Kohiti Road, Okaiawa. The audit investigations were completed during 11 and 12 April 2013 by Golder. The requirement for this audit is specified within special condition 6 of Resource Consent 4058-4. This consent was issued by the Taranaki Regional Council on 11 October 2011.

This letter report contains the following sections:

- Confirmation of scope of services.
- Audit approach.
- Summary of site processes.
- Description of odour control systems.
- Description of physical condition of equipment.
- Instrumentation review.
- Design aspects.
- Management aspects.
- Summary of audit measurement results.
- Conclusion & recommendations.

¹ This report is provided subject to the limitations attached this letter.



Confirmation of Scope of Services

Special Condition 6 of consent 4058-4 defines the scope of work required and states that:

“By the 30 April 2013, and every two years thereafter, the consent holder shall provide certification by a suitably qualified independent person that the works, processes and equipment relevant to all discharges to air from the site are operational in accordance with good engineering practice.”

Please note, Golder considers that an assessment of operational control systems at the site is outside of the scope of a review of 'good engineering practice'.

Audit Approach

The site audit was undertaken by Roger Cudmore (Principal, Golder Associates (NZ) Limited). He has the qualification of *B.Eng(Hons) Chemical & Process* and has over 15 years of experience designing, reviewing and overseeing the installation and operation of air extraction and biofilter treatment systems within numerous rendering plants throughout New Zealand.

Having reviewed the previous engineering practice audit (also undertaken by Golder) completed in 2010, it was decided that this audit should focus upon the similar aspects that contribute to the status of existing "engineering practice". However, a greater focus has been given to the design and monitoring of the odour control systems at the TBE and TBL sites. Therefore, this audit addresses the following aspects of good engineering practice with respect to the odour control systems that are operated by TBE and TBL:

- **Physical condition of equipment:** The state of odour control components, including consideration of materials used for construction.
- **Instrumentation review:** The accuracy of selected instrumentation and the adequacy of instrument for monitoring the odour control system.
- **Design aspects:** The current engineering design with respect to the air extraction, air cooling and biofilter systems.
- **Management aspects:** The procedures specified within site management plans (such as the Air Discharge Management Plan and Risk Management Plan) that help ensure that odour control equipment is maintained and operates reliably.

As part of the audit process, a number of measurements of pressure, temperature and air flows within odour extraction ducts were made using a calibrated pitot tube and differential pressure meter. The results of measurements are summarised before the final conclusion and recommendations section.

A summary of site processes and the odour control system is provided below to help provide context for the subsequent sections of this letter. This is followed by our findings with respect to the various aspects of engineering practice listed above.

Site Processes

The rendering processes operated by TBL and TBE are described by Golder (2010) "*Evaluation of the Air Discharge Control Operations, Golder Document No. 1078104236*". These processes are the same as those currently operated. However the chicken rendering line is currently being up-graded and will include a new continuous cooking, and decanter system ahead of the existing meal dryer and meal processing system.

Following the up-grade, TBL will operate the following:

- Bovine by-products rendering line including pre-breaker (for fallen stock), hogger, surge bin, pre-cooker, press, decanter (and separators), three indirect steam dryers and new meal processing plant.

- Blood processing line including a steam coagulator, decanter and indirect steam dryer and tallow recovery plant.
- New poultry rendering line that will include cooking, decanting, and indirect steam drying.
- Pressurised feather hydrolyser, indirect steam drying and milling line.

TBE continues to operate the edible (food grade) tallow and gelatine bone chip recovery plant. Edible by-products processes include grinding, melting, tallow refining, solids screening and direct gas-fired drying.

Odour Control System

The odour extraction, cooling system and biofilters comprise the main components of the odour control systems that are operated by TBL and TBE. These are described by Golder (2010) and summarised below.

Extraction Systems

The main extraction systems (with dedicated fans) are comprised of two concentrated sources extraction systems (*TBL conc. sources* and *TBE conc. sources*) that respectively target emissions directly from process equipment operated by TBL and TBE. The TBL plant also has two independent building air extraction systems (Factory Air 1 and 2) that extract building air from the TBL plant (including the fallen stock pre-breaker bin).

The concentrated sources air streams from TBL and TBE both include inputs from dryer exhaust streams.

Cooling Systems

The TBL dryer exhaust streams associated with the bovine line are pre-cooled via a 'waste-heat evaporation' (WHE) plant that uses the dryer exhaust heat to evaporate and concentrate wastewater streams that are recycled. These partially cooled dryer exhaust streams (ex the WHE system), are mixed with other concentrated source streams from TBL. The mixed stream is further cooled through a two stage water scrubbing system before it is discharged to a biofilter.

