Taranaki By-Products Ltd Monitoring Programme Annual Report 2012-2013

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Executive summary

Taranaki By-Products Limited (the Company, TBP) runs an animal rendering operation located on Kohiti Road at Okaiawa, in the Inaha Stream catchment. Two rendering plants operate on the site, an inedibles plant owned by Taranaki By-Products Limited, and a food-grade plant owned by Taranaki Bio-Extracts Limited (TBE). A trucking firm, Jackson Transport Limited, operates from the site also. This report for the period July 2012-June 2013 describes the monitoring programme implemented by the Taranaki Regional Council to assess the Company's environmental performance during the period under review, and the results and environmental effects of the Company's activities.

Taranaki By-Products Limited holds a total of 11 resource consents for all of the operations associated with the site, which include a total of 145 conditions setting out the requirements that the Company must satisfy. The Company holds one resource consent to allow it to take and use water, one consent for structures in a watercourse, one consent to realign a watercourse, four consents to discharge to the Inaha Stream and a tributary, three consents to discharge to land, and one consent to discharge emissions into the air at the site.

The Council's annual monitoring programme for the year under review included 12 inspections, 142 water samples collected for physico-chemical analysis, and two biomonitoring surveys of receiving waters. In addition, continuous monitoring of the temperature of cooling water discharged and of the Inaha Stream was undertaken, and a rating curve was maintained for measurement of flow in the stream.

The abstraction of water from the Inaha Stream was not found to have any adverse effect on the stream.

The discharge of cooling water to the Inaha Stream was not found to have any adverse effect on the stream. There was exceedance of the limit on receiving water temperature increase on 25 days, during low flows between February and April. An abatement notice was issued to undertake works to remedy this, before the next summer low flow period.

The Company operates a 'dual' wastewater disposal system, in which discharge may be either to the Inaha Stream directly or to the Company's dairy farm by spray irrigation. In the 2006-2007 monitoring period, a significant improvement in water quality of the stream was brought about by a change in management of the system so that disposal to land was maximised. The results of stream biomonitoring in 2012-2013 show that this improvement continued, to the extent that there was little difference in health of stream-bed communities above and below the rendering plants' site or the irrigation areas.

The total area of land utilised for irrigation increased, from 269 ha to 291 ha, in 2012-2013. At the end of the review period, 319 ha was available. About 50 ha was planted in maize and turnips, of which about 48 ha was irrigated with wastewater before and during the growing season. The reported average annual nitrogen loading from wastewater irrigation was about 75% of the limit where 300 kg/ha is allowed, and 51% where 200 kg/ha is allowed. The irrigation areas were found to be reasonably well managed, though 22 paddocks, or 21% of the relevant area, exceeded the limit where 300 kg/ha is allowed. Recording of nitrogen fertiliser application, including Zeal Grow (stickwater), was continued, with some omission of waste solids and chemical fertiliser data.

Groundwater monitoring continued to show moderate effects of irrigation. The spring used for supply of local residents downslope of the irrigation block south of Normanby Road was well within the guideline for nitrate concentration. Nitrate levels were elevated at several bores, with all but two, both down-gradient of long disposal areas, showing decrease at the end of the review period. Improved nitrogen budgeting, that includes both wastewater and fertiliser inputs, has been implemented to address this.

There was no substantiated complaint recorded in 2012-2013 in relation to wastewater disposal.

Management of the solid waste disposal area was satisfactory. The narrow plume, containing a high concentration of ammonia and organics, of low volume yield, detected downslope of the disposal area, is being monitored to determine if any remedial action is needed.

The wastewater treatment system continued to be upgraded in stages. Refinements were made to the dissolved air floatation (DAF) system, including the introduction of pH adjustment.

The stormwater system has discharged significantly lower amounts of sediment and grease to the Inaha tributary since improvements began in 2006-2007 that include diversion of first flushes of stormwater to the wastewater system, placement of additional sediment traps, and sealing of much of the catchment. Some breaches of the suspended solids and oil and grease limits were recorded, with no apparent adverse effect in the Inaha Stream.

Fencing and planting of riparian margins of the Inaha Stream above Kohiti Road was maintained, in compliance with the consent to install culverts. A donation was made to the Taranaki Tree Trust for riparian planting in the Inaha catchment, as agreed in the consent to discharge wastewater.

Substantial repair and maintenance works were undertaken on the main bio-filter for treatment of odorous emissions from the inedibles plant between October 2012 and April 2013. Work then commenced on an extension to the bio-filter to increase treatment capacity.

Air quality remained the outstanding environmental issue. In 2012-2013, of the 41 incidents registered in total for all of the Company's activities, 37 related to complaints about emissions to air causing odour. Six complaints were substantiated, and four infringement notices were issued accordingly, the other two incidents having reasonable defence as provided for within the Resource Management Act. This may be compared against 13 odour complaints in 2011-2012, 17 in 2010-2011, and 10 in 2009-2010, none of which was substantiated. The complaints related, almost entirely, to partially treated emissions during the repair, maintenance and upgrade of the bio-filters.

Investigation of complaints by Council found noticeable, but not objectionable, odour beyond the plant boundary on 49% of occasions. The source of odour was attributed entirely to the inedibles plant or its odour control system, particularly cooking odour. No odour complaint was associated with the edibles plant, wastewater treatment or irrigation systems, or burial of solid waste.

With respect to the abstraction of water from Inaha Stream, at the end of the period under review, the Company's overall level of environmental performance was good. Volume metering was installed, and a full record is now required to be provided under the Measurement and Reporting of Water Takes regulations.

With respect to the discharge of wastewater to Inaha Stream, at the end of the period under review, the Company's overall level of environmental performance was high. This represents a continuation of the improvement first noted in 2007-2008, with decreasing periods of discharge to the stream.

With respect to the discharge of cooling water to Inaha Stream, at the end of the period under review, the Company's overall level of environmental performance was poor, as the result of large temperature increases during a period of low flows in the stream. An abatement notice was issued to require the Company to address this before the next summer low flow period.

With respect to the discharge of stormwater to Inaha Stream, at the end of the period under review, the Company's overall level of environmental performance required improvement, in respect of the amount of solids and oils in the discharge, though no adverse effect was noted for the receiving water.

With respect to the discharge of wastewater to land, during the period under review, the Company's overall level of environmental performance required improvement. More even application of wastewater could be achieved, and better recording of supplementary fertiliser use.

With respect to the burial of solid wastes, during the period under review, the Company's overall level of environmental performance was good. Disposal or storage of materials unrelated to the rendering operations should be avoided.

With respect to the discharge of emissions to air, during the period under review, the Company demonstrated a poor level of environmental performance and compliance with the resource consent, with four infringement notices being issued for objectionable odour. This represents a deterioration from the previous three years, which occurred while the odour treatment system was being repaired and upgraded.

For reference, in the 2012-2013 year, 35% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 59% demonstrated a good level of environmental performance and compliance with their consents.

This report includes recommendations for the 2013-2014 year.

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1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is the Annual Report for the period July 2012-June 2013 by the Taranaki Regional Council on the monitoring programme associated with resource consents held by Taranaki By-Products Limited (TBP). The Company runs an animal rendering operation situated on Kohiti Road at Okaiawa, in the Inaha catchment.

This report covers 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) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Taranaki Regional Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the TBP's use of water, land, and air, and is the eighteenth combined annual report by the Taranaki Regional Council for Taranaki By-Products.

1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about compliance monitoring under the Resource Management Act and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consents held by Taranaki By-Products Limited 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 Inaha catchment.

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

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

Section 4 presents recommendations to be implemented in the 2013-2014 monitoring year.

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

1.1.3 The Resource Management Act (1991) and monitoring

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

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

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Taranaki Regional Council is recognising the comprehensive meaning of 'effects' inasmuch as is appropriate for each discharge source. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the Resource Management Act to assess the effects of the exercise of consents. In accordance with section 35 of the Resource Management Act 1991, the Council undertakes compliance monitoring for consents and rules in regional plans; and maintains an overview of performance of resource users against regional plans and consents. Compliance monitoring, (covering both activity and impact monitoring), also enables the Council to continuously assess its own performance in resource management as well as that of resource users, particularly consent holders. It further enables the Council to continually re-evaluate its approach and that of consent holders to resource management, and, ultimately, through the refinement of methods, and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental performance

Besides discussing the various details of the performance and extent of compliance by the Company in the Inaha catchment during the period under review, this report also assigns an overall rating. The categories used by the Council, and their interpretation, are as follows:

- a **high** level of environmental performance and compliance indicates that essentially there were no adverse environmental effects to be concerned about, and no, or inconsequential (such as data supplied after a deadline) non-compliance with conditions.
- a **good** level of environmental performance and compliance indicates that adverse environmental effects of activities during the year were negligible or minor at most, or, 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, or, there were perhaps some items noted on inspection notices for attention but these items were not urgent nor critical, and follow-up inspections showed they have been dealt with, and any inconsequential non-compliances with conditions were resolved positively, co-operatively, and quickly.
- **improvement desirable (environmental)** or **improvement required (administrative compliance)** indicates that the Council may have been obliged to record a verified unauthorised incident involving significant environmental impacts, or, there were measurable environmental effects arising from activities and intervention by Council staff was required, and there were matters that required urgent intervention, and/or, there were on-going issues around meeting

resource consent conditions even in the absence of environmental effects. Abatement notices may have been issued.

- **poor performance (environmental)** or **poor performance (administrative compliance)** indicates generally that the Council was obliged to record a verified unauthorised incident involving significant environmental impacts, or, there were material failings to comply with resource consent conditions that required significant intervention by the council even in the absence of environmental effects. Typically there were grounds for prosecution or infringement notice.

For reference, in the 2012-2013 year, 35% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 59% demonstrated a good level of environmental performance and compliance with their consents.

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 central and southern North Island. The Company 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 Limited.

The site is located beside Inaha Stream in mid-catchment, about 13 km from sea, and less than 1 km from Okaiawa, a village of about 50 dwellings. Intensive pastoral farming, mainly dairy, occurs around the site (Figure 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 tonnes per hour of raw material [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 litres/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.

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.

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 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 m^3/h DAF unit to which flocculent is added to assist in recovery of solids. The wastewater then moves sequentially through ponds 1-3, with a total volume of about 15,000 m^3, 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 8000 m^3. Aerators of about 315kW 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 hectares and a nominal volume of 30,000 m^3, 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 Inaha Stream directly or to adjacent land by spray irrigation. This 'dual' wastewater disposal system addresses the limited capacity of 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.

1.2.2 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 and disposal systems and burial areas.

Odour extraction, cooling and bio-filters 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 building air systems (Factory Air 1 and 2) at the TBP plant to capture fugitive emissions that are not collected by the concentrated sources system.

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 concentrated sources (CS) bio-filter. 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 Factory Air 1 (FA1) ventilation system extracts air from above the mixed abattoir and poultry rendering lines in the northern part of the TBP building. Factory Air 2 (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 concentrated sources bio-filter. TBE building air is ventilated directly to atmosphere as it contains no significant odour.

There are three bio-filter systems, comprising two factory air bio-filters, and a concentrated sources bio-filter. FA1 bio-filter is of coarse bark set in the ground, with three parallel zones that are each 30m x 40m x 1.5m (total volume of 5,400m^3). FA2 bio-filter is also formed of coarse bark, set above ground over pea gravel with two zones 25m x 30m x 1m (1,500 m^3). The CS bio-filter has two parallel beds 25m x 20m x 0.7m (700m^3) of coarse bark overlaid with fine bark compost. The locations of the bio-filters are given in Figure 2.

The CS bio-filter was repaired in November 2010, when two sides of both beds were replaced. Bed 3 of FA1 bio-filter was reconstructed between July and December 2011, improving the pipework for air distribution and for drainage of liquids. The remainder of FA1 bio-filter 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 bio-filter, the concentrated sources air flow from the TBP plant was redirected to it temporarily, reducing heat load on the designated CS bio-filter, now dedicated to the TBE plant. At the end of the 2012-2013 review period, construction had begun of a fourth zone for FA1 bio-filter, intended to receive the TBP plant concentrated sources streams.

1.3 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 Limited (TBE), was established for the venture that is owned by Taranaki By-Products Limited and Riverlands Eltham Limited 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. No increase in raw material input has occurred. The rendering and drying is carried out at lower temperatures than at the inedibles plant, resulting in less odour generation and heat emission. Total wastewater volume and concentration at the site has not changed. Certain utilities are shared between the two plants, including the steam generators, the wastewater treatment plant, and bio-filters for treatment of air emissions.

The (gas-fired) Duske drier, previously used on the chicken line with occasional smoking problems, was transferred to the new plant and operated at lower temperature, and replaced with indirect steam driers, resulting in lower loading on the biofilter odour control system. Surfaces of surrounding areas were sealed, leading to improved stormwater quality and reduction in background odour levels.

1.4 Resource consents

A summary of the consents held by Taranaki By-Products Limited in relation to activities at its Okaiawa plant is given in Table 1 below, and the consents are discussed in Sections 1.4.1 to 1.4.5. A copy of each of the consents can be found in Appendix I.

Table 1 Summary of resource consents held by Taranaki By-Products Limited

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	2,160m^3/day	2017	2019
2051-4	Take from Inaha Stream	2,160m^3/day(50L/s)	2017	2019
3941-2	Discharge treated wastewater to land and air	1,400m^3/day	2014	2019
4058-4	Discharge emissions to air from rendering operations		2015	2024
5426-1	Discharge stormwater to Inaha tributary	1,025L/s	2017	2019
5495-1	Discharge meat wastes by burial into land	200 tonne/day	2017	2019
5560-1	Discharge waste cheese by burial, and emit to air	100 tonne	-	2017
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

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.

1.4.1 Water abstraction permit

Section 14 of the Resource Management Act stipulates that no person may take, use, dam or divert any water, unless the activity is expressly allowed for by a resource consent or rule in a regional plan, or it falls within some particular categories set out in Section 14.

Taranaki By-Products Ltd (TBP Ltd) holds water permit **2051** to cover the abstraction of up to 50 litres/second of water from the Inaha Stream for a rendering operation. This permit was issued by the Taranaki Regional Council on 31 May 1999 under Section 87(d) of the Resource Management Act. It is due to expire on 1 June 2019.

Condition 1 requires the means of taking water to be satisfactory to Council.

Condition 2 imposes a minimum flow of 25 litres/second be maintained in the stream and condition 3 requires installation of a measuring device and records to be kept of daily abstraction and condition 4 requires a flow meter be installed in the Inaha Stream with records available on request.

Condition 5 required the consent holder to investigate and report on the use of wastewater for cooling water.

Condition 6 sets out provision for review of the consent.

1.4.2 Water discharge permits

Section 15(1) (a) of the Resource Management Act stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.
TBP Ltd holds four discharge permits that provide for discharge to surface water, one of wastewater, one of cooling water, and two of stormwater.

1.4.2.1 Wastewater discharge

TBP Ltd holds water discharge permit **2049** to cover discharge of up to 940 cubic metres/day of treated wastewater from a rendering operation and from a farm dairy into the Inaha Stream. This permit was issued by the Taranaki Regional Council on 31 May 1999 under Section 87(e) of the Resource Management Act. 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.**

Conditions 1 and 2 relate to the location and area of the mixing zone and 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.

The changes of conditions from the review were a requirement to operate the dual wastewater disposal system so as to minimise discharge to Inaha Stream, increasing the minimum dilution of treated wastewater in the stream, prohibition of discharge of stickwater, and annual review of the wastewater management plan.

The changes of conditions in relation to the inclusion of farm dairy wastewater were an increase in discharge volume, a limit on the number of cows provided for, and an additional review date.

1.4.2.2 Cooling water discharge

TBP Ltd holds water discharge permit 2050 to cover discharge of up to 2160 cubic metres/day of cooling water and backwash water into the Inaha Stream. This permit was issued by the Taranaki Regional Council on 31 May 1999 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2019.

There are 7 special conditions imposed on consent **2050.**

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.

1.4.2.3 Stormwater discharges

Rendering plants' site
TBP Ltd holds water discharge permit **5426** to cover discharge of up to 1095 litres/second of stormwater into an unnamed tributary of the Inaha Stream. This permit was issued by the Taranaki Regional Council on 31 May 1999 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2019.

There are five special conditions imposed on consent **5426.**

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 and condition 5 sets out provision for review of the consent.

Land re-contouring
TBP Ltd holds water discharge permit **7329** 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 Taranaki Regional Council on 30 June 2008 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2023.

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.

1.4.3 Air discharge permit

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

TBP Ltd 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 Taranaki Regional Council under Section 87(e) if the Resource Management Act on 11 October 2011. It expires on 1 June 2024,

The permit includes 12 special conditions.

Condition 1 requires the consent holder to adopt best options to minimise adverse effects of discharge on the environment.

Condition 2 prohibit 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.

1.4.4 Discharges of wastes to land

Sections 15(1)(b) and (d) of the Resource Management Act stipulate that no person may discharge any contaminant onto land if it may then enter water, or from any industrial or trade premises onto land under any circumstances, unless the activity is

expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

TBP Ltd holds two discharge permits that provide for disposal of untreated farm dairy effluent on 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 Taranaki Regional Council on 18 November 2004 under Section 87(e) of the Resource Management Act. 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 Taranaki Regional Council on 13 July 2004 under Section 87(e) of the Resource Management Act. 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.

1.4.4.1 Spray irrigation

Taranaki By-Products holds discharge permit **3941-2** to cover the discharge of up to 1400 cubic metres/day of treated wastewater by irrigation onto and into land. This permit was issued by the Taranaki Regional Council on 15 December 1999 under Section 87(e) of the Resource Management Act. 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 requirement to provide a spray irrigation management plan and specific matters it must address.

Condition 2 requires adherence to the plan and states that consent conditions prevail over any contradictory aspects.

Condition 3 provides for review of the management plan and Condition 4 requires a designated manager to implement the management plan.

Condition 5 requires adoption of the best practicable option to deal with adverse effects, with particular reference to minimisation of nitrogen in the effluent.

Condition 6 requires notification to Council when irrigation is not possible and discharge to the stream will cause dilution limits to be exceeded.

Condition 7 places a minimum limit on the level of dissolved oxygen in the discharge.

Conditions 8 and 9 stipulate there shall be no objectionable odour or spray drift as a result of irrigation.

Condition 10 limits the sodium adsorption ratio.
Condition 11 prohibits ponding of wastewater or direct discharge.

Conditions 12 and 13 specify the area of the irrigation spray zone and limit the rate of nitrogen loading.

Condition 14 requires the Consent holder to investigate and report on options for reducing ammonia concentrations in wastewater prior to discharge.

Conditions 15 and 16 restrict the average application rate and specify the return period between effluent applications.

Conditions 17 and 18 require the consent holder to monitor groundwater bores and to monitor consent activities deemed necessary by Council.

Condition 19 relates to liaison meetings with interested submitters to the consent, and condition 20 addresses notification of Ngai Manuhiakai hapu of discharge to Inaha Stream.

Condition 21 relates to mitigating effects in the case of contamination of groundwater.

Condition 19 allows for the consent holder to apply for change of conditions.

Conditions 20, 21 and 22 all set out provisions for review of specific conditions and the consent in general.

The changes of conditions from the review were a requirement to operate the dual wastewater disposal system so as to minimise discharge to Inaha Stream, adoption of the best practicable technology to minimise wastewater nitrogen concentration, and an annual review of the spray irrigation management plan.

The changes of conditions in relation to first extension of the irrigation area were increased wastewater volume, increased safety buffer zones, and greater liaison with neighbours and interested parties. The second change of consent simply increased the irrigation area with no other change of condition.

1.4.4.2 Burial

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

TBP Ltd 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 Taranaki Regional Council on 30 March 2000 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2019.

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.

TBP Ltd holds water discharge permit **5560-1** to discharge waste cheese and associated packaging by burial into land and discharge emissions into air in the vicinity of the Inaha Stream. This permit was issued by the Taranaki Regional Council on 15 October 1999 under Section 87(e) of the Resource Management Act. It is due to expire on 1 February 2000 for the air discharge and 1 June 2017 for the land discharge.

Condition 1 requires notification by the consent holder prior to operations.

Condition 2 requires the consent holder to house affected parties for the period of removal and disposal.

Condition 3 places a limit on tonnage and Condition 4 ensures access to Council employees for inspection and monitoring.

Condition 5 requires the consent holder to maintain a photographic record of disposal operation.

Conditions 6, 7 and 8 impose a time period on disposal operations and provide for an interim measure if the time frame is exceeded.

Conditions 9 and 10 prescribe the nature of cover at completion and prohibit the disposal of other wastes.

Condition 11 requires the consent holder to minimise odour and other effects arising from discharge.

Conditions 12, 13 and 14 relate to air discharge and require transported waste is covered and only transported in southerly wind conditions.

Condition 15 prohibits odours after February 2000.

Condition 16 relates to the construction of the disposal pit and Condition 17 prohibits the pit from intercepting groundwater.

Conditions 18 and 19 require the cover material be contoured away from disposal area and that the site be rehabilitated.

Condition 20 prohibits irrigation of effluent over the disposal area.

Condition 21 requires that the cover material remain intact and Condition 22 prohibits direct discharge of contaminants to a water body.

Condition 23 sets out provision for review of the consent.

1.4.5 Land use consents

1.4.5.1 Stream culverts

Section 13(1)(a) of the Resource Management Act stipulates that no person may use, erect, reconstruct, place, alter, extend, remove or demolish any structure or part of any structure 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 Ltd 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 Taranaki Regional Council on 4 October 2004 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2023.

Conditions 1 and 2 require the consent holder to adopt best 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 and Condition 13 provides for review of consent conditions.

1.4.5.2 Stream diversion

Section 13(2)(b) of the Resource Management Act 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 Ltd holds land use permit **7234-1** to realign a section of approximately 350 metres of the Inaha Stream for land improvement purposes. This permit was issued by the Taranaki Regional Council on 12 March 2008 under Section 87(a) of the Resource Management Act. It is due to expire on 1 June 2023.

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.

1.5 Monitoring programme: water

1.5.1 Introduction

Section 35 of the Resource Management Act sets out an obligation upon the Taranaki Regional Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region and report on these.

The Taranaki Regional Council may therefore make and record measurements of physical 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.

1.5.2 Programme liaison and management

There is generally a significant investment of time and resources by the Taranaki Regional Council in ongoing liaison with resource consent holders over consent conditions and their interpretation and application:

- in discussion over monitoring requirements,
- preparation for any reviews
- renewals
- new consents
- advice on the Council's environmental management strategies and the content of regional plans, and
- consultation on associated matters.

1.5.3 Site inspections

The TBP site was visited on 12 occasions during the 2012-2013 monitoring period. With regard to consents for the abstraction of water and for the discharge of wastes to water and land, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Sources of data being collected by the consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

1.5.4 Water take

The water take was 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.

1.5.5 Chemical sampling

The Council undertook sampling of the discharges from the site, of surface waters upstream and downstream of the discharge points and irrigation areas, and of groundwaters around the irrigation and waste burial areas.

The final discharge from the wastewater treatment system [the discharge from the aerobic pond, Pond 6] was sampled on four occasions in 2012-2013. The samples were analysed for both mineral and organic components, and general water quality parameters, to enable determination of compliance with consent conditions, and to calculate loadings on both Inaha Stream and land irrigation areas. The cooling water discharge and the receiving Inaha tributary were sampled concurrently with the wastewater. The stormwater discharge point was sampled when it was found to be discharging.

Monitoring of up to 10 sites in Inaha Stream and its tributaries was carried out to determine compliance with consent conditions, and to assess the impact of discharges to water and land.

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

Groundwater sampling was undertaken as part of monitoring of the irrigation of wastewater under consent **3941**, and of the burial of unprocessable material under consent **5495**. Nine monitoring bores and a spring were sampled two-monthly in connection with the irrigation areas. Up to five monitoring bores, around the waste burial area, were sampled.

1.5.6 Biomonitoring surveys

Two surveys of biological communities at up to eight sites in Inaha Stream and a major tributary were scheduled. 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.

1.5.7 Monitoring by Taranaki By-Products Limited

The Company monitors Inaha Stream, and wastewater discharged to the stream and to land, as an integral part of the management of its wastewater disposal system.

The flow rate of Inaha Stream (at Kohiti Road staff gauge) and of the wastewater discharge to the stream are measured daily in order to control dilution of the wastewater. The stream is sampled and analysed weekly to determine compliance with the consent limit on ammonia concentration. The wastewater is analysed weekly for nitrogen species to enable calculation of allowable ammonia discharge rate to the stream, and of the nitrogen loading on irrigation areas.

The results of this monitoring were forwarded to the Regional Council monthly.

1.6 Monitoring programme: air

1.6.1 Introduction

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

1.6.2 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.

1.6.3 Site inspections

The TBP site was visited on 12 occasions during the 2012-2013 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 2.3.3.
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 e.g. water monitoring or in response to complaints. A list of incidents which led to complaints is summarised in section 2.3.3 of this report.

1.6.4 Monitoring by Taranaki By-Products Limited

From 2 February 2012, the Company 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 includes production of a daily activities log, conduct of ambient odour surveys, and maintenance of a register of complaints. While the Plan was not submitted until 3 July 2012, its monitoring components 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.

Ambient odour surveys of the surrounding area are undertaken at up to 16 sites, including within Okaiawa township, at least two to three times per week, with additional surveys as required.

The results of bio-filter and weather monitoring, and comment from the daily activities log on events affecting environment quality, were forwarded to the Regional Council monthly. 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. In addition, physico-chemical sampling was stipulated as part of the Tailored Compliance Monitoring Programmes for 2012-2013.

Water samples were collected according to the Tailored Compliance Monitoring Programme. All components of the programme were carried out, with samples taken of the following on four scheduled occasions in 2012-2013:

1. Samples of the aerobic pond discharge to Inaha Stream were taken and analysed for the following constituents: temperature, dissolved oxygen, total and filtered carbonaceous BOD_5, COD (chemical oxygen demand), total sulphide, conductivity, pH, alkalinity, turbidity, suspended solids, total grease, ammonia, nitrite, nitrate and total nitrogen, total and dissolved reactive phosphorus, sodium, potassium, calcium, magnesium, chloride, sulphate and faecal coliforms (Table 4).

2. Cooling water from the discharge point to the fire-water reservoir was sampled and analysed for temperature, turbidity, conductivity, pH, total BOD_5 and ammonia (Table 5).

3. Samples were taken from the stormwater discharge point, when it was discharging, and analysed for temperature, turbidity, conductivity, pH, suspended solids, total BOD_5, ammonia, oil and grease, and faecal coliforms (Table 6).

4. Samples from the tributary which receives the stormwater, cooling water and fire-water reservoir discharges were taken at the confluence of the tributary with Inaha Stream, and analysed for temperature, turbidity, dissolved oxygen, total BOD_5, pH, alkalinity, chloride, ammonia, nitrate/nitrite, dissolved reactive phosphorus, suspended solids, oil and grease, and faecal coliforms (Table 7).

5. Water quality in the Inaha Stream was sampled at up to 10 sites and analysed for temperature, turbidity, conductivity, pH, dissolved oxygen, total and filtered carbonaceous BOD_5, ammonia, nitrate, nitrite, dissolved reactive phosphorus, chloride and faecal coliforms (Table 8).

For groundwater, up to nine monitoring bores and a spring were sampled on six occasions and analysed for temperature, conductivity, pH, ammonia, nitrite/nitrate and chloride. On one occasion, in Winter/ Spring, the samples were also analysed for calcium, magnesium, sodium, potassium, total alkalinity and sulphate, to enable an ion balance, and for COD. The water level in each of the bores was also measured (Figure 11).

In-stream temperature sensors [in Inaha Stream and the tributary that receives the cooling water discharge] were employed and the data downloaded and reset as required (Figure 7 and Figure 8).

The stream physico-chemical water quality sampling sites are illustrated in Figure 1 and described in Table 3. The aerial photograph was taken on 7 March 2012.

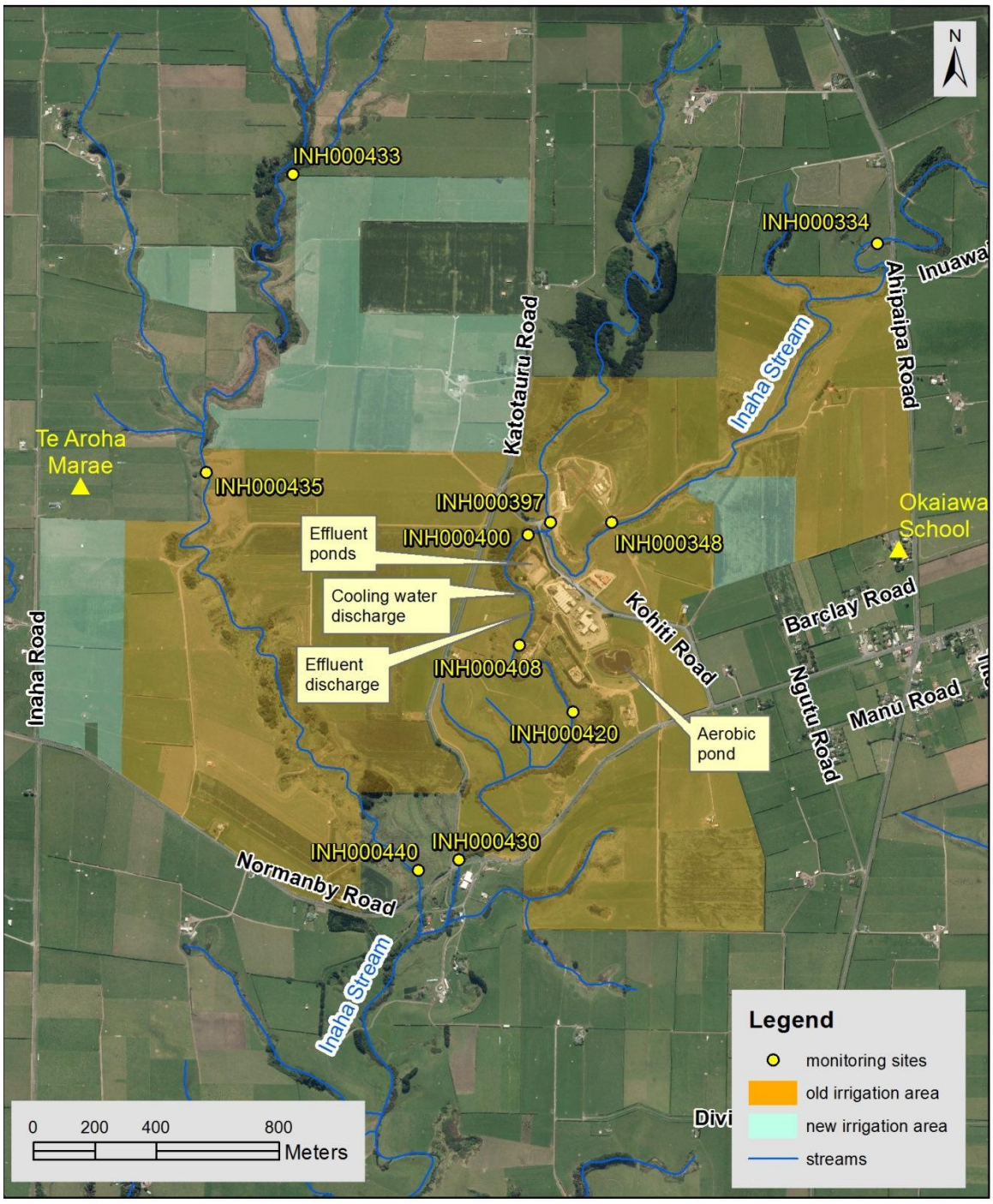

Figure 1 Chemical water quality monitoring sites for surface waters

The point-source sampling sites for the rendering operations area are illustrated in Figure 2 and described in Table 2.

Figure 2 Chemical monitoring sites for rendering operations area

Table 2 Sampling points for point-source discharges

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 Sampling points for receiving water

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 southern tributary, 3,500m u/s Inaha confluence	1701109	5625496	INH000433
9	Unnamed southern tributary 2,550m u/s Inaha confluence	1700816	5624558	INH000435
10	Unnamed southern tributary 250m u/s Inaha confluence	1701518	5623227	INH000440
11	State Highway 45	1700393	5620330	INH000470

A total of 12 routine inspections were undertaken during the 2012-2013. Council holds a record of detailed inspection notes which are available by request. Additional inspections were carried out in response to public complaints. Inspections were also carried out at the times of effluent and receiving water chemistry monitoring. During or immediately after each inspection by an officer of the Council contact was made with a Company representative to discuss the findings.

Particular attention is 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

2.1.2 Water abstraction

The water take resulted in no compliance issues with regard to the maintenance of the minimum flow (25 litres/second downstream of the abstraction point) required under special condition 2 on consent **2051**.

With regard to the limit on abstraction rate, consent **2051** allows 2,160 cubic metres/day, or 25 litres/second on average, and an instantaneous maximum of 50 litres/second. TBP continuously operates one of two pumps rated at 33 and 25 litres/second, the larger of which is normally the duty pump.

Under the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010, TBP was required by 10 November 2012 to take continuous measurements and keep daily records of volume taken, and thereafter supply by 31 July each year the record for the preceding 1 July to 30 June period. The Company installed a flow measurement and recording system as required. Inspection by Council on 31 January 2013 found that ABB WaterMaster electromagnetic flow meters were operating on both supply lines. Abstraction data, recorded at 15-minute intervals, for the period 1 March to 30 June were supplied on time. Data gathered earlier were not produced, owing to difficulties with the initial formatting. Verification of the accuracy of the system had yet to be done at the end of the reporting period, as suitably qualified persons had not been identified.

The daily abstraction record for the period March to June 2013 is presented in Figure 3.

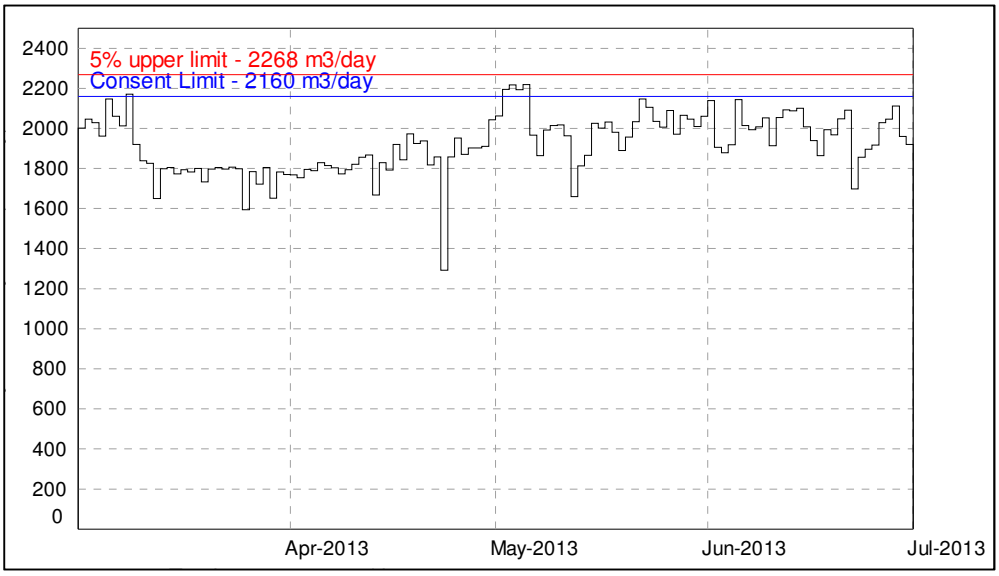

Figure 3 Daily water abstraction by Taranaki By-Products, March – June 2013, m³/day

The record shows that the limit of 2,160 m³/day on maximum daily abstraction volume was complied with throughout the period monitored, when the allowable error of ± 5% is taken into account. The measured daily volume exceeded the limit on four consecutive days, from 2 to 5 May 2013, by factors of up to 2.8% (2,219 m³/d). The maximum recorded abstraction rate over a 15-minute period was 29.0 litres/second, on 2 March 2013 until 0920 NZDT, which is less than the maximum absolute rate of 50 litres/second that is allowed.

