F J Ramsey (Trading) Limited
"Crusader Meats"

Benneydale Meat Processing Plant: Resource Consents Application & Assessment of Environmental Effects

22 February 2016

PART A
APPLICATION FOR RESOURCE CONSENTS

PURSUANT TO SECTION 88 OF THE RESOURCE MANGEMENT ACT 1991

To: Horizons Regional Council
Private Bag 11025
Manawatu Mail Centre
Palmerston North

F J Ramsey (Trading) Limited ("Crusader Meats") is applying for all necessary resource consents for the activities described in the attached Assessment of Environmental Effects (AEE) and supporting documentation, including:

- Discharge of up to 1,500 m^3/day of wastewater and slurry wastes from meat processing and ancillary activities to land in circumstances that may result in contaminants entering groundwater.

Existing consents relating to this activity expire on 22 May 2016. F J Ramsey (Trading) Limited is herewith applying for replacement consents from Horizons Regional Council (HRC).

Other than as described in this application there are no other activities that are part of the Crusader Meats operation which require resource consent applications at this time.

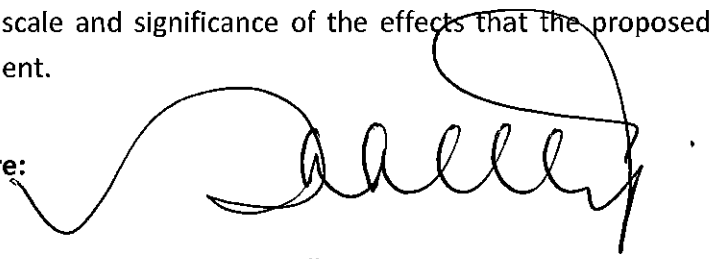
Appendix 1 of the attached AEE sets out a completed HRC consent application in the prescribed forms.

Location (Refer to Appendix 2 for land titles and Appendix 3 for a map of the properties.)

Block	Legal Description	Title	Map reference	Owners
Tiroa E	Part Tiroa E Block – refer title attached in Appendix 2	SA51C/863	NZTopo50 BG34 148359	The Trustees Tiroa E/Te Hape B PO Box 51 Te Kuiti 3941
Te Hape B	Part Te Hape B Block – refer title attached in Appendix 2	SA53A/19	NZTopo50 BG34 150345	As above
Tutaki	Rangitoto Tuhua 36 A 2 A 2 C Block	474061	NZTopo50 BG34 135347	David Seymour Hori Tamaki, John Tutaki, Rosebud Waaka

Effects on the Environment

Attached (as Part B of this document) is an AEE prepared in accordance with the Fourth Schedule of the Resource Management Act 1991 (RMA) and in the detail that corresponds with the scale and significance of the effects that the proposed activity may have on the environment.

Signature: 

Name:	Anne Kelly General Manager Crusader Meats State Highway 30 Benneydale RD-7 TE KUITI 3987
Date:	22 February 2016

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Additional copy and Address for invoicing:	F J Ramsey (Trading) Limited C/- Crusader Meats State Highway 30 Benneydale RD 7 TE KUITI 3987 Attention: Anne Kelly
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PART B

ASSESSMENT OF ENVIRONMENTAL EFFECTS

Contents

1 Introduction

1.1 Background

F J Ramsey (Trading) Limited and Crusader Meats New Zealand Limited (collectively known as Crusader Meats) own and operate a modern meat processing plant on State Highway 30, approximately 10 km east of Benneydale (Figure 1). The plant's resource consents are held by F J Ramsey (Trading) Limited. The two companies are wholly owned subsidiaries of F J Ramsey Limited, owned by John and Bernice Ramsey, whose other business operations include three deer farms, kiwifruit growing, and tourism operations.

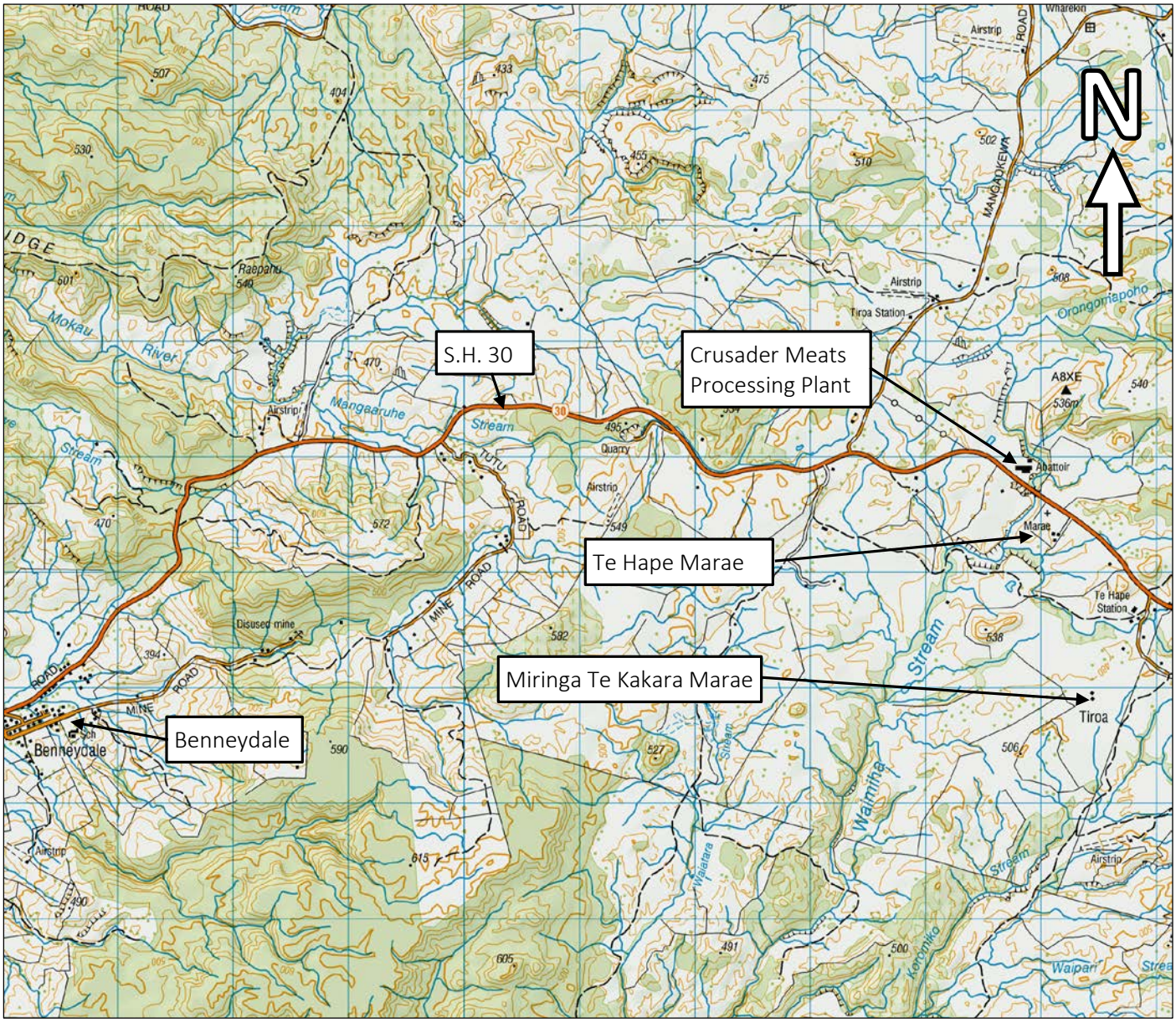

Figure 1
Plant location.

Crusader Meats currently processes around 600,000 sheep and lambs, 16,000 goats and 40,000 bobby calves annually. Livestock are sourced locally and from the wider North Island. The plant produces a variety of chilled and frozen cuts of lamb, mutton, veal and goat meat, supplying overseas markets under the LANZ Supreme, LANZ Finest and King Country Meats brands.

Renderable material, blood, washed hides and skins, and salted skins are further processed off-site.

Crusader Meats employs approximately 180 people at peak. Approximately 31% of the staff live in Benneydale, 26% in Te Kuiti, 15% in Mangakino, 17% in Tokoroa and 11% in Taumarunui. The plant is one of the biggest employers in the area, paying around $8.8 million per year in wages and salaries. The plant also contributes to the regional economy through payments to contractors, farmers and other suppliers. Total annual operating expenditure (including livestock purchases) is approximately $86 million.

The plant was established in 1992 by King Country Lamb Limited, which went into receivership in 1995. Crusader Meats purchased the plant from the receivers in late 1995. Over the years, Crusader Meats has invested substantially in upskilling workers and upgrading the processing facilities, utilities and wastewater treatment - developing the plant into an economically viable and environmentally responsible business with a current estimated capital value of around $30 million.

Water supply for the site is predominantly from a groundwater bore near the plant. Some water is also taken from the Waimiha Stream, 700 m south of the plant. Process wastewater is irrigated onto two properties (Tutaki and Te Hape B Blocks) south of State Highway 30. Slurry wastes from the yards and a wastewater pond are currently spread on parts of the Tutaki Block.

Unlike the many meat processing companies in New Zealand that rely on a river-discharge for disposal of at least some of their wastewater, Crusader Meats irrigates all of its wastewater to land – which minimises any effects on waterways. The irrigation also makes beneficial use of the nutrients in the wastewater, increasing the productivity of the land.

Sewage generated by the site's toilets, showers and kitchens is kept separate from the processing wastewater and treated in a package treatment plant before application to land via a subsurface drainage field adjacent to the plant.

Crusader Meats wishes to work with key stakeholders and obtain appropriate resource consents to enable the plant to continue operating, and as a result, to maintain the plant's contribution to the local economy.

1.2 Resource Consents Sought

The company holds three resource consents with Horizons Regional Council that are due to expire on 22 May 2016. These consents were granted on 22 May 2001.

Two of the resource consents (100696 and 100926) authorise the discharge of wastewater and yards' solids onto land and the third consent (100698) permits water to be taken from the Waimiha Stream (see Table 1).

With a reliable consented bore water take, Crusader Meats no longer requires water from the Waimiha Stream. Replacement of the surface water take consent (100698) is not proposed.

Note: in the consultation process, Crusader Meats proposed to renew the surface water take consent, but after further consideration, now proposes to let it lapse.

Table 1

Resource consents due to expire on 22 May 2016

Number	Type	Authorised activity	To be renewed
100696 & 100926	Discharge to land	Discharge meatworks effluent onto and into land on the Te Hape B Block, Tiroa E Block and Tutaki Block.	Yes
100698	Surface water take	Take water from the Waimiha Stream.	No

Copies of these consents 100696 & 100926 are attached in Appendix 4.

This application to replace the two consents has been lodged three months before the consents expire. The site can therefore continue to operate under the existing consents in accordance with s124 of the RMA until the new consents are determined, provided that the Regional Council exercises its discretion to allow the operation to continue. The Regional Council has confirmed in an email dated 12 November 2015 that it is agreeable to exercising its discretion in this instance.

Consents 100696 and 100926 authorise the discharge of processing wastewater and yards' solids to the Te Hape B/Tiroa E and Tutaki properties, respectively.

Crusader Meats is seeking one consent for all three properties.

The existing consents contain a comprehensive set of operational, monitoring and reporting conditions, including the following:

- The volume of wastewater applied to land shall not exceed 900 cubic metres per day.
- The nitrogen application rate shall not exceed 200 kg per hectare per year.
- The wastewater application depth shall not exceed 50 mm per day.
- There shall be no ponding as a result of the irrigation.
- There shall be no runoff of effluent into any watercourse or wetland area.
- No effluent spray-drift shall enter the Waimiha Stream or any of its tributaries.
- Wastewater shall not be applied within 20 m of any streams and wetlands.
- There shall be no objectionable odour beyond the property boundaries.
- Water quality in the Waimiha Stream shall be tested at three locations three times a year.
- Soil testing is required annually.
- An annual report of the monitoring results shall be prepared and distributed to specified interested parties.

1.3 Proposed Changes to the Activities and Consent Conditions

Crusader Meats proposes only minor changes to the conditions of the existing consents, as follows:

- An increase in the maximum daily irrigation volume to 1,500 m^3 to:
    - Match the permitted bore water take volume.
    - Allow for increased operational flexibility and a possible increase in production at the site.
- Allow for the spreading of yards' solids on land leased by Crusader Meats around the plant and effluent pond, north of the highway. This new application site (H102) is shown on the irrigation site plan in Appendix 5. It is also proposed that yards' solids and excess pond solids be applied to irrigation site H15 (renamed to H101 for solids application) in the Tiroa E Block (see Appendix 5). This area has been available for contingency wastewater irrigation, but has not been needed for this purpose.
- Specific conditions are proposed for the application of excess pond solids (pond slurry) to land. The same application rate limit as for wastewater (200 kg N/ha.year) is proposed for this material. Most of the nitrogen in the pond slurry is in an organic

slow-release form, which enables the 200 kg of nitrogen limit per hectare to be applied in one application without risk of excessive nutrient leaching.

- Crusader Meats has recently begun monitoring the water quality in the Waimiha Stream for additional parameters and for an additional site (increasing the total number of sampling sites from 3 to 4). It is proposed that this enhanced monitoring programme be ongoing to improve the monitoring of any effects on the Waimiha stream.
- Removal of the requirement for annual monitoring of soil infiltration rate. The monitoring results to date show high variability and no reduction in infiltration. With the low-application-rate irrigation system and no problems with runoff or ponding, such testing is not justified.
- Improvements to soil sampling methodology. It is proposed that the soil in eight irrigated paddocks be monitored with four of the paddocks sampled each year. Sampling of defined transects is also proposed. Non-irrigated paddocks would no longer be sampled. These changes will reduce the variability in test results and provide better information about the effects of the irrigation on soil quality in both the short and long term. No change is proposed to sampling depths or the total number of soil samples required to be taken.

1.4 Other Resource Consents Held by Crusader Meats

Crusader Meats also holds several resource consents with Horizons Regional Council that are not due for replacement at this time (Table 2).

Table 2

Resource consents not currently due for replacement.

Number	Type	Authorised activity	Granted	Expires
104518	Discharge to land	Discharge a maximum of 12 cubic metres per day of secondary treated domestic wastewater from a meat processing factory to land.	2 October 2008	2 October 2025
104934	Groundwater take	Take a maximum of 1,500 cubic metres per day of groundwater from Well Number 654001 for use within a meat works.	7 December 2009	1 July 2026
105267	Discharge to air	Discharge contaminants including particulates to air associated with the operation of a 2.9 megawatt oil fired boiler.	25 May 2010	1 July 2035

1.5 Term of Consents Sought

Policy 12-5(b) of the One Plan seeks to align consent durations to common catchment expiry dates.

The plant is located in the Cherry Grove (Whai_2) Water Management Zone (Upper Ongarue [Whai_2f] Sub-Zone) in the Whanganui River Catchment. The next common catchment expiry date for this Water Management Zone is 2025. Future dates for expiry or review of consents within that catchment must occur in 10-year increments, i.e. 2035 and 2045.

In accordance with Policy 12-5(b), Crusader Meats is seeking a consent term of 29 years to align with the future common catchment expiry date of 2045. A term of this duration can be granted on the basis that the proposed activities will be carried out in accordance with good practice guidelines, will be subject to review provisions under s128 of the RMA, and that such a duration is necessary to enable long-term investment in the site and to maintain the viability of the operation.

2 Existing Environment

2.1 General

This section provides an overview of the existing environment within which Crusader Meats is located. The existing facilities at the Crusader Meats site that are relevant to the consent applications are described in Section 3.

The plant is located at an elevation of 460 m above mean sea level. The elevation of the land treatment sites ranges from approximately 450 m to 480 m. Nearby hills reach an elevation of approximately 550 m.

The terrain ranges from flat to steep. Many steep sidings and stream margins are covered in scrub and bush with the easier terrain being in pasture for dry-stock farming of sheep and cattle.