The TBE dryer exhaust and other associated concentrated sources are all pre-cooled within the same single-stage water scrubber tower before discharging to a biofilter.

The Factory Air 1 and 2 airflows extract building air from TBL and discharge to a biofilter.

Biofilter Systems

There are three biofilter systems including the two factory air biofilters (1 & 2) and a concentrated sources biofilter that has two beds. These biofilters and associated sources are configured as follows:

The Factory Air #1: This biofilter consists of a 1.5 m deep bark bed with three areas each of 30 m x 40 m (5,400 m³ media in total). This bed was treating the combined TBL conc. sources and Factory Air #1 flows during the audit. This infers a biofilter bed loading rate of inlet air at 14 m³_{air}/hr/m³_{media}. This is below our recommended maximum guideline value of 20 m³_{air}/hr/m³_{media} for bark-bed biofilters used to treat warm and moist process air streams, and is therefore acceptable. As discussed later, TBL plan to use this bed to treat the Factory Air 1 flow.

It is proposed to expand this biofilter by another cell of 30 m x 40 m and 1.5 m deep. This would be dedicated to the TBL conc. sources flow and therefore further reducing the loading on Factory Air #1.

The Factory Air #2: This biofilter consists of a 1.5 m deep bark bed with a total area of 30 m x 25 m (1,125 m³ media in total). This bed was treating the Factory Air #2 flows during the audit – note this flow was found to heat up from 30°C to 43°C as it passed through the main fan, which is considered to result from the high backpressure this fan works against (discussed later). The measured combined flow was approximately 7 m³/s, which equates to a media air loading rate of 22 m³_{air}/hr/m³_{media}. This loading rate is well within an acceptable range given it relates to the treatment of building air alone.

Concentrated Sources: This biofilter consists of two 0.7 m deep bark beds, each with a total area of 20 m x 25 m (700 m³ media in total). This bed was only treating the TBE concentrated air flow, which is now the normal mode of operation – previously this dual bed also treated the concentrated source flow from TBL. The measured flow into the concentrated sources biofilter from the TBE plant was approximately 4 m³/s, which equates to a media air loading rate of 21 m³_{air}/hr/m³_{media}. For air that is cooled down to 40°C, or lower, this is an acceptable biofilter bed loading rate.

Physical Condition of the Odour Control System

All process equipment, extraction ducts, cooling equipment, fans and biofilters were found to be in a sound physical and functioning state. The TBE plant is much newer and in better condition than the older TBL plant. However, the latter plant processes inedible material that is inherently harsher on process equipment. This plant was undergoing the installation of new meal and chicken processing equipment during the audit. Components of the system are discussed as follows.

Extraction ducts

The extraction stainless steel ducts within the TBL plant are relatively old, but still appear in good engineering condition and showing no significant corrosion effects. By comparison the TBE stainless steel extraction ducts are in a relatively new and very good condition.

Fans

Fans that are operated to extract concentrated sources from TBE and TBL, as well as large factory air fans used by the TBL plant were all operating during the audit and appeared to be well maintained. They exhibited no excessive vibration, bearing noise or any significant leakages around fan seals, and therefore appear to be operating without any malfunction.

Cooling Equipment

All air stream cooling systems at TBE and TBL (i.e., scrubbers, WHEs, heat-exchangers) were in good physical condition and appear well maintained. They also exhibited no leaks or malfunctions but were not able to cool the concentrated sources discharge to 40°C, or less. The reason for this is likely to be the overloading of these simple type of water scrubbing towers with excessive steam vapour energy.

Biofilters

The initiatives at the site to up-grade the factory air biofilters and improving the physical condition of these systems is considered to be good engineering practice. These initiatives include the replacement of corrugated iron manifolds within the large 3,600 m² factory air # 1 biofilter with concrete pipes.

Factory air #2 biofilter currently uses corrugated iron manifolds, which will also need replacement in time due to corrosion.

Instrument Review

The instrument review consisted of checking temperature gauges within the process air extraction system, which was also undertaken by Golder (2010). The review is then followed by our recommendations of additional instrumentation for the odour extraction and treatment systems.