2.1.3 Discharges to water and land

2.1.3.1 Wastewater

The results of analysis of the discharge of wastewater by the Regional Council are outlined in Table 4, together with a summary of previous results since the last major upgrade of the wastewater treatment system, in 1997. Samples were typically taken between about 9 am and about 10 am.

The effluent from the final pond contained levels of components that reflected the variation in wastewater composition, strength and flow, and the changes in treatment, that occurred during the 2012-2013 period. As in the years since the 1997 upgrade, the mineral strength was always high, notably in nitrogen species.

Dissolved oxygen concentration, measured by probe at 0.4 to 2.5 g/m^3, was below the minimum limit of 1 g/m^3 in condition 6 on consent 3941 for irrigation of wastewater on two of four monitoring occasions, although mechanical aerators were operating in both Pond 4 and Pond 6. No sulphide was detected, indicating low potential for malodour.

Temperature was within the range previously recorded, at 20.8 – 27.1˚C. Recirculation of cooling water through pond 6 continued (since commencement in February 2002).

Total nitrogen concentration increased markedly in Summer 2013, possibly as a result of the dry weather. In 2012-2013, the measured total nitrogen concentration was in the range 380-810 g/m^3, largely in solution as ammonia (160-420 g/m^{3}N) and in oxidised form (nitrite/nitrate 128-183 g/m^{3}N).

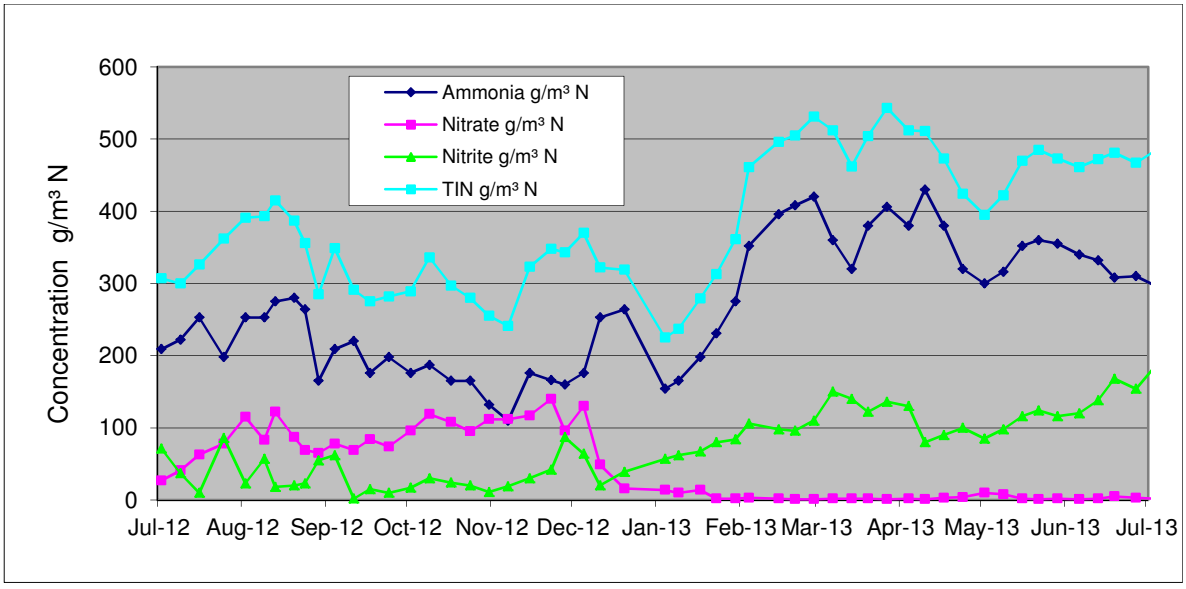

Figure 4 Results of treated wastewater monitoring for inorganic nitrogen species reported by TBP 2012-2013 (TIN = total inorganic nitrogen)

Table 4 Chemical monitoring results for effluent discharged from TBP's wastewater treatment system, with summary of previous monitoring data since July 1997. TRC site IND004004

Date	Flow	Temp	DO	Cond	pH	ALKT	SS	O&G	BOD_5	$fcBOD_5$	COD	TN	NH_4	NNN	DRP	Cl	SO_4	TS	Na	K	Ca	Mg	SAR	FC
Number		102	79	107	113	94	81	38	82	49	73	73	119	97	74	53	51	71	76	55	58	58	57	70
Maximum		31.1	12.6	561	8.5	2260	580	51	480	79	1400	680	570	189	54	287	260	2.4	366	177	68	20	14.0	20000
Minimum		7.4	<0.1	170	6.8	25	36	<0.5	14	0.7	140	110	40	0.03	21	129	64	<0.05	136	74	6.4	7.6	5.1	7
Median		20.6	0.2	281	8.0	568	130	<0.5	94	5.2	330	315	206	84	34	230	123	<0.05	216	118	17	11	9.8	385
28.11.12	0	22.9	2.5	320	7.4	220	100	-	72	24	330	380	160	183	43	312	140	<0.05	276	188	25	16	10.7	1300
19.03.13	0	27.1	0.6	480	8.2	1130	210		78	2.6	600	610	390	171	35	319	176	<0.05	328	174	22	14	13.4	1300
28.03.13	0	23.4	0.4	471	8.3	1410	360	(150)	160	4.6	7200	810	420	128	28	339	230	<0.05	343	170	15	11	**16.4**	-
26.06.13	5.7	20.8	1.3	339	7.5	325	87	-	52	4.0	410	380	270	177	47	272	142	-	274	146	22	13	11.5	7000

ALKT = alkalinity to pH 4.5 as $CaCO_2$
BOD_5 = total 5-day biochemical oxygen demand, g/m^3
Ca = calcium, g/m^3
C1 = chloride, g/m^3
COD = chemical oxygen demand g/m^3
Cond = conductivity, mS/m at 20˚C
DO = dissolved oxygen, g/m^3
DRP = dissolved reactive phosphorus, g/m^3P
FC = faecal coliforms, cfu/100 ml
Flow = flow rate, L/s
K = potassium, g/m^3
Mg = magnesium, g/m^3
Na = sodium, g/m^3
NH = ammonia, g/m^3N
NNN = nitrite/nitrate nitrogen, g/m^3N
O&G = oil & grease, g/m^3
pH
SAR = sodium adsorption ratio
SO_4 = sulphate, g/m^3
SS = suspended solids, g/m^3
Temp = temperature, ˚C
TG = total grease, g/m^3
TN = total nitrogen, g/m^3
TS = total sulphide, g/m^3

In comparison, from 52 samples collected in 2012-2013, TBP recorded ammonia-nitrogen, nitrite-nitrogen and nitrate-nitrogen concentration ranges of 110-430 g/m^3, 2-168 g/m^3 and 1-140 g/m^3, respectively. The TBP data, as presented in Figure 4, were produced from internal monitoring by TBP, and agreed reasonably well with the Council results on total nitrogen calculation, with some differences on individual nitrogen species. The total inorganic nitrogen (TIN) values plus an estimated 15 g/m^3 organic nitrogen concentration were used by TBP in calculating total nitrogen loadings on effluent irrigation areas. Overall, TIN values from March 2013 onward were higher than previously recorded.

Several parameters indicate the loading on and performance of the aerated Pond 4. Large variations in pH, alkalinity and nitrogen species, suspended solids and COD relate to this.

Visible fat levels were low, as usual. Faecal bacteria levels were similar to the average of previous values, except in June 2013, possibly as a result of reduced exposure to sunlight.

Sodium adsorption ratio was higher than the previous average on each monitoring occasion, ranging from 10.7 to 16.4, and exceeding the limit of 15 on consent 3941 on 28 March.

2.1.3.2 Cooling water

During each sampling run, the cooling water discharge (to the firewater pond) is monitored to keep a check on its quality. The results of this sampling are shown in Table 5 together with a summary of results since cooling water was diverted to the head of the firewater pond in February 1998.

Table 5 Chemical monitoring results for cooling water discharged from TBP's plant, with summary of previous monitoring data since February 1998. TRC site code IND002004

Date	Temp	Cond	pH	Turb*	BOD_5	NH_4
Number	64	66	65	33	66	65
Maximum	65.1	28.4	8.2	31	2.7	1.89
Minimum	6.0	17.8	6.6	2.2	<0.5	0.023
Median	27.1	21.8	7.7	7.8	1.0	0.099
28.11.12	31.1	22.6	7.9	5.0	0.9	0.037
19.03.13	41.2	26.1	7.6	2.2	0.9	0.132
28.03.13	41.7	26.9	7.7	1.2	<0.5	0.35
26.06.13	44.9	19.0	7.7	12	0.6	0.087

* Turbidity instrument changed after February 2005, from Hach 2001A to WTW turbo 550, giving higher results

BOD_5 = total 5-day biochemical oxygen demand, g/m^3
Cond = conductivity, mS/m at 20˚C
NH_4 = ammonia, g/m^{3}N
pH
Temp = temperature, ˚C
Turb – turbidity, NTU

Cooling water quality was within acceptable ranges. Temperatures reduced from the highs measured over the previous three summers (2009-2012), but not to former levels. The maximum temperature value of 44.9°C recorded for 26 June 2013 was the highest in winter.

2.1.3.3 Stormwater

During the 2009-2010 reporting period, there were two point-source discharges of stormwater from the rendering plants' site. Stormwater from the main yard, garage and raw materials

reception area flowed via a drain that runs from Kohiti Road into the firewater pond (STW001075), through which the tributary flows. The other discharge, from the meal load-out area and the main building roof, entered Inaha Stream through a pipe drain that exits immediately below the firewater reservoir outlet, via a settling pit, as overflow from the first-flush diversion system to the treatment ponds (STW001076). The overflow pipe inlet was capped in May 2010, to establish a manual release control system. (A third stormwater discharge (STW0001077), from the odour control and primary wastewater treatment area, was diverted to the treatment ponds prior to the reporting period). These discharge points were first sampled in the 1999-2000 monitoring period, following the issue of consent 5426 in May 1999.

The sampling results for the 2012-2013 reporting period are shown in Table 6, together with a summary of previous results. Two of the four samplings were undertaken in dry weather, when flows from the drain ranging from <0.1 to <0.5 litres/second were estimated.
The sampling on 28 March 2013 occurred following a period when 11mm of intermittent rain fell in a day, with an estimated stormwater flow into the firewater pond of 1 litre/second. About 1mm of rain fell on the evening prior to the sampling of 26 June.

Table 6 Chemical monitoring results for stormwater discharged from TBP's plant, with summary of previous monitoring data, since October 1999

Date	Flow	Temp	Cond	pH	Turb	SS	BOD_5	TG	O&G	HC	NH_4	FC
Number		49	54	53	30	53	43	13	36	21	53	48
Maximum		21.7	895	11.2	1400	6000	1600	630	180	180	340	12000000
Minimum		8.7	5.2	6.8	0.32	<2	<0.5	<5	<0.5	<0.5	0.036	46
Median		14.5	40.4	7.2	48	100	40	12	2.2	0.9	3.5	76000
28.11.12	<0.1	16.1	65.4	7.0	0.50	3	2.2		-		0.81	2000
19.03.13	1	18.5	71.7	7.1	440	**1200**	1400		**110**		24	3800000
28.03.13	<0.5	18.2	73.0	7.3	12	20	70		1.0		10.8	-
26.06.13	<0.1	14.5	60.0	7.0	120	**120**	74		14		4.1	69000

BOD_5 = total 5-day biochemical oxygen demand, g/m^3
Cond = conductivity, mS/m at 20˚C
FC = faecal coliforms, cfu/100 ml
Flow = flow, L/s
HC = total recoverable hydrocarbons, g/m^3
NH4 = ammonia, g/m^3N
pH
O&G = oil & grease, g/m^3
SS = suspended solids, g/m^3
Temp = temperature, ˚C
TG = total grease, g/m^3
Turb = turbidity, NTU

Consent 5426 places limits on pH range (6-9) and on maximum concentration of suspended solids (100 g/m^3) and oil and grease (15 g/m^3). For a total of 4 samples taken over the 2012-2013 period, the limit on suspended solids was breached twice, and the limit on grease once. Both limits were breached on 19 March, when suspended solids and oil and grease concentrations of 1,200 g/m^3 and 110 g/m^3, respectively, were recorded. The suspended solids limit was also breached on 26 June, when a concentration of 120 g/m^3 was recorded.

Elevated BOD, ammonia and faecal bacteria values were recorded for the 19 March 2013 sampling – the sample was turbid and had an organic odour.

It is noted that the stormwater drain sampled discharges to the large fire-water reservoir, where solids settle and floating material is trapped before discharge to Inaha Stream.

2.1.3.4 Inaha tributary at plant site

In addition to the aerobic pond effluent, and the cooling water and stormwater discharges, the tributary that flows through the fire-water reservoir was sampled on a regular basis. This sampling monitors the combined discharges of stormwater and cooling water from the plant, as well as any seepage from the ring drain around the aerobic pond under fine weather conditions. Until 2010-2011, two points (Sites C and D, (Figure 2)) were monitored to distinguish the effect of any inflow downstream of the reservoir. In 2010-2011, the reservoir outlet site (IND001014) was removed from the monitoring programme because the tributary had been piped to the Inaha Stream, and as stormwater could no longer overflow to the tributary below the reservoir unless released manually. The site at the Inaha confluence (IND001015) was retained. The sampling results are contained in Table 7.

Table 7 Chemical monitoring results for combined tributary and cooling, storm and fire water discharges from TBP plant, with summary of previous data since February 1998

Site	Date	Temp	DO	Cond	pH	Alk	Turb	BOD_5	O&G	NH_4	NNN	DRP	Cl	FC
Tributary at Inaha confluence IND001015	Number	67	65	70	71	66	32	59	53	71	47	63	45	64
	Maximum	33.6	9.2	44.8	7.7	84	20	13	1.3	8.0	10.8	0.26	52	45000
	Minimum	9.9	2.9	19.5	7.1	46	1.7	<0.5	<0.5	0.074	1.13	0.010	30	<23
	Median	22.7	6.9	25.4	7.4	60	4.2	3.2	<0.5	0.72	3.8	0.041	35	1100
	28.11.12	24.7	8.9	26.8	8.0	65	4.0	2.5	-	0.105	3.2	0.023	36	190
	19.03.13	27.7	5.1	33.6	7.7	84	5.9	>8	-	3.8	3.5	0.170	42	22000
	28.03.13	31.3	-	31.8	7.8	80	1.5	3.1	-	1.80	3.2	0.106	41	-
	26.06.13	16.1	8.0	24.0	7.3	44	4.3	2.0	<0.5	0.70	5.1	0.046	38	330

ALKT = alkalinity to pH 4.5
BOD_5 = total 5-day biochemical oxygen demand, g/m^3
Cond = conductivity, mS/m at 20˚C
FC = faecal coliforms, cfu/100 ml
DO = dissolved oxygen, g/m^3
DRP = dissolved reactive phosphorus, g/m^3
NH4 = ammonia, g/m^3N lkalinity to pH 4.5 as pH
O&G = oil & grease, g/m^3
Temp = temperature, ˚C
TS = total sulphide, g/m^3
Turb = turbidity, NTU

Generally, low levels of contaminants were found, as reflected in low BOD and grease levels, though relatively high BOD, ammonia and faecal coliform values were recorded for the 19 March sampling, after recent rainfall. The pH values for the samplings in November and March were higher than previously recorded, with a maximum of pH 8.0, possibly as the result of increased algal activity in the fire pond.

Faecal coliform counts varied widely under dry weather conditions. Temperatures complied with the maximum limit of 35˚ C set on consent 2050-1.

2.1.4 Results of receiving environment monitoring

2.1.4.1 Inaha Stream flows

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 metres 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 Regional Council took five stream gaugings in the 2012-2013 reporting period to maintain the staff gauge rating, at flows ranging from 53 litres/second (staff gauge 3.060m, 14 March 2013) to 1,946 litres/second (staff gauge 3.834m, 17 July 2012).

A change in the rating occurred in April 2011 as the result of the clearing of willow trees immediately upstream of Kohiti Road. Stream flows were too high over the remainder of the monitoring period to be wade-gauged to re-establish the rating. However, a temporary rating, based on surface velocity measurements, was developed by TBP in June 2011 when wastewater discharge to the stream recommenced. Stream flow remained relatively high over summer 2011-2012, preventing re-establishment of a rating, only two gaugings being done at moderate flows. Floods on 17/18 December 2011 and 22 March 2012 scoured the banks upstream of the bridge culvert, changing the rating again. Four more gaugings were undertaken, which were used to generate a new rating in August 2012. In the interim, TBP continued to use its temporary rating. A large flood, on 13 October 2012, appears to have changed the rating again. A further rating curve, with adjustment for lower flows, was produced in March 2013.

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 2012-2013, drawn from the staff gauge readings at Kohiti Road, is given in Figure 5, together with a plot of the rate of wastewater discharge to the stream as measured at the v-notch weir at the outlet of Pond 6. The rate of discharge to the stream for 2012-2013 is compared against the rate for the monitoring periods since 2008-2009 in Figure 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 litres/second. Special condition 2 on consent 2051 requires that a minimum flow of 25 litres/second 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 minimum dilution rate of 300-fold were achieved throughout 2012-2013. The lowest flow was about 53 litres/second, on 15 March 2013. The flow was below 100 litres/second on about 75 days over periods between 28 January and 29 April.

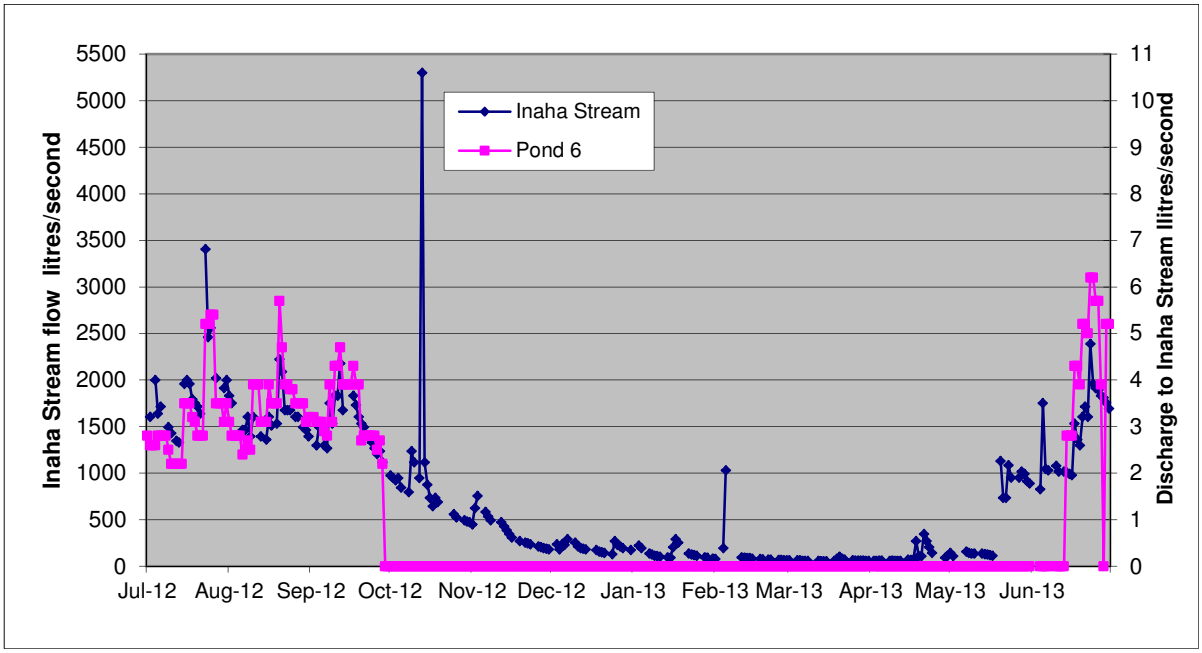

Figure 5 Hydrograph for Inaha Stream at Kohiti Road, July 2012 to June 2013, from daily staff gauge readings, with TBP discharge rate, litres/second

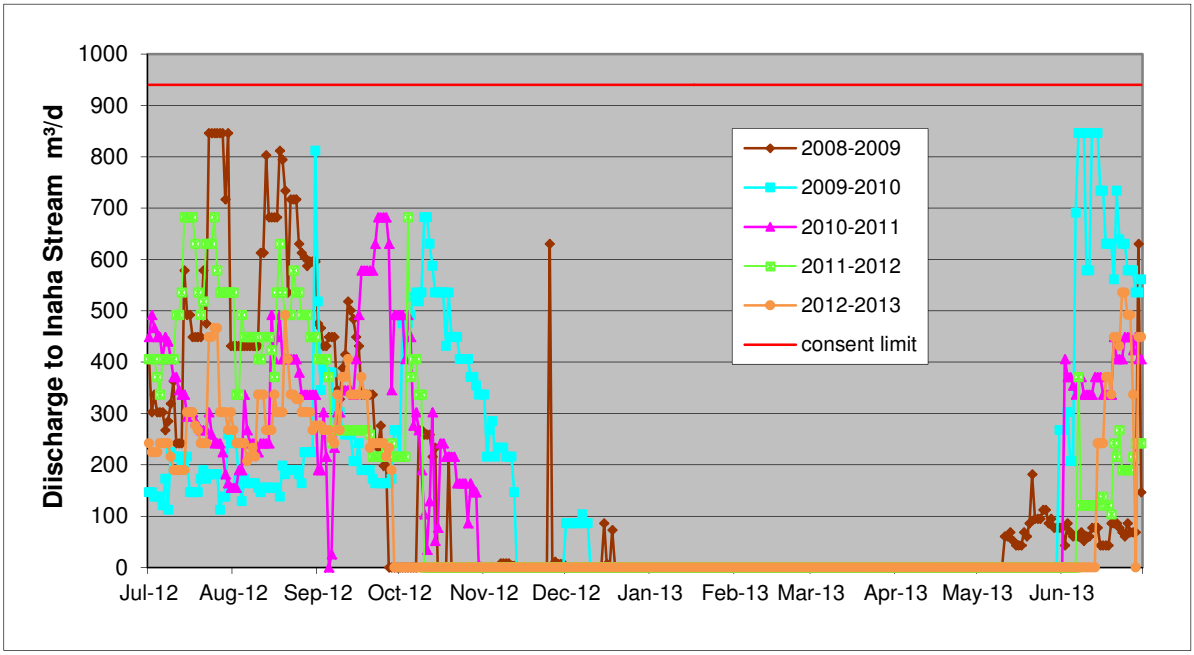

Figure 6 TBP discharge rate to Inaha Stream, July 2012 to June 2013, with previous four years' rates for comparison, m³/day

In comparison, for 2011-2012, the flow was below 100 litres/second on one day. The lowest flow recorded for Kohiti Road is 52 litres/second, from a gauging performed on 13 March 2001.

The TBP record shows that no wastewater was discharged to Inaha Stream when stream flows were below 100 litres/second, in accordance with condition 8 on consent 2049-4.

The TBP record shows that wastewater from the rendering plant was not discharged to Inaha Stream on 257 days in 2012-2013, between 28 September 2012 and 14 June 2013 during periods of low flow in the stream. The maximum recorded discharge rate of 6.2 litres/second, which is equivalent to 536 m^3/day or 57% of the consent limit of 940 m^3/day, was recorded for 24 June 2013.

In comparison, for 2011-2012, wastewater was not discharged on 240 days between 10 October 2011 and 6 June 2012. The maximum recorded discharge rate was 7.9 litres/second.

2.1.4.2 Instream temperature

The 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. The record over the 2012-2013 monitoring period for the temperature of cooling water discharged, and the increase in Inaha Stream temperature, is given in Figure 7 and Figure 8. The error on the cooling water temperature is ± 0.2˚C, and the error on the in-stream temperature increase is ±0.4˚C. The data for October 2012 were lost by the Company.

Special condition 3 on Consent 2050 requires that the temperature of the cooling water discharge not exceed 35˚C. In 2012-2013, the limit was complied with fully, for the second year in succession.

Special condition 9c on Consent 2049 and special condition 5g on Consent 2050 require that there be no more than a 3.0 degree Celsius temperature differential in the receiving waters below the mixing zone as a result of the wastewater and cooling water discharges, respectively. The maximum allowable temperature increase was exceeded by at least 0.5°C on 25 days between 13 February and 13 April, with a maximum increase of 5.6°C on Friday 15 March at 1515 NZST during the longest continuous period of 4.5 days, from 12 to 17 March. The limit had not been breached since April 2008, a period of five years. An abatement notice was issued in respect of this incident (refer to section 2.3.1).

The highest recorded temperature downstream of the discharge point in 2012-2013 was 26.1˚C, on 29 January 2013 at 1600 NZST. In comparison, the highest temperature ever recorded at this site is 30.9˚C, on 29 February 2008.

The temperature was above 25°C on 2 days, 29 and 31 January 2013, the longer continuous period being 4.75 hours.

The highest temperature recorded at the upstream site in 2012-2013 was 24.7˚C, on 29 January 2013 at 1530 NZST. This was the highest temperature recorded for the site, the previous highest being 24.0˚C, on 8 February 2009.

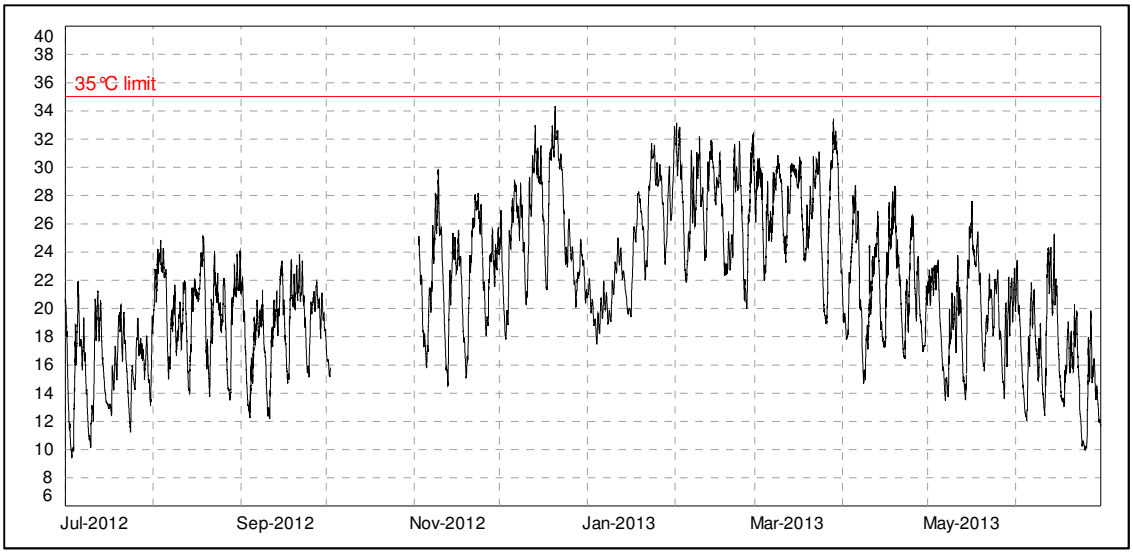

Figure 7 Cooling water temperature for period 1 July 2012 to 30 June 2013,˚C

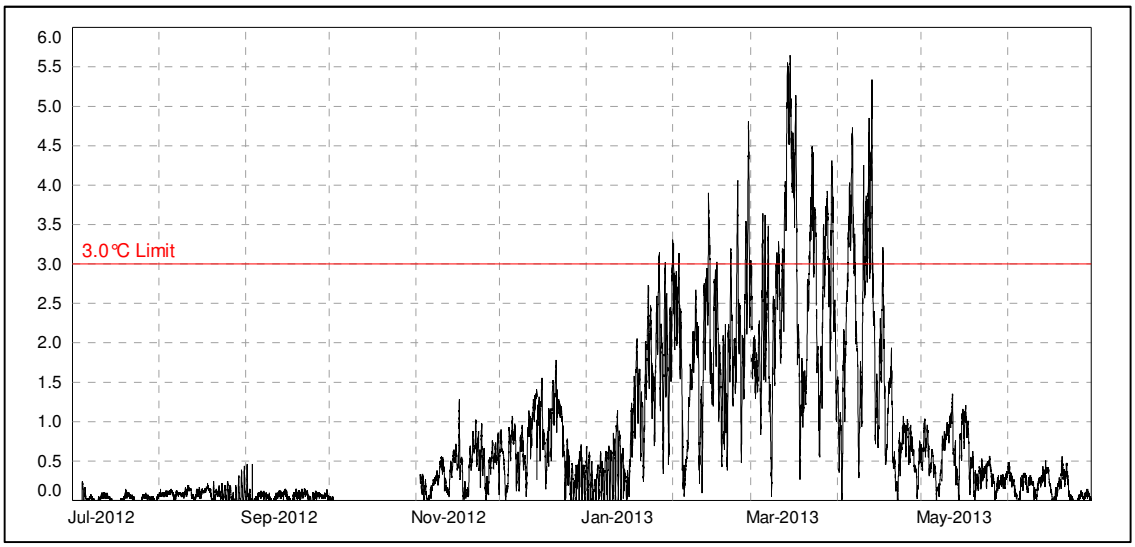

Figure 8 Inaha Stream temperature increase for period 1 July 2012 to 30 June 2013, ˚C

2.1.4.3 Water chemistry

Four sampling runs on Inaha Stream were undertaken during the 2012-2013 monitoring period. Site locations are given in Figure 1 and Table 3. One 'full' run of all 11 stream monitoring sites was carried out when wastewater was discharging directly to the stream, and three 'reduced' runs of 8 sites under lower stream flows when all wastewater was discharged to land. The results of the sampling and estimated flows for the main stem of Inaha Stream are presented in Table 8. The full set of results for each sampling run is given in Appendix II. (The uppermost tributary site was not sampled during the full run, on 26 June 2013, as access was blocked).

Discharge permit 2049, which allows the discharge of treated wastewater from TBP's rendering plant to Inaha Stream, places specific limits on the combined effect of all discharges from the plant on dissolved oxygen, biochemical oxygen demand and total ammonia and pH levels in the stream beyond the boundary of a 30-metre mixing zone.

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 are discussed separately below.

It is noted that TBP was not discharging treated wastewater during the first three of the four monitoring runs in 2012-2013, as all wastewater was being discharged to land during relatively low stream flows. This allowed assessment of the effects of leaching from the rendering plants' site, and of the minor discharges, such as cooling water, via the tributary that flows through the site.

Table 8 Water quality in the Inaha Stream 2012-2013

Site	Date	Temp	DO	%Sat	BOD_5	$fcBOD_5$	Turb	Cond	pH	NH_4	NNN	DRP	FC
1	28.11.12	16.0	9.1	94	0.8		4.7	19.9	7.7	0.021	1.84	0.050	670
3													
5	Inaha flow	16.6	10.1	105	1.0	0.5	5.9	22.1	8.0	0.013	2.2	0.041	430
6	196 L/s	19.1	9.6	104	1.2	0.7	5.7	23.0	8.0	0.060	2.5	0.037	380
7		21.1	9.5	108	1.6	1.0	9.6	23.5	7.8	0.056	2.8	0.040	530
8	TBP	21.3	9.7	110	1.6	0.6	8.4	23.6	7.8	0.073	3.0	0.039	400
11	0.0 L/s	20.7	11.3	127	1.8	0.7	7.0	27.9	8.5	0.016	2.9	0.042	250
1	19.03.13	17.2	6.9	73	1.6		3.0	23.8	7.5	0.017	0.43	0.059	16000
3													
5	Inaha flow	17.1	7.8	82	1.0	0.8	1.8	25.0	7.6	0.011	1.04	0.030	930
6	83 L/s	18.5	7.4	80	5.2	1.3	5.0	27.6	7.6	0.85	2.0	0.055	4000
7		17.8	5.7	61	>8	3.8	4.6	30.5	7.4	2.4	3.5	0.086	4500
8	TBP	18.0	7.0	75	13	>8	8.7	37.4	7.6	7.9	5.7	0.23	4600
11	0.0 L/s	16.0	9.1	93	2.6		8.5	38.2	7.8	0.033	3.5	0.097	4700
1	28.03.13	15.3	5.8	59	1.0		1.0	22.8	7.4	0.020	0.44	0.034	-
3													
5	Inaha flow	16.6	8.9	93	0.5	<0.5	0.64	25.8	7.6	0.011	1.52	0.013	-
6	60 L/s	19.7	7.4	82	3.9	0.7	3.4	28.3	7.5	0.73	2.8	0.042	-
7		19.4	7.2	79	5.5	0.8	4.7	29.4	7.4	0.28	4.3	0.056	-
8	TBP	18.3	7.3	78	2.6	<0.5	2.8	30.2	7.7	0.049	4.9	0.081	-
11	0.0 L/s	17.4	9.1	96	1.1		3.2	34.8	7.8	0.064	4.0	0.090	-
1	26.06.13	10.1	8.9	80	1.8		12	17.2	7.6	0.014	2.5	0.042	530
3		10.2	11.0	99	1.5		12	17.5	7.6	0.015	2.6	0.045	150
5	Inaha flow	10.1	-	-	1.8	<0.5	10	18.9	7.5	0.016	2.5	0.038	200
6	1,894 L/s	10.3	10.7	97	3.3	0.6	8.6	20.9	7.5	1.19	2.6	0.26	150
7		10.3	10.5	95	5.0	1.3	10	21.3	7.5	1.21	3.0	0.27	140
8	TBP	10.6	10.5	95	6.8	1.4	10	21.2	7.4	0.96	3.3	0.27	120
11	5.7 L/s	10.4	10.1	91	4.9	0.6	12	25.3	7.4	0.91	4.4	0.25	120

BOD_5 = total 5-day biochemical oxygen demand, g/m^3
$fcBOD_5$= filtered carbonaceous 5-day biochemical demand, g/m^3
Cond = conductivity, mS/m at 20˚C
DO = dissolved oxygen, g/m^3
DRP = dissolved reactive phosphorus, g/m^3P
FC = faecal coliforms, cfu/100 ml
NH4 = ammonia, g/m^3N
NNN = nitrate + nitrite, g/m^3N
O&G = oil & grease, g/m^3
pH
Temp = temperature, ˚C
Turb = turbidity, NTU
%Sat = percentage oxygen saturation

Dissolved oxygen
Consent 2049 requires that the discharge shall not reduce the concentration of dissolved oxygen of the receiving water to below 80% of saturation concentration, that is, about 6-9 g/m^3 in the case of Inaha Stream, depending on stream temperature. This limit is set for the protection of fish populations. Sampling runs were timed to take place when dissolved oxygen concentration is lowest, in early to mid-morning.

Dissolved oxygen was monitored on four occasions in 2012-2013. The results show compliance with the minimum limit on two of those occasions, in Spring 2012 and Winter 2013. On 19 March 2013, during a period of exceptionally low flow when only cooling water was allowed to be discharged, the reported oxygen concentration at the second site below the plants, some 500 metres downstream, fell to 61% of saturation. Reduced oxygen levels at this site, and the next site downstream above Normanby Road, have been observed before under similar conditions. In this case, BOD and ammonia concentration were elevated, as well. Investigation (refer section 2.3.1) was undertaken through site inspection, and a repeat survey was carried out on 28 March during the same flow recession. Inspection found that leachate from bio-filters had been entering the Inaha downstream of the first site below the plants. The leachate was then diverted to the wastewater treatment system, before the second survey, which found oxygen levels had increased below the plants to approximately the consent limit, at 78-82% of saturation, and BOD and ammonia had reduced to levels typical for low flow conditions.

In comparison, the lowest oxygen saturation value recorded since the wastewater treatment system upgrade in 1997 is 36%, at the second site downstream, on 28 February 2001 during extreme low flow conditions.

The profile of dissolved oxygen with distance down the catchment relates largely to channel and flow characteristics, with licensed discharges from TBP having less effect. Oxygen levels reduce where the water is slow, and distant from riffles or falls, as occurs in the deeper reaches during periods of low flow, notably at the three sites below TBP, and the uppermost site at Ahipaipa Road where a low of 59% of saturation was measured in March 2013.

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, and a slight decrease below the rendering plants at the second and third sites downstream, 500 metres 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.

Unusually high dissolved oxygen levels were recorded in November 2012, coincident with high pH, probably as the result of algal actvity.