The terrain of the land treatment areas is flat to gently undulating, and traversed by several swampy areas and small streams fed from springs, most of which dry up or have very low flow during the summer months. Spring-fed dams provide most of the stock drinking water on the Tutaki Block. Photos of the landscape are shown in Figure 2.

2.2 Catchment

The land generally falls to the Waimiha Stream, which is the main water course in the area. Other named streams in the area that flow into the Waimiha Stream are also significant:

- The Orongomapoho Stream. The meat plant and proposed land treatment areas in the Tiroa E Block are in the Orongomapoho Stream catchment.
- The Waiatara Stream. The southwestern part the Tutaki Block is in the Waiatara Stream catchment.

A plan of the local streams is shown in Figure 3.

The Waimiha Stream flows into the Ongarue River at Waimiha village about 11 km downstream of the Tutaki Block. The Ongarue River flows into the Whanganui River at Taumarunui. The distance to sea from the southern part of the Tutaki Block is 312 km (River Environment Classification Manawatu, 2010).

Stream catchment areas are summarised in Table 3.

Figure 2.

Views of the landscape at wastewater irrigation sites.

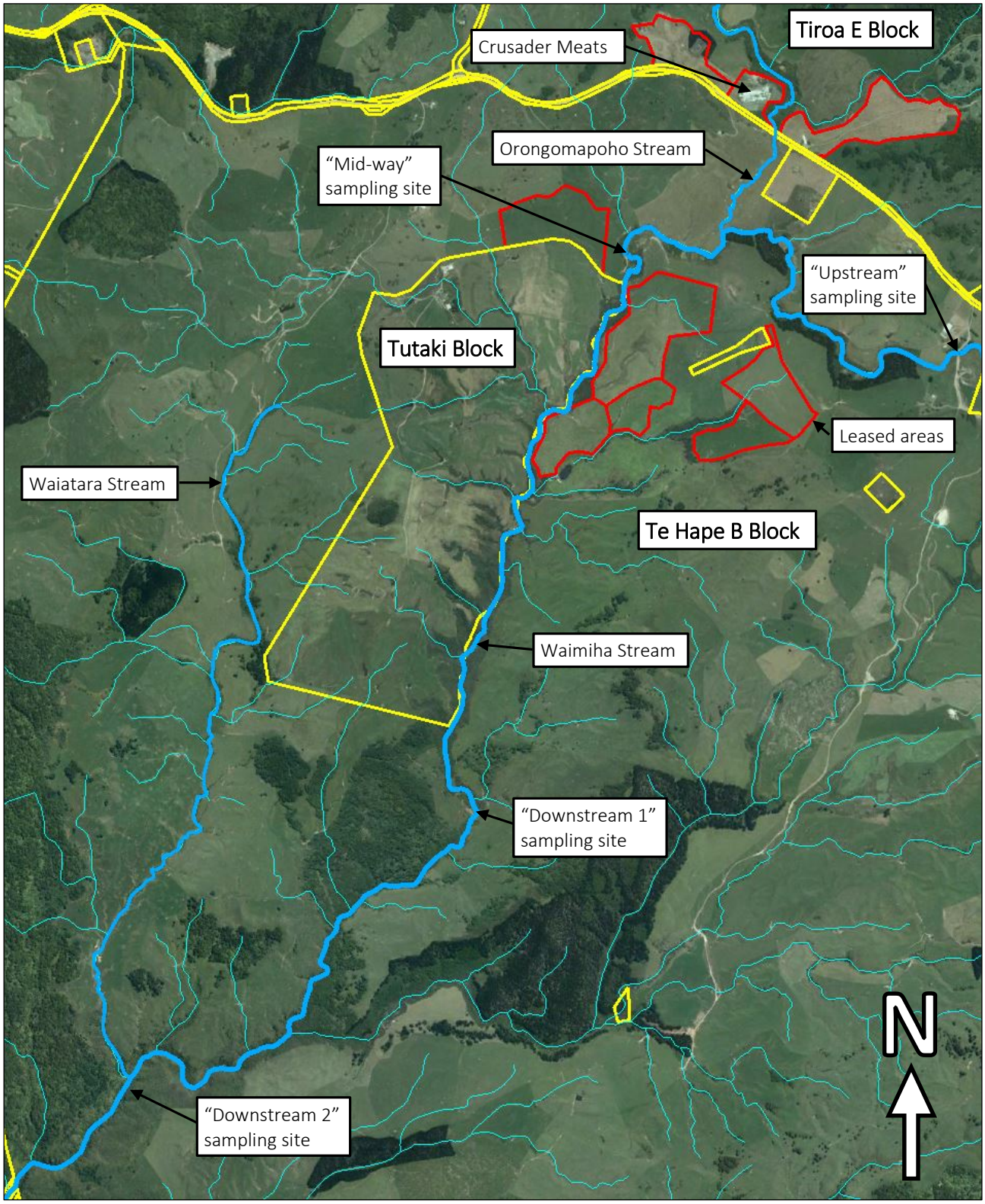

Figure 3

Local streams.

Table 3 Catchment areas. Refer to Figure 3.	
Catchment	Area* (km²)
Waimiha stream at "Upstream" sampling site	59.1
Waimiha Stream at "Mid-way" sampling site	73.6
Waimiha Stream at "Downstream 1" sampling site	78.6
Waimiha Stream at "Downstream 2" sampling site (below confluence with Waiatara Stream)	105
Orongomapoho Stream at confluence with Waimiha Stream	11.5
Waiatara Stream at confluence with Waimiha Stream	5.55

* Source: River Environment Classification Manawatu (2010)

Flows in the Waimiha Stream gauged near Te Hape by HRC staff during 1992 and 1993 (**Error! Reference source not found.**) ranged from 363 to 2635 L/s. The one-in-five-year low flow in the Stream has been estimated by HRC to be 280 litres per second.

Table 4 Flow gaugings for Waimiha Stream at Te Hape. Map reference NZMS260 S17:260962 (near the "upstream" sampling site - refer Appendix 5) (HRC, 1997)	
Date	Flow (L/s)
28/02/1992	496
12/05/1992	701
14/07/1992	2635
12/01/1993	917
11/05/1993	363
22/09/1993	1023

2.2.1 Surface Water Management Values

With regard to One Plan Surface Water Management Zones, the plant is located in the Upper Ongarue (Whai_2f) Sub-Zone of the Cherry Grove (Whai_2) Water Management Zone in the Whanganui River Catchment.

One Plan Surface Water Management Values and management objectives applicable zone-wide to the Upper Ongarue Sub-zone are as follows:

Value	Management Objective
Life supporting Capacity – Upland Volcanic Acidic (UVA)	The water body and its bed support healthy aquatic life/ecosystems.
Aesthetics	The aesthetic values of the water body and its bed are maintained or enhanced.
Contact recreation	The water body and its bed are suitable for contact recreation.
Mauri	The mauri of the water body and its bed is maintained or enhanced.
Industrial abstraction	The water is suitable as a water source for industrial abstraction or use, including for hydroelectricity generation.
Irrigation	The water is suitable as a water source for irrigation.
Stockwater	The water is suitable as a supply of drinking water for livestock.
Existing Infrastructure	The integrity of existing infrastructure is not compromised.
Capacity to Assimilate Pollution	The capacity of a water body and its bed to assimilate pollution is not exceeded.

Surface Water Management Values specific to the Waimiha Stream from the confluence with the Ongarue River are as follows:

Value	Management Objective
Trout Fishery Value – "Other Trout Fishery" classification	The water body and its bed sustain healthy rainbow or brown trout fisheries.
Trout Spawning (TS) Value	The water body and its bed meet the requirements of rainbow and brown trout spawning and larval and fry development.

2.3 Soils

The soils in the area are of volcanic tephra origin. They are well drained and have no significant rooting barrier within 1 m depth. The phosphorus retention capacity of the topsoil is classified as medium and the nitrogen leaching vulnerability is low. Plant available water is high to very

high. Permeability is high and relative runoff potential is very low. Source: S-mapOnline (http://smap.landcareresearch.co.nz/smap).

2.4 Climate

Annual rainfall for the site is approximately 1600 m based on Crusader Meats' records for the period 2002 to 2014. Monthly mean rainfall and monthly average daily minimum, maximum and mean temperatures recorded on site are shown in Figure 4 and Figure 5, respectively.

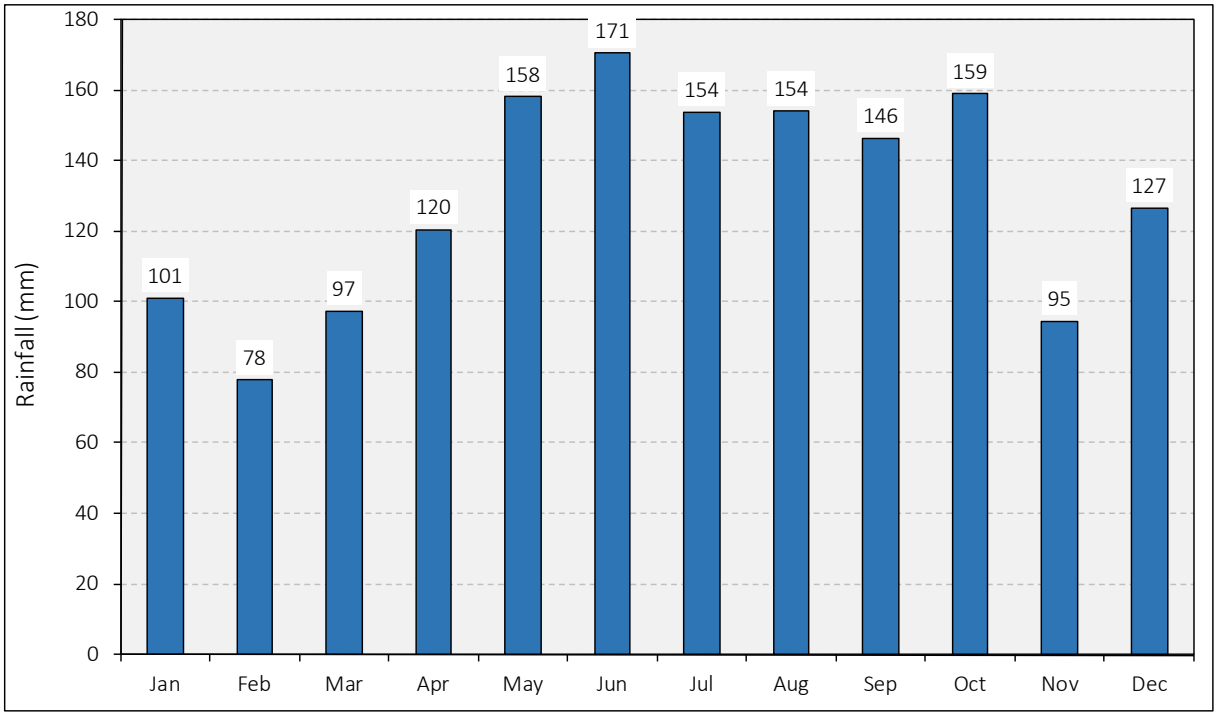

Figure 4
Monthly mean rainfall for 2000 to 2014 calculated from Crusader Meats' on-site rainfall records.

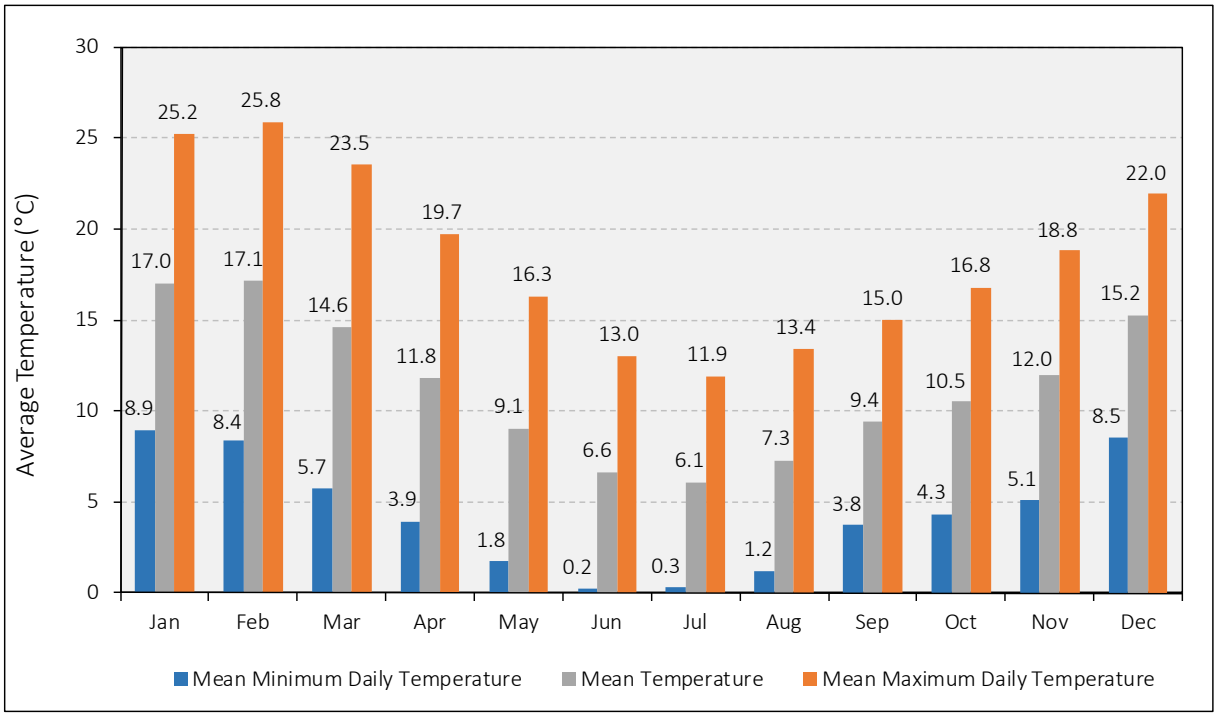

Figure 5

Monthly average minimum, mean and maximum temperatures for 2000 to 2014 calculated from Crusader Meats' on-site temperature records.

3 Description of Activity

3.1 Wastewater Sources and Primary Treatment

A schematic of water and wastewater flows at Crusader Meats is shown in Figure 6.

Process wastewater from the plant derives from a range of sources including the stockyards, a truckwash, slaughtering, boning, offal processing and skin washing.

Most of the wastewater results from cleaning and washing activities that are essential in maintaining hygienic conditions and food safety. Large volumes of water are necessary for cleaning, but Crusader Meat minimises the amount of water used (and wastewater produced) by reusing relatively clean wastewater streams from the processing areas in areas that do not require potable water (Figure 6).

Heat is recovered from the plant's 82°C steriliser wastewater and some of the 42°C wastewater for use in pre-heating the plant's potable hot water supply, which reduces energy use and cools the wastewater for reuse in the yards.

The untreated wastewater from the plant contains small quantities of blood, fat, meat scraps and biodegradable detergents from the processing areas, salt from preserving skins, and animal faeces and urine from the stockyards, truck wash and gut washing operations.

The wastewater from the stockyards and truckwash passes through a sedimentation tank (Figure 7) which removes most of the large solids from this effluent. The manure solids are removed from the sedimentation tank weekly and applied to land using a 4700 L slurry spreader (Figure 8).

All of the wastewater from the processing areas passes through a 0.5 mm wedge-wire screen (Figure 7), which removes most of the solid particles from the wastewater. These solids, together with offal and most of the blood, are trucked off-site to be processed into by-products.