Temperature gauges were checked with a digital hand-held thermometer (Fluke 50D) as previously used by Golder (2010) and again existing gauges were within 1°C to 2°C of the Fluke meter. Duct pressures were measured using a Nata certified digital manometer (DPM), however, no gauges were checked on the odour extraction system as there are few present, or else readily accessible. Installation of vacuum gauges on the odour extraction system is discussed and recommended below. The Fluke meter's temperature span was assessed by Golder to have an absolute accuracy within ± 1 °C for 0 °C and 100 °C. This accuracy was checked using ice and boiling water.

Supervisory control and data acquisition (SCADA) systems are used within the TBE and TBL plants to monitor temperatures within process equipment and automatically control steam flows to achieve desired operational temperature set-points. This allows operators to monitor and control rendering, drying and milling processes. However, there is only a basic level of on-line monitoring of temperature and pressure within strategic points of the air extraction, cooling and biofilter systems at either of the TBE or TBL sites. Recommendations regarding on-line monitoring within parts of the odour control system are provided below along with the instrumentation recommendations. Specifically, we recommend temperatures and vacuum/pressures are measured at locations as follows:

- Install industrial grade pressure/vacuum gauges near the terminus of each main air extraction duct, including concentrated sources and factory air ducts. These gauges should be situated approximately one metre back from the final opening of the factory air ducts (including the pre-breaker hood) and a similar distance for the vacuum gauge installed within concentrated source duct where they connect to first process plant item.
- Install industrial grade pressure/vacuum gauges at the inlet and discharge side of all concentrated source and factory air fans.
- Install robust water manometer or industrial grade pressure gauges on each biofilter inlet pipe within close proximity to the biofilter bed.
- Install industrial grade temperature gauges on the inlet of the biofilters that treat concentrated source air from TBE and TBL.
- Within each biofilter bed, install at least one combination of two pressure gauges, or water tube manometers, such that one is connected to the air manifold system and the other is lodged within the nearby stone layer that supports the inlet air manifold system. The inlet pressure gauge listed in the previous recommendation can also be utilised for measuring the inlet air manifold pressure. This combination of measurements provides a comparison of the distribution system air back pressure versus the media air back-pressure.
- For the large Factory Air #1 biofilter, we recommend the above distribution versus media pressure monitoring arrangement is also installed near the inlet to the large Factory Air # 1 biofilter and at opposite end of the main inlet manifold, where it terminates outside of the large bed.
- Install industrial grade temperature gauges on the inlets and outlets of the water scrubbers that cool the concentrated source air flows. Also install temperature gauges on the inlet cooling water supply and discharge line.
- For overhead air extraction manifolds that are difficult to access, run steel tubing down walls to mounted gauges that can be readily accessed and viewed from floor level.
- The above instrumentation provides the ability to monitor temperature and pressure drop trends across extraction ducts, cooling equipment, fans and the biofilters. This information provides a good indication of the gradual decay in fan performance that can occur due to duct blockages, biofilter media compaction, fan blade corrosion, or for any other reason.

Design Aspects

The key design features of the odour control system's extraction ducts, air cooling and odour treatment have been set in place for a number of years and have been driven by requirements of resource consent conditions. These aspects are discussed below.

Odour extraction system

The TBL odour extraction system relies heavily upon the two building air ducts and associated fans (Factory Air # 1 and # 2). The concentrated sources extraction system targets point sources of process odour before they escape into the rendering process building. However, at TBL the building air extraction system is relied upon to a large degree to ensure minor odour effects off-site.

The TBE plant has a concentrated sources system for containing process odours, but does not have a building air extraction system. This is partly because the material processed at TBE is inherently less odorous than at TBL, but also because the TBE concentrated sources system is significantly more effective at containing process odours compared to the equivalent system operated at TBL. The design of the odour system at TBE represents good design practice, as its concentrated sources system is the sole engineered system that is installed to limit the potential for off-site odours.

The combined building air and concentrated source extraction systems at TBL have been prescribed and designed in accordance with past consent conditions. The goal of this system is to contain all building air and treat this through a biofilter. Previously, this approach has been considered good engineering practice. However, nowadays most rendering plants in New Zealand have moved towards greater reliance (and typically total reliance) upon the operation of a more effective concentrated source odour extraction system. These systems rely less, or not at all, upon the extraction and treatment of large volumes of building air.