Biochemical oxygen demand
Consent 2049 requires that the discharge shall not raise the filtered carbonaceous biochemical oxygen demand (filtered cBOD) above $2g/m^3$. This limit is set to control excessive bacterial or fungal slime growths. The Regional Council monitored for both total and filtered cBOD on four occasions in 2012-2013. Total BOD is monitored to assess the potential for dissolved oxygen sag.

The limit was complied with on three of the four monitoring occasions, the maximum downstream filtered cBOD value ranging from 0.8 g/m^3, when there was no (licensed) wastewater discharge, to 1.4 g/m^3, when wastewater was discharged. On 19 March 2013, the filtered cBOD at the third site downstream was >8 g/m^3 (total BOD, 13 g/m^3), apparently as the result of an unauthorised discharge of bio-filter leachate.

Total BOD concentration increased significantly below the TBP discharge points during low flows and when wastewater was being discharged, to a maximum of 6.8 g/m^3.

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 dissolved oxygen 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 (as NH_3) 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 of 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.

On the first monitoring occasion, the pH at sites near the discharge point was between 7.8 and 8.0: therefore the total ammonia limit was 0.7 g/m^3. On the other three occasions, the pH at monitoring sites near the discharge point was less than 7.75: therefore the total ammonia limit was 1.5 g/m^3. Had samples been taken later in the day, when algal photosynthesis has increased stream pH (rather than early in the morning to monitor dissolved oxygen sag), the pH values recorded may have exceeded 8.0 below the discharge point. (The highest recorded pH of 8.1 was for a sample taken at the mixing zone boundary at 1330 NZST on 22 October 2002). The maximum pH change recorded in 2012-2013 while wastewater was being discharged was 0.0 units, which is within the consent limit.

Table 9 Results of ammonia monitoring immediately below TBP wastewater discharge point

Date	Time	Inaha flow	TBP flow	Temperature	pH	Ammonia	
		L/s	L/s	°C		g/m^3	% limit
28.11.12	1025	196	0	19.1	8.0	0.073	10
19.03.13	0948	83	0	18.5	7.6	1.03	69
28.03.13	1010	60	0	19.7	7.5	0.89	59
26.06.13	1046	1,894	5.7	10.7	7.5	1.44	96

The results of total ammonia monitoring during four routine compliance monitoring runs in 2011-2013 are presented in Table 9 above.

The total ammonia limit was complied with on all four monitoring occasions, for the fifth year in succession.

In previous monitoring periods, a slight increase in ammonia concentration was recorded between the first and second monitoring sites below the TBP discharge point, indicating either incomplete mixing, variation in discharge composition, or an intermediate input. Leachate from the bio-filters, discovered during 2012-2013, is a possible source.

Tributaries in irrigation areas

The results of physico-chemical monitoring for the two tributaries which run through irrigated areas on the western side of Inaha Stream are presented in Table 10. Site 4 is at the confluence of the northern tributary, just above Kohiti Road. Sites 9, 10 and 11 are upstream, amid and downstream of the irrigation area on the southern tributary that joins Inaha Stream immediately below Normanby Road. Refer to Figure 1.

Table 10 Water quality in Inaha Stream tributaries in irrigation areas, 2012-2013

Site	Date	Temp	DO	%Sat	BOD_5	Turb	Cond	pH	NH_4	NNN	DRP	FC
10	28.11.12	19.8	11.3	125	1.0	8.2	34.8	7.8	0.007	4.4	0.007	450
10	19.03.13	16.0	8.5	87	1.1	2.0	51.1	7.6	0.011	3.5	0.010	270
10	28.03.13	14.9	10.2	102	0.6	0.93	44.0	7.8	0.013	3.8	0.005	-
4 10	26.06.13	9.0 9.5	10.4 10.5	91 93	0.8 0.8	4.7 12	29.4 43.8	7.3 7.4	0.036 0.034	1.96 2.3	0.018 0.009	110 120

Key: refer to Table 8, page 33

The water quality of the two tributaries is more mineralised (having higher conductivity) than the main stem, reflecting the closer proximity of their catchment to the sea. There was no obvious effect of irrigation carried out by TBP on the northern tributary. Nitrate levels in the southern tributary appear to be increasing, both upstream and downstream of the irrigation area.

2.1.4.4 Biomonitoring

In accordance with condition 9 on consent 2049, biological surveys were undertaken in the 2012-2013 monitoring period to assess the effects of point and diffuse source discharges from the TBP operation on the biological communities of Inaha Stream. Given the decreasing period of wastewater discharge to Inaha Stream, and demonstrated improvement in the health of benthic communities below the discharge point by previous surveys, the frequency of biomonitoring was reduced from triannual to biannual for 2011-2012. The two surveys were conducted on 21 November 2012 and 15 March 2013. Sites for biomonitoring are listed in Table 11, and depicted in Figure 7. The full reports of the two surveys are given in Appendix IV.

Table 11 Biomonitoring sites

Stream	Site	Sitecode	Map reference, NZTM		Location	Date established
			Easting	Northing		
Inaha	U	INH000334	170313	5625271	Upstream of irrigation area, near Ahipaipa Road	20.05.2004
	1	INH000400	1701874	5624322	Upstream of treatment ponds, Kohiti Road	01.09.1987
	2d	INH000420	1702021	5623745	500 m downstream of cooling water discharge	20.01.1995
	3	INH000430	1701650	5623262	Upstream of Normanby Road	06.08.1981
	4	INH000450	1701454	5622948	100m downstream of 'irrigation' tributary	01.02.2005
Unnamed tributary	UT	INH000433	1701109	5625496	Upstream of irrigation area	18.03.2010
	MT	INH000435	1700827	5624524	Within irrigation area	20.05.2004
	DT	INH000440	1700393	5620330	Upstream of Normanby Road and Inaha Stream	20.05.2004

A new control site (UT) was established on the unnamed tributary during the March 2010 survey, as the existing control site (renamed MT) lies within the extension of the irrigation area that was licensed by variation of consent 3941 on 9 November 2009, and where irrigation commenced in December 2009.

The Council's standard 'kick-net' sampling technique was used at seven sites to collect streambed macroinvertebrate from the Inaha Stream, and an unnamed tributary of the Inaha Stream, to assess whether discharges (via point source and irrigation to land) have had any adverse effects on the macroinvertebrate communities of the stream. Samples were processed to provide number of taxa (richness), MCI and $SQMCI_s$ scores for each site.

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

The conclusions of the reports on the two biomonitoring surveys conducted in 2012-2013 are presented below, each prefaced with a comment on preceding stream and wastewater flows.

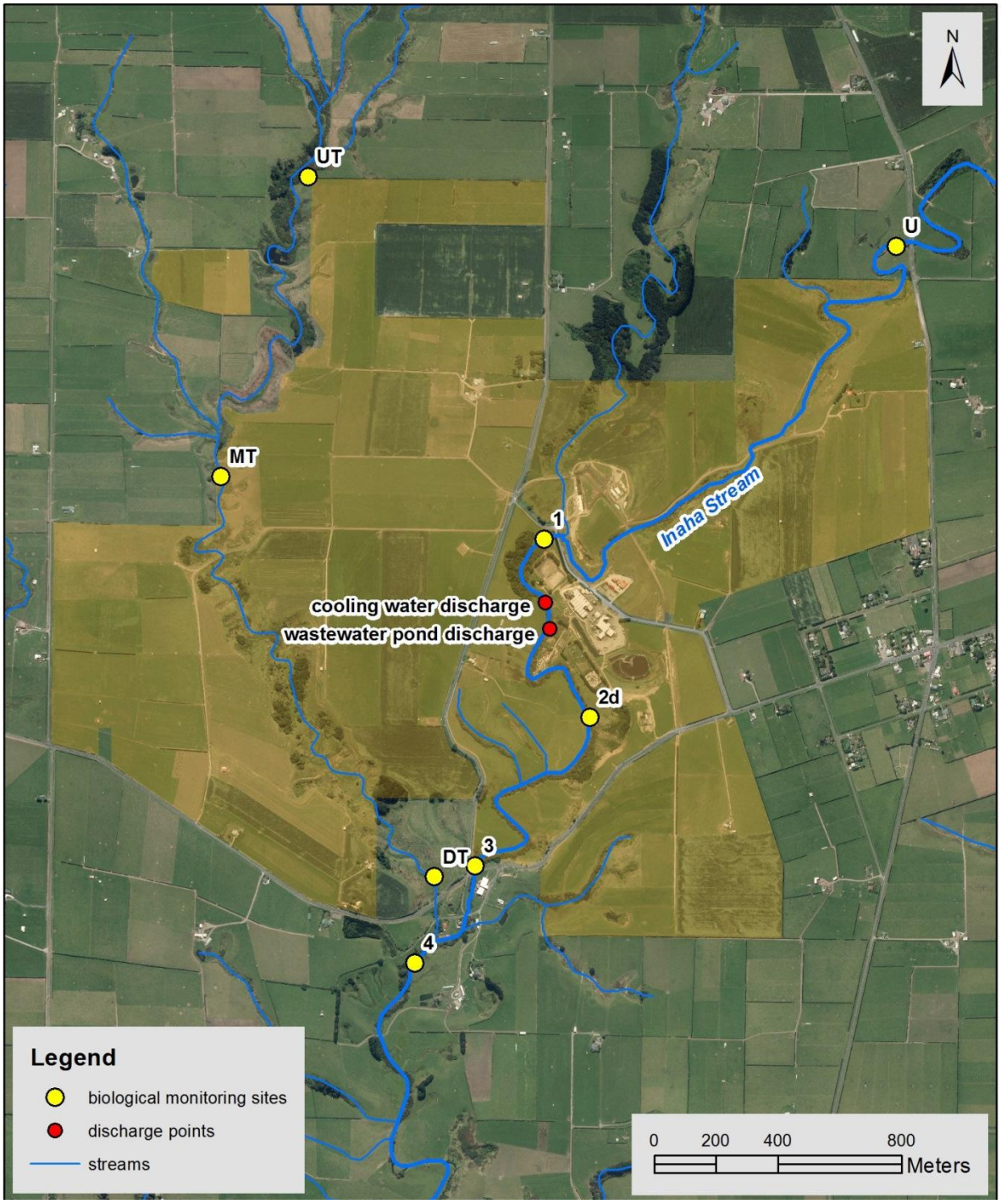

Figure 9 Biological monitoring sites

21 November 2012 survey

This November 2012 survey followed a period of 38 days since a fresh in excess of three times median flow in the nearby Waiokura Stream (the nearest appropriate water level recorder). In the month prior to this survey, there had been two minor freshes in the stream, neither of which exceeded the 3 times median flow. However, for the majority of this period the flows in the Waiokura Stream were at or above the median flow.

The Company's records showed that the last discharge of treated wastewater to the Inaha Stream occurred 52 days prior to this survey, on 1 October 2012. This is significant, as it means that this survey was preceded by an extended period in which no discharge occurred, indicating that the macroinvertebrate communities should be reflective of relatively 'natural' conditions. However, cooling water was discharged more or less on a continuous basis.

The results of this November 2012 biological survey indicated that the Inaha Stream was in fair to good health, with all five of the sites recording MCI scores higher than their long term medians and $SQMCI_S$ scores above their respective long term medians at four of the five sites (U, 2d, 3 and 4). In this survey, the MCI and $SQMCI_S$ scores recorded at the two sites most immediately downstream of the discharges from the rendering plant (sites 2d and 3) were significantly higher than their long term medians. In addition to this, the MCI scores at both sites continued to show improvement from the low scores recorded in 2009. Overall, these results indicated that the degree of impact from the wastewater discharge was much less evident than that recorded in previous surveys, which frequently recorded significant enrichment of the stream, and a consequent deterioration of the streambed macroinvertebrate communities. Usually, the sampling sites located upstream of the Taranaki By-Products plant supported macroinvertebrate communities with higher MCI and $SQMCI_S$ values compared to the three sites downstream of the factory discharges. In the current survey there were no statistically significant differences in MCI scores between sites. However, there was some variation in $SQMCI_S$ scores, with sites 1 and 4 recording significantly lower $SQMCI_S$ scores than that recorded at sites U and 2d. This does not indicate deterioration at these sites though, as the results for U and 2d were exceptionally high for this stream, being equal to their respective maximum scores of previous surveys. The abundance of the 'highly sensitive' *Deleatidium* mayfly and the absence of 'heterotrophic growths' at all sites supported these high scores, and overall, indicated the discharges (to land and to water) from the rendering plant had not caused a deleterious impact on the macroinvertebrate communities of the Inaha Stream.

Macroinvertebrate richnesses recorded at the three unnamed tributary sites (UT, MT and DT) were very similar to the historical medians for these sites. The community at the upstream control site (UT) was dominated by *Potamopyrgus* snails, amphipods (paraleptamphopids, *Paracalliope*, talitrids), mayfly (*Zephlebia* and *Austroclima*) and the caddisfly *Pycnocentria*, which reflected the instream habitat which consisted of willow roots and fine sediment. In contrast, the communities at site 2 downstream of the new irrigation area mainly comprised taxa more commonly associated with macrophyte beds (e.g. ostracod seed shrimps and damselfly larvae). Site DT was dominated primarily by talitrid amphipods, a fairly typical result for this site.

The MCI scores recorded for at sites UT and DT in the unnamed tributary were indicative of 'fair' health. However the MCI score recorded at site MT indicated 'poor'

water quality, although this is considered to be more reflective of the sampling technique, as macrophyte sweeps generally target more 'tolerant' taxa that prefer macrophyte habitat. The upstream site recorded an equal MCI score to that recorded at site DT, supporting the conclusion that the low score recorded at site MT was due to changes in habitat type rather than the result of the discharge of wastewater irrigation to land in the vicinity of the unnamed tributary.

Overall, the macroinvertebrate communities downstream of the Taranaki By-Products discharges in both the Inaha Stream and the unnamed tributary were of 'fair' to 'good' health. There results of this survey gave no indication that the discharges (to land and to water) from the rendering plant were having any significant adverse effect on the macroinvertebrate communities in either the Inaha Stream or the unnamed tributary. It appears that improved wastewater management (including extended diversion of the discharge to land) has continued to contribute to significantly improved communities downstream of the wastewater discharge point.

In the previous monitoring period, two changes were proposed to the bio-monitoring component of the 2012-2013 monitoring programme. These changes include a reduction from three to two bio-monitoring surveys per monitoring period (spring and summer surveys) and a requirement that all eight sites be surveyed each survey. These changes were incorporated; hence the unnamed tributary was included in this spring survey.

15 March 2013 survey

This March 2013 survey followed a period of 152 days since a fresh in excess of three times median flow in the nearby Waiokura Stream (the nearest appropriate water level recorder). In the month prior to this survey, there had been no freshes in the stream, with only three minor freshes occurring since December 1, none of which exceeded the 3 times median flow. The Waiokura Stream was below MALF at the time of this survey.

The Company's records showed that the last discharge of treated wastewater to the Inaha Stream occurred 166 days prior to this survey. This is significant, as it means that this survey was preceded by an extended period in which no discharge occurred, indicating that the macroinvertebrate communities should be reflective of relatively 'natural' conditions. However, cooling water was discharged more or less on a continuous basis.

The results of this March 2013 biological survey indicated that the Inaha Stream was in fair health, with all five sites recording MCI and $SQMCI_S$ scores similar to or higher than their long term medians. The overwhelming influence on the communities at the time of this survey was the very low flows that preceded this survey. This resulted in above average taxa richnesses at four of the five sites, and MCI scores that were well below that recorded in the previous survey. However, in this survey, the MCI scores recorded at the two sites most immediately downstream of the discharges from the rendering plant (sites 2d and 3) were still at least ten units higher than their long term medians. This shows that the MCI scores at both sites continue to show improvement from the low scores recorded in 2009. In addition, the $SQMCI_S$ scores at both sites were both significantly higher than their long term medians. Overall, these results indicated that the degree of impact from the wastewater discharge was much less evident than

that recorded in previous surveys, which frequently recorded significant enrichment of the stream, and a consequent deterioration of the streambed macroinvertebrate communities.

Usually, the sampling sites located upstream of the Taranaki By-Products plant supported macroinvertebrate communities with higher MCI and $SQMCI_S$ values compared to the three sites downstream of the factory discharges. In the current survey there were no statistically significant differences in MCI scores between sites. However, there was some variation in $SQMCI_S$ scores, with site 4 recording a $SQMCI_S$ score significantly higher than the other upstream sites, site U, 1 and 2d recording similar scores and site 3 recorded a score significantly less than any other site in the Inaha Stream. The abundance of the 'highly sensitive' *Deleatidium* mayfly and the absence of 'heterotrophic growths' at all impact sites supported these above average $SQMCI_S$ scores, and overall, indicated the discharges (to land and to water) from the rendering plant had not caused a deleterious impact on the macroinvertebrate communities of the Inaha Stream.

Unfortunately due to the low flows, no sample was collected from sites UT and MT in the unnamed tributary. The only site in this stream that was sampled (Site DT) was severely impacted by stock access, with destruction of habitat, sedimentation evidence of stock defecating directly into the stream. As a result of this stock access site DT experienced a significant loss of invertebrate taxa, with only 12 taxa recorded. This was eleven less than the median richness at this site and six taxa less than the previous minimum richness. The taxa that remained however were indicative of moderate water quality, and the community was dominated primarily by 'moderately sensitive' taxa including talitrid and *Paracalliope* amphipods and *Austroclima* mayflies, a fairly typical result for this site.

The MCI score recorded at site DT (105) in the unnamed tributary was indicative of 'good' health, and was the highest recorded of any site included in the current survey. Due to no upstream samples being collected, it is not possible to make any firm conclusions on the impacts of any upstream activities, including the irrigation of wastewater. However, the MCI and $SQMCI_S$ results recorded at site DT were above average, and this suggests that the wastewater irrigation to land in the vicinity of the unnamed tributary had not had any impact on the invertebrate communities of this stream.

Overall, the macroinvertebrate communities downstream of the Taranaki By-Products discharges in both the Inaha Stream and the unnamed tributary were of 'fair' to 'good' health. The results of this survey indicate that the macroinvertebrate communities were showing impacts from the low flows that preceded this survey, and other than the stock damage in the unnamed tributary, there was no indication that the discharges (to land and to water) from the rendering plant were having any significant adverse effect on the macroinvertebrate communities in either the Inaha Stream or the unnamed tributary. It appears that improved wastewater management has continued to contribute to significantly improved communities downstream of the wastewater discharge point.

2.1.5 Irrigation and groundwater monitoring

Irrigation

The exercise of consent 3941-2 to spray irrigate wastewater onto land is monitored by both TBP and Council. TBP measures and records wastewater volumes discharged on each paddock daily, and analyses (through a commercial laboratory until October 2011 and thereafter its own laboratory) nitrogen constituents of the wastewater at approximately weekly intervals. Some soil testing has been carried out.

Monitoring by Council includes inspection of irrigation areas, effluent analysis, chemical and biological survey of Inaha Stream, and sampling from groundwater bores drilled around the irrigation areas and of a spring situated near an irrigation area that is used to supply several households.

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

The area irrigated has progressively been 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.

In the 2012-2013 season, approximately 319 ha was available (licensed, including Shearers' property) for irrigation, of which 291 ha was utilised. This was larger than the area irrigated in 2011-2012 (271 ha), as a result of increased use of reticulated areas, and of Shearers' land. A total area of 50 ha was planted in maize and turnips, 48 ha of which was irrigated with wastewater before and during the growing season. This was a decrease from the 59 ha put in maize in 2011-2012, of which only 43 ha was irrigated before planting.

For 2012-2013, records produced by TBP show that, on the basis of weekly effluent tests for ammonia-nitrogen, nitrate nitrogen and nitrite-nitrogen, and assuming 15 g/m^3 organic nitrogen, the total mass of nitrogen discharged to land was 64,058 kg.

The 278 ha area utilised on the TBP farm received effluent nitrogen loading of 226 kgN/ha, and the 14 ha on Shearers' farm received 102 kgN/ha.

Loadings on the 92 individual paddocks irrigated on the TBP farm ranged from 23 to 439 kgN/ha/y, with an area of 57 ha (22 paddocks) exceeding 300 kgN/ha/y and an area of 7.5 ha (3 paddocks) exceeding 400 kg/ha/y. On Shearers' farm, nitrogen loadings ranged from 42 to 165 kgN/ha/y.

A summary of annual nitrogen application rates since 2001-2002 is given in Table 12.

Table 12 Irrigation periods and annual nitrogen application rates

Year	Nitrogen applied	300 kgN/ha areas		200 kgN/ha area	
		ha	kgN/ha/y	ha	kgN/ha/y
2001-02	9,409	62.7	150		
2002-03	18,513	65.8	253	11	168
2003-04	18,129	82.3	198	13	144
2004-05	17,911	93.2	177	15	94
2005-06	32,067*	163	197		
2006-07	27,719*	198	140		
2007-08	25,889	180	140	4.4	145
2008-09	22,737	148	154	1.9	31
2009-10	38,856	215	181	0	0
2010-11	44,732	233	188	10	76
2011-12	56,970	258	218	11	69
2012-13	64,058	278	226	14	102

* does not include Shearers'

The limit on consent 3941-2 for annual nitrogen loading is 300 kgN/ha, except for the Shearer block, where the limit is 200 kgN/ha.

Overall, during the 2012-2013 period, compliance with the annual nitrogen loading limits was achieved, the average nitrogen loadings being 75% of the 300 kg/ha limit, and 51% of the 200 kg/ha limit, respectively. For individual paddocks, compliance was recorded for 79% of the area where the limit is 300 kgN/ha, and 100% of the area where the limit is 200 kgN/ha.

Fertilisers

In August 2011, the Company produced its first "fertiliser budget", the outcome of a procedure TBP had developed for recording of nitrogen fertiliser application, including Zeal Grow (stickwater), urea and other chemical fertilisers used on crops and new grass, and soil conditioners such as dairy and rendering plant wastewater treatment pond solids.

In September 2013, the second completed fertiliser budget, for 2012-13, was supplied to Council. This budget included Zeal Grow application for the entire period, but not chemical fertilisers or soil conditioners after October 2012.

Recorded nitrogen application from fertilisers and soil conditioners, in addition to wastewater irrigation, ranged from 25 to 153 kg/ha, largely on paddocks that had not been irrigated. The highest combined annual nitrogen application rate of wastewater and fertiliser was 410 kg/ha. On six paddocks (15, 17, 18, 20, 38, and 85), 14.9 ha in total area, 300 kgN/ha was reported to have been exceeded as a result of the combined nitrogen application. All six paddocks were immediately above a watercourse, five along the western Inaha Stream tributary. None of these paddocks was upgradient of a monitoring bore.

Groundwater

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 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 13 and shown in Figure 10. The results of the sampling are given in Appendix III.

Table 13 Groundwater monitoring sites

Site name	Site code	Depth m	Grid reference, NZMP	
			Easting	Northing
BH1	GND1054	13.5	1702469	5624829
BH2	GND1055	6.8	1702001	5624440
BH3	GND1056	12.8	1702359	5623913
BH4	GND1057	11.0	1702308	5623294
Shearers' Spring	GND1058		1701770	5623022
BH5	GND1171	9.5	1701358	5624353
BH5B	GND1346	8.6	1701352	5624536
BH6	GND1172	11.8	1701575	5623867
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 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 (The new farm dairy was constructed over this site in April 2004). Bore 3 is beside Kohiti Road on the southeastern 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

floodings by ponded rainfall and wastewater. Bore 7 is downgradient of the southern side of the Ahipaipa block. Bore 8 is downgradient of the western side of the Katotauru/Normanby Roads block. Bore 9 is downgradient of the eastern side of Kingi block. Bore 10 is downgradient of the "Maori Trustee" block beside Upper Inaha Road.

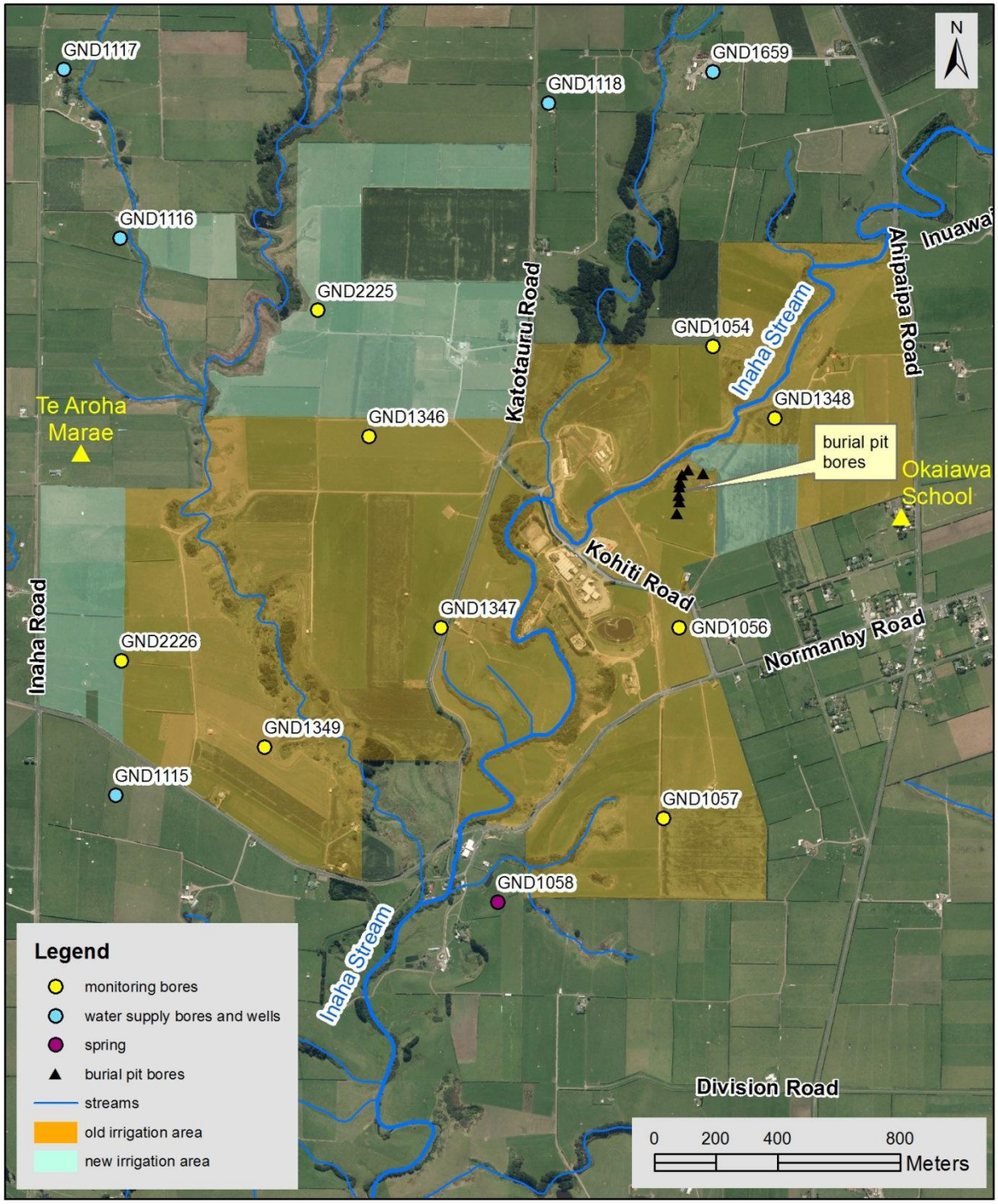

Figure 10 Pasture irrigation areas and groundwater monitoring sites

The spring on Shearers' property is used as a water supply for a number of households. It is therefore monitored to ensure that it is fit for human consumption, as it is relatively close to the boundary with Normanby block. The New Zealand health standard for nitrate-nitrogen concentration in drinking water for domestic supply is

11.3g/m^{3}N. Monitoring shows that nitrate levels in the spring, while remaining low, increased from 1.4 to 3.2g/m^{3}N over a period of about twelve years to June 2013.

The parameters of most interest with regard to operation of the wastewater irrigation system are the groundwater level, mineral strength (conductivity) and nitrate concentration. Figure 11 shows how these parameters have varied through time for groundwater at the ten monitoring points.

Background nitrate concentration, as found at control bores 1 and 5, and at bores 4, 6 and 5B before application of effluent, is typically 2 to 6 g/m^{3}N. At bore 1 on the northern boundary of the Kohiti Block, a spike in nitrate, to 30 g/m^{3}N, was recorded in December 2008, possibly as a result of fertiliser application on the neighbouring property up-gradient.

Bore 5B was initially a control bore in Katotauru block, before effluent irrigation was authorised up-gradient in November 2009, though an unknown amount of stickwater (ZealGrow) application and some effluent irrigation had occurred before then. Maize was grown immediately up-gradient in 2009-2010, and around the bore in 2011-2012. Nitrate concentration increased from <5 g/m^{3}N in 2006 to a peak of 101 g/m^{3}N in winter 2011, then reduced to 60 g/m^{3}N in June 2013. The peak nitrate concentration followed six, monthly applications of effluent on the paddock (55) immediately upgradient during a wet autumn and winter. In 2012-2013, reported annual nitrogen loading was 152 kgN/ha in the immediate vicinity, and was 411 kg/ha in the paddock upgradient, applied from September to March.

At the replacement impact bore 6B in Katotauru block, nitrate concentration increased from about 3 to 17 g/m^{3}N between 2006 and winter 2009, then increased more rapidly to about 65 g/m^3 in October 2011 and stabilised. This is likely to be the accumulative effect of the application of treated wastewater and stickwater over a distance of several hundreds metres up-gradient of bore 6B.

In Kohiti block (Bore 3), where effluent irrigation began in the 1990s at high application rates, large seasonal swings in nitrate concentration have occurred, with peaks in spring and troughs in autumn as groundwater level rises and falls. As effluent application rate has reduced, the peaks have reduced, from about 110 g/m^{3}N in 2002 to 27 g/m^{3}N in 2011. For most of the time, measured nitrate concentrations during 2012-2013 were below 6 g/m^{3}N. Reported annual nitrogen loading around bore 3 was 283 kg/ha in 2012-2013, evenly spread through the year.

At bore 4, in Normanby block, nitrate concentration was typically 7-13 g/m^{3}N, with spikes in winter of up to about 50 g/m^{3}N, until 2009-2010, when the winter increase lasted longer than before, and in 2010-2011 the baseline lifted to about 20 g/m^{3}N. There was a reduction, to 11 g/m^{3}N, in June 2012, following a hiatus in irrigation in 2011-2012, which remained in 2012-2013, although reported effluent application rates around the bore site (paddocks 90, 91 and 97) were relatively high, at 329 to 404 kgN/ha.

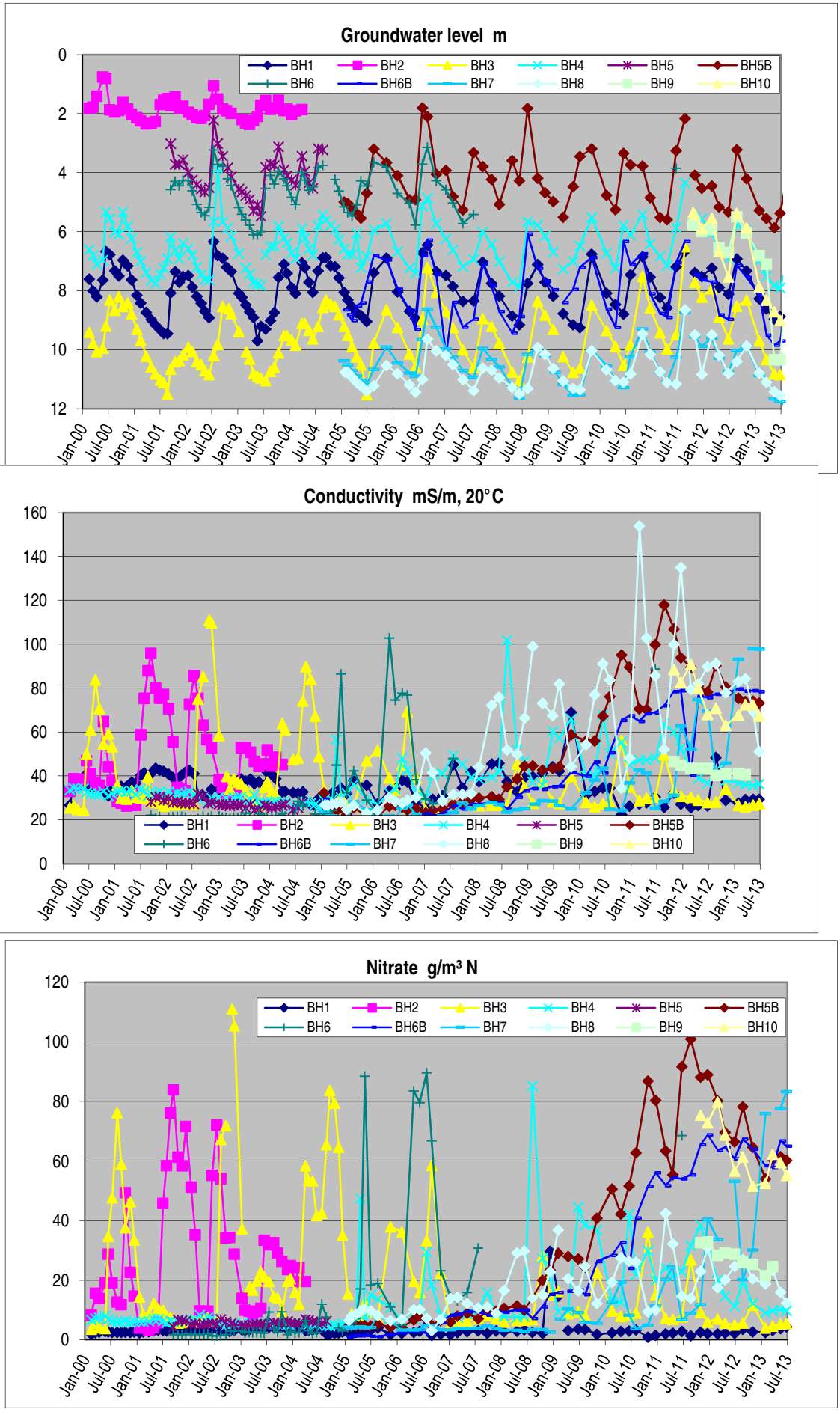

Figure 11 Water level, conductivity and nitrate concentration at irrigation monitoring bores 2000-2013

At bore 7, in the Ahipaipa block, nitrate levels remained at 3-5 g/m^{3}N, until autumn 2009, when the level increased to about 10 g/m^{3}N. In the following four autumn periods, the (measured) seasonal peak increased, reaching 83 g/m^{3}N in 2013, with troughs in winter/spring of lessening depth, being 20 g/m^{3}N in (August) 2012. The surrounding paddock (82) was used for maize cropping in 2008-2009, 2011-2012 and 2012-2013. Reported annual effluent nitrogen loading was 135 kg/ha in 2012-2013, applied in spring and winter. Dairy solids were applied in October 2012, at an estimated nitrogen application rate of 220 kg/ha.

At bore 8, on the western side of the Katotauru/Normanby block, nitrate levels have fluctuated between 3 and 42 g/m^{3}N over periods of several months, unrelated to season. Maize was grown in the paddock (20) up-gradient in 2008-2009. Nitrate levels ranged from 12 to 27 g/m^{3}N in 2012-2013. Other dissolved constituents, notably chloride and the major cations, have followed similar cycles. Reported annual effluent nitrogen loading was 280 kg/ha in 2012-2013, applied in four lots from October to February. ZealGrow was applied in August 2012 at an estimated nitrogen application rate of 67 kg/ha.

At (new) bore 9, downgradient of the eastern side of the newly irrigated Kingi block, the initial nitrate level in October 2011 was quite high, at 33 g/m^{3}N, and had reduced to 25 g/m^{3}N by March 2013. The bore was dry, at depth 10.3 m in May and June 2013. Reported annual effluent nitrogen loading in the adjacent paddock upgradient (41) was 155 g/m^{3}N between September and December 2012. There had been urea application in the paddock before recording started.