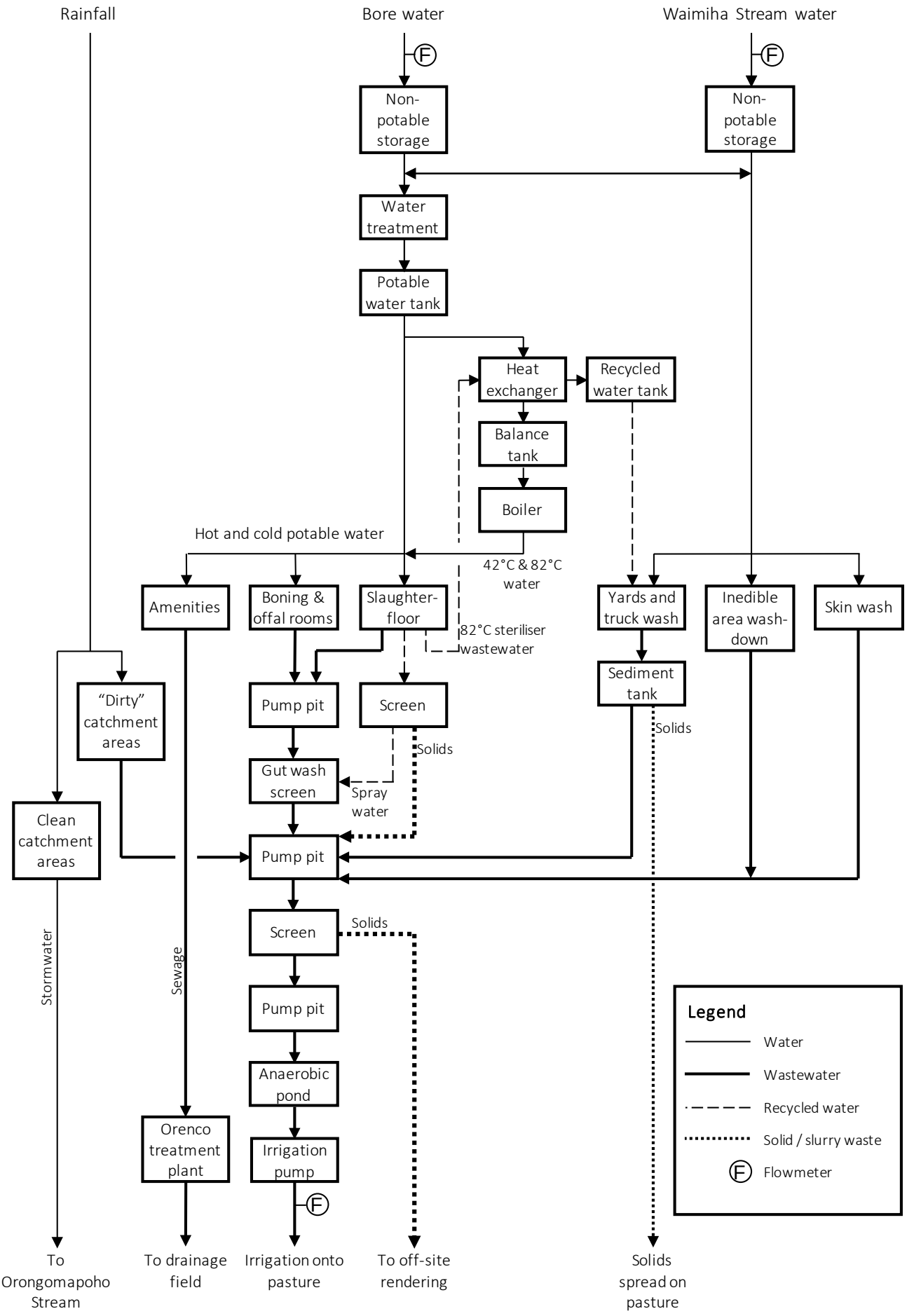

Figure 6

Schematic of water and waste flows.

Figure 7

Stockyards wastewater sedimentation tank (left) and main wastewater screen (right).

Figure 8

4700 L slurry spreader.

3.2 Wastewater Secondary Treatment and Storage

The primary-treated wastewater is pumped to an anaerobic pond (Figure 9) located approximately 350 m northwest of the plant (refer to site plan in Appendix 5).

The pond has an operating volume of 5000 m^3. It provides anaerobic treatment of the wastewater and enables wastewater to be stored during wet weather and machinery breakdowns, when irrigation of the normal daily wastewater volume is not possible.

Wastewater can be stored for up to 5.5 days at the current maximum production rate of 900 m³ per day, or about 8.5 days on average. The pond level is kept as low as possible to maximise the available storage capacity.

Figure 9
Anaerobic pond, installed in 1999.

The pond is lined with a high density polyethylene (HDPE) geomembrane. Beneath the liner is a leak detection system consisting of a network of underdrains with an exposed outlet at the base of the pond's southern embankment. The outlet is regularly inspected for leakage. There has been no evidence of leakage to date.

The pond removes organic matter from the wastewater by anaerobic biological processes as well as by physical mechanisms such as sedimentation of solids. The biological treatment processes produce biogas (a mixture of mainly methane and carbon dioxide), which is emitted to the atmosphere.

A high organic loading on this pond maintains a stable crust (Figure 10), which effectively filters the odour from the emitted biogas.

The pond outlet consists of a pivoting pipe suspended from floats. The outlet level rises and falls with the level of the pond. The outlet position is set just below the crust to remove the clear water between the crust and pond sediment. This minimises the carry-over of solids into the irrigation system and the blockage of irrigator nozzles.

Every two years during the annual plant maintence shutdown, the pond is cleaned out. The cleanout involves removing the clear wastewater from the pond by irrigation, mixing the crust and sediment layers into a slurry with a tractor mounted mixer, adding clean water as required, and irrigating the slurry onto selected paddocks in the Tutaki Block using a rain-gun irrigator. Further details are given in Section 3.5.2.

Figure 10

Anaerobic pond maintains a stable crust for odour control.

3.3 Land Treatment Areas

3.3.1 Available Land

The total area currently used or proposed for the land treatment of wastewater and slurry wastes (from the yards and pond) is approximately 180 ha (Table 5). This is the net area of irrigable land available. It excludes the area of required buffer zones and areas that are too steep or inaccessible for land treatment.

The land suitable for waste application is divided into 40 sites: 32 for wastewater irrigation and eight designated for slurry application. Sites mostly correspond with individual paddocks, but in some cases they are defined by a contiguous area of irrigable land spanning two or more paddocks.

Irrigation sites total 147.8 ha in area and the slurry application sites 32.2 ha.

The separation of land treatment areas into irrigation sites and slurry spreading sites is for convenience and ease of management. As required, slurry areas could be used for wastewater irrigation, and vice-versa, but it is not proposed to apply wastewater and slurry to the same area at the same time.

Details of the land application sites are shown on the site plan attached in Appendix 5 and in Table 5. Details relating to each block are discussed below.

Table 5 Existing and proposed areas for wastewater and slurry application.					
Activity	Block	Site	Area (ha)	N load* (kg/year)	Status
Wastewater irrigation	Te Hape B	H3	6.2	1240	Existing
		H4	5.0	1000	Existing
		H5	4.5	900	Existing
		H6	0.7	140	Existing
		H7	2.9	580	Existing
		H8	4.2	840	Existing
		H9	4.2	840	Existing but not yet used. Fencing and planting of adjacent wetlands is proposed before commencing irrigation.
		H10	6.0	1200	
		H11	2.8	560	
		H12	3.2	640	
		H13	5.5	1100	
		H14	6.8	1360	Existing
		Total	52.0	10400	
	Tutaki	T1	8.8	1760	Existing. Area revised
		T2	1.4	280	Existing. Area revised
		T3	4.6	920	Existing. Area revised
		T4	4.9	980	Existing. Area revised
		T5	4.1	820	Existing. Area revised
		T6	2.9	580	Existing
		T8	1.6	320	Existing
		T10	3.0	600	Existing. Area revised
		T11	2.2	440	Existing
		T12	7.6	1520	Existing
		T13	5.0	1000	Existing
		T14	2.1	420	Existing
		T15	3.4	680	Existing
		T16	1.8	360	Existing
		T17	11.0	2200	Existing
		T18	6.6	1320	Existing
		T19	5.0	1000	Existing
		T20	0.6	120	Existing
		T21	11.1	2220	Existing
		T22	9.9	1980	Existing
		Total	97.6	19520	
	All blocks	**Total**	**149.6**	**29920**	
Slurry spreading	Tiroa E	H101	14.3	2860	Existing site H15 for emergency irrigation use. Proposed for slurry spreading. Area revised
		H102	4.9	980	New
		Total	19.2	3840	
	Tutaki	T101	0.2	40	Existing
		T102	0.4	80	Existing
		T103	2.3	460	Existing
		T104	1.5	300	Existing
		T105	6.5	1300	Existing
		T106	2.9	580	Existing
		Total	13.8	2760	
	All blocks	**Total**	**33.0**	**6600**	
All activities	Te Hape B/Tiroa E	Total	71.2	14240	
	Tutaki	Total	111.4	22280	
	All blocks	**Total**	**182.6**	**36520**	

*Nitrogen load that can be applied based on an application limit of 200 kg N/ha.year.

Tutaki Block

The Tutaki block, which has a total area of 222.5 ha, is leased, farmed and managed by Crusader Meats. The total irrigable area in this block is approximately 111.4 ha. Wastewater is irrigated onto 97.6 ha, divided into 20 individual sites (T1-T22). The balance of 13.8 ha is used for slurry application, divided into six sites (T101-T106).

Te Hape B Block

F J Ramsey (Trading) Ltd holds easements and a lease over parts of the Te Hape B block for the purpose of conveying and applying wastewater and other waste material. The leased areas are shown on the plan in Appendix 3. The easement areas are defined on DPS 64767. Some of the leased areas and easements overlap.

The existing consented irrigation area in the Te Hape B block consists of 12 sites (H3-H14) totalling 52.0 ha in area. Sites H9-H13 (21.7 ha total) have not been used to date. Crusader Meats proposes to fence and plant adjacent wetlands before commencing irrigation in these five sites.

All of the irrigation sites are within areas defined by the easements or lease.

The easements provide for a significantly larger area of the Te Hape B block to be used for land treatment than currently consented, including paddocks around the Miringa Te Kakara Marae. In the application process for the existing consents, Crusader Meats agreed not it irrigate wastewater in the vicinity of Miringa Te Kakara Marae and an area close to the Waimiha Stream. No changes to the existing irrigation sites in the Te Hape B Block are proposed.

Farming activities on the Te Hape B irrigation areas are managed by the Te Hape Station farm manager. Crusader Meats coordinates the irrigation activities with the farm manager.

Tiroa E Block

F J Ramsey (Trading) Ltd leases parts of the Tiroa E Block as shown on the plan in Appendix 3. The leased areas consist of the meat processing plant site and two areas proposed for slurry application (H101 and H102; refer to site plan in Appendix 5).

Crusader Meats' lease on parts of the Tiroa E and Te Hape B blocks expires on 30 September 2019. Crusader Meats is seeking to renew the lease on Tiroa E so that the company can continue to operate the plant.

3.3.2 Land Use

The land treatment sites are all managed as dry-stock-grazed pasture.

3.4 Wastewater Irrigation

3.4.1 Reticulation

Wastewater from the anaerobic pond is pumped to irrigation areas on the Tutaki and Te Hape Blocks through a network of buried pipes, as shown on the site plan (Appendix 5).

The pipeline crosses the Orongomapoho and Waimiha Streams to the irrigation sites of the Te Hape Block and then crosses the Waimiha Stream again to the Tutaki Block.

The original PVC pipes on the pipe bridges have been replaced with HDPE pipe, to reduce the risk of pipe failure and leakage into the stream. The pipe bridge between the Te Hape and Tutaki blocks was completely replaced in 2013 (Figure 11).

Figure 11
New pipe bridge over the Waimiha Stream between the Te Hape and Tutaki blocks installed in 2013.

Sixteens hydrants for connection of irrigators in the Te Hape block are labelled “A” to “P” on the site plan. Hydrants “J” to “P” are in the vicinity of the Miringa Te Kakara Marae. This part of the reticulation system has been isolated with a valve and has not been used for the duration of the existing consent and is not proposed to be used. Hydrants A and B are also no longer used.

The main buried irrigation line in the Tutaki Block has been extended in recent years to span the length of the Tutaki Property.

Heavy duty portable hoses are used to extend the reach of the buried reticulation system into all of the irrigable areas.

3.4.2 Irrigators

The wastewater is irrigated using K-Line pod irrigators (Figure 12). This irrigation method is ideally suited to the rolling and undulating terrain of many of the irrigation areas. The free-draining soil together with the extremely low application rate of around 2 mm per hour enables the wastewater to be irrigated year-round under all but the wettest of soil conditions without runoff or ponding.

Figure 12
K-Line irrigation system.

Currently, 90 irrigation pods are used. They are moved between irrigation sites on a rotational basis. There are 18 irrigation lines, each consisting of five rotating sprinklers connected at around 15 m spacings along a length of 40 mm polyethylene pipe. Each sprinkler is contained inside a plastic "pod" that helps to keep the sprinkler upright and protects it from damage. The sprinklers are fitted with 3 mm diameter nozzles.

3.4.3 Hydraulic Application Rate

The irrigators are normally moved once a day. After the irrigation pump is started and the flow rate has stabilised, the flow rate is recorded and a timer is set to run the pump for a period that results in an application volume of between 860 and 900 m^3. The flow rate currently varies between 38 and 53 m^3 per hour, depending on the distance of the irrigators from the plant and their elevation. The pumping hours typically range between 17 and 23.5 hours per day.

The maximum hydraulic application rate is approximately 2 mm per hour or 48 mm per day, which ensures compliance with the consented maximum of application depth of 50 mm.

3.4.4 Management of Nitrogen Application

For each daily irrigation event the number of 5-pod irrigation lines in each irrigated site is recorded to apportion the volume of effluent applied to each irrigated site.

The mass of nitrogen applied to an irrigation site each day is calculated from the volume of wastewater applied to that site and the average nitrogen concentration in the wastewater for the calendar month.

On a regular basis, the effluent nitrogen and irrigation data are entered on a spreadsheet that calculates the nitrogen loading applied to each site over the last 12 months. The Irrigation Operator is informed of which sites are close to their maximum nitrogen loading, and how much more wastewater can be applied to specific sites.

3.4.5 Wastewater Characteristics

Samples of the anaerobic pond effluent are collected weekly and chilled. At the end of each month, a composite sample is produced from the weekly samples and tested by an independent laboratory for Chemical Oxygen Demand (COD) and Total Kjeldahl nitrogen (TKN). At least twice a year the samples are also tested for total phosphorus, total calcium, total magnesium, total potassium and total sodium. The sodium adsorption ratio (SAR) is calculated from the concentrations of total calcium, magnesium and sodium.

Test results are shown Figure 13 and summarised in Table 6.