Having reviewed the TBL odour extraction systems it is concluded that there is significant potential to further improve the containment of rendering odours at the site. This potential can be realised by upgrading the concentrated source system and further increasing its efficiency while significantly reducing reliance upon the large building air extraction systems. This is not to say that the existing system design is not good engineering practice (it is an alternative design approach), but a move towards a more self-contained point-source extraction and cooling system would move the TBL odour control system closer to best design practice. Furthermore, our review of the TBL concentrated sources extraction and cooling system has concluded that this system would benefit from a detailed design review and possible upgrading so it becomes far more efficient and effective at containing odours. This conclusion is based on the following:

- There appeared to be significant leakage of process odours from the ovine rendering equipment and down-stream meal dryers, therefore requiring the factory air extraction system to contain process odours. However, the buildings are considered by Golder to be too large for this to always be effective.
- The blood room decanter and conveyor related process emissions are not directly targeted by the concentrated source system in TBL and so extraction of building air via the end point of the Factor Air #2 system is relied upon. The odour and heat levels in this room are high and likely to be resulting in fugitive odours escaping the odour control system.
- The new ovine meal processing plant discharges humid air (that will be odorous) from a new meal transfer cyclone. This discharge could possibly be filtered and connected to the concentrated sources system rather than discharging directly into the rendering building, which then relies on the building air system to contain this odour source.
- The TBL concentrated source ducting is complex and requires vacuums throughout multiple branches to create an induced draft from a single location downstream where all flows have combined. A review of this layout and potential use of auxiliary fans may result in a more effective and controllable system.
- Several uncontrolled odour sources including wastewater sump, screen and WHE condensate tank are external to the rendering building – a design review of the concentrated source system at TBL should consider some, or all of these sources for inclusion into the concentrated source system. The condensate streams are especially odorous.
- The operation of two large building-air-extraction systems can be expected to drag significant quantities of meal dust into the main factory air ducts and the biofilters they supply. Residue on the ground that results from cleaning out the main factory air ducts confirms this is likely to be occurring and itself is creating a localised odour source. The very high back pressure of Factory Air #2 biofilter might also be explained by high levels of meal dust having built up within the bed.

Irrespective of the layout issues identified with the TBL concentrated sources system, the current plan to dedicate a single biofilter for the receipt and treatment of TBL concentrated sources would represent good engineering practice when implemented. Previously this stream has been directed to the concentrated source biofilter, which was also connected to the TBE concentrated sources discharge fan.

A review of the TBL concentrated source ducting and possible use of additional booster fans to enhance extraction efficiency is recommended. The ultimate goal would be to ensure that the TBL building extraction

system is not heavily relied upon for containing odours from the TBL rendering building. But another aim would be to ensure isolation of meal processing areas away from building air extraction systems and avoid significant meal dust loading of the biofilters and their respective air supply ducts. A lower electricity cost would also be a distinct outcome that a redesigned system could achieve.

Cooling Systems

The data summarised in Table 3 indicates the degree of cooling imparted on the concentrated sources from TBE and TBL was not sufficient. It is good engineering practice to achieve an inlet biofilter temperature of 40°C or lower for most of the time (a target of 99 % of time is recommended). The media temperature of the concentrated sources biofilter is currently too high at around 50°C. This could be replicated in the new biofilter bed that is proposed for treatment of TBL concentrated source air. During the audit, this air stream was found to be exiting the scrubber/cooling plant at around 50°C.

The restriction in the capacity for cooling TBL concentrated sources limits the potential to review the ducting system and therefore the effectiveness of the extraction system itself, as the latter invariably leads to a greater heat load to be managed by the cooling system. Consequently, a review of the pre-biofilter air cooling systems (i.e., water scrubbers) at TBL is considered an important component of any review of the concentration sources system design.

It was identified that the water tower scrubbers at TBL receive hot dryer exhaust air from the chicken and blood dryers, but also some hot exhaust streams from the WHE system that discharge directly into the water scrubbers. It is good engineering practice to cool these types of hot vapour laden air streams (exhibiting high levels of latent heat) within water cooled shell & tube, or plate type heat exchanges. These hot air flows are cooled less efficiently in water-spray tower type systems. The discharge of these hot flows into the water scrubbers (including chicken and blood dryer exhausts) is likely to explain the relatively high temperatures of the air streams exiting these scrubbers. Furthermore, the air flow temperatures post these scrubbers are too high for effective treatment by bark or soil-bark biofilter over the longer term. In the case of TBL, the high concentrated source stream temperature is currently mitigated by the mixing with the large factory air #1 stream.

Biofilters

There are plans to alter the connection of air streams to various biofilters at the site. Specifically the two large factory air flows, Factory Air #1 and Factory Air #2, will be respectively dedicated to their own biofilter beds, Factory Air #1 and Factory Air #2. On occasions the Factory Air #1 biofilter bed would also receive TBL concentrated sources flow, when the latter's biofilter requires maintenance.