(New) bore 10, was placed at the edge of the 200-metre buffer zone along Normanby Road (as is bore 8), about 270 metres from Upper Inaha Road, near to the boundary of the existing Katotauru/Normanby Roads block. Measured nitrate level ranged from 80 g/m^{3}N in February 2012 to 55 g/m^{3}N in June 2012. It is likely that previous irrigation on the adjacent block has affected this monitoring site. In 2012-2013, reported effluent nitrogen loading in the adjacent paddock (29) up-gradient was 277 kgN/ha, applied evenly through the year.

There is a strong correlation between increase in nitrate concentration (and conductivity) and elevation in groundwater level, consistent with rainfall flushing irrigated effluent or applied fertiliser components through the soil. Nitrate concentration appears to rise and fall quickly, which is consistent with the application of relatively low volumes of high strength wastewater.

2.1.6 Solid waste disposal

The disposal of solid wastes from meat rendering operations under consent 5495-1 is undertaken in accordance with a management plan that has been approved by Council. Raw material that cannot be processed is buried on the Kohiti Road property opposite the rendering plant (Figure 10). Pits must be dug to certain specifications after notification of Council; material placed in the pits must be covered with soil within four hours to control odour; and stormwater must be diverted away.

Monitoring by Council consists of monthly inspection, and sampling of groundwater from bores placed around the disposal area.

Over the 2012-2013 period, solid waste burial was found to be well managed. TBP notified Council, in accordance with the management plan, of waste burial on two occasions, and, for both burials, gave details of type and amount of material, reason for disposal, and results of an odour survey conducted at the time. On 18-20 February 2013, 225 tonne of product was buried following a delay in repairs after a mechanical failure in the beef line press. Due to the volume and nature of the material, it was not able to be processed through an alternative process line. On 11 March 2013, 25 tonne of raw material was buried following a road accident involving a Jackson Transport Limited truck carrying offal near Awakino. Subsequent inspections by Council showed exercise of consent 5495 to be satisfactory.

No complaint was received about odour associated with solid waste burial in the 2012-2013 period.

In addition to unprocessable material, solids from the farm dairy wastewater screen, including solids from Pond 5 desludging, were stored temporarily on the ground at the old burial pit site before being spread on land as fertiliser.

Groundwater monitoring at seven bores immediately down-gradient of the burial area has shown the formation of a plume approximately 150 metres in width. In 2012-2013, maximum (individual bore) nitrate concentrations ranged from <1 to 8.5 g/m^3N. Nitrate concentration in the control bore up-gradient increased from 3 to 8 g/m^3N between 2001 and 2005, then levelled until 2009, when a decrease to <3 g/m^3 occurred by June 2013.

Since 2010, there has been a notable increase in ammonia concentration at two bores, BP4 and BP7, both down-gradient of newly-used burial or farm solids storage areas. BP4, at the northwestern corner, reached 19 g/m^3N in November 2012, and BP7 peaked at 84 g/m^3N in May 2012. Both bores had elevated COD values, of up to 52 g/m^3, and some organic odour.

As the bores that contained elevated concentrations of nitrogen yielded low volumes on pumping, indicating slow movement of groundwater with little dilution, and as the plume is relatively narrow with no potential groundwater usage down-gradient, a watching brief is being maintained.

Should nitrogen contamination levels increase markedly, to the extent that Inaha Stream, 50 metres away, may be affected, remedial measures such as a denitrification trench may need to be considered.

2.2 Air

No emission monitoring or deposition gauging is undertaken as part of the air quality monitoring for TBP. Instead, an odour survey of the surrounding area is carried out at each of the monthly air quality inspections. These inspections identify any issues that need to be addressed.

Consent 4058 has as its main effects criterion a requirement that the odour is not to be noxious or offensive or objectionable, at or past the legal boundaries of the property. Further details of air-related incidents can be found in the Register of Incidents in section 2.3.

2.3 Investigations, interventions, and incidents

The monitoring programme for each year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the consent holder. During the year matters may arise which require additional activity by the Council eg 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 Taranaki Regional Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The 'Unauthorised Incident Register' (UIR) includes events where the company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

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

In the 2012-2013 period, it was necessary for the Council to undertake significant additional investigations and interventions, or record incidents, in association with TBP's conditions in resource consents or provisions in Regional Plans in relation to the Company's activities at its Okaiawa site on 41 occasions. The incidents are summarised in Table 14. In the case of odour complaint, it is noted whether the level of offensiveness was substantiated.

Table 14 Unauthorised incidents reported from 1 July 2012 to 30 June 2013

Water

Date	Incident	Description/Finding	Action
January – March 2013	Breach of temperature increase limit for Inaha Stream	TBP record showed intermittent breaches of up to 4.5 days duration	Abatement notice for works on cooling system to be completed before next summer (31 Oct 13)
19 March 2013	Breach of RFWP	High BOD and total ammonia in Inaha Stream below TBP. Leachate from bio-filter irrigation possible cause.	Diversion of bio-filter leachate to wastewater treatment system

Land

Date	Incident	Description/Finding	Action
5 December 2012	Complaint irrigator used too close to Te Aroha marae	Inoperative irrigator found set up ~160 metres from marae building, but only ~120 metres from marae boundary,	Explained that 150-metre limit from public place applies to marae boundary. Irrigator repositioned.

Air

Date	Incident	Description/Finding	Action
3 July 2012	Non-provision of plan	Air Management Plan not supplied by due date, 1 February 2012.	Management meeting and 14-day letter. Plan produced. Letter of explanation accepted.
7 July 2012	Odour complaint	No odour beyond boundary. Wind direction wrong for source to be TBP plant site.	Continued surveillance
24 November 2012	Odour complaint	Offensive odour of "dead animal" at a Ngutu Road address, attributed to failure of underground ducting to factory air bio-filter.	Letter of explanation accepted. Ducting replaced. Newsletter with explanation distributed
26 November 2012 0915, 1415 NZDT	Odour complaints (2)	Noticeable intermittent light earthy/musty odour on Barclay and Ngutu Roads, possibly from recently excavated bio-filter	Continued surveillance
29 November 2012 1355,1800 NZDT	Odour complaints (2)	Noticeable intermittent light cooking meat odour in Okaiawa.	Continued surveillance
1 December 2012	Odour complaint	Light noticeable intermittent odour beyond boundary	Continued surveillance
2 December 2012	Odour complaint	Light noticeable intermittent odour beyond boundary	Continued surveillance
6 December 2012	Odour complaint	No odour beyond boundary	Continued surveillance
18 December 2012	Multiple odour complaints	Offensive odour along Kohiti and Barclay Roads. During transfer of waste material for reprocessing after a fire in the driers	Letter of explanation accepted, as defence established
19 December 2012 1605, 2115 NZDT	Odour complaints (2)	No odour beyond boundary	Continued surveillance
21 December 2012	Odour complaint	No odour beyond boundary	Continued surveillance
31 December 2012	Odour complaint	Intermittent noticeable odour on Ahipaipa Road	Continued surveillance
10 January 2013	Odour complaint)	Objectionable cooking odour on Normanby Road, not at complainant's residence	Continued surveillance
11 January 2013	Odour complaints (2)	No odour beyond boundary	Continued surveillance
12 January 2013	Odour complaint	Light cooking odour on Raine Road	Continued surveillance
13 January 2013 0845,1630 NZDT	Odour complaints (2)	Light, sweet fermenting, and cooking odours on Ngutu Road	Continued surveillance
19 January 2013	Odour complaint	Objectionable "offal-type" odour on Ngutu Road Letter of explanation blames delays in bio-filter upgrade	**Infringement Notice**
20 January 2013	Odour complaint	Objectionable "offal-type" odour on Manu Road. Letter of explanation blames delays in bio-filter upgrade	**Infringement Notice**
26 January 2013	Odour complaint	No odour beyond boundary	Continued surveillance
31 January 2013	Odour complaint	Noticeable intermittent odour on Ahipaipa Road	Continued surveillance
12 February 2013	Odour complaint	Noticeable unidentified odour on Ahipaipa Road	Continued surveillance
13 February 2013 1020, 2150 NZDT	Odour complaints (2)	Intermittent unidentified odour on Ahipaipa Road, possibly from TBE plant breakdown.	Continued surveillance
15 February 2013	Odour complaint	Intermittent cooking odour on Barclay Road	Continued surveillance

23 February 2013	Odour complaint	Continuous objectionable cooking odour on Katotauru Road. Letter of explanation blames delays in bio-filter upgrade	**Infringement Notice**
5 March 2013	Odour complaint	Continuous objectionable bio-filter odour on Division Road. Letter of explanation blames delays in bio-filter upgrade	**Infringement Notice.** Bio-filters upgraded.
6 March 2013 0825, 1026 NZDT	Odour complaints (2)	Noticeable odour on Ahipaipa Road, none on Waihi Road, Hawera, under strong N wind	Continued surveillance
24 April 2013	Odour complaint	Noticeable odour on Katotauru Road	Continued surveillance
1 May 2013	Odour complaint	No odour beyond boundary	Continued surveillance
1 June 2013	Odour complaint	No odour at complainant's residence	Continued surveillance
20 June 2013	Odour complaint	No odour beyond boundary	Continued surveillance
25 June 2013	Odour complaint	Noticeable but not objectionable odour on Ahipaipa Road	Continued surveillance

A summary of the incidents registered in 2012-2013 is presented in Table 15, with those for the years since 2000 included for comparison. Incidents are described as relating to water, land or air. Odour complaint numbers, both total received and those substantiated, are distinguished in the air category.

Table 15 Summary of registered incidents relating to Taranaki By-Products Limited, 2000-2013

Year	Total	Water	Land	Air		
				Total	Odour	Substantiated odour
2000-2001	55	3	0	52	49	3
2001-2002	20	1	0	19	16	5
2002-2003	22	4	5	13	12	5
2003-2004	26	6	2	18	18	3
2004-2005	36	4	2	30	30	5
2005-2006	28	5	4	19	19	2
2006-2007	34	8	3	23	23	5
2007-2008	55	6	3	46	45	8
2008-2009	28	1	2	25	25	2
2009-2010	11	1	0	10	10	0
2010-2011	19	1	1	17	17	0
2011-2012	13	0	0	13	13	0
2012-2013	41	2	1	38	37	6

Over the 2012-2013 period, a total of two incidents were registered in relation to water, one in relation to land, and 38 in relation to air.

All except three of the incidents related to complaints by members of the public.

2.3.1 Water

The two incidents registered about effects on water in the 2012-2013 period both resulted from resource consent compliance monitoring, one by Council and one by the Company. No complaint was received about effect on water.

The Regional Fresh Water Plan (RFWP), and a condition on consent 2050-4 to discharge cooling water to Inaha Stream, were breached.

On 19 March 2013, during a routine water quality survey, samples taken of Inaha Stream during a period of very low flow at sites below the rendering plant showed high levels of filtered carbonaceous biochemical oxygen demand (fcBOD) and total ammonia. At that time, only cooling water was being discharged (consent 2050-4), as all wastewater was being spray-irrigated to land (consent 3941-2). The fcBOD of >8 g/m^3 and ammonia concentration of 7.9 g/m^3N exceeded that allowed, were wastewater being discharged to the stream (consent 2049-4), by factors of greater than four-fold and five-fold, respectively. Investigation showed the likely source of contamination to be leachate from the bio-filters that are situated beside the stream. A drainage system with a pump to the wastewater treatment ponds was installed to divert the leachate away from the stream. A bio-monitoring survey conducted on 15 March 2013 found no significant adverse effect on the stream. In view of the lack of effect, and the prompt remediation, no further action was taken in respect of this breach of the RFWP.

Consent 2050-4 (cooling water) was breached on several occasions over about three months, from January to April 2013, during a period of low flows in Inaha Stream. The monitoring record produced by TBP showed that the 3°C limit on maximum temperature increase was breached for periods of up to 4.5 days (from 12 to 17 March), with a maximum increase of 5.6°C. An Abatement Notice was issued, requiring works to be undertaken to improve the effectiveness of the cooling system, in order to achieve consent compliance by 31 October 2013, before the next summer.

2.3.2 Land

The incident registered about effects on land in the 2012-2013 period was the result of a complaint on 5 December 2012 about wastewater irrigation too close to Te Aroha marae on Upper Inaha Road, within the 150-metre buffer zone. Investigation found that an irrigator had been set up 160 metres from the marae building and 120 metres from the marae boundary. It was clarified with the Company that the buffer zone extends from the boundary of the marae, as all of the marae is considered to be a place of public assembly. No further action was taken.

2.3.3 Air

Over the 2012-2013 period, a total of 38 incidents were registered in connection with emissions to air from the rendering plants' operation. All but one of the incidents related to complaints by members of the public about odour. There were fourteen complainants, one of whom made ten complaints. All of the complaints were investigated by officers of the Regional Council as soon as practicable after each complaint was laid, through inspection of the rendering plants and surrounding area, except in one case when the complainant reported that the odour had dispersed.

Six of the 37 odour complaints were substantiated, in that offensive or objectionable odour was found beyond the boundary of property covered by consent 4058 at the time of inspection, and the odour affected someone.

The first substantiated complaint occurred on 24 November 2012. The odour source was ascribed by the Company to emissions that resulted from structural failure of the main ducting within the Factory Air bio-filter. The bio-filter ducting was replaced promptly and neighbouring residents were informed by newsletter. The Company's written explanation was accepted. No further action was taken by Council.

On 18 December 2012, three complaints were made about offensive odour within and south of Okaiawa, downwind of the Company's plant. Investigation found that there had been a fire in two driers two days before. The material being dried was spoiled by the firewater. This odorous material was removed from the damaged driers for reprocessing, via the meal load-out area and the main building entrance, resulting in the offensive emissions. This was treated as a single incident. The Company's written explanation was accepted. No further action was taken by Council.

The last four substantiated complaints occurred on 19 and 20 January, 23 February and 5 March 2013, all about strong processing odour. In written explanation, the Company stated that the odours occurred during delays in the upgrade of the main bio-filter for the inedibles plant, as the result of lack of bark deliveries. This explanation was not accepted, and four Infringement Notices (each a $1000 fine) were issued. The bio-filter upgrade was completed in early April 2013.

On 18 occasions, that is on 49% of investigations, Council officers found odour from the TBP site to be noticeable but not objectionable beyond the plants' boundary, ten times at the location of complaint. The source of odour detected was attributed mostly to the inedibles rendering plant, particularly cooking odour as the result of poor bio-filter performance. No odour was associated with the edibles plant, treatment of wastewater, irrigation of wastewater, or burial of solid waste.

On ten occasions that complaint was made, no noticeable odour was found upon inspection. It is noted that odorous emissions from a rendering plant site can be sporadic and of variable intensity.

The other incident related to non-provision of the Air Management Plan required to be supplied by 2 February 2012 under special condition 7 on discharge permit 4058-4. The Plan was provided five months late. A written apology and explanation was received from the Company, noting that the Plan, while produced late, had been put into effect within the prescribed timeframe. No further action was taken by Council.

2.4 Community consultation

A community liaison group was set up in July 2000. Its purpose is to facilitate communication between TBP, the Okaiawa community and the Council regarding resource consent matters. The group members are the Okaiawa Community Liaison Officer, representatives from TBP (Managing Director, Plant Manager and Environmental Manager), staff of the Council (Director - Resource Management, Compliance Manager, and Inspecting Officer), and site neighbours. Initially meetings were held monthly, then on an 'as required' basis.

It is noted that the Council in June 2003 initiated reviews of the consents (2049, 3941 and 4058, respectively) for discharges to water, land and air partly in response to concerns raised by members of the community. The consent reviews that ensued were instrumental in installation of additional odour control equipment, upgrade of the wastewater treatment system, and extension of the land disposal system.

The reviewed consents for discharge to land by spray irrigation and for discharge of emissions to air both had a condition inserted that requires liaison with interested parties on exercise of the consent.

Special condition 19 on discharge permit 3941-2 to discharge treated wastewater onto or into land by spray irrigation, imposed on 21 December 2005, reads:

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.

Special condition 4 on the replacement discharge permit 4058-4 to discharge emissions to air, issued on 11 October 2011, reads:

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 land owners 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.

A meeting under consent 3941-2 was held at Te Aroha marae on 4 August 2012, immediately after the hapu AGM. Thirteen members of Ngati Manuhiakai attended, together with one representative each of the Company and the Council.

Some of the topics discussed included:

- Licensed irrigation areas
- Buffer zones
- Effects on Inaha Stream and bio-monitoring
- Areas of particular importance to the hapu
- Future Company plans (no plant expansion, dairying increase possible)
- Riparian planting
- Old solid waste disposal site

A meeting under consent 4058-4 was held at Okaiawa Rugby Club rooms on 10 October 2012. A newsletter with an invitation to the meeting was hand delivered to local residents, and mailed to a number of community organisations and groups. Five persons attended, including a representative of Ngati Manuhiakai, together with Company and Council staff.

Matters covered included

- Plant operation, performance and events with regard to odour
- Recent and planned improvements for odour control
- Recent and potential improvements in wastewater treatment
- Licensed irrigation areas and buffer zones
- Community events
- Community newsletters
- Appointment of a new Community Liaison Officer

Four community newsletters were produced during the 2012-2013 reporting period.

2.5 Riparian management

Conditions on two consents held by TBP relate to the management of riparian margins of Inaha Stream, in connection with the discharge of wastewater to and the emplacement of culverts in the stream.

Donation to Taranaki Tree Trust
To mitigate any effect of its discharge of wastewater to Inaha Stream, TBP has since 1999 donated to the Taranaki Tree Trust $2,100 per year for the purpose of riparian planting and management in the Inaha catchment (GST exclusive and adjusted according to the consumer price index).

This agreement is written into special condition 18 on discharge permit 2049-4.

These donations have been used to subsidise riparian planting along the main stream and its tributaries. The effect of these measures will be to increase shading, with consequent decrease in water temperature and in nuisance algal growth; to reduce stock access and bank erosion; to reduce nutrient and sediment input to watercourses; and to enhance the appearance of the riparian margins.

At the end of 2012-2013, a total of $28,130.37 of TBP funding had been spent on or was committed to riparian management covering planting of stream margins. The works were carried out throughout the catchment, mainly along reaches above the Okaiawa plant. Funding was granted to landholders at a rate of 50% on plants as a rebate.

Fencing and planting above Kokiri Road
Land use consent 6431, that allows the emplacement of two culverts in Inaha Stream for farm access above Kokiri Road, requires TBP to prevent stock access to the stream and adjacent wetlands throughout the property by fencing or other means (condition 9), and to plant and maintain the controlled riparian areas (condition 10) within four years of granting. This requirement applies to a section approximately 2 km in length between Ahipaipa and Kokiri Roads. Consent 6431 was granted on 4 October 2004.

It is noted that Council produced two riparian management plans (RMP938 and RMP921) for TBP in September 2004, relating to the Inaha stem between Ahipaipa and Normanby Roads and the western tributary that runs through the Katotauru/Upper Inaha Roads irrigation area, respectively. Two other riparian plans relating to the western tributary (RMP014 and RMP1363), have become associated with the irrigation area as it has been extended up the catchment.

Prior to the 2007-2008 reporting period, some work was done on riparian margins of Inaha Stream above Kohiti Road, involving aerial spraying and removal of willows.

Following the realignment of Inaha Stream in April 2008, a length of approximately 1,200 metres extending downstream from Ahipaipa Road that spans the new channel section was fenced on both sides. Planting of the fenced areas with appropriate native species was completed in June 2008.

Fencing and planting of the remaining section of about 900 metres of riparian margin immediately above Kohiti Road was completed at the end of the 2008-2009 reporting period. Willows along this section were aerially sprayed in the 2009-2010 reporting period and removed in April 2011 (with some effect on the water level monitoring site below the bridge). Planting of the cleared section occurred in winter 2011, and replanting/blanking of areas further upstream.

2.6 Provision of reports, management plans, and certification

2.6.1 Reports and plans

TBP is required to provide to Council various management plans, contingency procedures, certifications and monitoring reports under five consents, as summarised in Table 16.

Table 16 Requirements for reports and plans imposed by special conditions

Requirement	Consent Number (and Condition Numbers)	Date(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 5 July 2013, 2 months late
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 31 May 2013
Monthly report under section 3.2 of management plan on daily activities log, weather, bio-filter performance	4058-4 (7)	Monthly	Reports received, with some delays of up to 3 months
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 13 May 2013
Monthly report under section 5.2 of management plan on wastewater characteristics, flows and irrigated areas	2049-4 (13)(15)	Monthly	Reports received, with some delays of up to 3 months
Wastewater to land			
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 23 May 2013
Annual report under section 4.3 of management plan on wastewater characteristics, flows and irrigated areas	3941-2 (1)(3)	Annually	Nitrogen budget received 14 November 2013
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 9 May 2013
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 30 May 2013

Management plans (4) are required for the disposal of wastewater to Inaha Stream and 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 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 operational 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.

The air management plan that is required under the new air discharge permit incorporates the operations and maintenance manual and the contingency plan on loss of processing capacity that were required under the old permit.

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 bio-filter performance. An annual report is required under the spray irrigation management plan. The (new) air management plan proposes an annual monitoring report for the year to June.

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).

In 2012-2013, TBP was required to review by 31 May the management plans for wastewater disposal to Inaha Stream and to land by spray irrigation, and for discharge of emissions to air. The reviews were undertaken in time. In conjunction, a review of the solid waste burial management plan was also undertaken. The reviewed plans were satisfactory.

With regard to monthly and annual monitoring reports, TBP did provide reports as required, mostly on time, but with some delays of up to three months.

2.6.2 Air discharge engineering practice certification

The first biennial engineering practice audit under the new permit **4058-4**, in respect of the works, processes and equipment relevant to all discharges to air from the site, was undertaken by air quality engineers Golder Associates on 11 and 12 April 2013. The audit gave greater focus to the design and monitoring of the odour control systems for the two rendering plants, compared to their initial audit in June 2010 under the old permit. The report on the evaluation is attached as Appendix V.

The report concludes:

Following our audit of the TBL (TBP) and TBE odour control system, it is concluded that the associated equipment, including ducts, 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 TBL and TBE odour control systems represent good engineering practice following the planned biofilter reconfiguration, it is concluded that the existing 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 (of) the documentation to make more specific reference to odour control system components (such as fans, 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.

3. Discussion

3.1 Discussion of plant performance

By providing a service that utilises offal, fallen stock, and other by-products of the meat and poultry processing industry, TBP's activities play a role in the sustainable management of natural and physical resources in Taranaki, as expressed in the RMA. The various matters of importance in sections 6 and 7 of the RMA, as well as the minimum water quality standards in section 107, are important considerations in this regard.

During 2012-2013 there was frequent contact between TBP staff and officers of Council at the Okaiawa rendering plants as part of routine monthly and any follow-up inspections, and the investigation of 41 incidents over that period. In addition, some 142 water samples were taken, 2 biomonitoring surveys conducted, temperature data processed monthly, and the stream gauged periodically in the vicinity of the plants.

This intensity of monitoring was the result of on-going concern about the performance of the plant, particularly with regard to generation of odour, but also to past adverse effects on Inaha Stream and, potentially, on groundwater.

Generally, the on-site management and operation of TBP's facility over 2012-2013 could be described as fair, with improvement in some aspects and deterioration in others.

The management and contingency plans, and monitoring reports that were required under four consents for the 2012-2013 period were all provided in reasonable time, with the exception of some monitoring reports, which were up to 3 months late. (See Table 16).

A meter for continuous measurement of water abstraction volume from Inaha Stream was installed in September 2012. The monitoring data provided, for the period from March 2013, demonstrated full compliance with the take consent, when measurement error was taken into account. Verification of meter accuracy had not yet been undertaken at the end of the monitoring period, owing to lack of qualified testers.

The wastewater treatment system continued to be upgraded in stages. In March 2013, a pH adjustment system for wastewater entering the DAF unit was installed to improve the removal of dissolved solids.

Control of wastewater discharge so as to maximise application to land was very good, with no discharge to Inaha Stream occurring for 257 days in 2012-2013, between 28 September and 14 June. In comparison, discharges of wastewater to water occurred on 240 days in 2011-2012, and 186 days in 2007-2008. The Company is endeavouring to extend this period. When discharge to Inaha Stream did occur, there was full compliance with the limits on minimum dilution and maximum ammonia concentration in the receiving water. This continued the improvement first noted in 2007-2008.

The cooling water discharge breached the 3˚C limit on stream temperature increase on 25 days during low stream flows between 13 February and 13 April, with a maximum

increase of 5.6°C. An abatement notice was issued to carry out works to remedy this before the next summer low flow period. The 35˚C limit on maximum temperature of the receiving tributary was complied with.

The stormwater system continued to discharge significantly lower concentrations of sediment and grease to the Inaha tributary, although breaches of the suspended solids and oil and grease limits were recorded for the point where stormwater enters the firewater pond. This improvement is attributed to diversion of the first flush to the wastewater treatment system, and to the placement of sediment traps in the catchment around the two rendering plants and transport depot. Work on sealing the entire catchment continued, thus removing a potential odour source and enabling better housekeeping.

The irrigation system was managed so as to produce an average nitrogen loading that easily complied with consent limits. However, distribution of wastewater over the TBP farm was less even than before, with reported loading exceeding the 300 kgN/ha limit on 21% of the area. The procedure established in 2011-2012 for recording of nitrogen fertiliser application, including Zeal Grow (stickwater), urea and other chemical fertilisers used on crops and new grass, and soil conditioners such as solids from the dairy feed pad and the wastewater treatment ponds, was kept up only for ZealGrow after October 2012. Two-monthly reporting to Council on a (wastewater) "nitrogen budget" and a "fertiliser budget", which was instituted in 2011-2012 under the Irrigation Management Plan to correspond with groundwater monitoring undertaken by Council, fell behind after December 2012.

There was one, unsubstantiated, complaint about irrigation.

Management of the solid waste disposal area was satisfactory, in general. There was some storage of organic material (dairy screenings) unrelated to the rendering operations, which had potential to leach, in the disposal area. A total of 225 tonne of product was buried in 2011-2012, a large increase from the 22 tonne recorded for 2011-2012. No complaint was received about use of the burial pits.

Fencing and planting of riparian margins of the Inaha Stream above-Kohiti Road was maintained, in compliance with the consent to install culverts. A donation was made to the Taranaki Tree Trust for riparian planting in the Inaha catchment, as agreed in the consent to discharge wastewater.

With respect to operation of the rendering plants, a site audit of odour control systems, carried out by air quality engineers Golder Associates in April 2013, concluded that the associated equipment appeared to be maintained and operated in a sound engineering state. The report noted initiatives underway, such as reconfiguration of the bio-filters, that should achieve improvement to current engineering practice. Better control of the temperature of air entering the bio-filters was likely to be required, through further upgrading/modification of existing systems, and an increased level of temperature/pressure monitoring along the extraction and bio-filter system was justified. Process management systems were found to be comprehensively documented, though expansion of the odour control system component was recommended. A review of the design philosophy of the inedibles plant odour control system was promoted, to make the concentration source system the primary means of containing odour. The Company has undertaken to follow the recommendations of the report, with minor modifications.

3.2 Environmental effects of exercise of consents

The abstraction of water from Inaha Stream was not found to have any adverse effect on the stream. Flows in the stream were very low in autumn 2012, being the lowest recorded since 2001.

The discharge of cooling water raised Inaha Stream temperature by more than the consent limit for periods of up to 4.5 days between February and April. This was not found to have any adverse effect on the stream.

In 2006-2007, a significant improvement in water quality of the stream was brought about by a change in management of the 'dual' wastewater disposal system, in which discharge may be either to the Inaha Stream directly or to land by spray irrigation so that disposal to land was maximised. The results of the two stream biomonitoring surveys conducted in 2012-2013 show that improvement was sustained, to the extent that there was no significant difference in benthic invertebrate communities above and below the wastewater discharge point.

No effect on stream communities was noted in relation to land irrigation.

With regard to discharge of wastewater to land, groundwater monitoring showed moderate effects of irrigation, overall. The spring used for supply of local residents downslope of the irrigation block south of Normanby Road was well within the guideline for nitrate concentration. Nitrate levels were elevated at several bores, with all but two, both down-gradient of long disposal areas, showing decrease at the end of the review period. Improved nitrogen budgeting, that includes wastewater and fertiliser inputs, was implemented to address this.

For the solid waste disposal area, no complaint about odour was received. A narrow plume containing high concentration of nitrate, detected downslope of the disposal area, is being monitored to determine if any remedial action is needed.

Over the 2012-2013 reporting period, TBP had an adverse effect on the environment as a result of the discharge of emissions into the air that carried unacceptable odours to local residents. The source of these odour emissions, as discussed in section 2.3.3, was attributed to the bio-filters, after structural failure and during a prolonged period of maintenance, and to product transfer after a fire. In terms of substantiated unauthorised incidents (which are the primary measure of the adverse effect that TBP has), there were six (6) odour incidents, compared to zero (0) over the previous three years.

Noticeable, but not objectionable, odour was found beyond the plant boundary on 49% of the 37 incident investigations by Council in 2012-2013. The source of odour was attributed entirely to the inedibles plant or its odour control system, particularly cooking odour. No odour complaint was associated with the edibles plant, wastewater treatment or irrigation systems, or burial of solid waste.

3.3 Evaluation of performance

A tabular summary of the Company's compliance record for the 2009-2010 monitoring period is set out in Table 17 to Table 26.

Table 17 Summary of performance for Consent 2051-4. Abstract water from the Inaha Stream

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 25L/s downstream of point of abstraction	Monitoring of flow	Yes
3. Operation of an abstraction measurement device, maintain records	Site inspection. Fixed rate pumps. Meters installed September 2012. Data provided for period since March 2013	Yes
4. Operation of a flow recorder at Kohiti Road	Staff gauge in stream, rated by Council. Daily level record and monthly report by Company	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

N/A = applicable

Table 18 Summary of performance for Consent 2049-4 Discharge treated wastewater to the Inaha Stream

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Mixing zone 30m 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. Company to undertake self monitoring	Review and compare results. 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, monitoring results and liaison	Yes
8. Discharge to cease when flows in the Inaha drop below 100L/s	Monitoring of Kohiti Rd flow gauge results	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
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 Company reports	Yes
15. Optional and annual reviews of wastewater plan	Liaison. Annual review by Company submitted 13 May 2013	Yes
16. Designated staff member	Part of Company Environmental Manager's job description, also Plant and Operations Manager's	Yes
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		High

N/A = applicable

Table 19 Summary of performance for Consent 2050-4 Discharge cooling water to Inaha tributary

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Activity monitoring by Company as required	Continuous temperature monitoring taken over by TBP, from 5 January 2010.	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 TBP, with checks 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 by TBP, and chemical and biological sampling by Council. Refer section 2.1.4.2	No. Major temperature breaches February to April 2013. Enforcement Order taken out
6. Discharge temperature measurement and recording	Monitoring carried out by TBP, from 5 January 2010	Yes, one month's data lost, for October 2012
7. Optional review provision	Next review date available June 2017	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Poor

N/A = applicable

Table 20 Summary of performance for Consent 5426-1 Discharge stormwater to Inaha tributary

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	Two breaches of suspended solids limit, and one breach of oil and grease limit
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	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Improvement desired

N/A = applicable

Table 21 Summary of performance for Consent 4058-4 Discharge emissions to air

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 Company and inspection by Council	BPO generally achieved
2. No offensive or objectionable odour beyond boundary	Odour surveys by Council and Company, and investigation and recording of complaints. No substantiated complaints	Four infringement notices issued for Dec/Jan and Feb/Mar events
3. Definition of noxious, offensive or objectionable odour		N/A
4. Designated staff member for emissions management	Part of Company Environmental Manager's job description. Also Plant and Operations Managers	Yes
5. Prohibition of fish rendering	Inspection by Council	Yes
6. Certification processes and equipment operated according to good engineering practice biennially from 30 April 2013	Biennial certification by suitably qualified independent person. Initial review of TBP and TBE plant operations conducted 11-12 April 2013, report received 5 July 2013	Report received, 2 months late
7. Preparation of Air Discharge Management Plan	Submission of Plan, on 3 July 2012	Yes, provided late
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. Review by Company submitted 31 May 2013	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
10. Limits on dust deposition rate	Inspection	Yes
11. Newsletter production, and community liaison meetings	Four newsletters produced. Community liaison meeting held 10 October 2012	Yes
12. Optional review provision to deal with significant adverse effects	Next review date available June 2015	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Poor

N/A = applicable

Table 22 Summary of performance for Consent 3941-2 Discharge treated wastewater to land

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	Liaison. Change to plan to maximise discharge to land, and mandatory annual reviews, required under review of consent 21 December 2005. Revision submitted 23 May 2013.	Yes
5. Designated staff member	Part of Company Environmental Manager's job description. Also Plant and Operations Manager's	Yes
6. Adopt best practicable option to minimise adverse effects, including total nitrogen minimisation	Liaison and inspection. DAF unit installed October 2004 and enlarged October 2008. Flocculant addition for solids (including nitrogen) removal from November 2007, and pH adjustment from March 2013	Upgraded system still being assessed
7. Seek permission for Inaha discharge when cannot irrigate, and Inaha low	Liaison and inspection	N/A
8. Limit on dissolved oxygen in final pond	Chemical sampling.	No, though no adverse effect
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	No, on one of four monitoring occasions
12. Prohibition of ponding and run-off	Inspection and complaint register	Yes
13. Spray buffer zones	Inspection and complaint register	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
14. Limit on nitrogen application rate	Monitoring by Company and review of irrigation records. Record also kept of N fertiliser application to establish total nitrogen loading	Yes, on average, though limit exceeded for 21% of area irrigated
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 and field measurement	Yes
17. Limit on return period	Inspection and provision of records	Yes
18. Installation and maintenance of monitoring bores	Liaison and inspection. Further maintenance required	Yes
19. Baseline and operational monitoring by Company	Results of wastewater, irrigation and soil monitoring by/for Company reviewed by Council	Yes
20. Consultation meetings with interested parties	Imposed by review of 21 December 2005. Meeting held at Te Aroha marae on 4 August 2012	Yes
21. Notification prior to Inaha discharge	Imposed by review of 21 December 2005. Liaison with Company and Ngati Manuhiakai	Yes
22. Provisions for contamination of groundwater or water supply	Groundwater monitoring by Council and complaint register	N/A
23. Optional review provision for operational requirements	Not sought by Company	N/A
24. Optional review provision upon receipt of ammonia reduction report	Not sought by Council	N/A
25. Optional review provision for nitrogen treatment and disposal	Not sought by Council	N/A
26. Optional review provision for environmental effects	Next review date available June 2014	`N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Improvement desired

N/A = applicable

Table 23 Summary of performance for Consent 5495-1 Discharge by burial of wastes from meat rendering

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 Company records.	Some dairy waste screenings stored in burial area.
3. Optional provision for review of waste burial management plan	Not sought by Company or Council. Revisions undertaken by Company in May 2013	N/A
4. Designated staff member	Part of Company Environmental Manager's job description. Also Plant and Operations Managers'	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
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	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		N/A
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	N/A
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. Two bores damaged, beyond influence of present disposal area	Yes
17. Optional review provision for operational requirements	Not sought by Company	N/A
18. 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		Good

N/A = applicable

Table 24 Summary of performance for Consent 5560-1 Discharge by burial of waste cheese

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notification prior to commencement of operations to plan monitoring	No operation during review period	N/A
2. Removal of affected parties during operations	No operation during review period	N/A
3. Discharge in accordance with information submitted, and limit on	No operation during review period	N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
tonnage		
4. Site access to Council for inspection and monitoring	Inspection by Council	Yes
5. Keeping photographic record of disposal operation	No operation during review period	N/A
6. Timeframe for operation	No operation during review period	N/A
7. Interim covering of wastes with soil if timeframe not met	No operation during review period	N/A
8. Immediate covering of wastes with treatment material	No operation during review period	N/A
9. Covering with clean soil upon completion	No operation during review period	N/A
10. No other wastes to be buried	Inspection by Council	N/A
11. Adopt best practicable option to minimise effects on the environment	Liaison and inspection	Yes
12. Covering of material during transportation	No operation during review period	N/A
13. Immediate covering of material discharged during transit	No operation during review period	N/A
14. Discharge only under certain wind conditions	No operation during review period	N/A
15. No emission of odours after 1 Feb 2000	Inspection by Council	Yes
16. Disposal pit liner to be as specified	No operation during review period	N/A
17. Pit not to intercept groundwater	Inspection by Council	Yes
18. Surface contour to direct away stormwater	Inspection by Council	Yes
19. Site rehabilitation and pasture re-establishment	Inspection by Council	Yes
20. No irrigation over disposal area	Inspection by Council	N/A
21. Cover material integrity to be maintained	Inspection by Council	N/A
22. No direct discharge to surface water	Inspection by Council	N/A
23. 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		Not exercised

N/A = applicable

Table 25 Summary of performance for Consent 6431-1 Place culverts in Inaha Stream

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. No work undertaken	N/A
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	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	Planting completed June 2009
11. Placement of culvert inverts 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		Good

N/A = applicable

Table 26 Summary of performance for Consent 7234-1 Disturb to realign Inaha Steam

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Consent to be exercised in accordance with documentation submitted	Inspection by Council. Sedimentation controls required in April – June 2008)	Yes
2. Notification prior to commencement of works	Notification given 17 March 2008	N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
3. Placement and design of rock wall for bank protection	Inspection by Council	Yes
4. Works prohibited between May and October, without permission	Inspection by Council	Yes
5. Riverbed disturbance to be minimised	Inspection by Council	Yes
6. Sediment discharge and effects to be minimised	Inspection by Council	Yes
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	Yes
9. Vegetation removed not to be buried near stream	Inspection by Council	Yes
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		High

N/A = applicable

Table 27 Summary of performance for Consent 7329-1 Discharge stormwater and sediment from re-contouring land and re-aligning Inaha Stream

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)	Yes
2. Limit on maximum soil area disturbed	Inspection by Council	Yes
3. Limit on maximum soil volume disturbed	Inspection by Council	Yes
4. Design criteria for run-off sediments traps to be followed	Inspection by Council.	Yes
5. Sediment discharge and effects to be minimised	Inspection by Council.	Yes
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. Stabilization of earthwork areas upon completion of soil disturbance activities	Inspection by Council	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
8. Procedure to be followed upon discovery of archaeological site	Liaison with Council (Retrospective)	Yes
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		High

N/A = applicable

With respect to the abstraction of water from Inaha Stream, at the end of the period under review, the Company's overall level of environmental performance was good. Volume metering was installed, and a full record is now required to be provided under the Measurement and Reporting of Water Takes regulations.