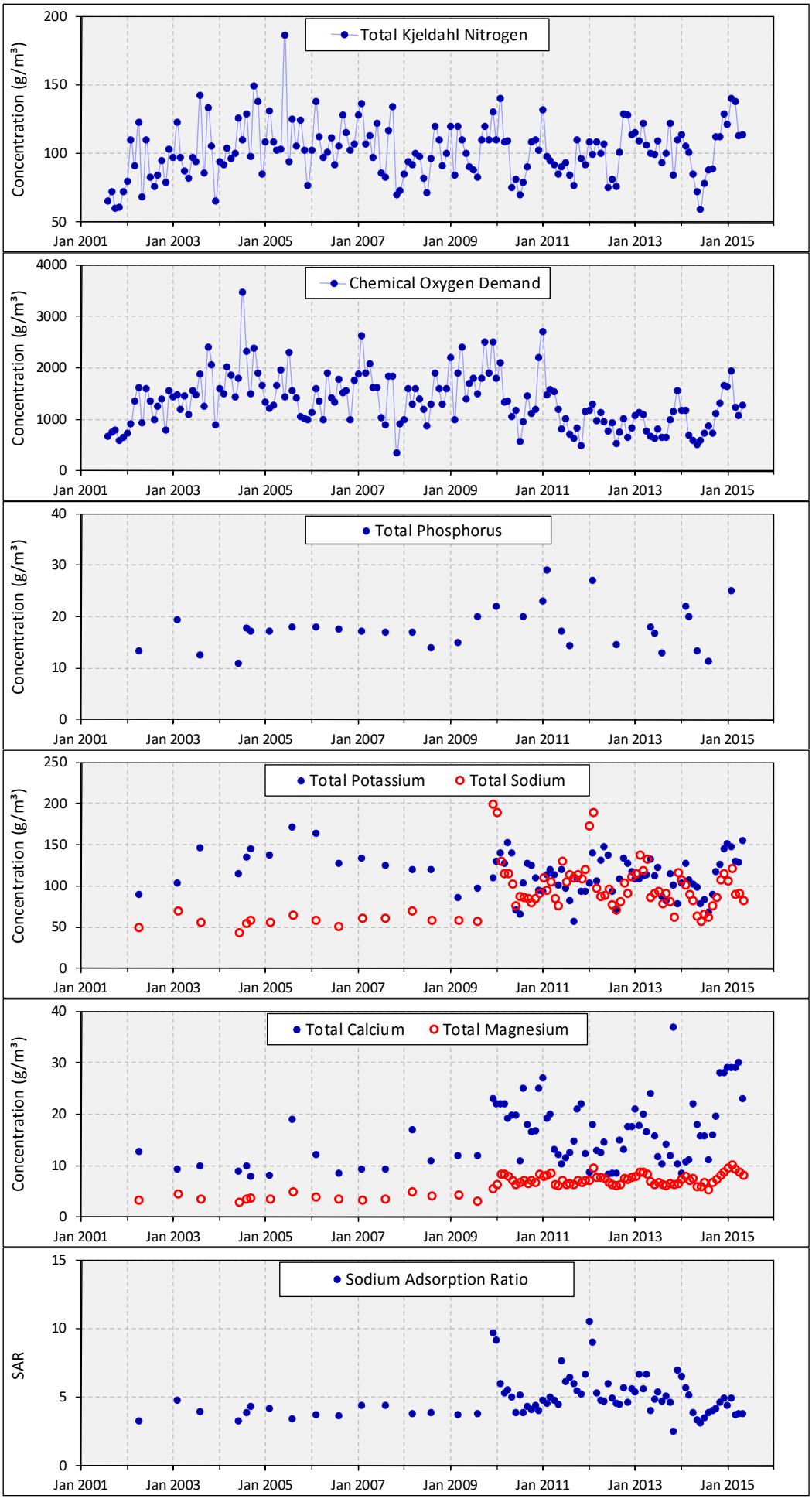

Figure 13. Wastewater Characteristics

Table 6 Median concentration of wastewater components since dry-salting of skins began in October 2009.	
Parameter	Concentration (g/m^3)
Total Kjeldahl nitrogen (TKN)*	104
Chemical oxygen demand (COD)	1185
Total phosphorus	19
Total potassium	111
Total sodium	95
Total calcium	17
Total magnesium	7.3
Sodium adsorption ratio (SAR)	4.9

* Equivalent to total nitrogen; anaerobic wastewater contains no nitrite or nitrate.

The COD of the pond effluent is between half and a third of that expected in the influent, indicating that at least 50% of the organic matter is removed in the anaerobic pond on average. Most of the COD is converted to methane and carbon dioxide.

Another transformation that occurs in the anaerobic pond is the conversion of organic nitrogen (mainly protein) to ammoniacal nitrogen. Total Kjeldahl nitrogen is a measure organic nitrogen plus ammoniacal nitrogen. Anaerobically-treated wastewater does not contain nitrite or nitrate, thus TKN is equivalent to total nitrogen for this wastewater.

Ammoniacal nitrogen has not been tested in the Crusader Meats pond effluent, but based on test results for similar treatment systems, the ammonia nitrogen concentration can be expected to range between 80% and 95% of TKN.

The nutrient concentrations and loads in the wastewater are as expected for a plant that processes predominantly sheep and lambs with minimal by-products processing on site (van Oostrom, 1991).

In October 2009, the plant began dry-salting skins as a means of preserving them for export. The process involves mixing dry salt (sodium chloride with 1% boric acid and 1% sodium metabisulphite) with the skins. Some salt unavoidably enters the wastewater system. To monitor salt levels in the wastewater and assess potential effects on soil quality (via the sodium adsorption ratio [SAR]), the frequency of effluent testing for potassium, sodium, calcium and magnesium was increased from 6-monthly to monthly. The median SAR of the

wastewater before dry-salting was 3.8. The median SAR has since increased to 4.9, remaining well within safe limits for application to soil.

Magnesium and calcium concentrations in the effluent have increased along with the concentration of sodium (Figure 13). The increases in magnesium and calcium are beneficial as these cations lower the effluent SAR and counteract the effects of sodium in the soil. The source of the increased magnesium and calcium in the wastewater is probably the bore water that has been used at the plant since January 2010, but this assumption has not been verified.

3.4.6 Wastewater Volumes and Loads

Crusader Meats has consistently complied with the all of the consent conditions relating to wastewater irrigation including the maximum daily discharge volume limit of 900 m³ per day, the maximum application depth of 50 mm, and maximum nitrogen loading rate of 200 kg N/ha.year. Detailed irrigation records are available in the site's annual environmental monitoring reports.

Table 7 summaries the annual volumes of wastewater and nutrient loads that have been applied to the irrigation sites since 2002.

Table 7
Irrigated wastewater annual volume and nitrogen load.

Year ending	Volume (m^3)	Nitrogen load (kg)
31/05/2003	182,090	16970
31/05/2004	183,760	18580
31/05/2005	186,460	21680
31/05/2006	169,560	19480
31/05/2007	177,640	19710
31/05/2008	153,800	15270
31/05/2009	145,390	14460
31/05/2010	139,350	15110
31/05/2011	165,890	15790
31/05/2012	176,150	17270
31/05/2013	162,460	16980
31/05/2014	165,330	16810
31/05/2015	177,530	19090

Variations in the annual volume of wastewater largely reflect variations in plant production and water use efficiency. Variations in the annual nitrogen loading largely reflect production levels.

The 149.6 ha area of land available for wastewater application has the potential to receive up to 29,920 kg of wastewater nitrogen per year at an application rate of 200 kg N/ha.year (Table 5). Sufficient land is available for Crusader Meats to increase production (and wastewater nitrogen load) by approximately 50%.

3.4.7 Improvements

Improvements made to the wastewater irrigation system over the past 15 years include the following:

- Rain gun irrigators have been replaced with low-application-rate K-Line irrigators, greatly reducing the risk of wastewater runoff into waterways.
- Pipe bridges and sections of buried pipeline have been upgraded to reduce the risk of pipe leakages and spillages into waterways.
- The buried pipeline network has been extended into the back paddocks of Tutaki Block.
- A monitoring system has been installed to automatically shut down the irrigation pump in the event of a major pipeline failure.

3.4.8 Management Plan

Crusader Meats proposes to update the existing management plan with any changes to the activity following granting of the replacement consent.

3.4.9 Proposed Changes to Activity

The main change proposed for this activity is an increase in the consented maximum daily volume of wastewater discharged from 900 m^3 to 1500 m^3, to

- Match the consent bore water take volume.
- Allow for increased operational flexibility and a possible increase in production at the site.

An increase in the discharge volume will involve applying the wastewater via more irrigators. Increasing the nitrogen application rate or maximum application depth is not proposed.

The ability to irrigate a greater daily volume of wastewater gives more flexibility in the timing of irrigation without increasing any environmental risks.

Another change is that existing irrigation site H15, currently reserved for emergency wastewater application, is proposed to be used for applying slurry wastes.

3.5 Slurry Application

3.5.1 Manure Slurry

The manure slurry from the yards' sedimentation tank is currently applied to sites T101-T106 in the Tutaki Block using a 4,700 L slurry spreader. These sites have a total area of 13.8 ha. Site T105 and part of an adjoining block (7.5 ha in total) are reserved for application of pond slurry every second year, reducing the available area for manure slurry spreading to 6.3 ha in these years.

The manure slurry contains faeces and urine, stockyard wash-down water and small quantities of wool. Some biodegradable detergent used in washing sheep may also be present.

Each load of manure slurry is estimated to contain 12 kg of nitrogen in the form of ammonia and organic nitrogen. With approximately 100 loads of slurry per year, the annual nitrogen load of this material is estimated to be 1200 kg at current production levels. This load requires a minimum land spreading area of 6.0 ha to comply with the nitrogen application rate limit of 200 kg N/ha.year.

Crusader Meats proposes to apply at least a portion of the manure slurry to two new sites adjacent to the plant (H101 and H102 – refer site plan, Appendix 5). This will reduce the time involved in carting the slurry, facilitate more frequent cleaning of the sedimentation tank, reduce the average nitrogen application rate and allow for possible increases in plant production.

3.5.2 Pond Slurry

Approximately 2,000 m^3 of pond slurry is applied to 7.5 ha of land (site T105 and part of an adjoining slurry application site) every second year with a rain gun irrigator during the annual maintence shutdown.

It is proposed in future that pond slurry may be applied to site H101 near the processing plant. Any irrigation of pond slurry in this area will not occur within 100 m of State Highway 30, to minimise potential odour effects.

During November 2015, approximately 2000 m³ of pond slurry was applied on site T105 and part of T106, a total area of 7.5 ha. The slurry was applied in two applications of around 13 mm depth each with a rest period of between applications to avoid any runoff. The instantaneous application rate of the rain gun irrigator is approximately 8 mm/h.

The characteristics of the slurry are given in the Table 8. The minimum area that would have been required to comply with the consented nitrogen application rate limit of 200 kg N/ha.year is 7.1 ha.

Table 8
Pond slurry characteristics and maximum proposed application rate.

Parameter	Concentration* (g/m³)	Load kg	Maximum application rate** kg/ha
Total potassium	79	158	22
Total sodium	58	116	16
Total calcium	220	440	62
Total magnesium	35	70	10
Sodium adsorption ratio	0.97	-	-
Total phosphorus	62	124	17
Total nitrogen	710	1,420	200
Ammoniacal nitrogen	67	144	20
Nitrate-N + Nitrite-N	<0.02	0	0
Total Kjeldahl nitrogen	710	1,420	200
Chemical oxygen demand	29,000	58,000	8169
Volume		2000 m³	

* Average concentration for two composite samples collected during slurry pumping

** Maximum application rate of 200 kg N/ha to 7.1 ha of land. The slurry was actually applied to approximately 7.5 ha.

4 Assessment of Environmental Effects

4.1 Overview

The main potential adverse environmental effects of the proposed activities are:

- Changes to soil chemistry affecting infiltration rate and soil quality
- Leaching of nutrients to groundwater and surface waters
- Risk of runoff into water courses
- Odour
- Spray drift

These potential effects are discussed below.

4.2 Effects on Soil Quality

4.2.1 Chemical Properties

The results of annual testing of soil samples taken from the Te Hape B and Tutaki blocks at depths of 0-100 mm (Figure 14) and 100-200 mm (Figure 15) show trends that are beneficial for pasture production and farm productivity, such as increases in soil nitrogen, phosphorus and organic matter. However, for most parameters no significant effects of the irrigation can be established with the available data. There is no indication that the effluent irrigation is having any adverse effects on soil quality.

The most notable effect of the irrigation is an increase in soil Olsen P levels. Phosphorus applied in excess of plant requirements tends to accumulate in the soil. The highest Olsen P levels are found in Te Hape Block paddocks that had received effluent nitrogen loading rates of up to 800 kg N/ha.year prior to May 1993, and up to 400 kg N/ha.year from 1993 to 2000.

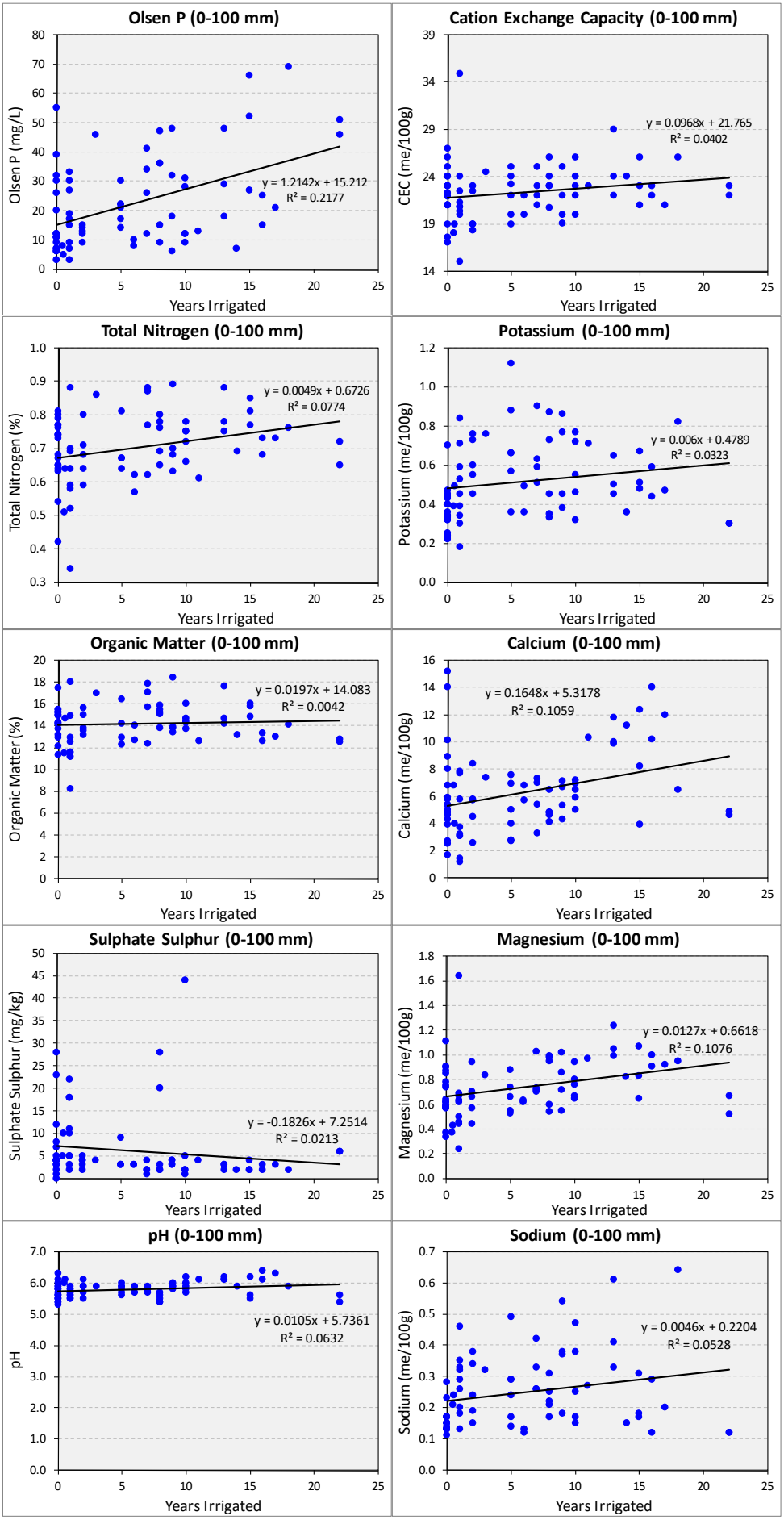

Figure 14

Changes in soil chemical properties with wastewater irrigation (0-100 mm depth samples).