Reconfiguration of biofilters and dedication of a bed to each TBL and TBE concentrated source system is consistent with good engineering practice. Given these proposed changes the subsequent air loading rates to the various biofilters are likely to change. These changes are accounted for in the following discussion on the biofilter design aspects.

Factory Air #1: This biofilter will soon receive only Factory Air #1 alone. During this audit the former flow was measured at 75,600 m³/hr. It is expected that the Factory Air #1 may reduce from this value when TBL conc. source flow is removed. However assuming this flow, then a bed air loading rate of approximately 15 m³_{air}/hr/m³_{media} would result. This is an acceptable loading rate and indicates there is some spare capacity (up to 50%).

TBL Concentrated Sources (Factory Air #1 extension): It is proposed to install a fourth cell to the Factory Air #1 biofilter (i.e. adding a 40 m x 30 m x 1.5 m deep bark bed) and dedicating this to the TBL concentrated sources stream. This bed would allow approximately 30,000 m³/hr to 36,000 m³/hr of pre-cooled concentrated sources air to be treated from TBL. This should provide for effective containment of odour emissions from these sources – these are likely to be the most significant sources of rendering odour at the site. An air flow of 30,000 m³/hr to 36,000 m³/hr equates to a media air loading rate of warm moist air in the order of 15 to 20 m³_{air}/hr/m³_{media}. This should allow for effective odour treatment, however the current air stream temperature of 50°C is too high and needs reducing to 40°C, or less during normal operation.

Factory Air #2: The Factory Air #2 biofilter will continue to treat Factory Air #2 air stream, which was measured at only 25,000 m³/hr during the audit. This would result in a media air loading rate of

22 m³_{air}/hr/m³_{media}. This is an acceptable air loading rate and indicates there is some spare capacity (up to 35%).

The high backpressure within the inlet duct that supplies building air to the Factory Air #2 biofilter (i.e., 3.3 kPa) indicates the base of this bed and/or the distribution system could be partially blocked. Operating at such a high pressure is not good engineering practice for biofilter operation. The situation may well be alleviated with the proposed biofilter configuration changes. This aside, an inspection of the air distribution system is recommended.

Concentrated Sources: This biofilter was treating the TBE concentrated sources during the audit and this is proposed to continue for the foreseeable future (we recommend that this bed can be renamed as TBE concentrated sources). The media loading rate of warm air at 21 m³_{air}/hr/m³_{media} was established from flow measurements (see data summary section). As with the TBL concentrated sources, the current inlet air temperature of around 50°C is too high and needs reducing to 40°C, or less during normal operation.

Management Aspects

Our site observations indicate this equipment to be well maintained and operating normally. However, it is useful to assess the management systems that support the on-going maintenance and operation of equipment and instrumentation. The site maintains formally documented management systems for the control of site processes, which were reviewed. These included the following site process documents:

- Process control and description.
- Calibration of measuring device schedule.
- Site repairs and maintenance programme.
- System auditing.

Process Control and Description: The process control description document provides instructions to plant operators on the management and monitoring of process stages including raw material receipt through to the meal room procedures. The document provides instructions with respect to the following:

- 1) Key operating steps for the operator to implement.
- 2) Key actions/steps to implement.
- 3) Key monitoring targets/set-points and methods for recording.

These generic instructions are provided for all process stages and associated plant and for each raw material type. Therefore, key items such as pre-cookers, feather hydrolyser, meal dryers and the waste heat evaporators as well as other plant have specific instructions.

The process control description document (SP120) appears to provide a comprehensive list of operator instructions for all process stages within the rendering plant and including the waste heat evaporators.

Following our review of this, it is recommended that the blood decanter has more specific instructions for the plant operator. These are currently included under section 5 (d) and combined with blood coagulator instructions. It is also recommended that operating set-point vacuums for the waste heat evaporators are also specified along with key process operating temperatures.

Calibration of Measuring Device Schedule: The calibration of measuring devices document details standard procedures for calibration, monitoring and verification of measuring devices, as well as procedures for taking corrective actions and associated record keeping. This system should be effective at ensuring accurate monitoring of key process parameters.

Golder recommends that including a list of temperature and vacuum gauges that this system applies to would be a useful addition to the existing document (SP090). This should extend to measuring devices associated with the odour extraction, cooling and biofilter systems.