With respect to the discharge of wastewater to Inaha Stream, at the end of the period under review, the Company's overall level of environmental performance was high. This represents a continuation of the improvement first noted in 2007-2008, with decreasing periods of discharge to the stream.

With respect to the discharge of cooling water to Inaha Stream, at the end of the period under review, the Company's overall level of environmental performance was poor, as the result of large temperature increases during a period of low flows in the stream. An enforcement order was issued to address this before the next summer low flow period.

With respect to the discharge of stormwater to Inaha Stream, at the end of the period under review, the Company's overall level of environmental performance required improvement, in respect of the amount of solids and oils in the discharge, though no adverse effect was noted for the receiving water.

With respect to the discharge of wastewater to land, during the period under review, the Company's overall level of environmental performance required improvement. More even application of wastewater could be achieved, and better recording of supplementary fertiliser use.

With respect to the burial of solid wastes, during the period under review, the Company's overall level of environmental performance was good. Disposal or storage of materials unrelated to the rendering operations should be avoided.

With respect to the discharge of emissions to air, during the period under review, the Company demonstrated a poor level of environmental performance and compliance with the resource consent, with four infringement notices being issued for objectionable odour. This represents a deterioration from the previous three years, which occurred while the odour treatment system was being repaired and upgraded.

3.4 Recommendations from the 2010-2012 Biennial Report

In the 2010-2012 Biennial Report, it was recommended:

1. THAT monitoring of air emissions from the rendering operations of Taranaki By-Products Limited in the 2012-2013 year continue at the same level as in 2011-2012.

2. THAT monitoring of water abstraction and of wastewater, cooling water, stormwater and solids discharges from the rendering operations of Taranaki By-Products Limited in the 2012-2013 year continue at the same level as in 2011-2012 with the appropriate adjustments to reflect changes, in wastewater treatment and disposal, and in environmental effects.

3. THAT the Council notes the option for a review of resource consent 4058-4 (discharge to air) in June 2013, as set out in condition 12 on consent 4058-4 was not exercised, on the ground that current conditions are adequate to deal with any potential adverse effects.

These recommendations were implemented. The monitoring programmes for water abstraction and discharges and for air emission were continued essentially unchanged during the 2012-2013 monitoring period.

3.5 Alterations to monitoring programmes for 2013-2014

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

In the case of TBP, the programme for 2012-2013 was essentially unchanged from that for 2011-2012.

It is proposed that for 2013-2014, the air quality monitoring programme, being monthly inspection, be maintained.

With regard to the water quality monitoring programme for 2013-2014, it is proposed that the existing programme be maintained as in 2012-2013.

Recommendations to this effect are attached to this report.

3.6 Exercise of optional review of consents

One of the eleven consents associated with the rendering plants at Okaiawa provides for review in June 2014.

Resource consent 3941-2 (discharge wastewater to land) provides for an optional review of the consent in June 2014.

Condition 25 on consent 3941-2 allows the Council to review the consent, for the purpose of ensuring that the respective conditions are adequate to deal with any adverse effects of the respective activities on the environment.

Based on the results of monitoring in the year under review, and in previous years as set out in earlier annual compliance monitoring reports, it is considered that there are no grounds that require a review of the consent to be pursued.

A recommendation to this effect is presented in Section 4 of this report.

4. Recommendations

1. THAT monitoring of air emissions from the rendering operations of Taranaki By-Products Limited in the 2013-2014 year continue at the same level as in 2012-2013.

2. THAT monitoring of water abstraction and of wastewater, cooling water, stormwater and solids discharges from the rendering operations of Taranaki By-Products Limited in the 2013-2014 year continue at the same level as in 2012-2013 with the appropriate adjustments to reflect changes, in wastewater treatment and disposal, and in environmental effects.

3. THAT the option for a review of resource consent 3941-2 (discharge of wastewater to land) in June 2014, as set out in condition 25 on consent 3941-2 not be exercised, on the ground that current conditions are adequate to deal with any potential adverse effects.

Glossary of common terms and abbreviations

The following abbreviations and terms are used within this report:

Biomonitoring	assessing the health of the environment using aquatic organisms
BOD	biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate.
BODF	biochemical oxygen demand of a filtered sample
bund	a wall around a tank to contain its contents in the case of a leak
CBOD	carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate
cfu	colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample
COD	chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction
Condy	conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20˚C and expressed in mS/m
DO	dissolved oxygen
DRP	dissolved reactive phosphorus
FC	faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample
fresh	elevated flow in a stream, such as after heavy rainfall
g/m^3	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
l/s	litres per second
MCI	macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats
mS/m	millisiemens per metre
mixing zone	the zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point
	ammonium, normally expressed in terms of the mass of nitrogen (N)
NH4	ammonium, 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 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)
pH	a numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic, i.e. a change of 1 represents a ten-fold change in strength. For example a pH of 4 is ten times more acidic than a pH of 5
Physicochemical	measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment
resource consent	refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12,14 and 15), water permits (Section 14) and discharge permits (Section 15)
RMA	Resource Management Act 1991 and subsequent amendments
SS	suspended solids
Temp	temperature, measured in ˚C (degrees Celsius)
Turb	turbidity, expressed in NTU
UIR	Unauthorised Incident Register entry – an event recorded by the Council on the basis that it had potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan

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

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Appendix I

Resource consents held by Taranaki By-Products Limited

Consent 2049-4

TARANAKI REGIONAL COUNCIL
CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE: 06-765 7127
FAX: 06-765 5097
www.trc.govt.nz

Please quote our file number on all correspondence

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

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

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

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 NH_3] 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.

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

TARANAKI REGIONAL COUNCIL

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DISCHARGE PERMIT

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

Name of Consent Holder:	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

TRK992051

TARANAKI
REGIONAL
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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
Renewal Granted Date:	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 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

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

TRK992051

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 means of taking water shall be maintained to the satisfaction of the General Manager, 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 General Manager, 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 General Manager, Taranaki Regional Council, upon request.

4. THAT the consent holder shall install and operate to the satisfaction of the General Manager, Taranaki Regional Council, a flow recorder at Kohiti Road, and shall keep records of the flows in the Inaha Stream; such records to be made available to the General Manager, Taranaki Regional Council, upon request.

5. THAT the consent holder shall investigate and report on the use of treated wastewater as cooling water; the report to be received by the General Manager, Taranaki Regional Council, not later than ten months from the date the consent is granted.

6. 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

Consent 3941-2

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Please quote our file number on all correspondence

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

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.

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.

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.

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

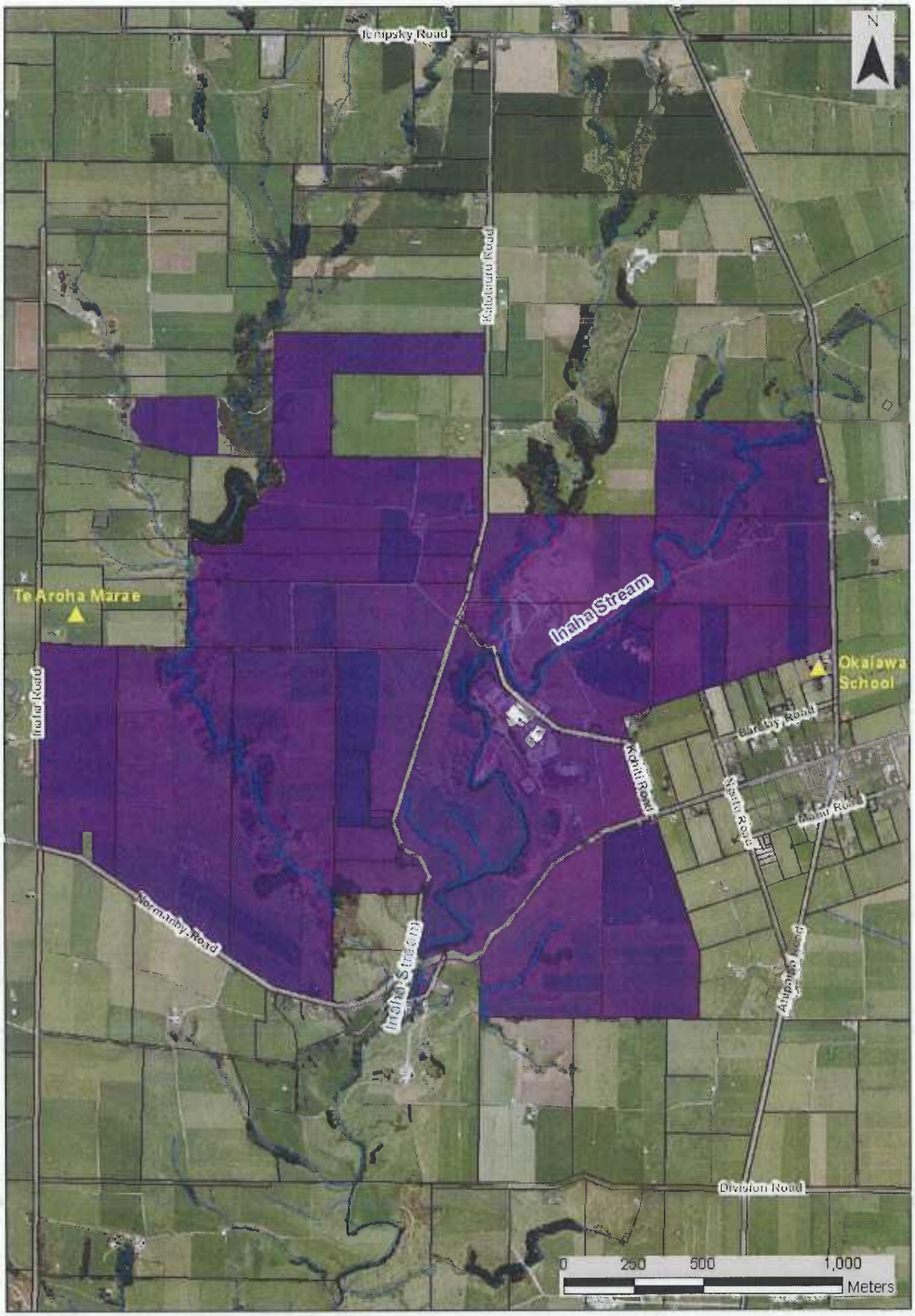

Figure 1 Location of the authorised area to receive wastewater, via spray irrigation, onto and into land

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Discharge Permit

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

Name of Consent Holder:	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.

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.

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 g/m^2/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

TARANAKI REGIONAL COUNCIL

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DISCHARGE PERMIT

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

Name of Consent Holder:	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:

Component	Concentration
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

Consent 5495-1

TARANAKI
REGIONAL
COUNCIL

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Discharge Permit

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

Name of Consent Holder:	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

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 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.

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.

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

Consent 5560-1

TARANAKI REGIONAL COUNCIL

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Discharge Permit

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

Name of Consent Holder:	Taranaki By-Products P O Box 172 HAWERA
Consent Granted Date:	15 October 1999

Conditions of Consent

Consent Granted:	To discharge waste cheese and associated packaging by burial into land and to discharge emissions into air from the removal and disposal operation at or about GR: Q21:116-854	
Expiry Date:	1 February 2000 1 June 2017	[for air discharge] [for land discharge]
Review Date(s):	June 2005, June 2011	[for land discharge]
Site Location:	Katotauru Road, Okaiawa	
Legal Description:	Ngatimanuhiakai 17B2 Block Blk IV Waimate SD	

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 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

Air discharge and land discharge

1. THAT the consent holder shall notify the Taranaki Regional Council at least 24 hours prior to commencement of the removal and disposal operations to plan monitoring.

2. THAT the consent holder, at the consent holder's reasonable expense, shall undertake to remove all affected parties from the discharge area for the duration of the removal and disposal operations or to otherwise mitigate the effects, to the satisfaction of the General Manager, Taranaki Regional Council.

3. THAT the consent holder shall ensure that the discharge licensed by this consent takes place in general accordance with the information submitted in support of application 774 and does not exceed 100 tonnes.

4. THAT the consent holder shall allow the Taranaki Regional Council, its employees or agent access to the discharge site at all reasonable times for the purpose of inspecting the site and/or taking samples of water or other material for analytical purposes.

5. THAT the consent holder shall keep a photographic record of the disposal operation and shall forward a copy of the photographic record to the Taranaki Regional Council upon request.

6. THAT the disposal operation shall be completed as far as practicable within one 15 hour period.

7. THAT if Condition 6 is not achieved the discharged wastes shall be covered with at least 0.5 m of clean soil as an interim measure.

8. THAT the discharged material shall be immediately covered upon placement in the disposal pit with hydrated lime and agricultural lime (dolomite) as an interim cover.

9. THAT at the completion of the disposal operation a low permeability compacted clean soil cover with a minimum thickness of 1.0 m shall be placed over the discharged wastes.

10. THAT the site shall not be used for simultaneous disposal, or re-opened for subsequent disposal, of any other wastes.

11. THAT 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 odour and to remedy or mitigate any actual or potential effects on the environment arising from the discharge.

Air discharge only

12. THAT during transportation all waste material shall be covered.

13. THAT any material discharged during transit shall be recovered immediately.

14. THAT the discharge shall only be undertaken when the prevailing wind is from the southerly quarter (ie. south-east to south-west).

15. THAT there shall be no emission of odours from the removal and disposal operation after 1 February 2000.

Land discharge only

16. THAT the disposal pit shall be constructed with a low permeability compacted soil liner with a minimum thickness of 0.6 m.

17. THAT the disposal pit shall not intercept groundwater (the water table).

18. THAT the cover material and surrounding land shall be contoured such that all stormwater is directed away from the disposal area.

19. THAT the disposal site shall be rehabilitated and pasture re-established.

20. THAT there shall not be any irrigation of effluent from the Taranaki By-Products wastewater disposal system over the disposal area.

21. THAT the integrity of the cover material shall be maintained after the completion of the discharge.

22. THAT the exercise of this consent shall not lead, or be liable to lead, to a direct discharge of contaminants to a surface waterbody.

23. 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 2005 and/or June 2011, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this consent, which were 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 15 October 1999

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Consent 6431-1

TARANAKI REGIONAL COUNCIL

CHIEF EXECUTIVE
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Please quote our file number on all correspondence

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:	4 October 2004

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

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

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

   i) the administration, monitoring and supervision of this consent; and
   ii) charges authorised by regulations.

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this 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.

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

Consent 7234-1

TARANAKI REGIONAL COUNCIL

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Please quote our file number on all correspondence

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

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

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

1. The 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.

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

Consent 7329-1

TARANAKI REGIONAL COUNCIL

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Please quote our file number on all correspondence

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

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

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

1. The 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.

7. All earthwork areas shall be stabilised vegetatively or otherwise as soon as is practicable immediately following completion of soil disturbance activities.

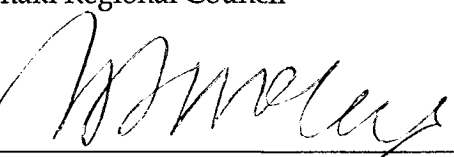
8. In the event of any archaeological site or koiwi being encountered during the exercise of this consent, activities in the vicinity of the discovery shall cease. The consent holder shall contact the Chief Executive, Taranaki Regional Council, to obtain details of the relevant iwi authority. The consent 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

Appendix II

Inaha Stream chemistry monitoring data

Taranaki By-Products water quality monitoring survey **Date:** 28 November 2012 **Flows:** Kapuni: 1,100 L/s

Inaha: 196 L/s SG: 3.185 m

TBP: 0.0 L/s

Site	Code	Lab ID	Time	Temp	DO	DO sat.	Cond	pH	Turb	TSS	TG/O&G	BOD	fcBOD	NH4	NO_2	NO_3	DRP	Cl	FC
			NZST	°C	gm^{-3}	%	mSm^{-1}	pH	NTU	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}	$gm^{-3}N$	$gm^{-3}N$	$gm^{-3}N$	$gm^{-3}P$	gm^{-3}	cfu/100ml
Ahipaipa Road	INH000334	123851	0853	16.0	9.1		19.9	7.7	*4.7*			0.8		0.021	0.004	1.84	0.050	26.4	670
Below Ahipaipa Rd	INH000340																		
Above Kohiti Rd	INH000348																		
Kohiti Road	INH000400	123852	0903	16.6	10.1		22.1	**8.0**	*5.9*			1.0	0.5	0.013	0.004	2.2	0.041	29.3	430
Mixing zone	INH000408	123857	1025	19.1	9.6		23.0	**8.0**	*5.7*			1.2	0.7	0.060	0.008	2.5	0.037	30.9	380
500m d/s	INH000420	123858	1035	21.1	9.5		23.5	7.8	*9.6*			1.6	1.0	0.056	0.013	2.8	0.040	31.8	530
Normanby Rd	INH000430	123860	1045	21.3	9.7		23.6	7.8	*8.4*			1.6	0.6	0.073	0.014	3.0	0.039	32.0	400
SH45	INH000470	123861	1110	20.7	11.3		27.9	8.5	*7.0*			1.8	0.7	0.016	0.013	2.9	0.042	42.6	250
Trib. Kohiti	INH000397																		
Trib. Normanby u/s	INH000433																		
Trib. Normanby mid	INH000435																		
Trib. Normanby d/s	INH000440	123859	1055	19.8	9.7		34.8	*7.8*	*8.2*			1.0		0.007	4.4		0.007	53.6	450
Discharge	IND004004	123853	0936	22.9	2.5		320	7.4	*44*	100		72	24	160	87	96	43	312	1300
Pond 4	IND004005	123864	0940	26.9	?		351	7.0						210	156	38			
Pond 3	IND004006	123863	0943	26.4			260	7.5						114					
Pond 2	IND004007	123862	1000	31.2			515	7.2						590					
C/w tributary	IND001015	123856	1015	24.7	8.9		26.8	8.0	*4.0*	7		2.5		0.105	0.044	3.1	0.023	36.4	190
Up c/w tributary	IND001014																		
Cooling water	IND002004	123855	0955	31.1			22.6	7.9	*5.0*			0.9		0.037					
Stormwater No 1	STW001075	123854	0920	16.1			65.1	7.0	*0.50*	3		2.2		0.81			0.028	83.0	2000

Site	Code	Lab ID	Alk	COD	TN	TP	TS	SO4	Na	K	Ca	Mg	SAR	KAR
			gm^{-3} $CaCO_3$	gm^{-3}	$gm^{-3}N$	$gm^{-3}P$	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}		
Discharge	IND004004	123853	220	330	380	47	<0.05	140	276	188	25	15.6	10.7	4.3
Pond 4	IND004005	123864	380	800	370									
Pond 3	IND004006	123863	635	**200**	**126**									
Pond 2	IND004007	123862	2040	**6950**	**690**									
C/w tributary	IND001015	123856	65											

Notes: Inaha Stream appeared ‘clear, no odour, steady flow”. CW trib discharging at ½ pipe.

Taranaki By-Products water quality monitoring survey **Date:** 19 March 2013 **Flows:** Kapuni: 1,121 L/s

Inaha: 83 L/s SG: 3.095 m

TBP: 0.0 L/s

Site	Code	Lab ID	Time	Temp	DO	DO sat.	Cond	pH	Turb	TSS	TG/O&G	BOD	fcBOD	NH4	NO_2	NO_3	DRP	Cl	FC
			NZST	°C	gm^{-3}	%	mSm^{-1}	pH	NTU	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}	$gm^{-3}N$	$gm^{-3}N$	$gm^{-3}N$	$gm^{-3}P$	gm^{-3}	cfu/100ml
Ahipaipa Road	INH000334	135346	0835	17.2	6.9	?	23.8	7.5	*3.0*			1.6		0.017	0.004	0.43	0.059	33.6	16000
Below Ahipaipa Rd	INH000340																		
Above Kohiti Rd	INH000348																		
Kohiti Road	INH000400	135437	0855	17.1	7.8	?	25.0	7.6	*1.8*			1.0	0.8	0.011	0.005	1.04	0.030	36.0	930
Mixing zone	INH000408	135352	0948	18.5	7.4	?	27.6	7.6	*5.0*			5.2	1.3	0.85	0.37	1.63	0.055	38.2	4000
500m d/s	INH000420	135353	1007	17.8	**5.7**	?	30.5	7.4	*4.6*			**>8**	**3.8**	**2.4**	0.34	3.2	0.086	40.5	4500
Normanby Rd	INH000430	135355	1045	18.0	7.0	?	**37.4**	7.6	*8.7*			**13**	**>8**	**7.9**	0.30	5.4	0.23	46.1	4600
SH45	INH000470	135356	1110	16.0	9.1	?	36.2	7.8	*8.5*			2.6		0.033	0.001	3.5	0.097	59.6	4700
Trib. Kohiti	INH000397																		
Trib. Normanby u/s	INH000433																		
Trib. Normanby mid	INH000435																		
Trib. Normanby d/s	INH000440	135354	1057	16.0	8.5	?	**51.2**	*7.6*	*2.0*			1.1		0.011	0.022	3.5		**102**	270
Discharge	IND004004	135348	0910	27.1	0.6	?	**480**	8.2	*110*	210	?	78	2.6	**390**	198		35	319	1300
Pond 4	IND004005	135359	1020	33.5	0.3	?	**532**	8.0						**480**	260	0		312	
Pond 3	IND004006	135358	1017	37.1			**742**	7.6						**980**					
Pond 2	IND004007	135357	1030	38.4			**662**	6.6						**860**					
C/w tributary	IND001015	135351	0935	27.7	5.1	?	33.6	7.7	*5.9*	9	?	>8		3.8	**2.1**	1.4	0.170	42.3	22000
Up c/w tributary	IND001014																		
Cooling water	IND002004	135350	0930	41.2			26.1	7.6	*2.2*			0.9		0.132					
Stormwater No 1	STW001075	135349	0922	18.5			71.7	7.1	*440*	**1200**	**110**	**1400**		24.5					**3800000**

Site	Code	Lab ID	Alk	COD	TN	TP	TS	SO4	Na	K	Ca	Mg	SAR	KAR
			gm^{-3} $CaCO_3$	gm^{-3}	$gm^{-3}N$	$gm^{-3}P$	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}		
Discharge	IND004004	135348	1130	600	**610**	39	<0.05	176	328	174	22	14.4	13.4	4.2
Pond 4	IND004005	135359	1270	1260	**810**									
Pond 3	IND004006	135358	**4210**	**13600**	**1440**									
Pond 2	IND004007	135357	2530	8800	900									
C/w tributary	IND001015	135351	84											

Notes: Inaha Stream appeared “clear, no odour, steady flow”. CW trib discharge “swift”. Stormwater flow ~1 L/s. TBP daily staff gauge reading used.

Taranaki By-Products water quality monitoring survey

Date: 28 March 2013
Maundy Thursday

Flows: Kapuni: 263 L/s
Inaha: 60 L/s SG: 3.066 m
TBP: 0.0 L/s

Site	Code	Lab ID	Time	Temp	DO	DO sat.	Cond	pH	Turb	TSS	TG/O&G	BOD	fcBOD	NH4	NO_2	NO_3	DRP	Cl	FC
			NZST	°C	gm^{-3}	%	mSm^{-1}	pH	NTU	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}	$gm^{-3}N$	$gm^{-3}N$	$gm^{-3}N$	$gm^{-3}P$	gm^{-3}	cfu/100ml
Ahipaipa Road	INH000334	135509	0850	15.3	**5.8**	59	22.8	7.4	*1.0*			1.0		0.020	0.002	0.44	0.034	30.9	
Below Ahipaipa Rd	INH000340																		
Above Kohiti Rd	INH000348																		
Kohiti Road	INH000400	135510	0923	16.6	8.9	93	25.8	7.6	***0.64***			0.5	<0.5	0.011	0.003	1.52	0.013	35.7	
Mixing zone	INH000408	135515	1010	**19.7**	7.4	82	28.3	7.5	*3.4*			3.9	0.7	0.73	0.25	**2.6**	0.042	38.5	
500m d/s	INH000420	135516	1025	19.4	7.2	79	29.4	7.4	*4.7*			5.5	0.8	0.28	0.156	**4.1**	0.056	39.7	
Normanby Rd	INH000430	135518	1050	18.3	7.3	78	30.2	7.7	*2.8*			2.6	<0.5	0.049	0.042	**4.9**	0.081	42.4	
SH45	INH000470	135519	1105	17.4	9.1	105	34.8	7.8	*3.2*			1.1		0.064	0.034	4.0	0.090	56.7	
Trib. Kohiti	INH000397																		
Trib. Normanby u/s	INH000433																		
Trib. Normanby mid	INH000435																		
Trib. Normanby d/s	INH000440	135517	1040	14.9	10.2		44.0	*7.8*	*0.93*			0.6		0.013	0.003	3.8	0.005	89.5	
Discharge	IND004004	135511	0929	23.4	0.4		**471**	8.3	*200*	360	150	160	4.6	420		**128**	28	**339**	
Pond 4	IND004005																		
Pond 3	IND004006																		
Pond 2	IND004007																		
C/w tributary	IND001015	135514	0958	31.3	-		31.8	7.8	*1.5*	2	?	3.1		1.80	0.79	2.4	0.106	41.4	
Up c/w tributary	IND001014																		
Cooling water	IND002004	135513	0950	41.7			26.9	7.7	*1.2*			<0.5		0.35					
Stormwater No 1	STW001075	135512	0929	18.2			73.0	7.3	*12*	20	1.0	70		10.8			0.36		

Site	Code	Lab ID	Alk	COD	TN	TP	TS	SO4	Na	K	Ca	Mg	SAR	KAR
			gm^{-3} $CaCO_3$	gm^{-3}	$gm^{-3}N$	$gm^{-3}P$	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}		
Discharge	IND004004	135511	1410	**7200**	**810**	**89**	<0.05	**230**	**343**	170	15	11	16.4	4.8
Pond 4	IND004005													
Pond 3	IND004006													
Pond 2	IND004007													
C/w tributary	IND001015	135514	80											

Notes: Inaha Stream "clear, no odour, low steady flow"; CW trib discharge had slight tinge and slight pungent odour. Stormwater flow <0.5 L/s, pungent meaty odour; P6 effluent had pungent meaty odour: Soxhlet total grease test yielded green-brown residue, nitrate+nitrite=128 g/m³N.

Taranaki By-Products water quality monitoring survey **Date:** 26/27 June 2013 **Flows:** Kapuni: 2,043 L/s

Inaha: 1,894 L/s SG: 3.825 m

TBP: 5.7 L/s

Site	Code	Lab ID	Time	Temp	DO	DO sat.	Cond	pH	Turb	TSS	TG/O&G	BOD	fcBOD	NH4	NO_2	NO_3	DRP	Cl	FC
			NZST	°C	gm^{-3}	%	mSm^{-1}	pH	NTU	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}	$gm^{-3}N$	$gm^{-3}N$	$gm^{-3}N$	$gm^{-3}P$	gm^{-3}	cfu/100ml
Ahipaipa Road	INH000334	136412	0922	10.1	8.9	80	17.2	7.6	*12*			1.8		0.014	0.008	2.5	0.042	23.0	530
Above Kohiti Rd	INH000348	136413	0940	10.2	11.0	99	17.5	7.6	*12*			1.5		0.015	0.009	2.6	0.045	23.5	150
Kohiti Road	INH000400	136415	0953	10.1	-	-	18.9	7.5	*10*			1.8	<0.5	0.016	0.009	2.5	0.038	25.0	200
Mixing zone	INH000408	136420	1046	10.3	10.7	97	20.9	7.5	*8.6*			3.3	0.6	1.19	1.06	2.6	0.26	26.6	150
500m d/s	INH000420	136421	1055	10.3	10.5	95	21.3	7.5	*10*			5.0	1.3	1.21	1.03	3.0	0.27	26.0	140
Normanby Rd	INH000430	136424	1153	10.6	10.5	95	21.2	7.4	*10*			6.8	1.4	0.96	0.77	3.3	0.27	27.7	120
SH45	INH000470	136425	1215	10.4	10.1	91	25.3	7.4	*12*			4.9	0.8	0.91	0.33	4.4	0.25	32.6	120
Trib. Kohiti	INH000397	136414	0947	9.0	10.4	91	29.4	7.3	*4.7*			0.8		0.036	0.008	1.96	0.018	38.3	110
Trib. Normanby u/s	INH000433																		
Trib. Normanby mid	INH000435																		
Trib. Normanby d/s	INH000440	136423	1200	9.5	10.5	93	43.8	*7.4*	*12*			0.8		0.034	0.007		0.009	63.2	120
Discharge	IND004004	136416	1008	20.8	1.3	15	339	7.5	*42*	87	-	52	4.0	218	194		47	272	7000
Pond 4	IND004005	136428	1130	28.1			368	6.2							287			557	
Pond 3	IND004006	136427	1125	29.0			485	7.4											
Pond 2	IND004007	136426	1119	-			457	7.0											
C/w tributary	IND001015	136419	1030	16.1	8.0	82	24.0	7.3	*4.3*	6	<0.5	2.0		0.70	0.065	5.1	0.046	30.8	330
Up c/w tributary	IND001014																		
Cooling water	IND002004	136418	1015	44.9			19.0	7.7	*12*			0.6		0.087					
Stormwater No 1	STW001075	136417	1020	14.4			60.0	7.0	*120*	**120**	14	74		4.1					69000

Site	Code	Lab ID	Alk	COD	TN	TP	TS	SO4	Na	K	Ca	Mg	SAR	KAR
			gm^{-3} $CaCO_3$	gm^{-3}	$gm^{-3}N$	$gm^{-3}P$	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}	gm^{-3}		
Discharge	IND004004	136416	325	410	380	50		142	274	149	22	12.9	11.5	3.6
Pond 4	IND004005	136428	112	720	490									
Pond 3	IND004006	136427	2210	830	560									
Pond 2	IND004007	136426	560	4000	1000									
C/w tributary	IND001015	136419	44											

Notes: Inaha Stream appeared “clear, no odour, swift flow”. CW trib discharge clear, no odour, 1/8 pipe.. Stormwater flow v. minor, sl. turbid, HC odour.