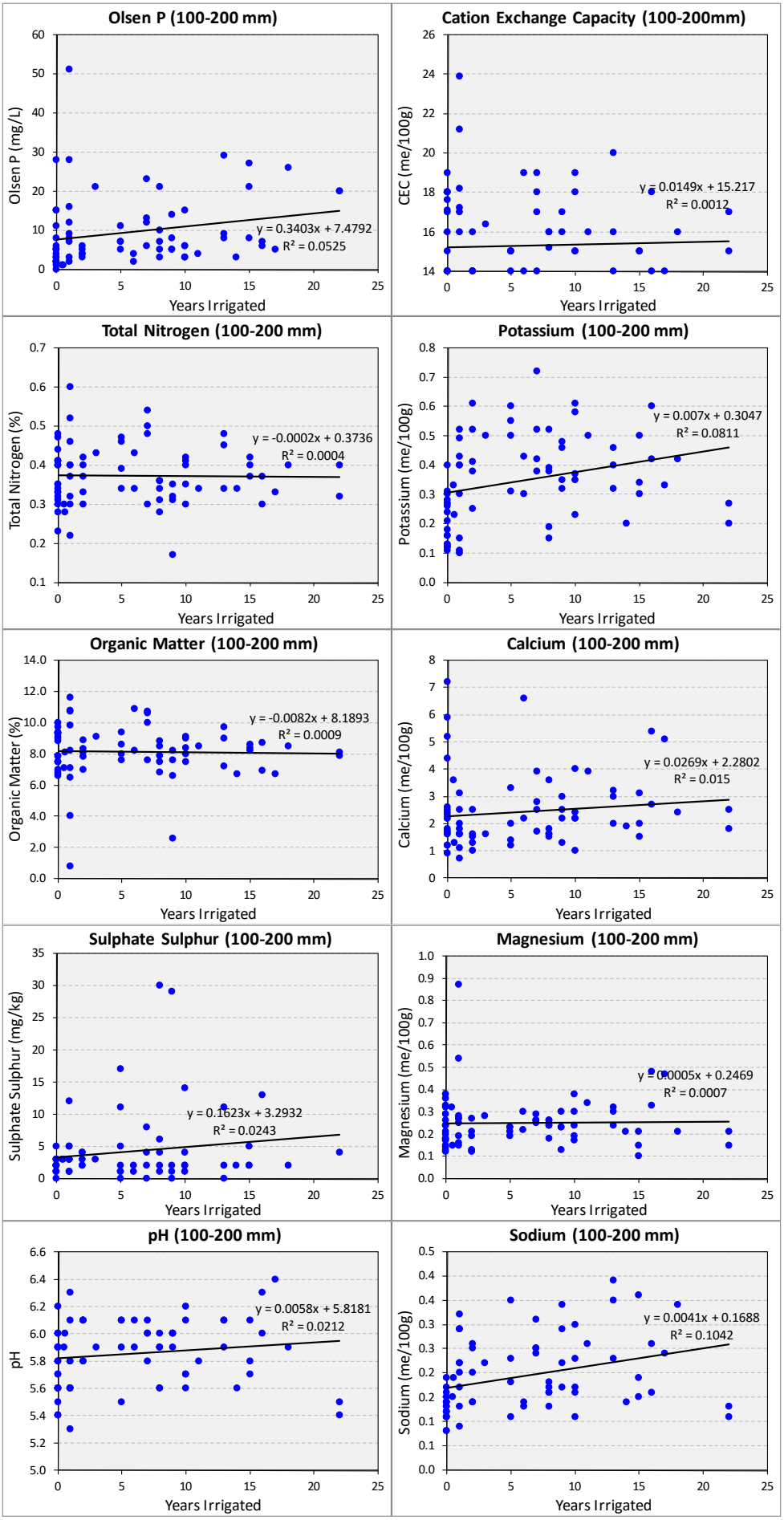

Figure 15

Changes in soil chemical properties with wastewater irrigation (100-200 mm depth samples).

4.2.2 Soil Permeability

Sodium Adsorption Ratio

Elevated levels of sodium in soils can result in reduced soil infiltration rates and reduced hydraulic conductivity, which in turn increases the potential for ponding and run-off.

Elevated sodium levels in wastewater do not cause a problem with irrigation under normal operations, provided the sodium adsorption ratio (SAR) of the wastewater is within acceptable limits. If the SAR of the wastewater is outside the limits, elevated sodium can be overcome by applying gypsum or lime to soils periodically to bring the SAR to within the recommended limits.

The SAR of a wastewater is defined as:

$$SAR = \frac{\frac{Na}{23}}{\sqrt{\frac{Ca}{40} + \frac{Mg}{24}}}$$

Where:

- Na is sodium concentration (g/m³)
- Ca is calcium concentration (g/m³)
- Mg is magnesium concentration (g/m³)

The median SAR of the wastewater is 4.9 (see Section 3.4.5). This value is which is well within guideline limits for irrigation water applied to soils with low clay content (ANZECC,2000) and therefore the sodium in the wastewater is not expected to have adverse effects on soil permeability.

4.2.3 Soil Infiltration Monitoring Data

The results of soil infiltration-rate monitoring in the Tutaki and Te Hape Blocks indicate that the wastewater irrigation appears to be increasing the infiltration rate of the soil (Figure 16).

Soil infiltration rates typically range between 20 and 150 mm/h, with an average of around 60 mm/hour. Results are highly variable within sites as well as between sites.

As the soil infiltration rate is not being adversely affected by the wastewater irrigation, and Crusader Meats proposes that infiltration rate monitoring be discontinued.

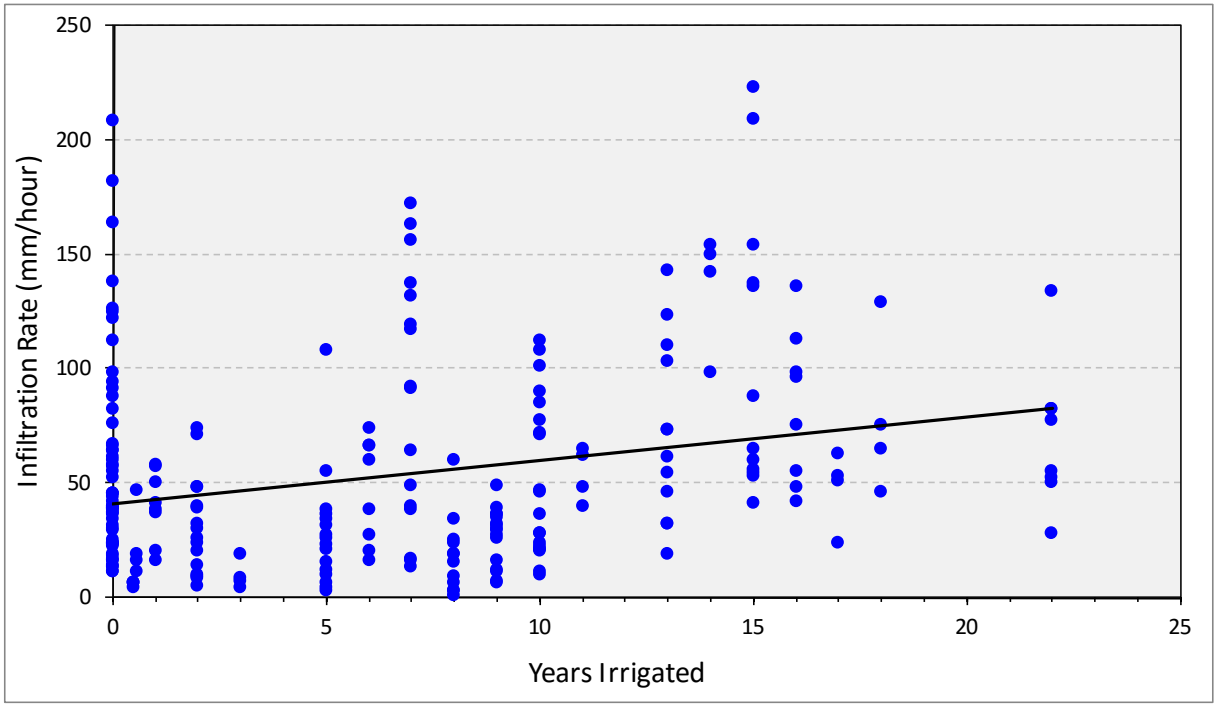

Figure 16

Steady-state soil infiltration rate test results for the Tutaki and Te Hape Blocks, 2001 to 2015. Four irrigated and one non-irrigated site were tested annually on a rotational basis, with four replicates per site. The results for individual tests are shown.

4.3 Effects on Groundwater

Potential effects relate to recharge of the area's shallow aquifer by irrigated wastewater and possible ingress into the groundwater of contaminants (primarily nitrate) derived from wastewater.

The main design criteria currently used for land disposal systems in New Zealand relate to the nitrogen and hydraulic application rates. When nitrogen is applied to soil in excess of plant uptake requirements there is potential for nitrate to leach into groundwater in the soil drainage water during wet weather or under high irrigation hydraulic loads. Unlike ammonium and organic nitrogen, nitrate is mobile in the soil and largely moves with the soil drainage water. The nitrate may be either formed in the soil from the oxidation of organic nitrogen and ammoniacal nitrogen present in the wastewater, or it may already be present in aerobically treated wastewater.

Nitrate that is not taken up by plants eventually leaches to groundwater or is converted to nitrogen gases by denitrification and returned to the atmosphere. Denitrification is a biological process undertaken by bacteria. It varies seasonally, with greatest rates occurring at those times of year when soils are moist and warm and adequate soil nitrate and carbon are available.

There are two main potential risks associated with excessive nitrate leaching to groundwater:

- Nitrate can potentially have toxic effects in drinking water above a concentration of 11 g NO_3-N/m^3.
- Nitrate-enriched groundwater flowing to surface waters can potentially cause undesirable biological growth (such as algae) in the receiving water though nutrient enrichment.

The following operational controls and environmental factors will ensure that nitrate leaching from the proposed irrigation and associated effects will remain minor or less than minor:

- The proposed maximum nitrogen application rate is 200 kg N/ha.year. This application limit is generally considered to be conservative. Nitrogen application rates of 250 kg/ha/year or higher are common for comparable wastewater land treatment sites in New Zealand.
- All of the nitrogen in the wastewater is in the form of ammonium and organic nitrogen. The ammonium and organic nitrogen needs to be converted to nitrate in the soil before leaching can occur. There is therefore less risk of leaching with this wastewater than with wastewaters that have been aerobically treated and contain nitrate. The relatively high organic content of the Crusader Meats wastewater further reduces the risk by promoting denitrification in the soil.
- The groundwater is not used as a drinking water source. The nearest consented bore other than the Crusader Meats Bore is over 7 km from the site. The Crusader Meats bore draws from a deep aquafer. The bore water is chemically very different from that tested in local springs indicating that the two water sources are not connected. It is very unlikely that the irrigation activities could affect the bore water quality.
- The shallow groundwater at the irrigation sites flows from numerous springs that tend to dry up in summer. The primary effect of nitrate leaching will therefore be increase the nitrate load of the Waimiha stream and downstream rivers.
- Ammonia, phosphorus and faecal bacteria are strongly retained in the soil and are not expected to significantly affect groundwater of surface waters.
- Over time, phosphorus leaching will occur if the phosphorus adsorption capacity of the soil becomes saturated and plant uptake cannot remove the wastewater-applied phosphorus. The main potential adverse effect would be to ultimately increase nutrient enrichment of receiving through leaching and potentially via the erosion of phosphate-rich topsoil into waterways.
- Annual soil testing will continue to be undertaken to monitor the accumulation of phosphorus and other constituents in the soil.

4.4 Effects on Surface Waters

Potential nutrient enrichment effects on the Waimiha Stream are expected to be minor and this is indicated by monitoring results discussed below.

4.4.1 Waimiha Stream Water Quality

The results of water quality monitoring of the Waimiha Stream are shown in Table 9. The sampling sites are shown in Figure 3.

Statistical analysis of the data using the Paired-Sample T-test (1-tailed) shows that the average concentration of ammonia nitrogen (NH_4N), total Kjeldahl nitrogen (TKN) and total oxidised nitrogen (NO_xN) increased significantly (95% level of confidence) between the "Upstream" and "Midway" sites, and between the "Midway" and "Downstream" sites.

For *E. coli*, the results show a significant increase between the "Upstream" and "Midway" sites and between the "Upstream" and Downstream" sites, but not between the "Midway" and downstream sites. This statistical analysis for *E. coli* was undertaken on log-transformed data.

Total suspended solids (TSS) concentrations were not significantly different between the sampling sites.

In all cases where the downstream concentration increase is statistically significant, the increases are small nominally (e.g. 0.005 g/m³ for ammoniacal nitrogen) or as a percentage the upstream load (e.g. 6% for total oxidised nitrogen). The median concentration increases are summarised in Table 10.

Table 9

Waimiha Stream monitoring results.

Sample date	Upstream					Midway					Downstream 1				
	TSS g/m³	NH_4N g/m³	TKN g/m³	NO_xN g/m³	*E. coli* /100 ml	TSS g/m³	NH_4N g/m³	TKN g/m³	NO_xN g/m³	*E. coli* /100 ml	TSS g/m³	NH_4N g/m³	TKN g/m³	NO_xN g/m³	*E. coli* /100 ml
06/09/01	5	<0.01	0.2	0.50	4	4	<0.01	0.2	0.64	17	<3	<0.01	0.2	0.69	23
05/02/02	6	<0.01	0.3	0.576		<3	<0.01	0.1	0.598		<3	<0.01	0.2	0.637	
25/05/02	11	<0.01	0.4	0.670		9	<0.01	0.4	0.672		11	0.03	0.4	0.651	
13/11/02		<0.01	0.2			3	<0.01	0.1	0.617		<3	<0.01	0.2	0.608	
15/01/13	3	0.02	0.3	0.464			0.04	0.2	0.484			0.02	0.3	0.513	
25/03/03					236					276					326
04/06/03	5	0.01	0.1	0.495		3	<0.01	0.2	0.488		<3	<0.01	0.3	0.545	
07/06/03*					727					2419					>2419
01/09/03	5	0.02	0.2	0.788	41	5	0.01	0.3	0.898	152	4	<0.01	0.3	0.907	238
08/10/03					3968					328					167
20/03/04					65					130					166
01/05/04					249					548					624
29/06/04	8	0.03	0.1	1.10	22	8	0.03	0.2	1.24	87	8	0.03	0.2	1.29	108
09/12/04	3	<0.01	0.3	0.577	47	3	0.01	0.3	0.688	89	<3	0.01	0.3	0.692	76
16/02/05	<3	<0.01	<0.1	0.552	228	<3	0.06	0.3	0.679	326	3	0.10	0.5	0.644	345
01/05/05	2	<0.01	0.1	0.505	186	3	0.01	0.3	0.605	209	3	0.10	0.4	0.622	216
06/10/05	8	<0.01	0.3	0.982	396	12	0.01	0.4	1.060	358	10	0.03	0.5	1.040	365
02/02/06	9	<0.01	0.3	0.681	328	4	<0.01	0.2	0.777	613	5	<0.01	0.3	0.777	488
21/06/06	6	<0.01	<0.1	1.080	40	4	0.02	0.3	1.140	64	5	0.08	0.4	1.190	42
11/11/07	<3	<0.01	<0.1	0.547	198	<3	0.04	0.3	0.616	206	19	0.08	0.4	0.648	215
11/07/07	19	0.03	0.4	1.04	120	19	0.03	0.3	1.11	98	19	0.03	0.3	1.10	127
12/09/07	9	<0.01	0.3	0.85		4	<0.01	0.5	1.10		4	0.07	0.4	1.12	
01/01/08	<3	<0.01	0.11	0.53	200	<3	<0.01	0.27	0.39	610	<3	<0.01	0.21	0.40	81
01/05/08	<3	<0.01	0.23	0.80	220	<3	<0.01	0.35	0.92	170	<3	<0.01	0.40	0.92	140
01/10/08	<3	<0.01	0.23	0.77	67	3.4	<0.01	0.12	1.10	150	3	<0.01	0.37	1.10	690
01/01/09	<3	<0.01	0.16	0.67	870	<3	0.013	0.32	0.63	460	<3	0.034	0.25	0.65	460
01/05/09	<3	<0.01	0.18	0.65	210	<3	0.01	0.28	0.64	190	<3	<0.01	0.40	0.68	120
01/01/10	4.1	<0.01	0.20	0.54	1600	<3	<0.01	0.33	0.53	2000	<3	0.015	0.25	0.50	
31/03/10	<3	0.0136	<0.10	0.61	1600	3.2	0.02	0.136	0.52	190	3.4	0.032	0.197	0.48	230
24/06/10	5	<0.010	0.22	1.24	58	5	<0.010	0.22	1.31	64	7	<0.010	0.25	1.32	53
23/09/10	9	<0.010	0.62	1.15	70	21	<0.010	0.34	1.18	110	25	<0.010	0.35	1.21	60
02/02/11	4	<0.010	0.30	0.63	200	<3	<0.010	0.25	0.72	290	3	<0.010	0.35	0.71	390
31/05/11	6	<0.010	0.22	1.07	51	5	<0.010	0.17	1.17	56	5	<0.010	0.18	1.19	100
23/09/11	<3	<0.010	0.15	0.67	70	<3	<0.010	0.14	0.84	87	<3	<0.010	0.16	0.85	70
31/01/12	<3	<0.010	0.17	0.62	200	<3	<0.010	0.19	0.72	440	<3	<0.010	0.19	0.73	210
15/06/12	<3	<0.010	<0.10	0.87	53	<3	<0.010	0.11	0.97	91	<3	<0.010	<0.10	0.94	54
15/02/13	<3	0.021	0.13	0.74	170	<3	0.032	0.30	0.61	520	<3	0.042	0.20	0.63	220
11/06/13	8	<0.010	0.27	0.89	72	5	<0.010	0.22	1.00	130	9	0.013	0.40	0.99	410
27/09/13	6	0.016	0.30	0.97	150	6	0.026	0.18	1.09	230	6	<0.010	0.25	1.17	190
14/01/14	<3	<0.010	0.12	0.59	250	<3	<0.010	0.26	0.59	690	<3	0.018	0.22	0.57	390
27/05/14	3	<0.010	0.16	0.53	140	<3	<0.010	0.34	0.53	150	3	<0.010	0.26	0.57	210
30/09/14	4	0.017	0.08	0.77	98	<3	0.013	0.11	0.95	160	<3	0.017	0.12	0.95	110
10/02/15	<3	<0.010	0.08	0.61	330	<3	<0.010	0.12	0.50	370	<3	0.024	0.16	0.50	2000
22/05/15	8	<0.010	0.33	0.73	330	7	0.012	0.30	0.85	820	8	0.011	0.36	0.88	1200
Mean	4.7	0.009	0.200	0.738	365	4.3	0.013	0.241	0.799	366	4.5	0.023	0.282	0.811	360
Median	4.0	0.005	0.200	0.670	192	3.0	0.005	0.255	0.720	198	3.0	0.010	0.280	0.710	210
PSTT**						-	U	U	U	U	-	U,M	U,M	U,M	U