Site Repairs and Maintenance Programme: The repairs and maintenance programme is the key management system for ensuring the reliable operation of the site odour control systems. The system documents hazards and risks associated with product quality and goes on to list control measures, procedures for fixing defects. It also details monitoring, verification and reporting procedures. This is a comprehensive system and our only recommendation is that the scope of hazards and risks be expanded to include *offsite odour effects*. This would provide a more formal documented link between the R&M programme and engineering components of the odour control system.

Auditing of Management Systems: The management systems at the site, including those discussed above, are themselves subject to an internal audit procedure (SP190). Reviews of different management systems are scheduled throughout the year and undertaken by the Plant Manager on an annual basis. The aim of the audit is to up-date the systems and to check upon their effectiveness. Additionally, other site managers (plant engineering, environmental and operations) are required to undertake weekly reality checks (i.e., effectiveness reviews) of checklists that relate to their responsibilities.

The monitoring of the internal auditing is also undertaken by the plant manager and has the responsibility for ensuring corrective actions are implemented and records are maintained. Monitoring via an external audit by NZFSA is undertaken at a frequency determined by performance history.

We consider that the internal auditing system represents good practice. However, we recommend the trigger for a NZFSA audit is less open ended. For example any breaches of consent, or other performance criteria could be specified as triggers that may require a NZFSA audit, should one not have been completed within a nominated time period.

Summary of Data

This section summarises measured temperatures, pressures, relative humidity and flow rates obtained from this audit and those recorded by Golder (2010). This includes the extraction manifold (Table 1) and the biofilters (Table 2 and Table 4) and various air streams (Table 3).

Table 1: Extraction manifold parameters.

Source	Pressure (Pa)	Temperature (°C)	Relative [#] humidity (%)
Inedible concentrated sources (TBP)	-1,350 (-1,450)	60	100
Edible concentrated sources (TBE)	NR	49	100
Factory building air 1	-800 (-860)	41	NR
Factory building air 2	-1,100	30	NR

Notes: NR = not recorded; # Estimated during flow measurements.

Table 2: Biofilter Inlet air flows.

Biofilter	Source(s)	Flow rate (m ³ /hr) measured in 2013 and 2010
Concentrated Sources	TBE edible concentrated Sources	14,500 (13,000)
Factory Air 1	Inedible concentrated sources + Factory building air 1	75,600 (69,000)
Factory Air 2	Factory building air 2	25,000 (24,000)

Table 3: Air stream temperatures.

Location	Temperature (°C)	
	2013	2010
TBP concentrated sources – suction side of the 1st scrubber	58	51.5
TBP concentrated sources – suction side of the 2nd scrubber	58.7	60.1
TBP concentrated sources – immediately downstream of blower	50.7	42.6
Factory Air 1 – immediately upstream of the blower	33.4	33.3
TBP concentrated sources – midway between blower and biofilter	40.7*	55.8
TBE concentrated sources – midway between blower and biofilter	48.8	54.4
Factory Air 1 – midway between blower and biofilter	40.7*	35.4
Factory Air 2 – immediately upstream of the blower	43.0+	24.0
Concentrated sources biofilter – bed 1 (200 mm deep)	50.4, 49.9	52.3
Concentrated sources biofilter – bed 2 (200 mm deep)	49.5, 49.3	48.0
Factory Air 1 Biofilter – biofilter media (200 mm deep)	32.8, 33.2, 33.8	33.9, 29.7
Factory Air 2 Biofilter – biofilter media (200 mm deep)	31.1, 28	26.4, 28.0

Notes: * flow includes TBL concentrated sources and factory air no. 1 flow.

+ temperature downstream of fan at 30 °C, so large increase of 13 °C across fan.

Table 4: Biofilter back-pressures.

Biofilter	Manifold	Biofilter Media	
	Pressure (Pa)	Pressure (Pa)	Average Temperature (°C)
Concentrated Sources (TBE)	250 (110)	NR	50
Factory Air 1	2,300 (2,733)	NR	33
Factory Air 2	3,330	NR*	30

Notes: * has flow extracted from the bed and into Factory Air 1 Biofilter.

Conclusions & Recommendation

Following our audit of the TBL and TBE odour control system, it is concluded that the associated equipment, including ducts, fans, cooling system and biofilters, appear to be maintained and operated in a sound engineering state. There are also initiatives underway at the site that should achieve improvements to current engineering practice. These include the reconfiguration of biofilters, so that concentrated sources from each site have a dedicated biofilter and extraction system.