Appendix III

Groundwater monitoring data

Site name	Site code	Description	Grid reference, NZTM	
			Easting	Northing
Irrigation bores				
BH1	GND1054	Control, NE Kohiti Road block	1702469	5624829
BH2	GND1055	Kohiti Road block, near Inaha Stream	1702001	5624440
BH3	GND1056	Kohiti Road block, above TBP plant	1702359	5623913
BH4	GND1057	East Normanby Road block	1702308	5623294
Shearer	GND1058	Shearers' spring	1701770	5624284
BH5B	GND1346	Control, NW Katotauru Road block	1701352	5624536
BH6 B	GND1347	Katotauru Road block, beside road	1701586	5623914
BH7	GND1348	Ahipaipa Road block	1702671	5624595
BH8	GND1349	West Normanby Road block	1701013	5623526
BH9	GND2225	Kingi block east, above Inaha trib	1701186	5624945
BH10	GND2226	Inaha Road block	1700548	5623806
Burial pit bores				
BP1	GND1063	Control, upslope	1702475	5624400
BP2	GND1064		1702439	5624414
BP3	GND1065		1702390	5624425
BP4	GND1066		1702370	5624409
BP5	GND1067		1702363	5624386
BP6	GND1068		1702362	5624370
BP7	GND1069		1702359	5624342
BP8	GND1350		1702362	5624323
BP9	GND1356		1702353	5624284

Site	Date	LEVEL	TEMP	CONDY	PH	NNN	NH4	CL	HCO3	SO4	NA	K	CA	MG	COD
		m	℃	mS/m @20℃	pH	g/m3 N	g/m3 N	g/m3	g/m3 HCO3	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3
BH1															
GND1054	22-Aug-12	6.92	13.8	48.5	6.3	3.49	0.018	118							
GND1054	31-Oct-12	7.33	14.2	28.9	6.4	2.66	0.004	54.8	50.0	15.4	25.4	3.3	18.2	10.2	<5
GND1054	29-Jan-13	8.27	14.8	27.7	6.4	2.43	0.026	49.4							
GND1054	20-Mar-13	8.61	13.7	29.3	6.6	3.11	0.006	54.0							
GND1054	14-May-13	8.96	14.2	29.4	6.4	3.80	0.007	53.4							
GND1054	25-Jun-13	8.87	13.6	29.4	6.5	4.35	<0.003	51.8							
BH3															
GND1056	22-Aug-12	8.52	14.0	28.2	6.4	5.62	0.018	48.0							
GND1056	31-Oct-12	8.31	14.4	34.1	6.3	11.6	0.004	57.2	46.4	4.2	38.9	3.4	17.0	9.3	<5
GND1056	29-Jan-13	9.70	15.6	26.6	6.4	3.94	0.009	49.4							
GND1056	20-Mar-13	10.33	14.8	26.0	6.5	4.61	<0.003	45.6							
GND1056	14-May-13	10.81	14.4	26.8	6.4	5.32	0.041	50.2							
GND1056	25-Jun-13	10.84	13.8	27.4	6.4	5.35	<0.003	51.2							
BH4															
GND1057	22-Aug-12	5.77	14.3	42.8	6.3	19.4	<0.003	53.1							
GND1057	31-Oct-12	5.99	14.4	38.0	6.3	12.2	0.003	59.6	56.1	14.6	42.5	3.9	18.5	11.8	<5
GND1057	29-Jan-13	6.99	15.4	36.8	6.4	8.96	0.009	59.7							
GND1057	20-Mar-13	7.51	14.5	36.0	6.5	9.72	0.003	57.4							
GND1057	14-May-13	7.83	14.2	35.7	6.4	10.2	<0.003	58.0							
GND1057	25-Jun-13	7.90	13.7	36.4	6.4	9.74	<0.003	59.4							
BH5B															
GND1346	22-Aug-12	3.22	14.0	90.3	6.2	78.2	0.053	96.4							
GND1346	31-Oct-12	4.20	14.3	80.6	6.2	64.6	<0.003	90.0	37.8	6.0	52.8	7.0	63.8	30.6	<5
GND1346	29-Jan-13	5.27	15.1	75.4	6.2	54.0	0.011	82.9							
GND1346	20-Mar-13	5.55	14.2	73.9	6.3	60.6	<0.003	78.3							
GND1346	14-May-13	5.87	14.0	74.1	6.2	61.5	0.005	73.4							
GND1346	25-Jun-13	5.37	13.7	73.3	6.3	60.2	<0.003	75.2							
BH6B															
GND1347	22-Aug-12	7.14	14.2	77.3	6.2	67.4	0.005	82.7							
GND1347	31-Oct-12	7.55	14.4	77.5	6.2	64.0	0.003	89.3	25.6	1.1	51.6	5.1	53.1	30.2	<5
GND1347	29-Jan-13	8.14	15.8	79.7	6.2	58.4	0.029	111							
GND1347	20-Mar-13	9.50	14.4	78.7	6.2	57.9	<0.003	92.2							
GND1347	14-May-13	9.84	14.5	78.9	6.1	66.8	0.008	93.2							
GND1347	25-Jun-13	9.70	11.5	78.5	6.2	65.0	<0.003	92.8							
BH7															
GND1348	22-Aug-12	10.03	13.9	39.3	6.5	20.2	0.008	51.2							
GND1348	31-Oct-12	9.87	14.1	45.8	6.5	30.1	0.004	55.8	42.7	5.2	36.8	5.3	29.2	17.0	<5
GND1348	29-Jan-13	10.87	16.3	93.2	6.3	76.0	0.046	103							
GND1348	14-May-13	11.66	14.2	98.1	6.2	77.6	0.004	97.3							
GND1348	25-Jun-13	11.75	13.7	97.9	6.3	83.3	<0.003	99.6							
GND1349	22-Aug-12	10.39	14.0	91.3	6.2	27.0	0.029	205							

Site	Date	LEVEL	TEMP	CONDY	PH	NNN	NH4	CL	HCO3	SO4	NA	K	CA	MG	COD
		m	℃	mS/m @20℃	pH	g/m3 N	g/m3 N	g/m3	g/m3 HCO3	g/m3	g/m3	g/m3	g/m3	g/m3	g/m3
BH8															
GND1349	31-Oct-12	9.87	14.1	78.0	6.2	20.5	<0.003	178	53.7	3.0	47.4	4.9	56.2	32.7	<5
GND1349	29-Jan-13	10.79	14.8	83.1	6.2	18.8	0.006	205							
GND1349	20-Mar-13	11.10	14.1	84.3	6.2	23.4	0.004	179							
GND1349	14-May-13	11.42	14.4	69.4	6.2	16.0	<0.003	164							
GND1349	25-Jun-13	11.55	13.7	51.2	6.3	12.3	<0.003	108							
BH9															
GND2225	22-Aug-12	5.49	14.3	40.3	6.4	26.0	0.008	47.4							
GND2225	31-Oct-12	6.04	14.3	41.0	6.3	25.4	0.007	53.9	37.8	2.6	35.0	3.0	22.6	16.2	<5
GND2225	29-Jan-13	6.81	15.9	41.2	6.3	21.5	0.005	98.2							
GND2225	20-Mar-13	7.10	15.5	40.6	6.4	24.6	0.022	60.5							
GND2225	14-May-13	>10.34													
GND2225	25-Jun-13	>10.34													
BH10															
GND2226	22-Aug-12	5.37	13.8	71.0	6.3	61.4	0.006	74.5							
GND2226	31-Oct-12	5.87	14.4	63.1	6.2	51.6	0.003	68.2	35.4	3.3	45.6	4.1	40.9	25.3	<5
GND2226	29-Jan-13	7.86	15.6	67.8	6.2	52.6	0.003	86.6							
GND2226	20-Mar-13	8.32	14.6	72.6	6.2	62.3	0.038	76.0							
GND2226	14-May-13	8.71	16.7	72.4	6.3	59.5	0.015	86.1							
GND2226	25-Jun-13	9.00	13.6	67.4	6.3	55.2	0.014	70.5							
Shearers' spring															
GND1058	22-Aug-12		14.8	31.4	6.6	3.20	<0.003	63.6							
GND1058	31-Oct-12		16.1	31.2	6.5	3.70	<0.003	63.2	52.5	6.4	30.3	2.6	18.0	11.3	<5
GND1058	29-Jan-13		16.5	31.1	6.6	3.03	<0.003	65.4							
GND1058	20-Mar-13		15.6	30.5	6.7	2.81	0.009	60.2							
GND1058	14-May-13		15.5	30.4	6.6	3.14	<0.003	58.3							
GND1058	25-Jun-13		14.0	30.6	6.6	3.16	<0.003	61.1							
BP1															
GND1063	07-Nov-12	7.57	14.8	21.8	6.5	2.50	0.007	33.8	67.1	1.8	22.4	3.0	13.3	7.0	5
GND1063	24-Jun-13	9.56	13.8	20.6	6.6	2.84	0.056								9
BP3															
GND1065	07-Nov-12	7.68	15.6	174	6.5	0.74	0.064	221	743.0	9.9	178	31.8	116	79.1	20
GND1065	24-Jun-13	9.52													
BP4															
GND1066	07-Nov-12	6.16	15.6	205	6.6	0.08	19.1	190	1163.9	24.5	272	35.0	95.7	81.7	52
GND1066	24-Jun-13	6.55	14.3	216	6.8	3.73	9.85								<5
BP5															
GND1067	07-Nov-12	5.79	14.8	200	6.7	8.53	6.29	174	1176.1	1.9	218	30.1	131	103.0	27
BP6															
GND1068	07-Nov-12	5.79													
BP7															
GND1069	07-Nov-12	5.68	15.4	140	6.7	7.02	31.8	114	756.4	9.8	119	32.8	72.3	56.6	24
GND1069	24-Jun-13	6.87	14.2	160	6.7	0.08	69.9								41

Appendix IV

Biological monitoring reports

To James Kitto, Job Manager
From B Jansma & K Smith, Scientific Officers
Report No. BJ211
Date 18 September 2013
Doc number 1251775

Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, November 2012.

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

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

This summer biological survey was the first of two scheduled in the Inaha Stream catchment in the 2012-2013 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 spring bio-monitoring survey had been delayed due to adverse river flow conditions, but was finally undertaken at eight sites on 21 November 2012 (Table 2 and Figure 1). Five of the eight sites surveyed were in the Inaha Stream and the remaining three sites were in an unnamed tributary of the Inaha Stream (Figure 1). The locations of these 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 on the Inaha Stream is situated approximately 100 metres downstream of the convergence point between the Inaha Stream and the unnamed tributary.

Table 2 Bio-monitoring 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	Kick
	1	INH000400	Upstream of treatment ponds, Kohiti Road	Kick
	2d	INH000420	500 m downstream of cooling water discharge	Kick
	3	INH000430	Upstream of Normanby Road	Kick
	4	INH000450	100 m downstream of 'irrigation' tributary confluence	Kick
Unnamed tributary of Inaha Stream	UT	INH000433	Upstream of irrigation area	Kick
	MT	INH000435	Middle site within the new irrigation area	Vegetation sweep
	DT	INH000440	50m upstream Normanby Road	Kick

The standard '400ml kick-sampling' technique was used to collect streambed macroinvertebrates from seven sites in this survey; five of which were in the Inaha Stream and the other two sites were in the unnamed tributary (UT & DT) (Table 2). This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

The standard 'vegetation sweep' sampling technique was used at site MT to collect streambed macroinvertebrates (Table 2). This 'sweep-net' technique is very similar to Protocol 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 as:

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

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 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.

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.

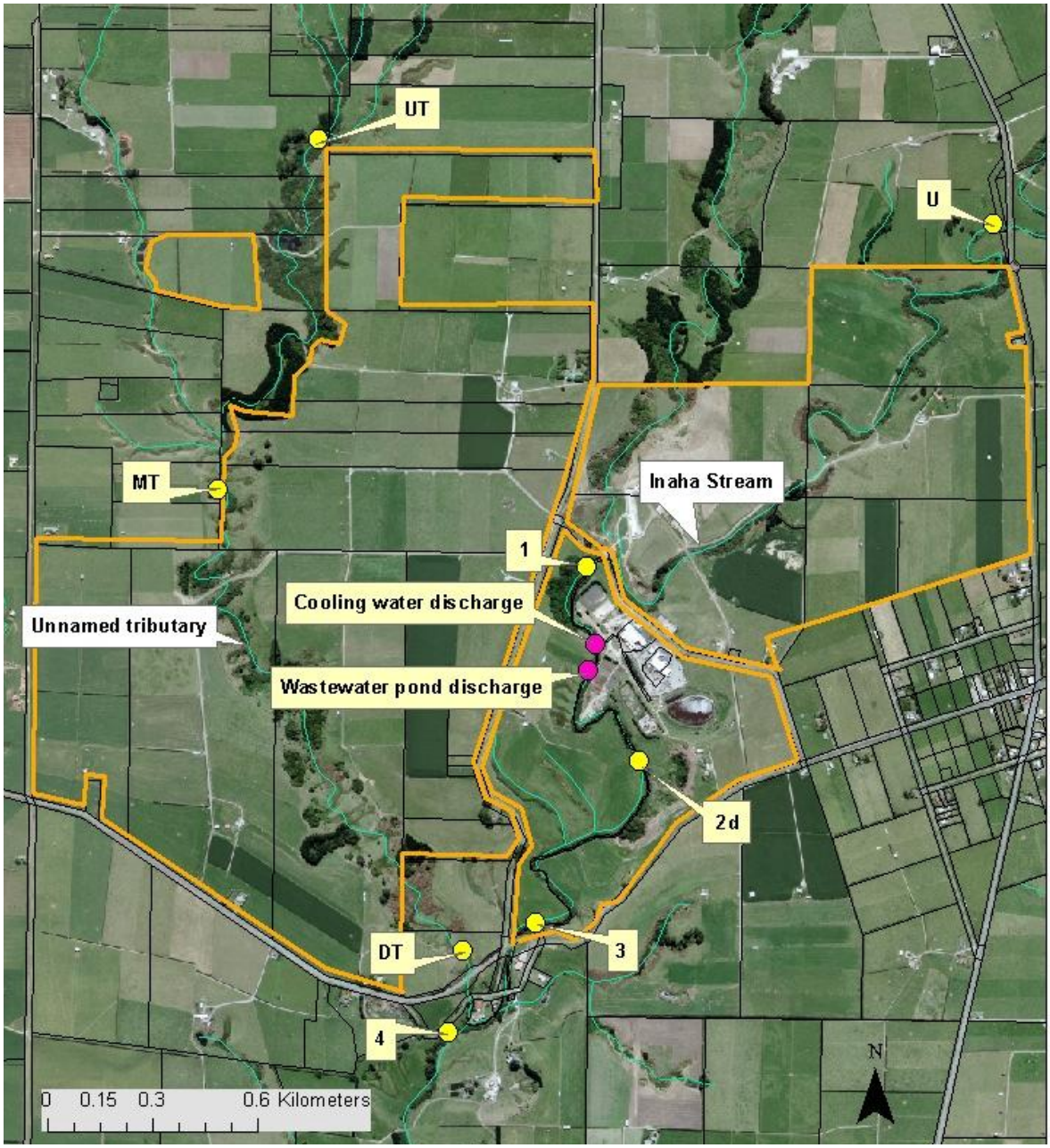


Figure 1 Aerial photo showing biomonitoring sites in the Inaha Stream and an unnamed tributary stream relating to discharges from the Taranaki By-Products plant. The orange line outlines the irrigation areas around the rendering plant.

Results and discussion

This November 2012 survey followed a period of 38 days since a fresh in excess of three times median flow in the nearby Waiokura Stream (the nearest appropriate water level recorder). In the month prior to this survey, there had been two minor freshes in the stream, neither of which exceeded the 3 times median flow. However, for the majority of this period the flows in the Waiokura Stream were at or above the median flow.

Freshes would likely scour a proportion of the fine organic matter and filamentous periphyton growths from the streambed, which could impact upon macroinvertebrate community compositions. The fact that there were no major fresh events in the month prior suggests that there will have been little influence on the community, and as such, the community should be reflective of preceding water quality conditions.

The Company's records showed that the last discharge of treated wastewater to the Inaha Stream occurred 52 days prior to this survey, on 1 October 2012. This is significant, as it means that this survey was preceded by an extended period in which no discharge occurred, indicating that the macroinvertebrate communities should be reflective of relatively 'natural' conditions. However, cooling water was discharged more or less on a continuous basis.

There was a swift to steady, moderate flow at all Inaha Stream sites (U, 1, 2d, 3 and 4). Due to willow clearance works between sites U and 1, the clear uncoloured flow at site U became brown and dirty at sites 1 and 2d, clearing slightly to be uncoloured but cloudy at sites 3 and 4. Water temperatures in the Inaha Stream ranged between 12.8°C and 17.4°C.

A moderate flow was noted in the unnamed tributary, with this flow being uncoloured cloudy and swift at site UT, uncoloured cloudy but slow at site MT and uncoloured, clear and swift at site DT. Water temperatures in the unnamed tributary ranged between 12.1C to 14.5°C.

Site U in the Inaha Stream was unshaded, while sites 1 and 2d were partially shaded, and sites 3 and 4 were completely shaded. The substrate at all sites along the Inaha Stream consisted mainly of sand, gravels and cobbles, with some silt and boulders present at some sites. Patchy algal mats and filaments were recorded at site U only, while a slippery film was noted at all other sites.

In the unnamed tributary, sites MT and DT were unshaded and site UT was partially shaded. The substrate at site UT was predominantly willow root with some fine sediment also. At site UT the substrate mainly consisted of silt, sand, while site DT had mainly gravels, cobbles, and some silt and sand. No algal growth was observed at either site UT or MT, while site DT had a slippery film and patches of algal filaments. Macrophytes were recorded as widespread at sites MT and DT.

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 seventh 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 and an indication of an abundant supply of organic matter and nutrient enrichment to the stream, and such growths have been recorded (often in abundance) on many previous sampling occasions, 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 3. The full results from this current survey are given in Tables 4 and 5.

Table 3 Previous numbers of taxa and MCI scores 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	23	18-32	23	24	85-99	95	102	23	4.3-6.5	5.2	6.5
1	64	15-30	22	21	82-104	95	98	40	3.6-6.3	5.1	5.1
2d	51	10-29	21	20	52-106	77	106	40	1.2-6.5	1.9	6.5
3	64	6-35	20	22	43-99	80	95	40	1.3-5.6	2.3	5.8
4	21	17-31	26	23	77-99	90	104	21	2.0-6.6	4.2	4.9
UT	4	13-19	15	19	97-109	105	98	4	5.3-5.5	5.5	6.3
MT	17	12-29	19	20	71-94	82	77	17	3.1-5.7	4.4	5.0
DT	17	18-25	22	23	80-94	85	98	17	3.5-4.8	4.5	4.9

Inaha Stream

Site U

A moderate community richness of 24 taxa was recorded at site U, the 'control' site on the Inaha Stream. This richness was one taxon higher than the median for this site (Table). The community (Table 4) was characterised by one 'highly sensitive' taxon (*Deleatidium* mayfly), six 'moderately sensitive' taxa (mayfly (*Austroclima*), elmid beetles, caddisflies (*Costachorema*, *Pycnocentria* and *Pycnocentrodes*) and *Aphrophila* cranefly), and three 'tolerant' taxa (oligochaete worms, and *Maoridiamesa* and orthoclad midge larvae). The abundance of the one 'highly sensitive' (mayfly *Deleatidium*), and the absence of any 'heterotrophic growths' on the streambed, indicated good preceding water quality conditions at this control site.

The moderate proportion of 'sensitive' taxa (67%) resulted in an MCI score of 102 units which is the highest MCI score recorded at this site to date (Table 3 and Figure 2). The SQMCI$_S$ score of 6.5 units was significantly higher than the median for this relatively new site (Stark, 1998) and reflected the numerical dominance of several 'sensitive' taxa especially the extremely abundant mayfly *Austroclima* and very abundant 'highly sensitive' *Deleatidium* mayfly. These results are reflective of good preceding water quality conditions.

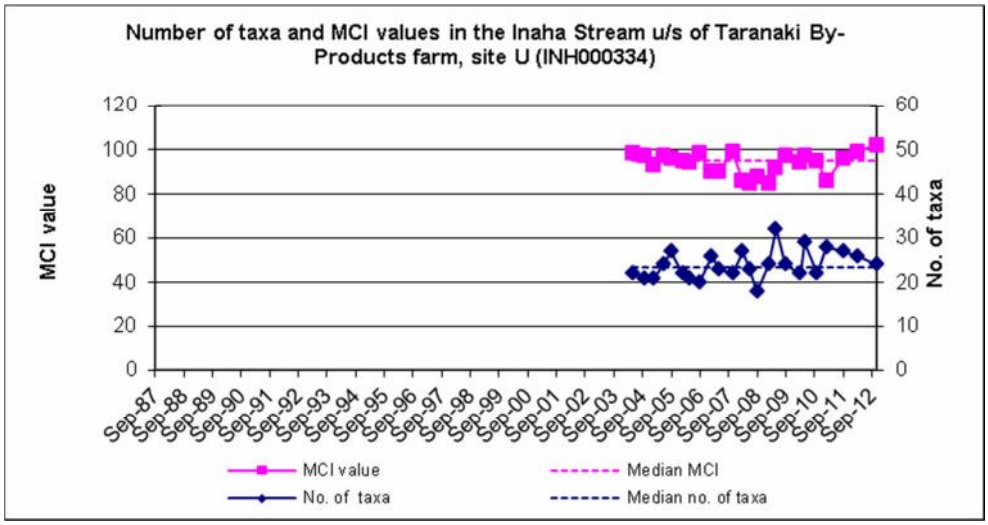


Figure 2 Numbers of macroinvertebrate taxa and MCI values recorded at site U in the Inaha Stream since May 2004

Table 4 Macroinvertebrate fauna of the Inaha Stream in relation to Taranaki By-Products wastes discharges sampled on 21 November 2012

Taxa List	Site Number	MCI score	U	1	2d	3	4
	Site Code		INH000334	INH000400	INH000420	INH000430	INH000450
	Sample Number		FWB12427	FWB12428	FWB12429	FWB12430	FWB12431
COELENTERATA	Coelenterata	3	-	-	-	R	-
PLATYHELMINTHES	*Cura*	3	-	R	-	-	-
NEMERTEA	Nemertea	3	-	R	-	-	R
ANNELIDA	Oligochaeta	1	A	VA	A	VA	VA
	Lumbricidae	5	R	C	R	-	C
MOLLUSCA	*Latia*	5	-	R	-	-	-
	Potamopyrgus	4	C	VA	R	R	R
	Sphaeriidae	3	-	R	-	R	C
CRUSTACEA	Ostracoda	1	-	-	-	C	-
	Paracalliope	5	C	-	-	C	R
	Paraleptamphopidae	5	-	C	R	-	-
	Talitridae	5	-	-	-	-	C
EPHEMEROPTERA	*Austroclima*	7	VA	VA	XA	XA	VA
	Coloburiscus	7	C	R	A	C	A
	Deleatidium	8	XA	VA	VA	A	A
	Zephlebia group	7	R	A	C	VA	A
PLECOPTERA	*Zelandobius*	5	C	-	R	C	C
	Zelandoperla	8	R	-	-	-	-
COLEOPTERA	Elmidae	6	VA	A	VA	VA	A
	Hydrophilidae	5	R	R	-	-	-
MEGALOPTERA	*Archichauliodes*	7	R	C	A	A	A
TRICHOPTERA	*Aoteapsyche*	4	R	A	A	VA	VA
	Costachorema	7	A	R	C	-	-
	Hydrobiosis	5	C	R	C	C	R
	Orthopsyche	9	-	-	-	-	R
	Oecetis	4	-	-	-	R	R
	Pycnocentria	7	A	-	R	A	A
	Pycnocentrodes	5	VA	C	VA	VA	VA
	Triplectides	5	-	-	R	-	R
DIPTERA	*Aphrophila*	5	A	-	R	-	R
	Harrisius	6	-	-	-	R	-
	Maoridiamesa	3	VA	R	R	-	-
	Orthocladiinae	2	A	-	-	-	-
	Polypedilum	3	C	-	R	R	R
	Tanytarsini	3	C	-	-	-	-
	Muscidae	3	R	-	-	-	-
	Austrosimulium	3	-	R	-	R	-
	Tanyderidae	4	-	-	-	R	-
	No of taxa		24	21	20	22	23
	MCI		102	98	106	95	104
	SQMCIs		6.5	5.1	6.5	5.8	4.9
	EPT (taxa)		11	8	11	10	12
	%EPT (taxa)		46	38	55	45	52
'Tolerant' taxa	'Moderately sensitive' taxa			'Highly sensitive' taxa			

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

Site 1

A community richness of 21 taxa was found at this site, which was similar to the richness recorded at site U upstream and one taxon less than the median for the site (Table 3 and Figure 3). The community at this site was characterised by one 'highly sensitive' taxon (mayfly *Deleatidium*), three 'moderately sensitive' taxa (mayfly (*Austroclima* and *Zephlebia*) and elmid beetles); and three 'tolerant' taxa (oligochaete worms, *Potamopyrgus* snails and caddisfly *Aoteapsyche*) (Table 4). The composition of the community was relatively similar to that recorded in the previous survey.

The MCI score of 98 units recorded at site 1 represented a decrease of 1 unit from the summer survey although this score was higher than the median for this site of 95 units. This MCI score was similar to that recorded at site U in this survey. The insignificant change in MCI score from the previous survey reflects the similarity in community composition.

A moderate $SQMCI_s$ score of 5.1 units was recorded at site 1 in this survey, which was a 0.8 unit increase from the $SQMCI_s$ score of 4.3 units recorded at this site in the previous survey. This score was also significantly (Stark, 1998) lower than that recorded at site U. This was the result of a number of changes in taxa abundance including; a decrease in the numerical dominance of the 'highly sensitive' mayfly *Deleatidium* and a significant increase in the numerical dominance of the 'tolerant' taxon *Potamopyrgus* snails at site U. Subtle changes in habitat were the most likely reason for this result. Overall this site recorded average MCI and $SQMCI_S$ scores, and as such does not indicate any impact from the upstream activities, including the irrigation of wastewater.

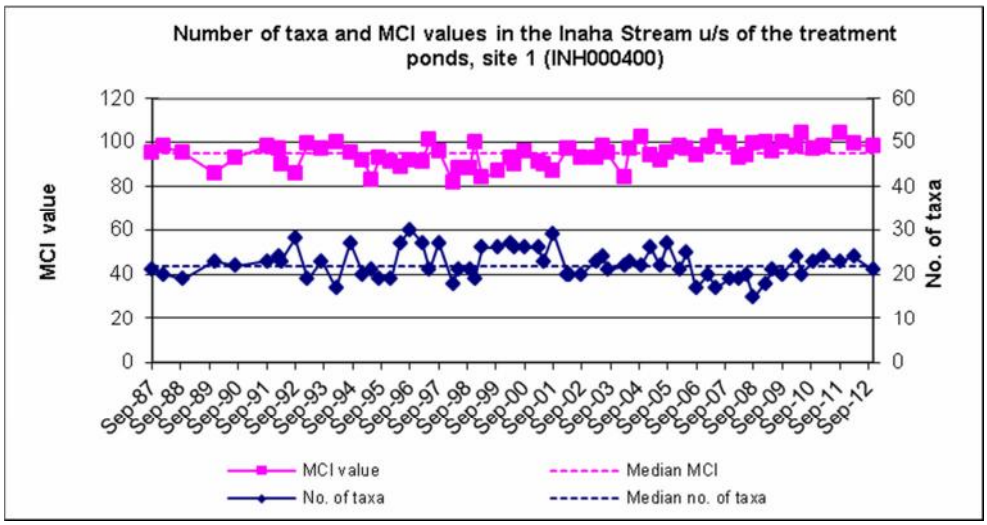


Figure 3 Numbers of macroinvertebrate taxa and MCI values recorded at site 1 in the Inaha Stream since September 1987

Site 2d

A moderate community richness of 20 macroinvertebrate taxa was recorded at site 2d, downstream of the spray irrigation area and the point source discharges of organic wastewater and cooling water to the stream. This richness was similar to that recorded at sites U and 1, and the median previously recorded for this site (Table 3 and Figure 5). The characteristic taxa in the community included one 'highly sensitive' mayfly (*Deleatidium*). Five 'moderately sensitive' taxa were also recorded in abundance (*Austroclima* and *Coloburiscus* mayfly, elmid beetles, dobson fly larvae (*Archichauliodes*) and the stony cased

caddisfly *Pycnocentrodes*), as were two 'tolerant' taxa (oligochaete worms and *Aoteapsyche* caddisfly).

The relatively low proportion of 'tolerant' taxa comprising this community (25%) resulted in a MCI score of 106 units. This result was six units higher than that recorded in the previous survey (Figure 4), and was statistically significantly (Stark, 1998) higher than the historical median MCI score for this site. This result was also equal to the previous maximum MCI score recorded at this site. No statistically significant difference in MCI was recorded between site 2d and the two upstream sites U and 1 which indicated that the discharges into the Inaha stream were unlikely to be impacting on the macroinvertebrate community at the time of this survey. This site continues to show a strong improvement in respect to the MCI scores at the site since the spring 2009 survey, during which a low MCI score was recorded at the site coincidental with the proliferation of heterotrophic growths at the site (Figure 5).

A significant increase in the numerical dominance of the 'moderately sensitive' mayfly *Austroclima* was recorded at the site from the previous survey which was coincidental with a decrease in the presence of filamentous algae at the site (Table 4). This resulted in an increase in the $SQMCI_s$ score from 5.9 units in the previous survey to 6.5 units in this survey. This $SQMCI_s$ score for the current survey was well above the median $SQMCI_S$ score for the site of 1.9 units and was also statistically significantly higher than the nearest upstream site 1 (Stark, 1998).

Over the last few surveys, the main influence on the community at this site has been the degree of algal or macrophyte growth on the stream bed. This indicates that the influence of the wastewater discharge has been reduced, and this is supported by the steadily improving MCI and $SQMCI_S$ scores. The current results indicate that there has been little to no impact on the instream communities from the upstream activities undertaken by Taranaki By-products.

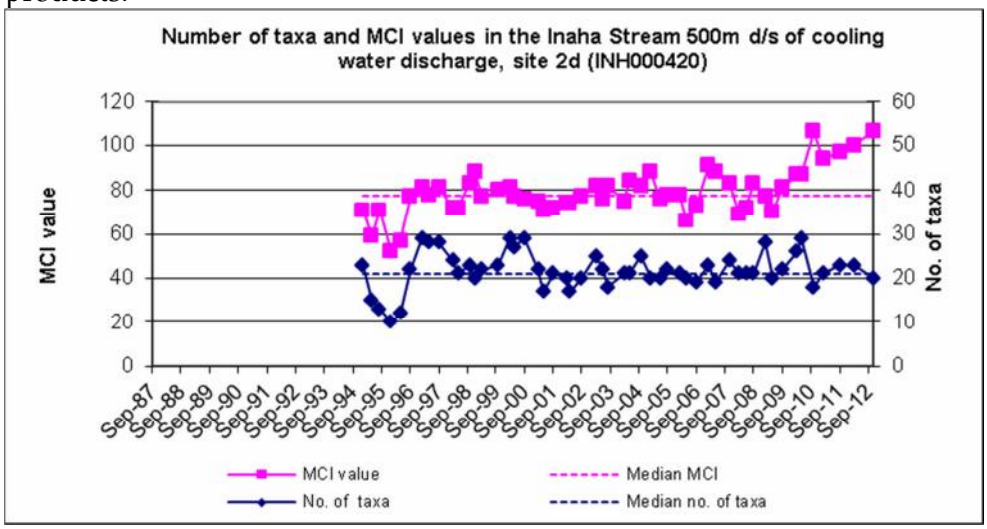


Figure 4 Numbers of taxa and MCI values recorded at site 2d in the Inaha Stream since 1995

Site 3

In this summer survey, a total of 22 taxa was recorded at site 3, two taxa higher than the median number of taxa recorded at the site (Table 3, Figure 5). Although similar to that recorded in the previous survey, this richness is somewhat lower that recorded in previous surveys conducted from spring 2009 to spring 2011.

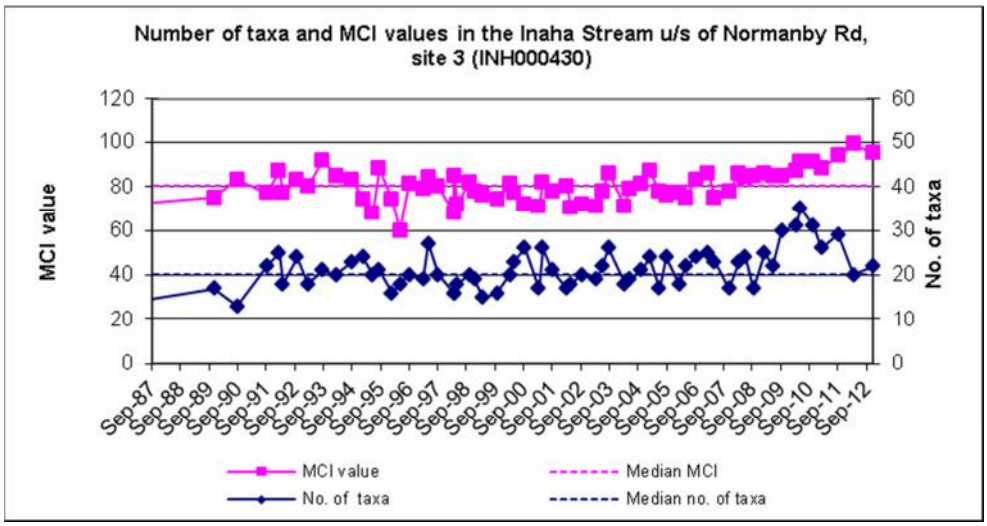


Figure 5 Numbers of taxa and MCI values recorded at site 3 in the Inaha Stream since 1989

The community at site 3 was characterised by one 'highly sensitive' taxon (mayfly *Deleatidium*), six 'moderately sensitive' taxa (mayfly *Austroclima* & *Zephlebia*, elmid beetles, dobsonfly larvae (*Archichauliodes*) and caddisfly larvae (*Pycnocentrodes* and *Pycnocentria)* and two 'tolerant' taxa (oligochaete worms and caddisfly *Aoteapsyche*).

The moderate proportion of 'tolerant' taxa (41% of total richness) in the community at this site resulted in the MCI score of 95 units for the site. This MCI score was significantly (Stark, 1998) higher than the historical median for the site and the second highest score recorded at this site to date (Figure 5). As at site 2d, there was no significant difference recorded in the MCI scores between site 3 and sites U and 1 although site 2d did have a significantly higher MCI score.

The $SQMCI_s$ score recorded at site 3 (5.8 units) in this survey was significantly (Stark, 1998) higher than the historical median $SQMCI_s$ score of 2.3 units. This result also represented a significant (Stark, 1998) increase from the previous survey (4.6 units) due mainly to the increase in numerical dominance of the 'moderately sensitive' mayfly (*Austroclima)* which went from being very abundant in the previous survey to extremely abundant in the current survey. This change in numerical dominance was similar to that observed at site 2d in the current survey and it also coincided with a decrease in filamentous algae at the site from the previous survey. In comparison to the other upstream sites, this $SQMCI_s$ score was not significantly different to that recorded at sites U, 1 or 2d.

Although the current results show apparent deterioration from that recorded at site 2d, this is more a function of the high results recorded at site 2d, than actual deterioration at site 3. The current results are still significantly higher than the long term median for this site, for both MCI and $SQMCI_S$ scores, and as such, it is considered that the recovery recorded in the previous surveys is continuing.

Site 4

A moderate taxa richness of 23 taxa was recorded at this site which was three taxa less than the historical median for the site (Table 3 and 4). The community was characterised by one 'highly sensitive' taxon (*Deleatidium*), seven moderately sensitive' taxa (mayfly (*Austroclima, Coloburiscus* and *Zephlebia*), elmid beetles, dobsonfly larvae (Archichauliodes) and caddisfly

larvae (*Pycnocentria* and *Pycnocentrodes*)) and two 'tolerant' taxa (oligochaete worms and net spinning caddisfly *Aoteapsyche*) (Table 4).

Only one-third of the macroinvertebrate community at site 4 consisted of 'tolerant' taxa which resulted in a MCI score of 104 units, significantly higher than the historical median score for the site, and five units higher than the maximum MCI score recorded in the 21 previous surveys (Table 3 & Figure 8). This is the second highest score recorded in the current survey in this survey, and nine units higher than that recorded at site 3 upstream.

The numerical dominance of eight 'sensitive' taxa resulted in a moderate $SQMCI_s$ score of 4.9 units at site 4, indicative of reasonable preceding water quality. This $SQMCI_s$ score was insignificantly (Stark, 1998) higher than the historic median score for the site and was the lowest score recorded in the current survey. It also represents a significant reduction from that recorded in the previous survey, which recorded the highest $SQMCI_s$ score of any survey undertaken in relation to the Taranaki By-Products site, due primarily to the 'highly sensitive' mayfly *Deleatidium* being recorded in abundance.

Although the $SQMCI_S$ score suggests some deterioration at this site from upstream, and also since the previous survey, the MCI score is still significantly higher than the long term median. It is likely that the change in $SQMCI_S$ score is habitat related, and overall, this site is in above average health, indicating no impact from the unnamed tributary inflow.

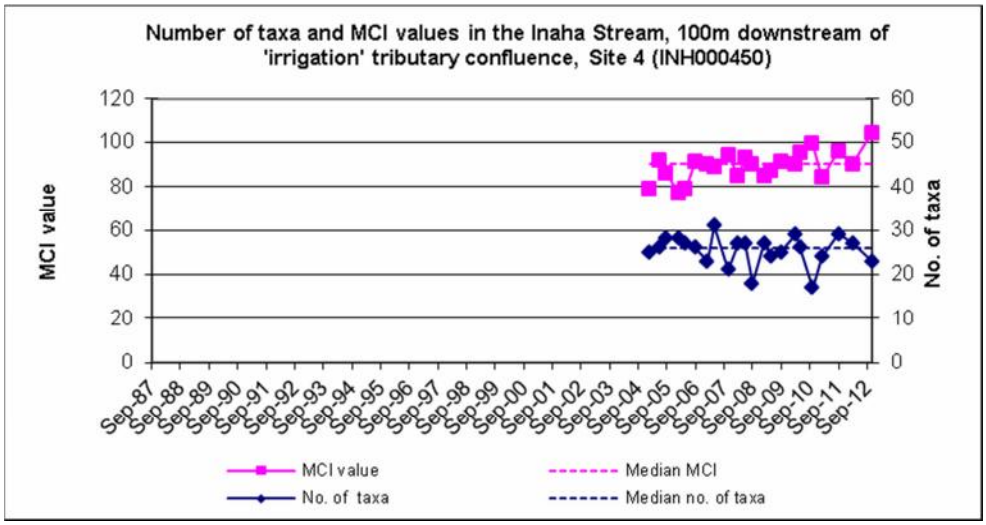


Figure 6 Numbers of taxa and MCI values recorded at site 4 in the Inaha Stream since 2005

Unnamed tributary of the Inaha Stream

Site UT

This recently established site has been monitored on five occasions since March 2010.

A moderate community richness of 19 taxa was recorded at site UT, four taxa more than the median for this site, and equal to the maximum richness recorded in the previous survey (Table 3, Figure 7). The community was characterised by six 'moderately sensitive' taxa (amphipods (paraleptamphopids, *Paracalliope* and talitrids), two mayfly taxa *Austroclima* and *Zephlebia* and sandy cased caddisfly (*Pycnocentria*)) and one 'tolerant' taxon (*Potamopyrgus* snails) (Table 5).