* Stream in flood

** PSTT (Paired-Sample T-Test, 1-tailed). This tests whether the average downstream concentration is significantly higher (95% level of confidence) than the average upstream concentration for each parameter. "U" indicates a significant increase in concentration compared to the "Upstream" site and "M indicates a significant increase compared to the "Midway" site. "-" indicates no significant difference in concentration compared to upstream sampling site(s). For *E. coli* this test was undertaken on log-transformed data.

Note: Values reported as less than the analytical limit of detection (LOD) have been estimated as LOD/2.

Table 10 Median contaminant concentrations for the Upstream and Downstream 1 sampling sites in the Waimiha Stream.			
Parameter	Upstream (g/m^3)	Downstream 1 (g/m^3)	Increase
Total suspended solids	4.0	3.0	-25%
Ammoniacal nitrogen	0.005	0.010	100%
Total Kjeldahl nitrogen	0.200	0.280	40%
Total oxidised nitrogen	0.670	0.710	6%
Soluble inorganic nitrogen*	0.675	0.720	7%
Total nitrogen**	0.875	1.000	14%
E. coli	192 /100 mL	210 /100 mL	9%
Catchment area***	59.1 km^2	78.6 km^2	33%

* Ammoniacal nitrogen + total oxidised nitrogen

** Total Kjeldahl nitrogen plus total oxidised nitrogen

*** Above each sampling site – refer to Figure 3.

The contribution of the wastewater irrigation to the increase in stream nitrogen load is likely to be minor as normal farming activities will also tend to increase the nitrogen concentration in the stream over the 5.5 km distance between the Upstream and Downstream 1 sampling sites.

The concentration of oxidised nitrogen at the Upstream sampling site has increased on average over the last 18 years (Figure 17). This increase is due to upstream activities as the wastewater irrigation cannot affect water quality at the Upstream sampling site.

The concentration of oxidised nitrogen at the Upstream sampling site has increased on average over the last 18 years (Figure 17). This increase is due to upstream activities as the wastewater irrigation cannot affect water quality at the Upstream sampling site.

For ammoniacal nitrogen, downstream concentrations have tended to reduce over time (Figure 18).

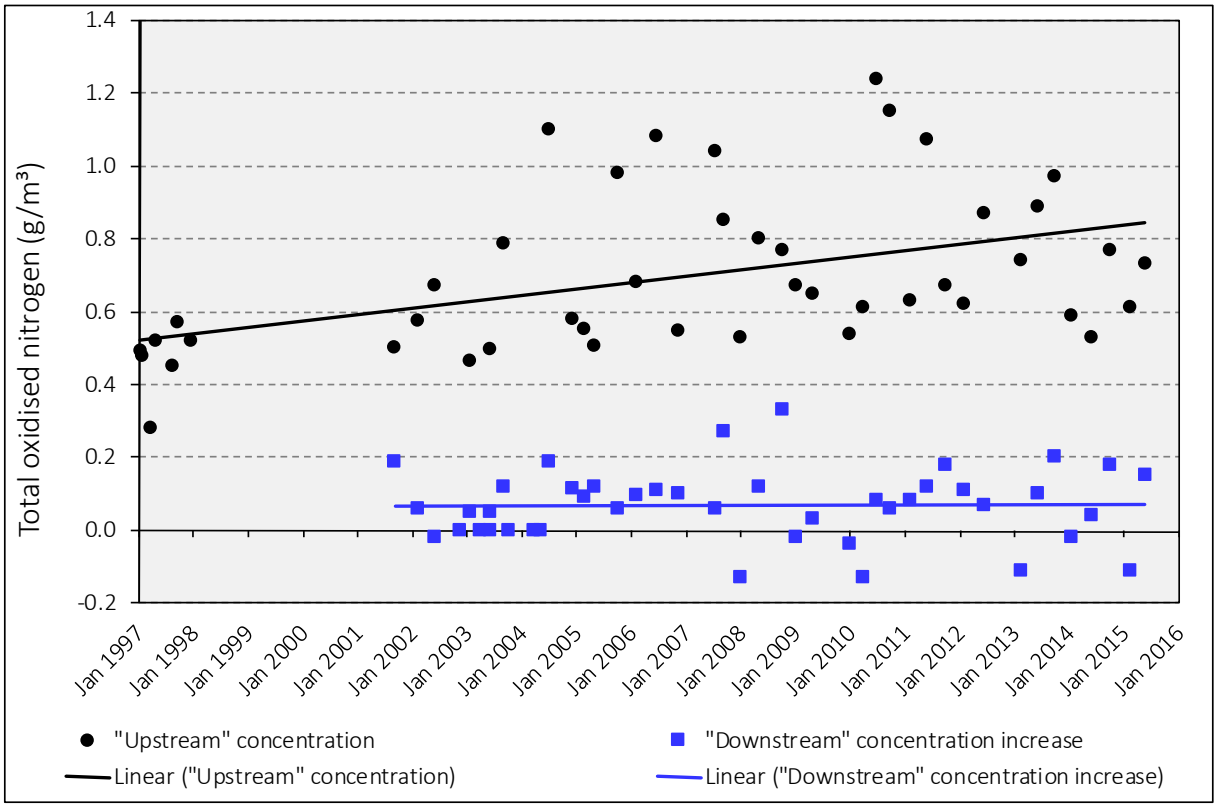

Figure 17

Total oxidised nitrogen concentration in the Waimiha Stream at the Upstream sampling site (1997 to 2015) and the increase in concentration at the Downstream site (2001 to 2015).

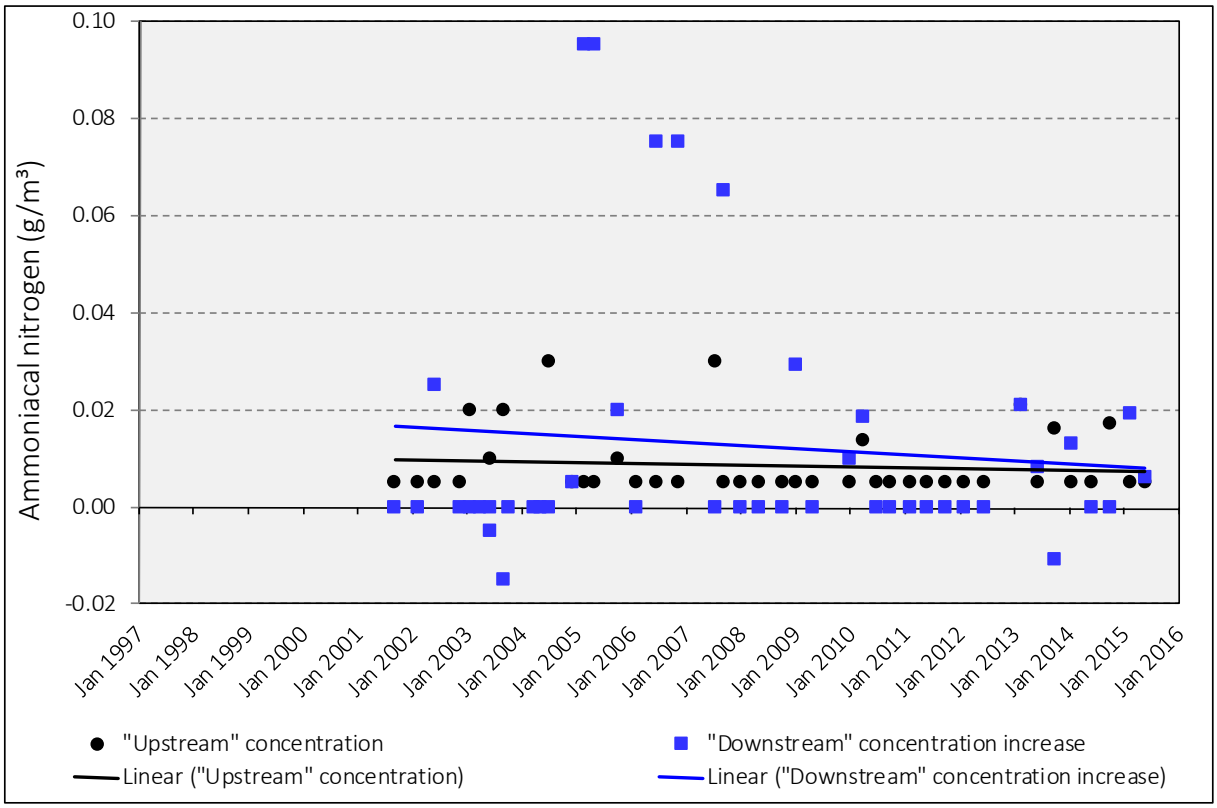

Figure 18

Ammoniacal nitrogen concentration in the Waimiha Stream at the Upstream sampling site and the increase in concentration at the Downstream site.

4.4.2 Tutaki Block Stream Sampling Study

To assess the potential effects of the land treatment activities on a stream flowing through the Tutaki Block, and several other streams emanating from springs in the block, the streams were sampled on 2 November 2015 and tested for key parameters that could indicate contamination by wastewater. The sampling sites are shown in Figure 19.

The stream flowing through the block enters at three locations (2c, 2b and 2a), which were all sampled to obtain background contaminant levels. The three streams merge and flow into the Waimiha Stream at location 2d (Figure 19). Other significant streams arise from springs within the block and were sampled near the property boundary.

The Waimiha stream was also sampled at the usual three sampling locations (Upstream, Midway, Downstream 1), as well just below the confluence with the Waiatara Stream (Downstream 2; refer Figure 3).

The test results are given in Table 11 and the key findings are summarised as follows:

- *E. coli* levels in the Waimiha Stream were significantly higher than the Tutaki Block samples – except for two of the "upstream" samples (2a and 2c – which cannot be attributed to the irrigation activity) and sample 9. *E. coli* in all of the Tutaki samples were at levels that would normally be found in farm streams.
- The dissolved reactive phosphorus (DRP) concentration in the Tutaki samples were all significantly lower than in the Waimiha Stream.
- The total phosphorus (TP) concentrations in the Tutaki streams were generally higher than in the Waimiha Stream. The highest concentration was in sample 2b, upstream of the land treatment sites. Note: The sampler reported that, due to very low flows and water levels at some of the sampling sites, some samples unavoidably contained small amounts of sediment. This will tend to increase TP but not DRP.
- Total oxidised nitrogen (NO_xN; nitrate-N plus nitrite-N) concentrations in the Tutaki block streams were variable and on average similar to those in the Waimiha Stream, but all well below concentrations that would indicate excessive nitrate leaching into shallow groundwater, which flows from the springs on the property.
- Ammoniacal nitrogen (NH_4N) concentrations were below the level of detection in the Waimiha Stream and most of the Tutaki streams. The samples with detectable levels of ammonia tend to have lower levels of oxidised nitrogen (NO_x-N). The cause of this pattern is uncertain but the concentrations involved are not of significant concern.
- As with TP, total nitrogen (TN) concentrations in the Tutaki stream samples (including two of the "upstream" samples) were generally higher than in three Waimiha Stream but within the normal range for farm streams and well below levels that would indicate significant adverse effects due to the wastewater irrigation.

- Overall the results show no evidence of unusual water quality in the Tutaki Block streams or adverse effects due to the wastewater irrigation activities.