To ensure the TBE and TBL odour control systems represent good engineering practice following the planned biofilter reconfigurations, it is concluded that the existing cooling systems are likely to require some upgrading, or modification to ensure that inlet airstreams to the biofilters are normally 40°C or lower.

It is concluded that an increased level of manual temperature and pressure gauge monitoring is justified on various positions along the extraction, cooling and biofilter system. This would improve monitoring of important temperature and pressure trends and the ability to ensure operation of the system in accordance with good engineering practice.

The site has comprehensively documented management systems for ensuring reliable operation of process equipment and achieving processing goals. An expansion the documentation to make more specific

reference to odour control system components (such as fans, ducts, cooling systems and the biofilters) is recommended.

Finally it is recommended that the design philosophy of the TBL odour control system is reviewed with a view to place it more in line with current good design practice, as is evident with the TBE odour control system. Specifically, that entails a review of and improvement to the concentrated source system extraction system efficiency such that it is the primary means of containing rendering plant odours. This would also entail changes to help reduce meal dust loading to the odour control system and subsequent problems this causes.

Please contact the undersigned if you have any queries regarding this report.

Yours sincerely

GOLDER ASSOCIATES (NZ) LIMITED



Roger Cudmore
Principal

RC/RLC/dj



Richard Chilton
Senior Air Quality Scientist

Attachments: Report Limitations

i:\projects-numbered\13781x\4xxx\1378104_138_tbp_consent\4058-4certification\letters (correspondence)\1378104138_002_lr_rev0\1378104138_002_lr_reve site report.docx

Report Limitations

This Report/Document has been provided by Golder Associates (NZ) Ltd (“Golder”) subject to the following limitations:

- i) This Report/Document has been prepared for the particular purpose outlined in Golder’s proposal and no responsibility is accepted for the use of this Report/Document, in whole or in part, in other contexts or for any other purpose.
- ii) The scope and the period of Golder’s Services are as described in Golder’s proposal, and are subject to restrictions and limitations. Golder did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Report/Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Golder in regards to it.
- iii) Conditions may exist which were undetectable given the limited nature of the enquiry Golder was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Report/Document. Accordingly, if information in addition to that contained in this report is sought, additional studies and actions may be required.
- iv) The passage of time affects the information and assessment provided in this Report/Document. Golder’s opinions are based upon information that existed at the time of the production of the Report/Document. The Services provided allowed Golder to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.
- v) Any assessments, designs and advice made in this Report/Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Report/Document.
- vi) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Golder for incomplete or inaccurate data supplied by others.
- vii) The Client acknowledges that Golder may have retained subconsultants affiliated with Golder to provide Services for the benefit of Golder. Golder will be fully responsible to the Client for the Services and work done by all of its subconsultants and subcontractors. The Client agrees that it will only assert claims against and seek to recover losses, damages or other liabilities from Golder and not Golder’s affiliated companies. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any legal recourse, and waives any expense, loss, claim, demand, or cause of action, against Golder’s affiliated companies, and their employees, officers and directors.
- viii) This Report/Document is provided for sole use by the Client and is confidential to it. No responsibility whatsoever for the contents of this Report/Document will be accepted to any person other than the Client. Any use which a third party makes of this Report/Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Report/Document.