The moderate proportion of 'tolerant' taxa (26%) in the community at site UT resulted in an MCI score of 98 units which was seven units lower than the historical median MCI score of 105 units but within the range recorded of the previous four surveys (Tables 3 and 5). An improved $SQMCI_s$ score of 6.3 units was recorded for site UT which reflected the extreme abundance of the 'moderately sensitive' sensitive mayfly *Austroclima* (Tables 3 and 5). Overall this indicates that water quality in the unnamed tributary at the time of this survey was reasonable, and similar to that recorded in previous surveys.

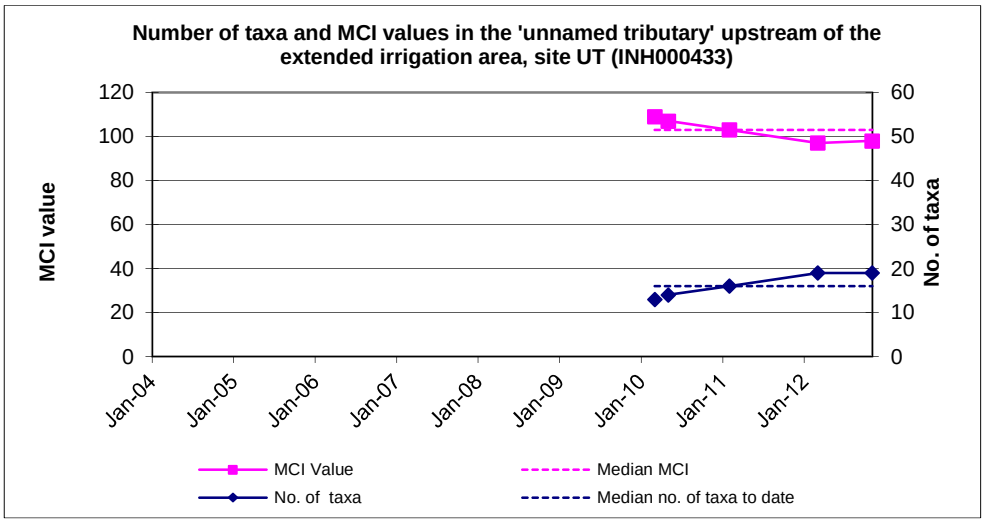


Figure 7 Numbers of taxa and MCI values recorded at site UT in the unnamed tributary of the Inaha Stream

Site MT

A total taxa richness of 20 taxa was recorded at the site in this survey, similar to the long term median for this site, but a marked decrease from the previous survey, which recorded the highest richness ever recorded at this site (Table 3 and Figure 9). The current richness was very similar to that recorded at the upstream site UT (Table 3).

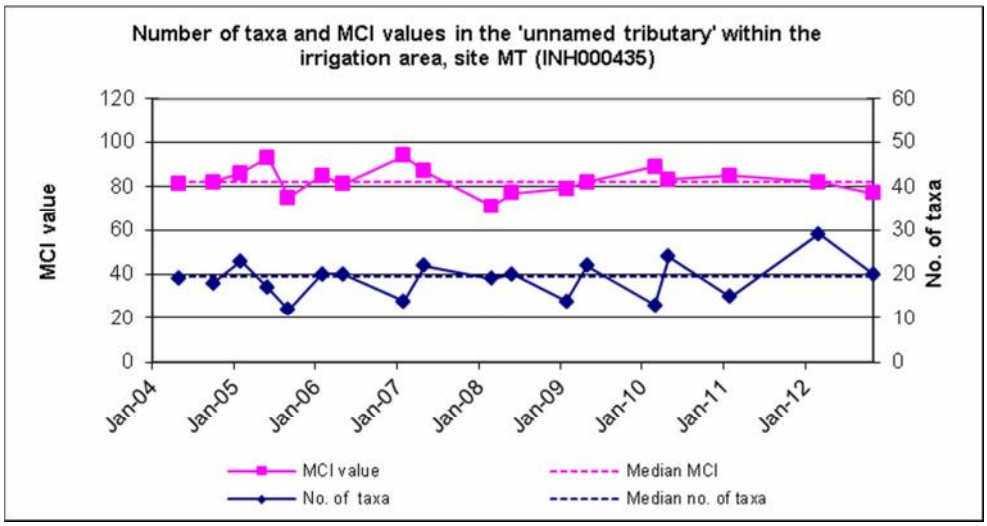


Figure 8 Numbers of taxa and MCI values recorded at site MT in the unnamed tributary of the Inaha Stream since 2004

Table 5 Macroinvertebrate fauna of the unnamed tributary of the Inaha Stream in relation to Taranaki By-Products wastes discharges sampled on 21 November 2012

Taxa List	Site Number	MCI score	UT	MT	DT
	Site Code		INH000433	INH000435	INH000440
	Sample Number		FWB12432	FWB12433	FWB12434
PLATYHELMINTHES	*Cura*	3	-	-	C
ANNELIDA	Oligochaeta	1	C	C	VA
	Lumbricidae	5	R	-	C
MOLLUSCA	*Physa*	3	-	R	R
	Potamopyrgus	4	VA	VA	VA
	Sphaeriidae	3	-	R	-
CRUSTACEA	Ostracoda	1	-	A	-
	Isopoda	5	R	-	-
	Paracalliope	5	A	XA	A
	Paraleptamphopidae	5	A	-	R
	Talitridae	5	A	VA	XA
	Paranephrops	5	R	-	-
EPHEMEROPTERA	*Austroclima*	7	XA	A	VA
	Deleatidium	8	-	-	R
	Zephlebia group	7	A	VA	VA
PLECOPTERA	*Zelandobius*	5	R	-	C
ODONATA	*Austrolestes*	4	-	C	-
	Xanthocnemis	4	-	A	-
HEMIPTERA	*Microvelia*	3	-	R	-
COLEOPTERA	Elmidae	6	-	-	C
	Hydrophilidae	5	-	R	-
TRICHOPTERA	*Costachorema*	7	-	-	R
	Ecnomidae/Psychomyiidae	6	R	-	-
	Hydrobiosis	5	R	-	C
	Orthopsyche	9	C	-	R
	Polyplectropus	6	-	A	-
	Psilochorema	6	R	-	-
	Oxyethira	2	-	R	-
	Pycnocentria	7	A	-	-
	Triplectides	5	-	R	R
DIPTERA	*Paralimnophila*	6	-	-	R
	Zelandotipula	6	-	-	C
	Maoridiamesa	3	-	-	C
	Orthocladiinae	2	R	R	C
	Polypedilum	3	-	-	C
	Paradixa	4	-	R	-
	Empididae	3	-	R	-
	Psychodidae	1	R	-	-
	Austrosimulium	3	C	A	R
		No of taxa	19	20	23
		MCI	98	77	98
		SQMCIs	6.3	5.0	4.9
		EPT (taxa)	8	4	8
		%EPT (taxa)	42	20	35

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

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

The community at the site was characterised by five 'moderately sensitive' taxa (amphipods (*Paracalliope* and *Talitridae)*, mayfly (*Austroclima* and *Zephlebia*) and the caddisfly (*Polyplectropus)*), four 'tolerant' taxa (*Potamopyrgus* worms, ostracod seed shrimp, damselfly larvae (*Xanthocnemis*) and caddisfly larvae (*Polyplectropus)*). This assemblage was typical of small, weedy, softer-bedded, enriched streams under moderate flow conditions. Relatively good physicochemical water quality conditions were indicated by the presence of several 'sensitive taxa' in the community and the absence of 'heterotrophic growths' on the stream bed at this site.

The moderately low MCI score of 77 units recorded at this site in the current survey was five units less than the historical median MCI score for site and reflected the relatively high proportion (65%) of 'tolerant taxa' present in the community (Table 3). This MCI score was significantly (Stark, 1998) less than the MCI score recorded at the upstream site UT given that the proportion of 'sensitive' taxa decreased by more than half at this site (Figure 5). The change in habitat sampled is considered to be the most likely reason for this result.

The numerical dominance of the 'moderately sensitive' amphipod *Paracalliope* (extremely abundant) in the community resulted in a $SQMCI_s$ score of 5.0 units which was significantly less (Stark, 1998) than the score recorded at the upstream site (UT), but 0.6 unit higher than the median for this site. Overall, this does not indicate any deterioration in water quality at this site, and it can be concluded that the irrigation of wastewater in the catchment has not impacted on the instream communities at site MT.

Site DT

A taxa richness of 23 taxa was recorded at site DT in the current survey, which was one more than the historical median for the site and similar to the previous survey (Figure 10). This taxa richness was slightly higher than that recorded at site UT, the control site on the unnamed tributary and that recorded at site MT.

The community at this site was dominated by four 'moderately sensitive taxa' (amphipods (*Paracalliope* and talitrids) and two mayfly taxa (*Austroclima* and *Zephlebia*)). This community assemblage was consistent with a stream which had widespread macrophyte habitat present and was also indicative of reasonable preceding water quality.

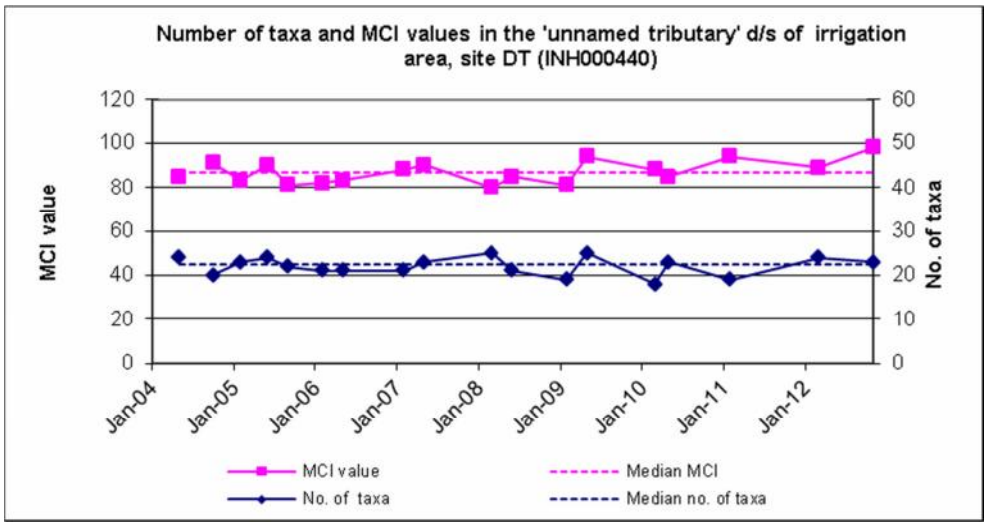


Figure 9 Numbers of taxa and MCI values recorded at site UT in the unnamed tributary of the Inaha Stream since 2004

A relatively low proportion of the macroinvertebrate community (35%) at this site consisted of 'tolerant' taxa, which resulted in an MCI score of 98 units. This result was significantly higher (Stark, 1998) than the historical median for this site, and that recorded in the previous survey, and was the highest MCI score recorded at this site to date. This result was equal to the MCI score recorded at the control site UT, and significantly higher (Stark, 1998) than that recorded at the site MT, the nearest upstream site.

The $SQMCI_S$ score of 4.9 units recorded at the site was 0.4 unit higher than the historical median for the site and represented the highest $SQMCI_s$ score recorded there to date. This relatively high $SQMCI_S$ score was primarily a result of reduced dominance of 'tolerant' taxa (compared with previous surveys), coupled with the extreme abundance of the 'moderately sensitive' amphipod Talitridae.

Catchment overview

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 spring 2009 survey, and this shows an improved management of the wastewater discharge since that time.

The MCI and $SQMCI_S$ also show improvement since that time, with the three sites downstream of the main point source wastewater discharge showing continued improvement. The most marked improvement is the change in $SQMCI_S$ scores at sites 2d and 3, the two sites closest to this discharge point. Figure 10 shows how the $SQMCI_S$ scores at these sites have improved to now consistently record scores similar to the two upstream sites. Site 4 was less impacted by the discharge in the past, but is now also consistently recording similar scores to those at sites U and 1. The MCI scores show similar results, although the degree of improvement is not as evident as that for the $SQMCI_S$ scores (Figure 11). This is because the MCI scores at sites 3 and 4 have not shown as great an impact in the past. Site 2d on the other hand did, with most early surveys showing significant reductions in MCI score from site 1 to site 2d.

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 and Figure 11 both show that results in recent times recorded MCI and $SQMCI_S$ scores in the Inaha Stream that were not significantly different to each other, and this is considered to be a direct reflection of the improved management of the irrigation system, and consequently a reduced need to discharge wastewater to the stream.

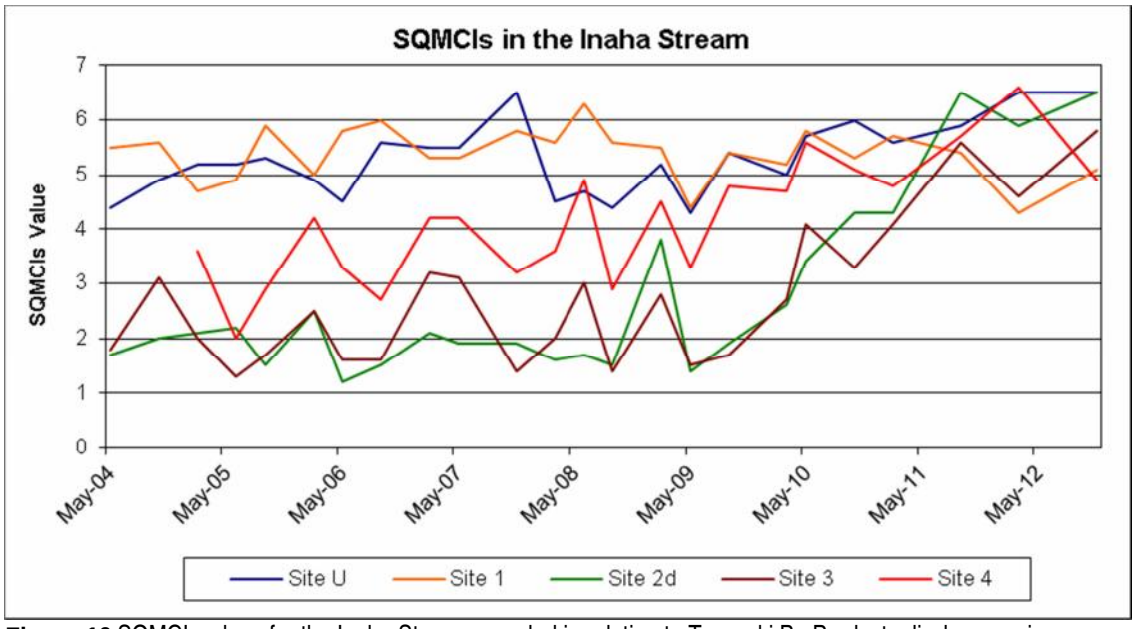


Figure 10 SQMCI$_S$ values for the Inaha Stream sampled in relation to Taranaki By-Products discharges since May 2004.

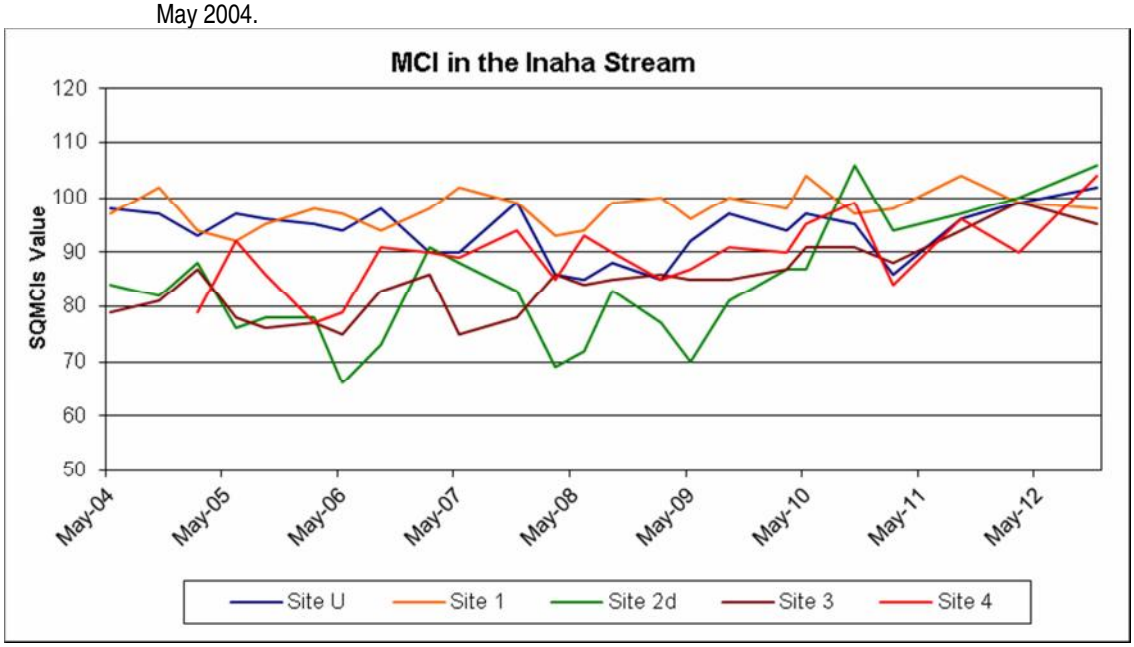


Figure 11 MCI values for the Inaha Stream sampled in relation to Taranaki By-Products discharges since May 2004.

Summary

An eight site bio-monitoring survey was undertaken using either the Council's standard 'Kick-net '(at seven sites) and the standard '400 ml sweep sampling' (at one site) in the Inaha Stream and an unnamed tributary to assess whether discharges (via point source and irrigation to land) 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 SQMCI$_S$ takes into account taxa abundances as well as sensitivity to pollution. It may indicate subtle changes in

communities, and therefore be the more relevant index if non-organic impacts are occurring. Significant differences in either the MCI or the $SQMCI_S$ between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

The results of this November 2012 biological survey indicated that the Inaha Stream was in fair to good health, with all five of the sites recording MCI scores higher than their long term medians and $SQMCI_S$ scores above their respective long term medians at four of the five sites (U, 2d, 3 and 4). In this survey, the MCI and $SQMCI_S$ scores recorded at the two sites most immediately downstream of the discharges from the rendering plant (sites 2d and 3) were significantly higher than their long term medians. In addition to this, the MCI scores at both sites continued to show improvement from the low scores recorded in 2009. Overall, these results indicated that the degree of impact from the wastewater discharge was much less evident than that recorded in previous surveys, which frequently recorded significant enrichment of the stream, and a consequent deterioration of the streambed macroinvertebrate communities. Usually, the sampling sites located upstream of the Taranaki By-Products plant supported macroinvertebrate communities with higher MCI and $SQMCI_S$ values compared to the three sites downstream of the factory discharges. In the current survey there were no statistically significant differences in MCI scores between sites. However, there was some variation in $SQMCI_S$ scores, with sites 1 and 4 recording significantly lower $SQMCI_S$ scores than that recorded at sites U and 2d. This does not indicate deterioration at these sites though, as the results for U and 2d were exceptionally high for this stream, being equal to their respective maximum scores of previous surveys. The abundance of the 'highly sensitive' *Deleatidium* mayfly and the absence of 'heterotrophic growths' at all sites supported these high scores, and overall, indicated the discharges (to land and to water) from the rendering plant had not caused a deleterious impact on the macroinvertebrate communities of the Inaha Stream.

Macroinvertebrate richnesses recorded at the three unnamed tributary sites (UT, MT and DT) were very similar to the historical medians for these sites. The community at the upstream control site (UT) was dominated by *Potamopyrgus* snails, amphipods (paraleptamphopids, *Paracalliope*, talitrids), mayfly (*Zephlebia* and *Austroclima*) and the caddisfly *Pycnocentria*, which reflected the instream habitat which consisted of willow roots and fine sediment. In contrast, the communities at site 2 downstream of the new irrigation area mainly comprised of taxa more commonly associated with macrophyte beds (e.g. ostracod seed shrimps and damselfly larvae). Site DT was dominated primarily by talitrid amphipods, a fairly typical result for this site.

The MCI scores recorded for at sites UT and DT in the unnamed tributary were indicative of 'fair' health. However the MCI score recorded at site MT indicated 'poor' water quality, although this is considered to be more reflective of the sampling technique, as macrophyte sweeps generally target more 'tolerant' taxa that prefer macrophyte habitat. The upstream site recorded an equal MCI score to that recorded at site DT, supporting the conclusion that the low score recorded at site MT was due to changes in habitat type rather than the result of the discharge of wastewater irrigation to land in the vicinity of the unnamed tributary.

Overall, the macroinvertebrate communities downstream of the Taranaki By-Products discharges in both the Inaha Stream and the unnamed tributary were of 'fair' to 'good' health. There results of this survey gave no indication that the discharges (to land and to water) from the rendering plant were having any significant adverse effect on the macroinvertebrate communities in either the Inaha Stream or the unnamed tributary. It appears that improved wastewater management has continued to contribute to significantly improved communities downstream of the wastewater discharge point.

In the previous monitoring period, two changes were proposed to the bio-monitoring component of the 2012-2013 monitoring programme. These changes include a reduction from three to two bio-monitoring surveys per monitoring period (spring and summer surveys) and a requirement that all eight sites be surveyed each survey. These changes were incorporated; hence the unnamed tributary was included in this spring survey.

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To James Kitto, Job Manager
From B Jansma, Scientific Officer
Report No. BJ212
Date 14 October 2013
Doc number 1264015

Biomonitoring of the Inaha Stream and an unnamed tributary above and below the Taranaki By-Products plant, Okaiawa, March 2013.

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

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

This late summer biological survey was the second of two scheduled in the Inaha Stream catchment in the 2012-2013 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 bio-monitoring survey was undertaken at only six sites on 15 March 2013 (Table 2 and Figure 1). Five of the six sites surveyed were in the Inaha Stream and the remaining one site was in an unnamed tributary of the Inaha Stream (Figure 1). The locations of these 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 on the Inaha Stream is situated approximately 100 metres downstream of the convergence point between the Inaha Stream and the unnamed tributary.

Table 2 Bio-monitoring 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	Kick
	1	INH000400	Upstream of treatment ponds, Kohiti Road	Kick
	2d	INH000420	500 m downstream of cooling water discharge	Kick
	3	INH000430	Upstream of Normanby Road	Kick
	4	INH000450	100 m downstream of 'irrigation' tributary confluence	Kick
Unnamed tributary of Inaha Stream	UT	INH000433	Upstream of irrigation area	Not Sampled
	MT	INH000435	Middle site within the new irrigation area	Not Sampled
	DT	INH000440	50m upstream Normanby Road	Kick

Due to the drought conditions experienced at the time of this survey, sites UT and MT were not sampled.

The standard '400ml kick-sampling' technique was used to collect streambed macroinvertebrates from all sites in this survey (Table 2). This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

Although not sampled in the current survey, the standard 'vegetation sweep' sampling technique is usually used at site MT to collect streambed macroinvertebrates (Table 2). This 'sweep-net' technique is very similar to Protocol 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 as:

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

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 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.

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.

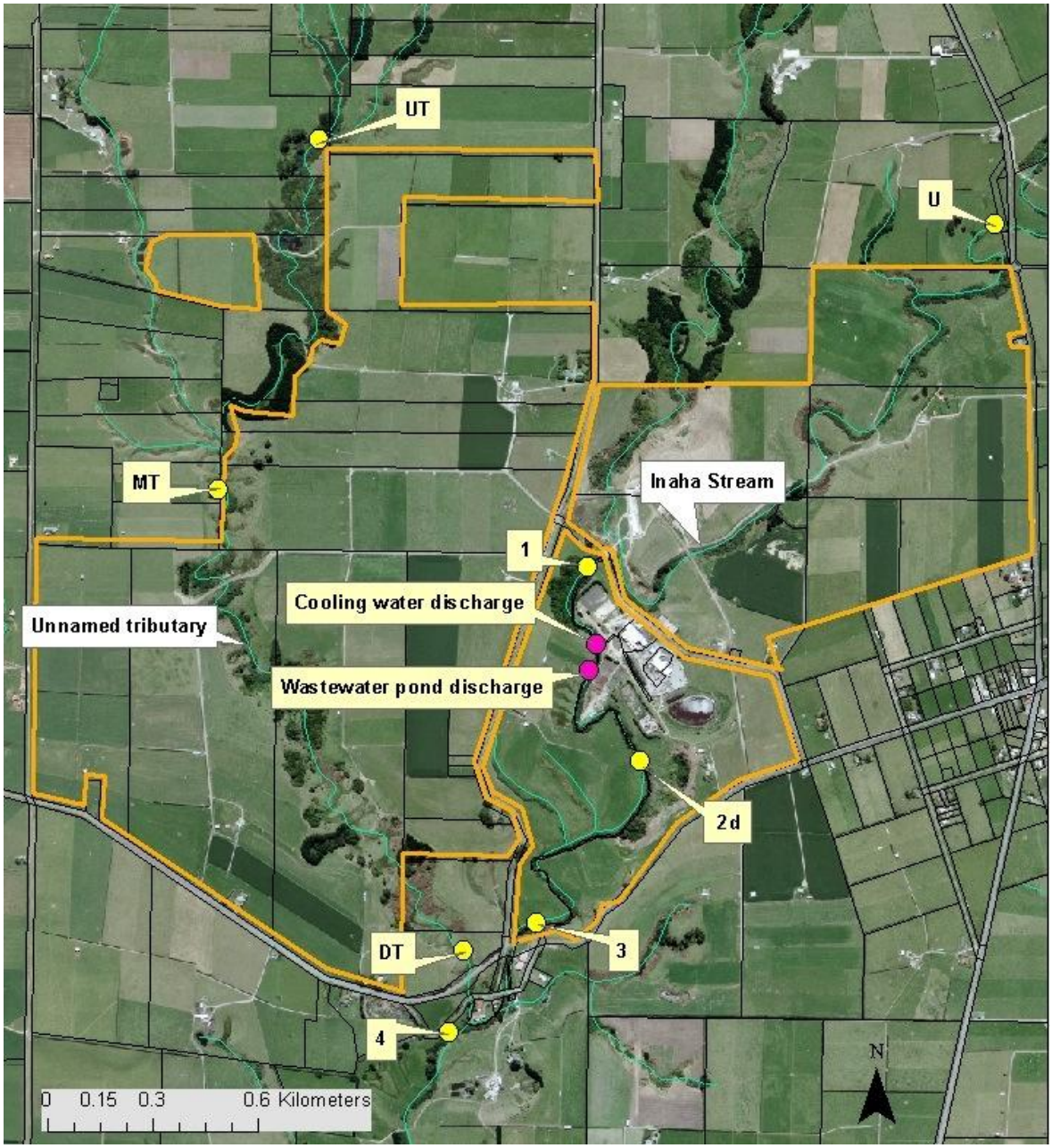

Figure 1 Aerial photo showing biomonitoring sites in the Inaha Stream and an unnamed tributary stream relating to discharges from the Taranaki By-Products plant. The orange line outlines the irrigation areas around the rendering plant.

Results and discussion

This March 2013 survey followed a period of 152 days since a fresh in excess of three times median flow in the nearby Waiokura Stream (the nearest appropriate water level recorder). In the month prior to this survey, there had been no freshes in the stream, with only three minor freshes occurring since December 1, none of which exceeded the 3 times median flow. The Waiokura Stream was below MALF at the time of this survey.

Freshes would likely scour a proportion of the fine organic matter and filamentous periphyton growths from the streambed, which could impact upon macroinvertebrate community compositions. The fact that there were no major fresh events in the month prior suggests that there will have been little influence on the community, and as such, the community should be reflective of preceding water quality conditions.

The Company's records showed that the last discharge of treated wastewater to the Inaha Stream occurred 166 days prior to this survey. This is significant, as it means that this survey was preceded by an extended period in which no discharge occurred, indicating that the macroinvertebrate communities should be reflective of relatively 'natural' conditions. However, cooling water was discharged more or less on a continuous basis.

There was a swift to steady but very low flow at all Inaha Stream sites (U, 1, 2d, 3 and 4). This flow was clear and uncoloured at these sites, and water temperatures in the Inaha Stream ranged between 14.8°C and 19.1°C.

A very low flow was also noted at site DT in the unnamed tributary, with this flow being uncoloured and clear. The water temperature at this site was 12.6°C.

Site U in the Inaha Stream was unshaded, while sites 1, 2d and 3 were partially shaded, and site 4 was completely shaded. The substrate at all sites along the Inaha Stream consisted mainly of fine and coarse gravels, cobbles and boulders, with some silt and sand also present. Patchy algal mats were recorded at all sites except for site 4, where just a slippery film was noted. Patches of filamentous algae were noted at sites U and 3, while this growth was widespread at site 2d. Due to the low flows, macrophytes were able to become more established, being present on the bed at sites U and 2d.

In the unnamed tributary, site DT was unshaded and had a substrate that consisted mainly of gravels, cobbles, and some silt, sand and boulders. Only a slippery film was noted at this site, and macrophytes were observed growing on the banks of this site. Of concern was the observation of significant stock damage at this site. This had resulted in extensive pugging of the stream bank, the destruction of macrophytes and significant sedimentation of the stream bed (Photo 1).

Photo 1 Stock damage in the unnamed tributary of the Inaha Stream (Site DT)

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 eighth 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', and an indication of an abundant supply of organic matter and nutrient enrichment to the stream, and such growths have been recorded (often in abundance) on many previous sampling occasions, 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 3. The full results from this current survey are given in Tables 4 and 5.

Table 3 Previous numbers of taxa and MCI scores 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	24	18-32	24	23	85-102	95	83	24	4.3-6.5	5.3	5.8
1	65	15-30	22	31	82-104	95	98	41	3.6-6.3	5.1	5.7
2d	52	10-29	21	27	52-106	78	88	41	1.2-6.5	1.9	5.5
3	65	6-35	20	29	43-99	80	91	41	1.3-5.8	2.4	4.6
4	22	17-31	26	28	77-104	90	89	22	2.0-6.6	4.2	6.3
UT	5	13-19	16	-	97-109	103	-	5	5.3-6.3	5.5	-
MT	18	12-29	20	-	71-94	82	-	18	3.1-5.7	4.5	-
DT	18	18-25	23	12	80-98	85	105	18	3.5-4.9	4.6	4.8

Inaha Stream

Site U

A moderate community richness of 23 taxa was recorded at site U, the 'control' site on the Inaha Stream. This richness was one taxon less than the median for this site (Table). The community (Table 4) was characterised by six 'moderately sensitive' taxa (*Paracalliope* amphipods, mayfly (*Austroclima*), elmid beetles, dobson fly larvae (*Archichauliodes*), and caddisflies (*Pycnocentria* and *Pycnocentrodes*)), and three 'tolerant' taxa (oligochaete worms. The extreme abundance of two 'moderately sensitive' taxa and the absence of any 'heterotrophic growths' on the streambed, indicated good preceding water quality conditions at this control site, especially considering the low flows observed at the time of sampling.

The reduced of 'sensitive' taxa (43%) resulted in an MCI score of 83units which is the lowest MCI score recorded at this site to date (Table 3 and Figure 2). The $SQMCI_S$ score of 5.8 units was slightly higher than the median for this relatively new site and reflected the numerical dominance of several 'sensitive' taxa especially the extremely abundant amphipod

Paracalliope and *Pycnocentria* caddisfly. These results are reflective of good preceding water quality conditions, but also that the flows which preceded this survey had been very low.

Table 4 Macroinvertebrate fauna of the Inaha Stream in relation to Taranaki By-Products wastes discharges sampled on 15 March 2013

Taxa List	Site Number	MCI score	U	1	2d	3	4
	Site Code		INH000334	INH000400	INH000420	INH000430	INH000450
	Sample Number		FWB13156	FWB13157	FWB13158	FWB13159	FWB13160
COELENTERATA	Coelenterata	3	-	-	R	-	-
PLATYHELMINTHES	*Cura*	3	-	-	C	C	R
NEMERTEA	Nemertea	3	R	R	-	R	R
ANNELIDA	Oligochaeta	1	A	C	A	A	A
	Lumbricidae	5	-	R	-	-	-
MOLLUSCA	*Ferrissia*	3	-	-	-	-	R
	Latia	5	-	C	-	-	-
	Physa	3	-	-	-	R	-
	Potamopyrgus	4	R	XA	C	C	A
	Sphaeriidae	3	-	-	R	-	-
CRUSTACEA	Ostracoda	1	R	A	VA	A	C
	Paracalliope	5	XA	VA	C	C	C
	Talitridae	5	-	-	-	R	R
	Paranephrops	5	-	R	-	-	R
EPHEMEROPTERA	*Austroclima*	7	VA	XA	XA	VA	XA
	Coloburiscus	7	R	C	C	A	VA
	Deleatidium	8	-	VA	A	A	A
	Nesameletus	9	-	R	-	-	-
	Zephlebia group	7	R	A	A	C	A
ODONATA	*Antipodochlora*	5	-	R	-	-	-
COLEOPTERA	Elmidae	6	VA	VA	VA	A	VA
	Hydraenidae	8	-	R	-	-	-
	Hydrophilidae	5	-	-	-	R	-
MEGALOPTERA	*Archichauliodes*	7	A	VA	A	A	VA
TRICHOPTERA	*Aoteapsyche*	4	A	A	A	VA	VA
	Costachorema	7	-	-	-	R	-
	Hydrobiosis	5	C	A	C	C	C
	Neurochorema	6	R	-	-	R	-
	Polyplectropus	6	-	-	R	-	-
	Psilochorema	6	-	R	-	-	-
	Hudsonema	6	-	A	C	-	R
	Oecetis	4	-	-	R	-	R
	Oxyethira	2	A	A	R	C	R
	Paroxyethira	2	R	-	R	-	-
	Pycnocentria	7	XA	VA	A	VA	VA
	Pycnocentrodes	5	VA	A	VA	R	A
	Triplectides	5	-	R	C	R	C
DIPTERA	*Aphrophila*	5	-	-	-	C	-
	Maoridiamesa	3	R	R	R	R	-
	Orthocladiinae	2	C	-	C	VA	R
	Polypedilum	3	-	C	VA	VA	A
	Tanytarsini	3	C	C	-	C	R
	Empididae	3	R	R	-	-	-
	Muscidae	3	R	-	-	-	-
	Austrosimulium	3	C	R	A	A	A
	Tanyderidae	4	-	R	-	-	R
	No of taxa		23	31	27	29	28
	MCI		83	98	88	91	89
	SQMCIs		5.8	5.7	5.5	4.6	6.3
	EPT (taxa)		8	12	12	11	11
	%EPT (taxa)		35	39	44	38	39
'Tolerant' taxa	'Moderately sensitive' taxa			'Highly sensitive' taxa			

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

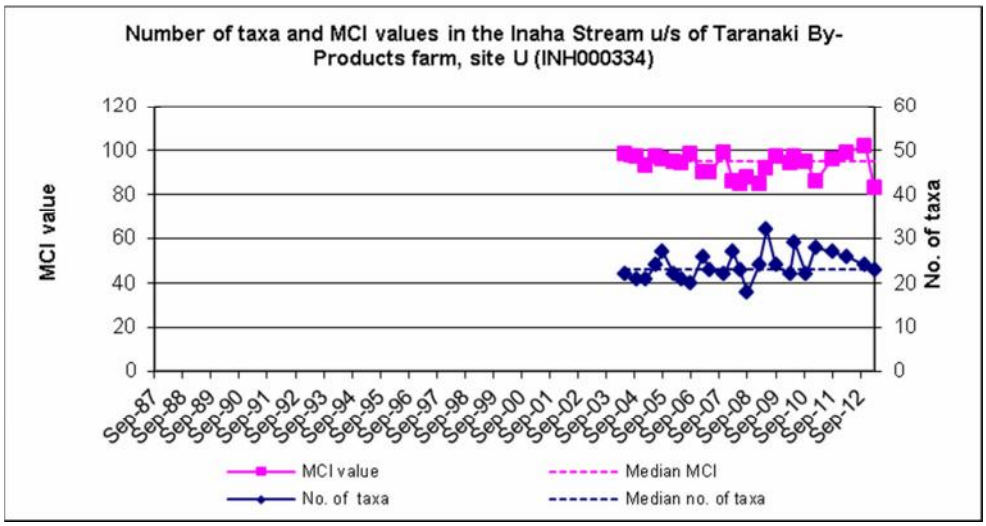

Figure 2 Numbers of macroinvertebrate taxa and MCI values recorded at site U in the Inaha Stream since May 2004

Site 1

A community richness of 31 taxa was found at this site, which was the highest recorded to date for this site, eight taxa more than that recorded at site U upstream and nine more than the median for the site (Table 3 and Figure 3). The community at this site was characterised by one 'highly sensitive' taxon (mayfly *Deleatidium*), nine 'moderately sensitive' taxa (mayfly (*Austroclima* and *Zephlebia*), elmid beetles, dobsonfly larvae (*Archichauliodes*), and caddisfly larvae (*Hydrobiosis*, *Pycnocentria* and *Pycnocentrodes*); and four 'tolerant' taxa (*Potamopyrgus* snails, ostracod seed shrimp, net building caddisfly (Aoteapsyche) and axe-head caddisfly (Oxyethira)) (Table 4). The composition of the community was relatively similar to that recorded in the previous survey, with the addition of some taxa that are reflective of the low flow conditions (e.g. ostracod seed shrimp).