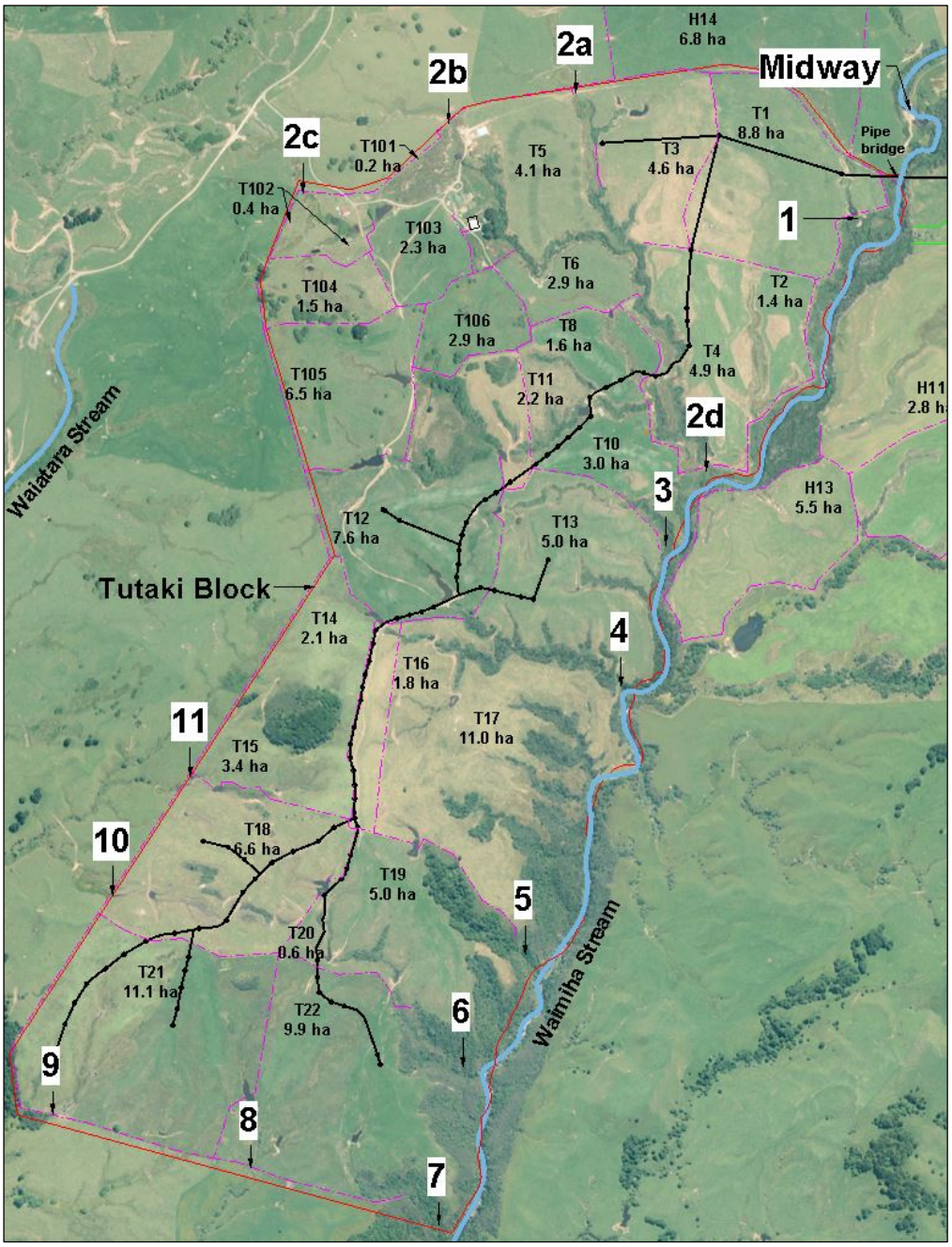

Figure 19

Tutaki Block stream water quality sampling sites, 2 November 2015.

Table 11

Water quality in Tutaki Block streams and Waimiha Stream sampled on 2 November 2015.

Sampling details		Sample characteristics							
Site*	Time	pH	TN g/m³	NH_4N g/m³	NO_xN g/m³	TKN g/m³	DRP g/m³	TP g/m³	*E. coli* /100 ml
Tutaki 1	10:20	6.9	1.00	0.034	0.46	0.54	0.007	0.064	8
Tutaki 2A (upstream)	09:57	6.8	1.37	0.033	1.08	0.29	0.004	0.015	180
Tutaki 2B (upstream)	09:43	6.6	1.17	<0.010	0.022	1.15	<0.004	0.091	40
Tutaki 2C (upstream)	09:35	6.8	0.39	<0.010	0.17	0.22	<0.004	0.020	310
Tutaki 2D (downstream)	10:38	7.4	1.38	0.011	1.12	0.26	0.007	0.018	90
Tutaki 3	10:50	7.4	1.70	<0.010	1.44	0.26	0.006	0.015	41
Tutaki 4	11:12	7.2	1.91	<0.010	1.65	0.26	0.006	0.030	37
Tutaki 5	11:40	7.1	2.00	<0.010	1.50	0.54	0.006	0.036	14
Tutaki 6	11:59	7.4	2.20	<0.010	1.81	0.37	0.004	0.019	16
Tutaki 7	12:33	7.2	1.16	<0.010	0.93	0.22	0.008	0.019	4
Tutaki 8	12:59	6.9	1.04	0.054	0.45	0.58	0.004	0.025	23
Tutaki 9	14:38	7.1	1.14	0.065	0.33	0.81	0.004	0.035	390
Tutaki 10	14:54	6.9	1.07	0.015	0.77	0.31	<0.004	0.029	20
Tutaki 11	15:10	6.8	0.59	0.058	0.176	0.41	<0.004	0.054	77
Waimiha Upstream	09:02	7.0	0.78	<0.010	0.65	0.13	0.012	0.022	280
Waimiha Midway	10:10	7.4	0.88	<0.010	0.73	0.14	0.008	0.017	150
Waimiha Downstream 1	13:15	7.4	0.90	<0.010	0.73	0.17	0.008	0.017	100
Waimiha Downstream 2	15:59	7.5	0.97	<0.010	0.75	0.22	0.010	0.019	150

* Refer to Figure 19 for Tutaki Block stream sampling sites and Figure 3 for Waimiha Stream sampling sites.

4.5 Runoff and Spray Drift

Potential effects of runoff and spray drift into waterways have been avoided by adopting the low-application-rate K-line irrigation with a low spray trajectory. As a further precaution, a buffer zone of 20 m is maintained between the irrigated wastewater and all wetlands and watercourses.

4.6 Odour

Although the anaerobically treated wastewater has a fairy strong odour that is detectable downwind of paddocks being irrigated, the irrigation sites are sufficiently far from roads and dwelling that any odour effects are minor.

Crusader Meats has received no odour complaints in the past 15 years and odour was not raised as an issue at the community consultation meeting held in October 2015.

5 Consultation

5.1 Annual Monitoring Report

Every year since 2002 Crusader Meats has sent a copy of the Annual Environmental Monitoring Report (the 2015 report is attached in Appendix 6) to the following parties to keep them informed of the consent monitoring results:

- Te Hape Marae
- Miringa Te Kakara Marae
- Tiroa E / Te Hape B Trustees
- Tutaki family

The covering letter for the report each year included an invitation to request a private or public meeting if there are any issues that the report recipient wished to discuss. No meeting requests have been received.

5.2 Consultation for Replacement Consents

A consultation meeting was held at the Crusader Meats plant on Saturday 17 October 2015. Invitations to the meeting and a briefing paper on the consent applications were sent to the following:

- Tiroa E/Te Hape B Trust,
- Tutaki Family
- Te Hape Marae
- Miringa Te Kakara Marae
- Department of Conservation
- John Wi

A copy of the briefing paper is attached in Appendix 7. The proposal in the briefing paper differs from that in the completed application with respect to the following:

- Crusader Meats no longer proposes to renew the surface water take consent.
- Crusader Meats now proposes a maximum nitrogen application rate for pond slurry of 200 kg N/ha – not 400 kg N/ha.
- The consent term sought is now 29 years rather than 35 years.
- An increase in the wastewater application rate to pasture managed as cut-and-carry is no longer proposed.

In addition to Crusader Meats representatives, nine people attended the meeting (Table 12). The meeting began at 8:00 a.m. and concluded in the early afternoon. A tour of the plant, wastewater pond and irrigation sites was undertaken during a break in the meeting. The tour included stops at the "Upstream" and "Midway" sampling sites in the Waimiha Stream, and at a paddock that was being irrigated.

Discussions were wide ranging. Topics included:

- The application process
- Proposed changes to consent conditions
- Avoiding and managing wastewater spills
- The quality of the Waimiha Stream
- The surface water and groundwater takes
- The property lease
- The annual monitoring report
- Consent duration

The attendees appeared to be largely supportive of Crusader Meats and the proposed consent application. There were no issues or concerns raised that could not be resolved at the meeting by clarification of the proposed activities and potential effects.

Table 12
Attendees of consultation meeting held on Saturday 17 October 2015.

Name	Representing
Erana Stevens	Department of Conservation
Tutahanga Tepu	Tiroa E / Te Hape B Trust
Rangimaria Jean Moana	Miringa Te Kakara Trust
Richard Kingi	Tiroa E / Te Hape B Trust
Judith Humbert	Miringa Te Kakara Marae
Maxine Nathan	Tiroa E / Te Hape B Trust
Destiny Ordish	Tiroa E / Te Hape B Trust
John Wi	Te Ihingarangi Iwi Trust
Rowyne Yeatman	Tiroa E / Te Hape B Trust
Anne Kelly	Crusader Meats
Mike Ramsey	Crusader Meats
Albert van Oostrom	Consultant to Crusader Meats

5.3 Land-owner Approvals

A signed approval from Dion Tutaki, representing the owners of the Tutaki Block, is attached in Appendix 8.

Signed approval for the consent applications has been requested from the Tiroa E / Te Hape B Trust, but written approval has not yet been received. A copy of the completed application will be provided to the Trust and a further request for written approval will be made.

Crusader Meats holds easements and a lease that legally entitle the company to undertake the existing and proposed activities on the Tiroa E and Te Hape B blocks, subject to the activities being authorised by resource consents.

5.4 Approvals from other Interested Parties

Requests for approval for the consent applications were made to the following additional parties:

- Te Hape Marae
- Miringa Te Kakara Marae
- Department of Conservation
- Fish & Game NZ

Written approval from the Department of Conservation is attached in Appendix 8.

A copy of the completed application will be sent with an affected party approval form to each of the remaining parties who have not yet provided their written approval.

6 References

ANZECC (2000). Australian Water Quality Guidelines for Fresh and Marine Waters, Australian and New Zealand Environment and Conservation Council.

HRC (2001). Flow gauging results for the Waimiha Stream at Te Hape received in a fax from Horizons Regional Council on 25 January 2001.

River Environment Classification Manawatu (2010). Retrieved from MfE Data Service, 5 November 2015, https://data.mfe.govt.nz/layer/1826-river-environment-classification-manawatu-2010/

van Oostrom, A. J. (2001). Waste management. *In:* Y. H. Hui, W.-K. Nip, R. W. Rogers, & O. A. Young (Eds.), *Meat Science and Applications (Vol. 24, pp. 635–671).* Marcel Dekker, New York.

Appendix 1. HRC Application Forms

Resource Consent
application form cover sheet

This form needs to be completed with all consent applications submitted to Horizons Regional Council. If sending multiple applications this cover form only needs to be completed once.

Consent holder name: F J Ramsey (Trading) Limited
Please note: Resource Consents cannot be issued in the name of a **Trust, Estate or Partnership** as they are not a legally enforceable entity. Consents can be issued to a person(s) or to a company.

Contact person: *(if different from above)* Mike Ramsey, Plant Manager

Phone no: 07 878 7077 **Fax no:** 07 878 7080
Mobile no: 027 454 3876 **Best contact time:** 08:00-16:30 weekdays
Email address: anne@crusadermeats.co.nz
Postal address: Crusader Meats, 979 State Highway 30, Benneydale, RD-7, Te Kuiti
Post code: 3987

Please tick each of the following consents you are applying for and attach the respective application forms to the back of this form:

- ◉ **Drilling of Well** — Lodgement fee $320 incl GST
- ◉ **Surface Water Take** — Stock Water: lodgement fee $977.50 incl GST; Irrigation: lodgement fee $1,207.50 incl GST; Other: lodgement fee $885.50 incl GST
- ◉ **Dairyshed Discharge** — Lodgement fee $1,012 incl GST
- ◉ **Change in Land Use Activity to Dairy Farm** — Lodgement fee $885.50 incl GST
- ◉ **Addition of Land Parcels** — no charge
- ◉ **Gravel Take** — Lodgement fee within allocation $1,667.50 incl GST
- ○ **Change of Consent Conditions** — Lodgement fee $885.50 incl GST
- ◉ **Land Disturbance / Vegetation Clearance** — Lodgement fee $885.50 incl GST
- ◉ **Ground Water Take** — Stock Water: lodgement fee $908.50 incl GST; Irrigation: lodgement fee $1,863 incl GST; Other: lodgement fee $885.50 incl GST
- ◉ **Dairyshed Change of Consent Conditions** — Lodgement fee $870 incl GST
- ◉ **Existing land use for intensive farming** — Lodgement fee $885.50 incl GST
- ◉ **Works in a Waterbody** — Lodgement fee $885.50 incl GST
- ◉ **Other** — Lodgement fee $885.50 incl GST

☑ Discharge to Land

Continued Overleaf

Ring Horizons Regional Council's Consents Team on freephone 0508 800 800 if you require any assistance

Location/ property address of the proposed activity: 979, 970 and 798 State Highway 30, Benneydale

Legal description of all land titles (this can be found on your rates demand): Refer AEE Appendix 2

Valuation numbers for all land titles (this can be found on your rates demand): 5862/45600 (Tiroa E Block); 5862/50500 (Te Hape B Block); 5862/50800 (Tutaki Block)

Map reference (if known): NZTopo50 BG34 148359 (Tiroa E Block, Meat Processing Plant)

◒ **Map attached showing location**

Ring Horizons Regional Council's Consents Team on freephone 0508 800 800 if you require a map

Do you own the property where this activity will take place? Yes ○ No ◒

If no, please state owner of property? 1) Tiroa E/Te Hape B Trustees 2) Tutaki Family

Contact details of property owner: 1) PO Box 51, Te Kuiti 3941 2) 9 Maniaiti Rd, Benneydale 3987

Please note that written approval is required from this landowner and should accompany this application

Contact person at Horizons Regional Council

If you have already dealt with a member of the consents team please advise their name? Andrew Bashford

Signature of applicant: _____ **Date:** 22/2/16
(or person authorised to sign on behalf of the Applicant)

Address for service of applicant if different from above: Albert van Oostrom & Associates
21 Dawson Street, Hamilton East, Hamilton 3216

Phone no: 07 856 8367 **Fax no:** 07 856 8362

Mobile no: 027 485 9234 **Best contact time:** 8:00-17:00

Contact person: Albert van Oostrom

Have you attached the following:

○ **Activity application forms as ticked above**
○ **Map showing location and all required points of reference as requested on the activity application form**
◒ **Lodgement fee**

Please note: if you do not provide enough information your application may not be accepted

The information provided on this form will be used to process the consent application and, if granted, to monitor the exercise of the consent. The information requested is required by the Resource Management Act 1991. Horizons Regional Council may disclose the information if a request is made by another party, under provisions of the Local Government Official Information and Meetings Act. Horizons Regional Council may also publicly disclose some of this information in circumstances where consent conditions have been breached. Under the Privacy Act 1993, you have the right of access to personal information about you held by Horizons Regional Council and you are also entitled to request information about you to be corrected.

horizons regional council
11-15 Victoria Avenue
Private Bag 11 025
Manawatu Mail Centre
Palmerston North 4442
T 0508 800 800
F 06 952 2929
help@horizons.govt.nz
www.horizons.govt.nz

Application
discharge to land

Is this application replacing a current consent? Yes ■ No □
If yes, do you agree to surrender your current consent should this application be granted? Yes ■ No □

Current consent number *if applicable*: 100696 and 100926

Consent holder: F J Ramsey (Trading) Limited

Contact person: Anne Kelly, General Manager

Please describe in detail what it is that you wish to do. ***Please use reverse of form to describe full details of the activity.***

Where does the material / contaminant come from? Crusader Meats' meat processing plant

Are you treating the contaminants prior to discharge? (i.e. settling ponds) Yes ■ No □
Describe the nature of the treatment Screening and anaerobic pond

What is the area of land you are discharging to? *(in hectares)* Approximately 183 ha irrigable area

Are there any waterbodies or drainage on the property? Yes ■ No □
Please note these areas on the site plan / map required below

What volumes are you discharging? **Daily** 1,500 **Weekly** 10,500 **Annually** 300,000

Period of time consent is required for *(max 35 years)*: 29 years to 1 July 2045

Please provide a site plan / map to scale showing the location(s) of the discharge and distances to any waterbodies, buildings and property boundaries
Please note: if you do not provide enough information your application may not be accepted

Fees and charges

A lodgement fee of **$885.50** (incl GST) is required with your application. Failure to send the fee may result in rejection of your application.

Signature of applicant: _____ **Date:** 22/02/2016
(or person authorised to sign on behalf of the Applicant)

Ring Horizons Regional Council's consents team on freephone 0508 800 800 if you require assistance.