Appendix IV

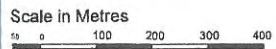
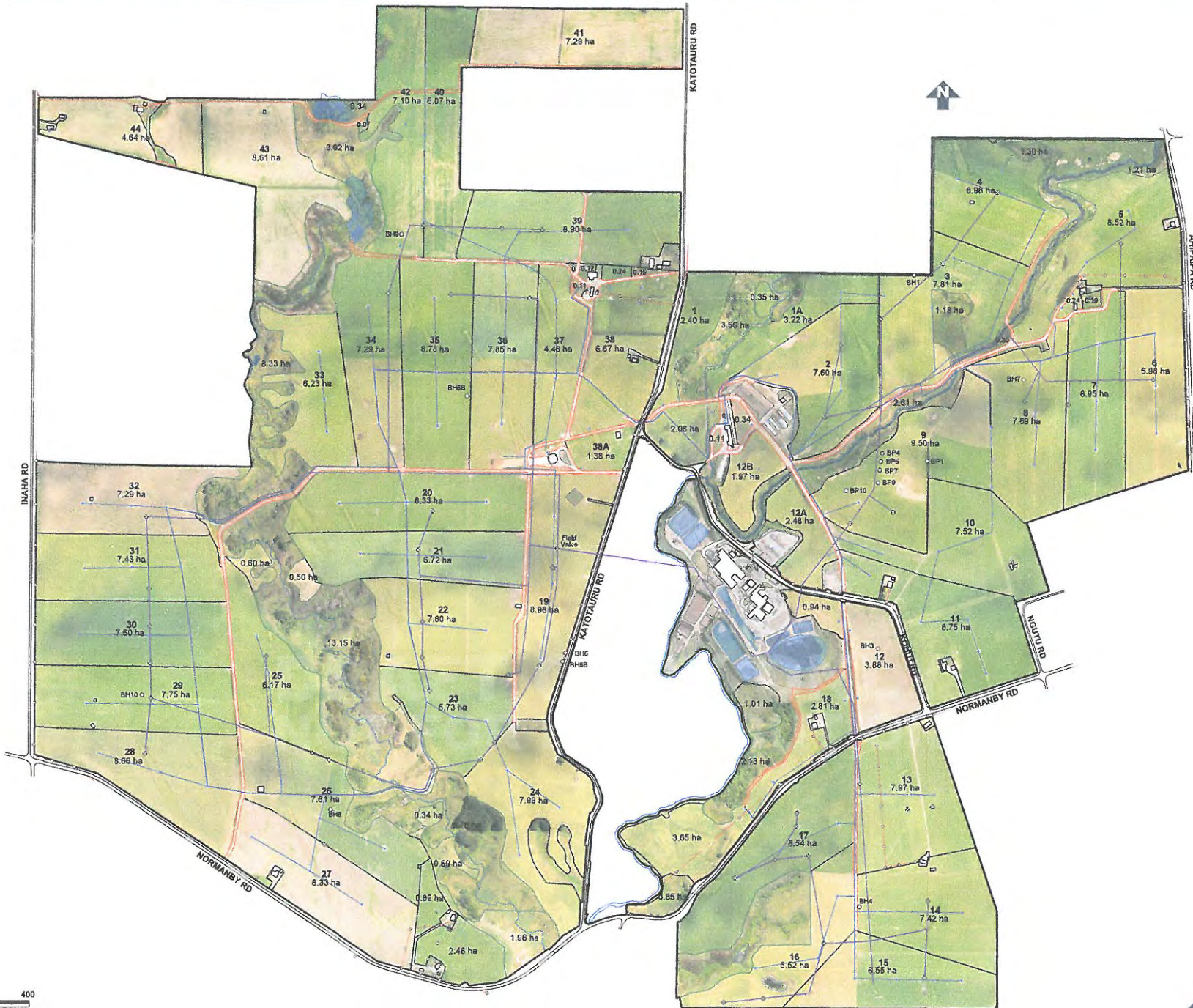
TBP paddock numbers

TARANAKI BY PRODUCTS LTD: Kohiti Road | HAWERA

Contact: Rowan
Mobile No: +64 221 864 684

FARM LEGEND

- Trough
- Tank
- Main Race
- Building
- Paddock
- Service Area
- Non-Grazing
- Stream
- Powerline
- Water Line Main
- Water Line Trough
- Spray Irrigation Piping
- Powerpole
- ⊗ Hydrant
- Bore - Irrigation:
 - GND 1054 TBP BH 1
 - GND 1056 TBP BH 3
 - GND 1057 TBP BH 4
 - GND 1346 TBP BH SB
 - GND 1354 TBP BH 6
 - GND 1347 TBP BH 6B
 - GND 1348 TBP BH 7
 - GND 1349 TBP BH 8
 - GND 2225 TBP BH 9
 - GND 2226 TBP BH 10
- Bore - Burial:
 - GND 1063 TBP BP 1
 - GND 1066 TBP BP 4
 - GND 1067 TBP BP 5
 - GND 1069 TBP BP 7
 - GND 1356 TBP BP 9
 - GND 2506 TBP BP 10



Copyright © 2016 GPSi Limited • PO Box 13398 Tauranga Central 3141 • Tel: 002 2 477 48 (0600 2 GPiS IT) • Fax: 07 573 8877 • service@gpsil.co.nz • www.gpsil.co.nz • All Rights Reserved • Version: J31861 - WORKING REVISION 01

Mod Date: 09 February 2016 | Survey Date: 09 December 2015 | GPS Co-ordinates: 174°11'15.08"E, 39°31'35.66"S

TARANAKI BY PRODUCTS LTD
 Farm Total Area: 423.55 ha
 Paddock Area: 340.70 ha
 Service Area: 17.19 ha
 Race Area: 6.78 ha
 Non-Grazing Area: 51.53 ha