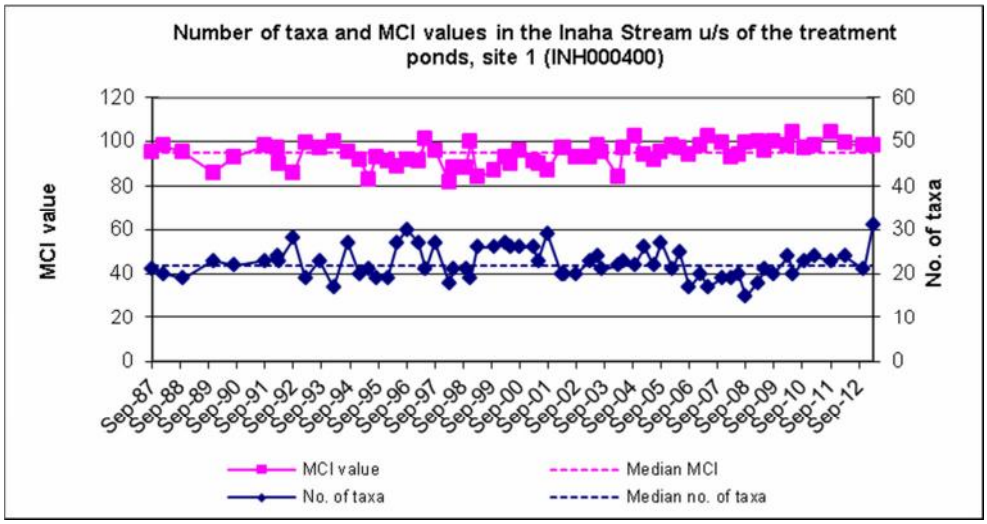

Figure 3 Numbers of macroinvertebrate taxa and MCI values recorded at site 1 in the Inaha Stream since September 1987

The MCI score of 98 units recorded at site 1 represented no change from the spring survey and this score was an insignificant three units higher than the median for this site of 95 units. This MCI score was significantly higher than that recorded at site U in this survey (Stark, 1998), the increased proportion of 'sensitive' taxa at this site (58%), which included three 'highly sensitive' taxa.

A moderate $SQMCI_s$ score of 5.7 units was recorded at site 1 in this survey, which was a 0.6 unit increase from the $SQMCI_s$ score of 5.1 units recorded at this site in the previous survey. This score was not significantly (Stark, 1998) different to that recorded at site U, despite a number of significant changes in taxa abundance including. This lack of change was because both 'tolerant' taxa such as *Potamopyrgus* snails, and 'sensitive' taxa such as *Deleatidium* mayfly, increased significantly in abundance. This reflected the fact that this site provided a better quality habitat, with improved shading, but also that slightly more habitat was sampled at site 1 than at site U. Overall this site recorded average MCI and $SQMCI_S$ scores, and as such does not indicate any impact from the upstream activities, including the irrigation of wastewater.

Site 2d

A moderately high community richness of 27 macroinvertebrate taxa was recorded at site 2d, downstream of the spray irrigation area and the point source discharges of organic wastewater and cooling water to the stream. This richness was four taxa more and four taxa less than that recorded at sites U and 1 respectively, and six taxa more than the median recorded for this site (Table 3 and Figure 5). The characteristic taxa in the community included one 'highly sensitive' mayfly (*Deleatidium*). Nine 'moderately sensitive' taxa were also recorded in abundance (*Austroclima* and *Zephlebia* mayfly, elmid beetles, dobson fly larvae (*Archichauliodes*), sandy cased caddisfly (*Pycnocentria*) and the stony cased caddisfly *Pycnocentrodes*), as were five 'tolerant' taxa (oligochaete worms, ostracod seed shrimp, *Aoteapsyche* caddisfly, *Polypedilum* midge larvae and *Austrosimulium* sandfly larvae).

The moderate proportion of 'tolerant' taxa comprising this community (52%) resulted in a MCI score of 88units. This result was eighteen units less than that recorded in the previous survey (Figure 4), a statistically significant reduction (Stark, 1998), and was only ten units higher than the historical median MCI score for this site. When compared against recent results at this site, this is a poor result (Figure 4). However, no statistically significant differences in MCI scores were recorded between site 2d and the two upstream sites U and 1 which indicated that this poor result was related to the very low flows that preceded this survey, and that the discharges into the Inaha stream were unlikely to be the cause of this result. This result breaks the trend of strong improvement in respect to the MCI scores at the site recorded since the spring 2009 survey, when a low MCI score was recorded at the site coincidental with the proliferation of heterotrophic growths at the site (Figure 5). However, it is expected that this is only a short term break to this trend, being related to weather conditions at that time.

A significant increase in the abundance of the 'tolerant' ostracod seed shrimps was recorded at the site from the previous survey which was related to the low flows. However the 'moderately sensitive' mayfly still a dominated the community numerically, despite an increased presence of filamentous algae at the site (Table 4). Overall this resulted in a significant reduction in the $SQMCI_s$ score from 6.5 units in the previous survey to 5.5 units in this survey. This $SQMCI_s$ score for the current survey was well above the median $SQMCI_S$ score for the site of 1.9 units, but similar to that recorded at the nearest upstream site 1. This result also represented little change in $SQMCI_S$ score from site U upstream.

Over the last few surveys, the main influence on the community at this site has been the degree of algal or macrophyte growth on the stream bed. This indicates that the influence of the wastewater discharge has been reduced, and this is supported by the steadily improving MCI and $SQMCI_S$ scores. The current results indicate that although the low flows had caused deterioration in macroinvertebrate health, there had been little to no impact on the instream communities from the upstream activities undertaken by Taranaki By-products.

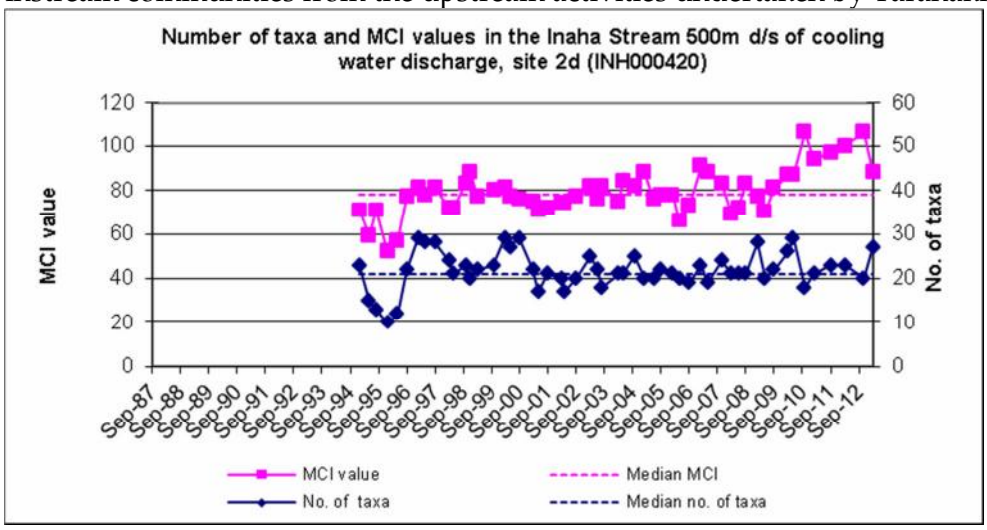

Figure 4 Numbers of taxa and MCI values recorded at site 2d in the Inaha Stream since 1995

Site 3

In this summer survey, a total of 29 taxa was recorded at site 3, nine taxa higher than the median number of taxa recorded at the site (Table 3, Figure 5). This is richness is somewhat higher than that recorded in the two most recent surveys, but similar to that recorded from spring 2009 to spring 2011.

The community at site 3 was characterised by one 'highly sensitive' taxon (mayfly *Deleatidium*), five 'moderately sensitive' taxa (mayfly *Austroclima* & *Coloburiscus,* elmid beetles, dobsonfly larvae (*Archichauliodes*) and caddisfly larvae (*Pycnocentria)* and six 'tolerant' taxa (oligochaete worms, ostracod seed shrimps, caddisfly (*Aoteapsyche*), orthoclad and *Polypedilum* midge larvae and *Austrosimulium* sandfly larvae).

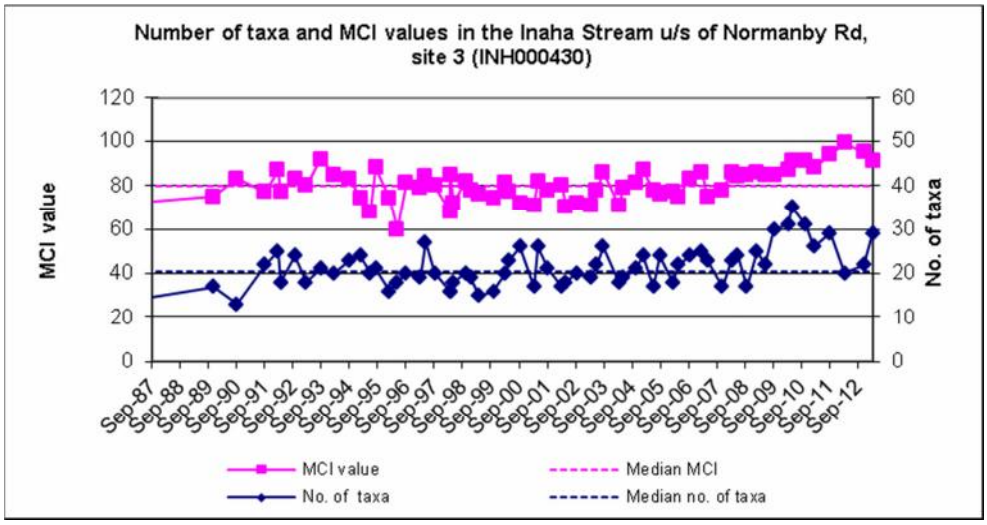

Figure 5 Numbers of taxa and MCI values recorded at site 3 in the Inaha Stream since 1989

The moderate proportion of 'tolerant' taxa (45% of total richness) in the community at this site resulted in the MCI score of 91 units for the site. This MCI score was significantly (Stark, 1998) higher than the historical median for the site but within the range of previously recorded values (Figure 5). As at site 2d, there were no significant differences recorded in the MCI scores between site 3 and any upstream site.

The $SQMCI_s$ score recorded at site 3 (4.6 units) in this survey was significantly (Stark, 1998) higher than the historical median $SQMCI_s$ score of 2.4 units. However, this result did represent a significant (Stark, 1998) reduction from the previous survey (5.8 units) due mainly to the decrease in numerical dominance of the 'moderately sensitive' mayfly (*Austroclima)* which went from being extremely abundant in the previous survey to very abundant in the current survey. The increased abundance of a number of 'tolerant' dipterans also contributed to this reduced score. This change in numerical dominance was similar to that observed at site 2d in the current survey and it also coincided with an increase in filamentous algae at the site from the previous survey, and it is clear that the low flows also contributed. In comparison to the other upstream sites, this $SQMCI_s$ score was significantly less than that recorded at sites U, 1 or 2d.

The current results do not show any real deterioration from that recorded at site 2d, as the deterioration in $SQMCI_s$ score was considered to be related to subtle changes in habitat. The current results are still significantly higher than the long term median for this site, for both MCI and $SQMCI_S$ scores, and as such, it is considered that the recovery recorded in the previous surveys is continuing.

Site 4

A relatively high taxa richness of 28 taxa was recorded at this site which was two taxa more than the historical median for the site (Table 3 and 4). The community was characterised by one 'highly sensitive' taxon (*Deleatidium*), seven moderately sensitive' taxa (mayfly (*Austroclima* and *Coloburiscus*), elmid beetles, dobsonfly larvae (Archichauliodes) and caddisfly larvae (*Pycnocentria* and *Pycnocentrodes*)) and five 'tolerant' taxa (oligochaete worms, *Potamopyrgus* snails, net spinning caddisfly (*Aoteapsyche*), P*olypedilum* midges and *Austrosimulium* sandfly larvae) (Table 4).

Half of the macroinvertebrate community at site 4 consisted of 'tolerant' taxa which resulted in a MCI score of 89 units, similar to the historical median score for the site, but fifteen units less than that recorded in the previous survey (Table 3 & Figure 6). Although this indicates a reduced community health, it also reflects the fact that the previous survey recorded the second highest score recorded at this site to date (Figure 6).

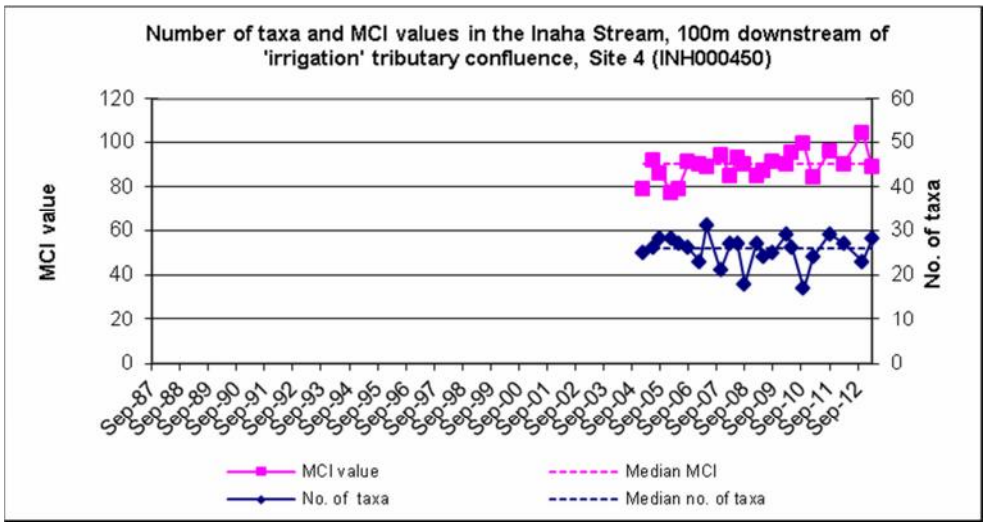

Figure 6 Numbers of taxa and MCI values recorded at site 4 in the Inaha Stream since 2005

The numerical dominance of eight 'sensitive' taxa resulted in a moderately high $SQMCI_s$ score of 6.3 units at site 4, indicative of reasonable preceding water quality. This $SQMCI_s$ score was significantly (Stark, 1998) higher than the historic median score for the site and was the highest score recorded in the current survey. It also represents a significant increase from that recorded in the previous survey. This improved score is related in part to the 'moderately sensitive' mayfly *Austroclima* being recorded in extreme abundance.

Although the MCI score suggests some deterioration at this site from the previous survey, the $SQMCI_S$ score was significantly higher than the long term median. It is considered that the change in MCI score is flow related, and that overall, this site is in above average health, indicating no impact from the unnamed tributary inflow.

Unnamed tributary of the Inaha Stream

Site UT

This recently established site has been monitored on five occasions since March 2010. Unfortunately due to the very low flows experienced in the catchment at the time of this survey, there was no flow at site UT, although a crayfish was observed walking along the stream bed (Photo 2). Due to the low flows, no sample was collected at this site.

Photo 2 Top A live freshwater crayfish observed in the dry stream bed at site UT
Right Site UT with no flow

Historical results are presented in Table 3 and Figure 7.

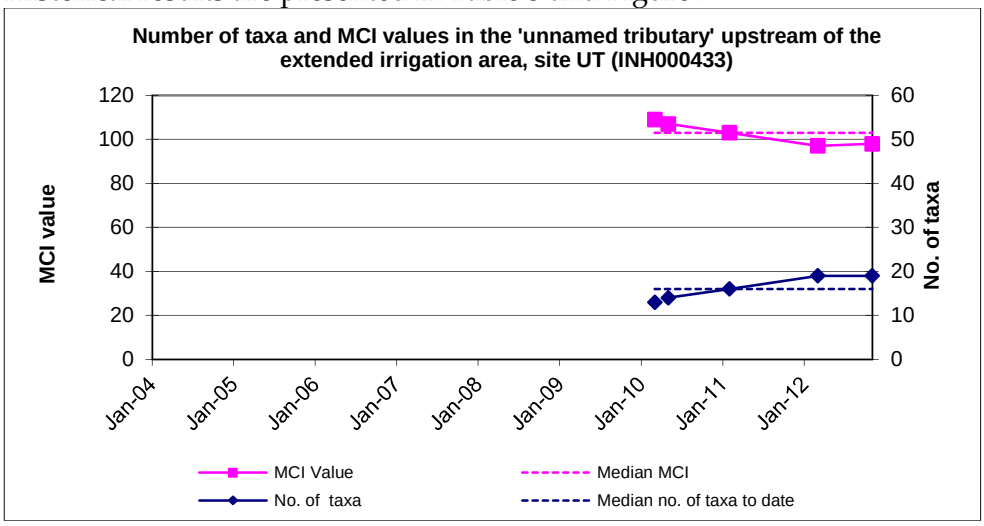

Figure 7 Numbers of taxa and MCI values recorded at site UT in the unnamed tributary of the Inaha Stream

Site MT

As with site UT, there was insufficient flow at site MT to facilitate the collection of a sample. Historical data is presented in Table 3 and Figure 9.

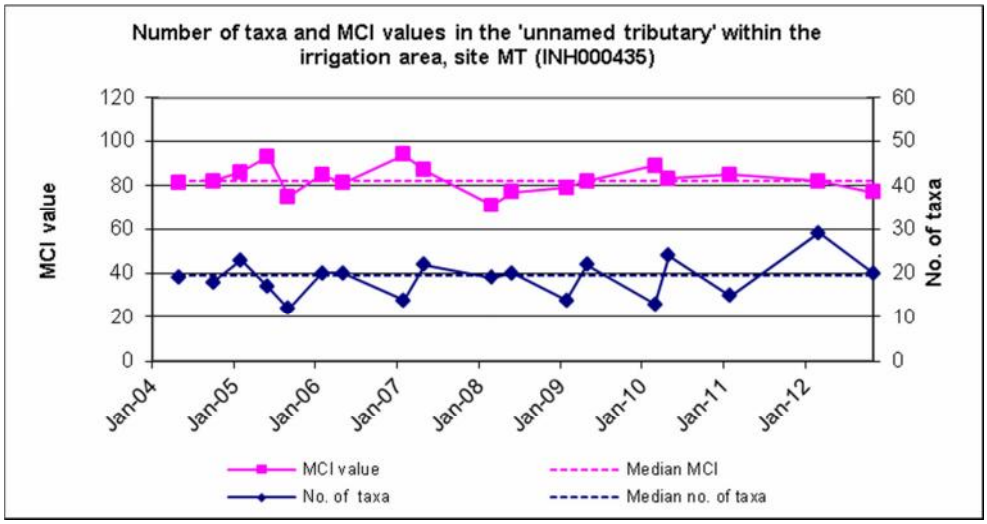

Figure 8 Numbers of taxa and MCI values recorded at site MT in the unnamed tributary of the Inaha Stream since 2004

Site DT

A taxa richness of only 12 taxa was recorded at site DT in the current survey, which was eleven less than the historical median for the site and the previous survey and six taxa less than the previous minimum richness recorded at this site (Table 3, Figure 10). This taxa richness is also at least eleven taxa less than any richness recorded in the Inaha Stream during the current survey, and is a direct result of the significant stock damage observed at the time of the survey. This damage destroyed macroinvertebrate habitat reducing the number of taxa that the site could support. Although the low flows will have impacted on the community also, it is unlikely to have caused the reduced community richness, as illustrated in the Inaha Stream. The extended period of stable flow in the Inaha Stream allowed the colonisation of additional species, resulting in well above average richnesses at four of the five sites monitored.

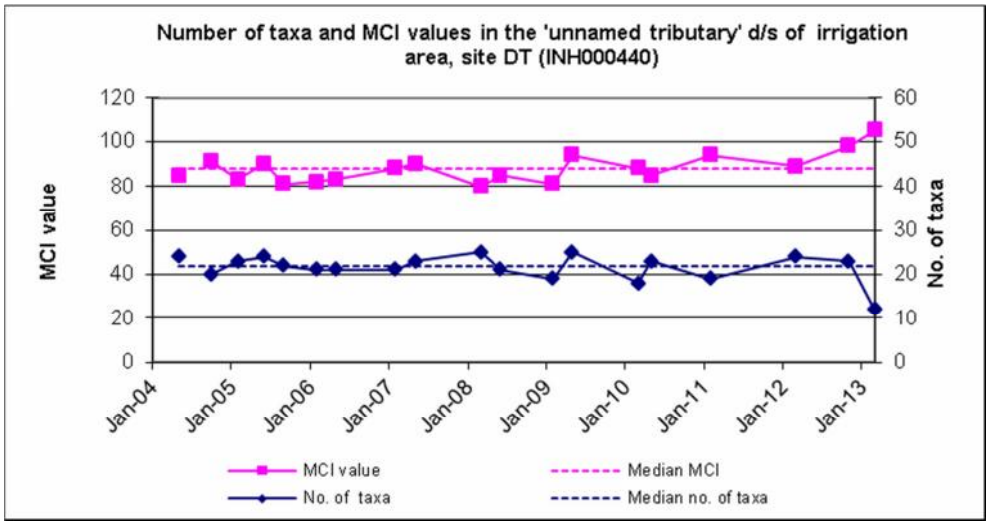

Figure 9 Numbers of taxa and MCI values recorded at site UT in the unnamed tributary of the Inaha Stream since 2004

The community at this site was dominated by three 'moderately sensitive taxa' (amphipods (*Paracalliope* and talitrids) and one mayfly taxon (*Austroclima*)), and the 'tolerant' snail *Potamopyrgus*. This community assemblage was similar to that recorded in previous surveys, consistent with a stream which had macrophyte habitat present and was also indicative of reasonable preceding water quality.

Table 5 Macroinvertebrate fauna of the unnamed tributary of the Inaha Stream in relation to Taranaki By-Products wastes discharges sampled on 15 March 2013

Taxa List	Site Number	MCI score	DT
	Site Code		INH000440
	Sample Number		FWB13161
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	C
ANNELIDA (WORMS)	Oligochaeta	1	R
	Lumbricidae	5	R
MOLLUSCA	*Potamopyrgus*	4	VA
CRUSTACEA	*Paracalliope*	5	VA
	Talitridae	5	A
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	A
	Deleatidium	8	R
	Zephlebia group	7	C
COLEOPTERA (BEETLES)	Elmidae	6	C
TRICHOPTERA (CADDISFLIES)	*Orthopsyche*	9	R
DIPTERA (TRUE FLIES)	Sciomyzidae	3	R
		No of taxa	12
		MCI	105
		SQMCIs	4.8
		EPT (taxa)	4
		%EPT (taxa)	33
'Tolerant' taxa	'Moderately sensitive' taxa	'Highly sensitive' taxa	

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

A relatively low proportion of the macroinvertebrate community (33%) at this site consisted of 'tolerant' taxa, which resulted in an MCI score of 105 units. This result was significantly higher (Stark, 1998) than the historical median for this site (Table 3), and seven units higher than that recorded in the previous survey, and was the highest MCI score recorded at this site to date (Figure 9).

The $SQMCI_S$ score of 4.8 units recorded at the site was 0.2 unit higher than the historical median for the site and was only 0.1 unit lower than the highest $SQMCI_s$ score recorded there to date, which was recorded in the previous survey. This relatively high $SQMCI_S$ score was primarily a result of reduced dominance of 'tolerant' taxa (compared with previous surveys).

Catchment overview

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 spring 2009 survey, and this shows an improved management of the wastewater discharge since that time.

The MCI and $SQMCI_S$ scores also show improvement since that time, with the three sites downstream of the main point source wastewater discharge showing continued improvement. The most marked improvement over time is the change in $SQMCI_S$ scores at sites 2d and 3, the two sites closest to this discharge point. Figure 10 shows how the $SQMCI_S$ scores at these sites have improved to now consistently record scores similar to the two upstream sites. Site 4 was less impacted by the discharge in the past, but is now also consistently recording similar scores to those at sites U and 1. The MCI scores show similar results, although the degree of improvement is not as evident as that for the $SQMCI_S$ scores (Figure 11). This is because the MCI scores at sites 3 and 4 have not shown as great an impact in the past. Site 2d on the other hand did, with most early surveys showing significant reductions in MCI score from site 1 to site 2d. The current survey does show the impacts of the very low flows that preceded this survey, allowing the colonisation of more 'tolerant' taxa, resulting in a notable drop in MCI score at site U, 2d, 3 and 4.

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 and Figure 11 both show that results in recent times recorded MCI and $SQMCI_S$ scores in the Inaha Stream that were not significantly different to each other, and this is considered to be a direct reflection of the improved management of the irrigation system, and consequently a reduced need to discharge wastewater to the stream.

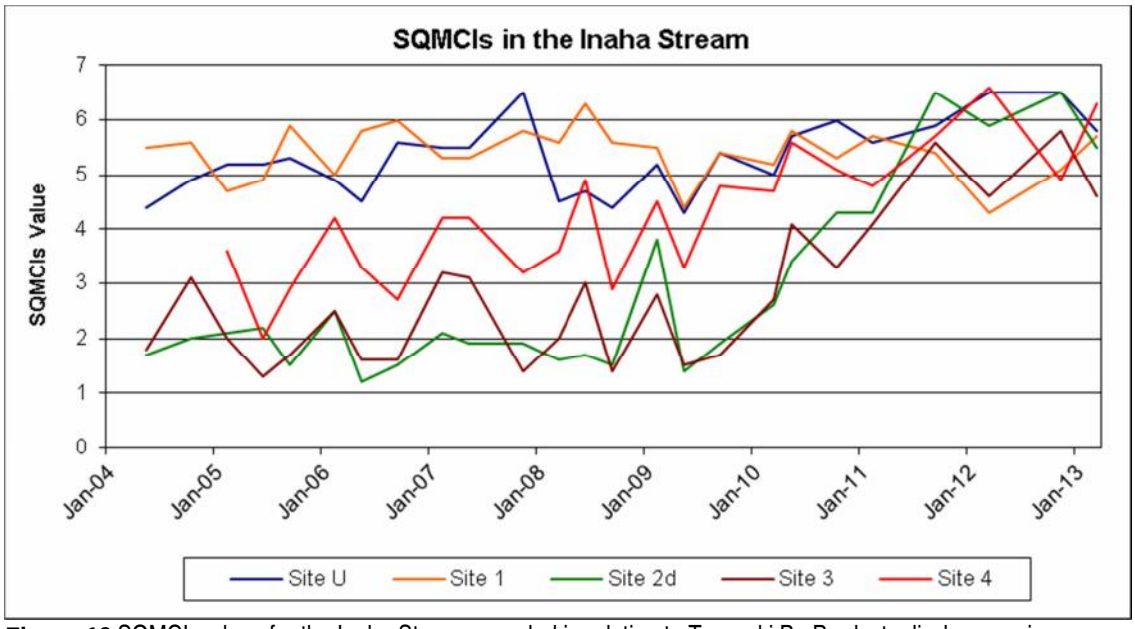

Figure 10 $SQMCI_S$ values for the Inaha Stream sampled in relation to Taranaki By-Products discharges since May 2004.

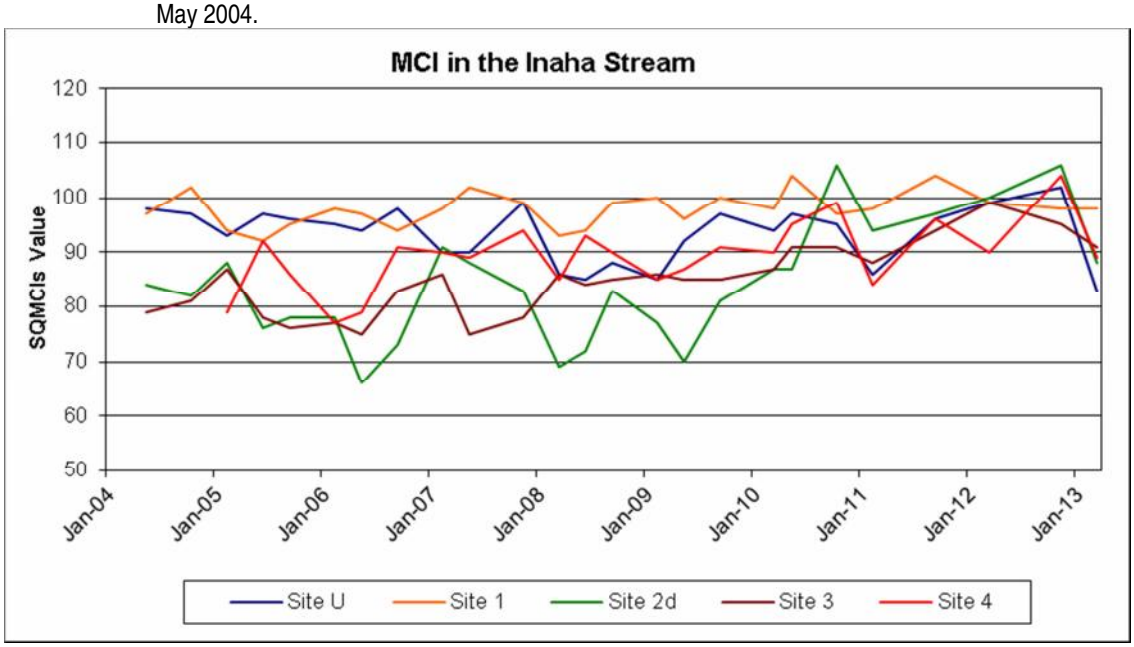

Figure 11 MCI values for the Inaha Stream sampled in relation to Taranaki By-Products discharges since May 2004.

Summary

A six eight site bio-monitoring survey was undertaken using either Council's standard 'Kick-net sampling' technique in the Inaha Stream and an unnamed tributary to assess whether discharges (via point source and irrigation to land) had had any adverse effects on the macroinvertebrate communities of the streams. Originally it was intended to undertake an eight site survey, but two sites in the unnamed tributary were not sampled due to insufficient flow. Samples were processed to provide number of taxa (richness), MCI and $SQMCI_S$ scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The $SQMCI_S$ takes into account

taxa abundances as well as sensitivity to pollution. It may indicate subtle changes in communities, and therefore be the more relevant index if non-organic impacts are occurring. Significant differences in either the MCI or the $SQMCI_S$ between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

The results of this March 2013 biological survey indicated that the Inaha Stream was in fair health, with all five sites recording MCI and $SQMCI_S$ scores similar to or higher than their long term medians. The overwhelming influence on the communities at the time of this survey was the very low flows that preceded this survey. This resulted in above average taxa richnesses at four of the five sites, and MCI scores that were well below that recorded in the previous survey. In this survey, the MCI scores recorded at the two sites most immediately downstream of the discharges from the rendering plant (sites 2d and 3) were at least ten units higher than their long term medians. This shows that the MCI scores at both sites continue to show improvement from the low scores recorded in 2009. In addition, the $SQMCI_S$ scores at both sites were both significantly higher than their long term medians. Overall, these results indicated that the degree of impact from the wastewater discharge was much less evident than that recorded in previous surveys, which frequently recorded significant enrichment of the stream, and a consequent deterioration of the streambed macroinvertebrate communities.

Usually, the sampling sites located upstream of the Taranaki By-Products plant supported macroinvertebrate communities with higher MCI and $SQMCI_S$ values compared to the three sites downstream of the factory discharges. In the current survey there were no statistically significant differences in MCI scores between sites. However, there was some variation in $SQMCI_S$ scores, with site 4 recording a $SQMCI_S$ score significantly higher than the other upstream sites, site U, 1 and 2d recording similar scores and site 3 recorded a score significantly less than any other site in the Inaha Stream. The abundance of the 'highly sensitive' *Deleatidium* mayfly and the absence of 'heterotrophic growths' at all impact sites supported these above average $SQMCI_S$ scores, and overall, indicated the discharges (to land and to water) from the rendering plant had not caused a deleterious impact on the macroinvertebrate communities of the Inaha Stream.

Unfortunately due to the low flows, no sample was collected from sites UT and MT in the unnamed tributary. The only site in this stream that was sampled (Site DT) was severely impacted by stock access, with destruction of habitat, sedimentation evidence of stock defecating directly into the stream. As a result of this stock access site DT experienced a significant loss of invertebrate taxa, with only 12 taxa recorded. This was eleven less than the median richness at this site and six taxa less than the previous minimum richness. The taxa that remained however were indicative of moderate water quality, and the community was dominated primarily by 'moderately sensitive' taxa including talitrid and *Paracalliope* amphipods and *Austroclima* mayflies, a fairly typical result for this site.

The MCI score recorded at site DT (105) in the unnamed tributary was indicative of 'good' health, and was the highest recorded of any site included in the current survey. Due to no upstream samples being collected, it is not possible to make any firm conclusions on the impacts of any upstream activities, including the irrigation of wastewater. However, the MCI and $SQMCI_S$ results recorded at site DT were above average, and this suggests that the wastewater irrigation to land in the vicinity of the unnamed tributary had not had any impact on the invertebrate communities of this stream.

Overall, the macroinvertebrate communities downstream of the Taranaki By-Products discharges in both the Inaha Stream and the unnamed tributary were of 'fair' to 'good'

health. The results of this survey indicate that the macroinvertebrate communities were showing impacts from the low flows that preceded this survey, and other than the stock damage in the unnamed tributary, there was gave no indication that the discharges (to land and to water) from the rendering plant were having any significant adverse effect on the macroinvertebrate communities in either the Inaha Stream or the unnamed tributary. It appears that improved wastewater management has continued to contribute to significantly improved communities downstream of the wastewater discharge point.

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Appendix V

Evaluation of the air discharge control operations by Golder Associates

July 2013

2 July 2013 Project No. 1378104138_002_LR_Rev0

Bevan Chapman
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PO Box 172
Hawera 4640

SITE VISIT REPORT - CONSENT 4058-4 CERTIFICATION

Dear Bevan,

This letter[1] 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 precooled 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:

<u>*The Factory Air #1:*</u> This biofilter consists of a 1.5 m deep bark bed with three areas each of 30 m x 40 m (5,400 m^3 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 $m^3_{air}/hr/m^3_{media}$. This is below our recommended maximum guideline value of 20 $m^3_{air}/hr/m^3_{media}$ 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.

<u>*The Factory Air #2:*</u> This biofilter consists of a 1.5 m deep bark bed with a total area of 30 m x 25 m (1,125 m^3 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 m^3/s, which equates to a media air loading rate of 22 $m^3_{air}/hr/m^3_{media}$. This is 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 m^3 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 m^3/s, which equates to a media air loading rate of 21 $m^3_{air}/hr/m^3_{media}$. 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 that 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 m^2 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 biofiler 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 #1alone. During this audit the former flow was measured at 75,600 m^3/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 $m^3_{air}/hr/m^3_{media}$ 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 m^3/hr to 36,000 m^3/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 m^3/hr to 36,000 m^3/hr equates to a media air loading rate of warm moist air in the order of 15 to 20 $m^3_{air}/hr/m^3_{media}$. 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 m^3/hr during the audit. This would result in a media air loading rate of

22 $m^3_{air}/hr/m^3_{media}$. 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 $m^3_{air}/hr/m^3_{media}$ 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 ha**s** 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

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