The information provided on this form will be used to process the consent application and, if granted, to monitor the exercise of the consent. The information requested is required by the Resource Management Act 1991. Horizons Regional Council may disclose the information if a request is made by another party, under provisions of the Local Government Official Information and Meetings Act. Horizons Regional Council may also publicly disclose some of this information in circumstances where consent conditions have been breached. Under the Privacy Act 1993, you have the right of access to personal information about you held by Horizons Regional Council and you are also entitled to request information about you to be corrected.

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www.horizons.govt.nz

Appendix 2. Certificates of Title

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

R.W. Muir
Registrar-General
of Land

Guaranteed Search Copy issued under Section 172A of the Land Transfer Act 1952

Identifier **SA51C/863**
Land Registration District **South Auckland**
Date Issued 15 December 1992

Prior References
GN B118208.2 SA38B/531

Estate	Fee Simple
Area	6084.1078 hectares more or less
Legal Description	Part Tiroa E Block and Part Tiroa E Block and Part Tiroa E Block and Part Tiroa E Block and Part Tiroa E Block and Part Tiroa E Block and Part Tiroa E Block and Section 18 Block XI Pakaumanu Survey District and Section 1-3 Survey Office Plan 58849 and Section 1 Survey Office Plan 58851 and Section 1-2 Survey Office Plan 58852

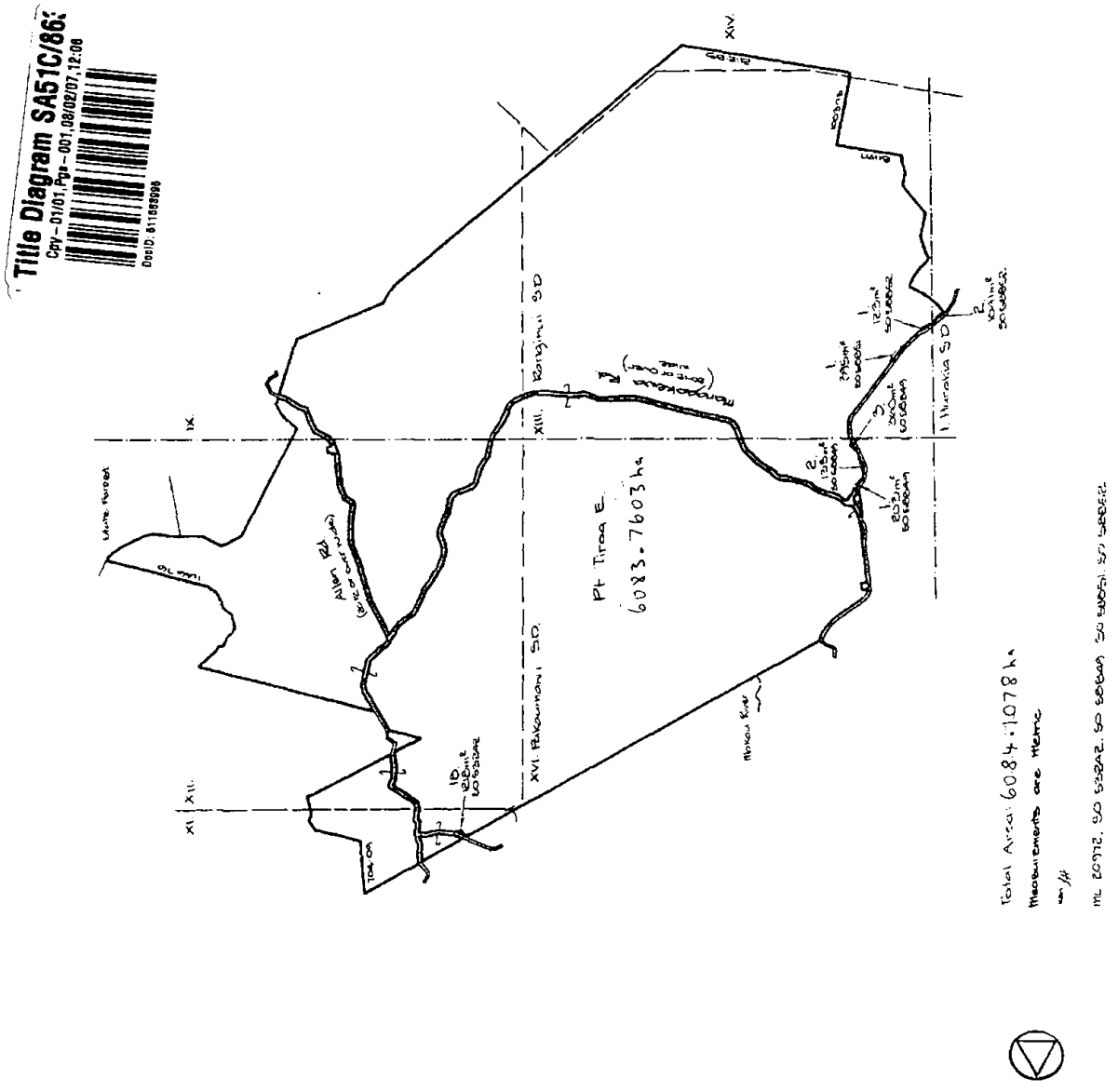
Proprietors
Barbara Kohineteraupara Moana, Destiny Mary Te Kore Ahumai Ordish, Hardie Peni, Maxine Te Ora Ngati Huinga Nathan, Richard Patrick Te Hauraki Kingi, Rowyne Louise Yeatman and Tutahunga Alfred Tepu as Trustees jointly

Interests

6395264.2 Lease of Lot 1 DPS 63658 and Lots 1 and 2 DPS 86668 Term 19 years 364 days commencing on the 1.10.1999 CT 214822 issued - 26.4.2005 at 9:00 am

8346922.1 Status Order determining the status of the within land to be Maori Freehold Land - 18.11.2009 at 9:00 am

CERTIFICATE OF TITLE



COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

R.W. Muir
Registrar-General
of Land

Guaranteed Search Copy issued under Section 172A of the Land Transfer Act 1952

Identifier **SA53A/19**
Land Registration District **South Auckland**
Date Issued 08 October 1993

Prior References
SA51C/862

Estate	Fee Simple
Area	4495.4581 hectares more or less
Legal Description	Part Te Hape B Block and Part Te Hape B Block and Part Te Hape B Block and Part Te Hape B Block and Section 4 Survey Office Plan 58849 and Section 1 Survey Office Plan 58850 and Section 2-3 Survey Office Plan 58851

Proprietors

Barbara Kohineteraupara Moana, Destiny Mary Te Kore Ahumai Ordish, Hardie Peni, Maxine Te Ora Ngati Huinga Nathan, Richard Patrick Te Hauraki Kingi, Rowyne Louise Yeatman and Tutahunga Alfred Tepu as Trustees jointly

Interests

Subject to a right of way (in gross) over parts marked A, B, C, D, E, F, G, H, I, J, K and L, a right to drain, discharge or convey sewage (in gross) over parts marked C, G, H, I, J, K, M, N, O, P, Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14 and Q15 and a right to convey water over part marked M on DPS 64747 in favour of F J Ramsey Trading Limited created by Transfer B172050 - 17.11.1993 at 2.18 pm (affects Te Hape B Block)

6395264.2 Lease of Lot 1 DP 312805 and Lots 3, 4, 5, 6 and 7 DPS 86668 Term 19 years 364 days commencing on the 1.10.1999 CT 214822 issued - 26.4.2005 at 9:00 am

8323173.1 Status Order determining the status of the within land to be Maori Freehold Land - 23.10.2009 at 9:00 am

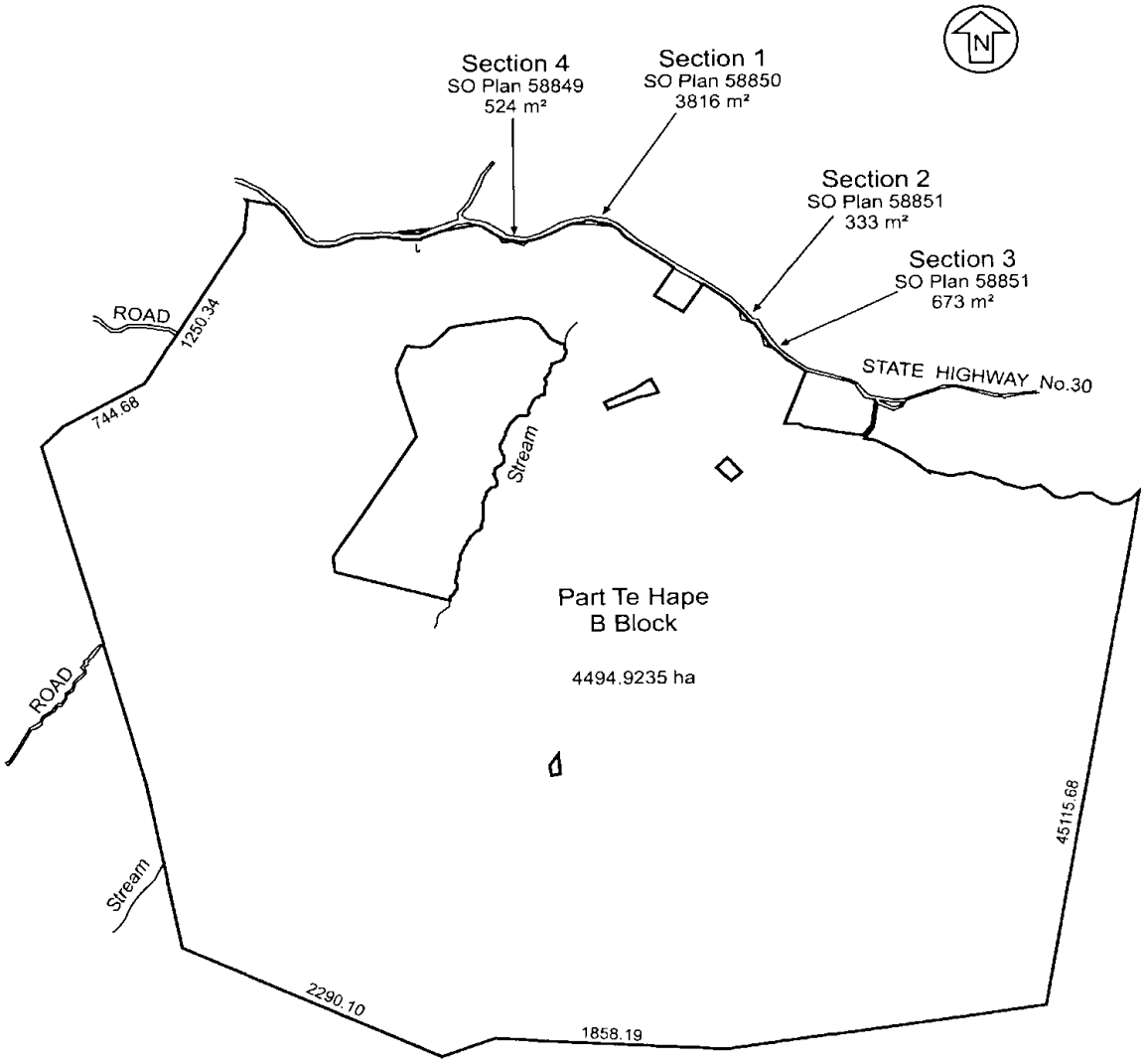
8880333.1 Roadway Order laying out a roadway over within land providing access to Pukemakoiti 1 Block and Pukemakoiti 2 Block CFR 423913 - 5.10.2011 at 7:00 am

9205538.1 Notice pursuant to Section 195(2) Climate Change Response Act 2002 - 19.10.2012 at 4:37 pm (affects part Te Hape B Block)

Title Diagram SA53A/19

Cpy – 01/01, Pgs – 001, 20/02/07, 15:11

OneID 312813834



TOTAL CT AREA: 4495.4581 ha

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

R.W. Muir
Registrar-General
of Land

Guaranteed Search Copy issued under Section 172A of the Land Transfer Act 1952

Identifier **474061**
Land Registration District **South Auckland**
Date Issued 16 April 2009

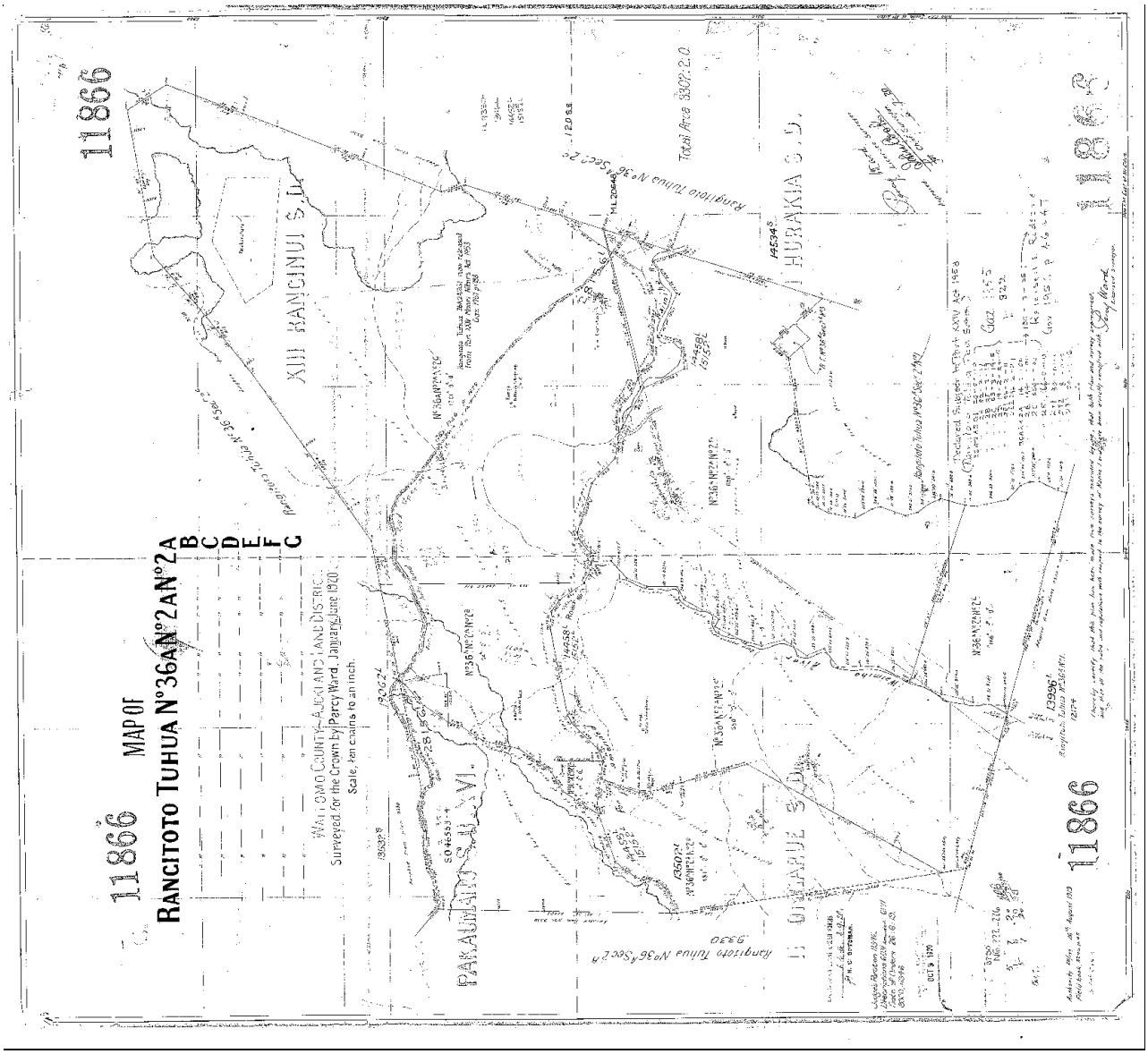
Prior References
474060

Estate	Fee Simple
Area	222.5771 hectares more or less
Legal Description	Rangitoto Tuhua 36 A 2 A 2 C Block

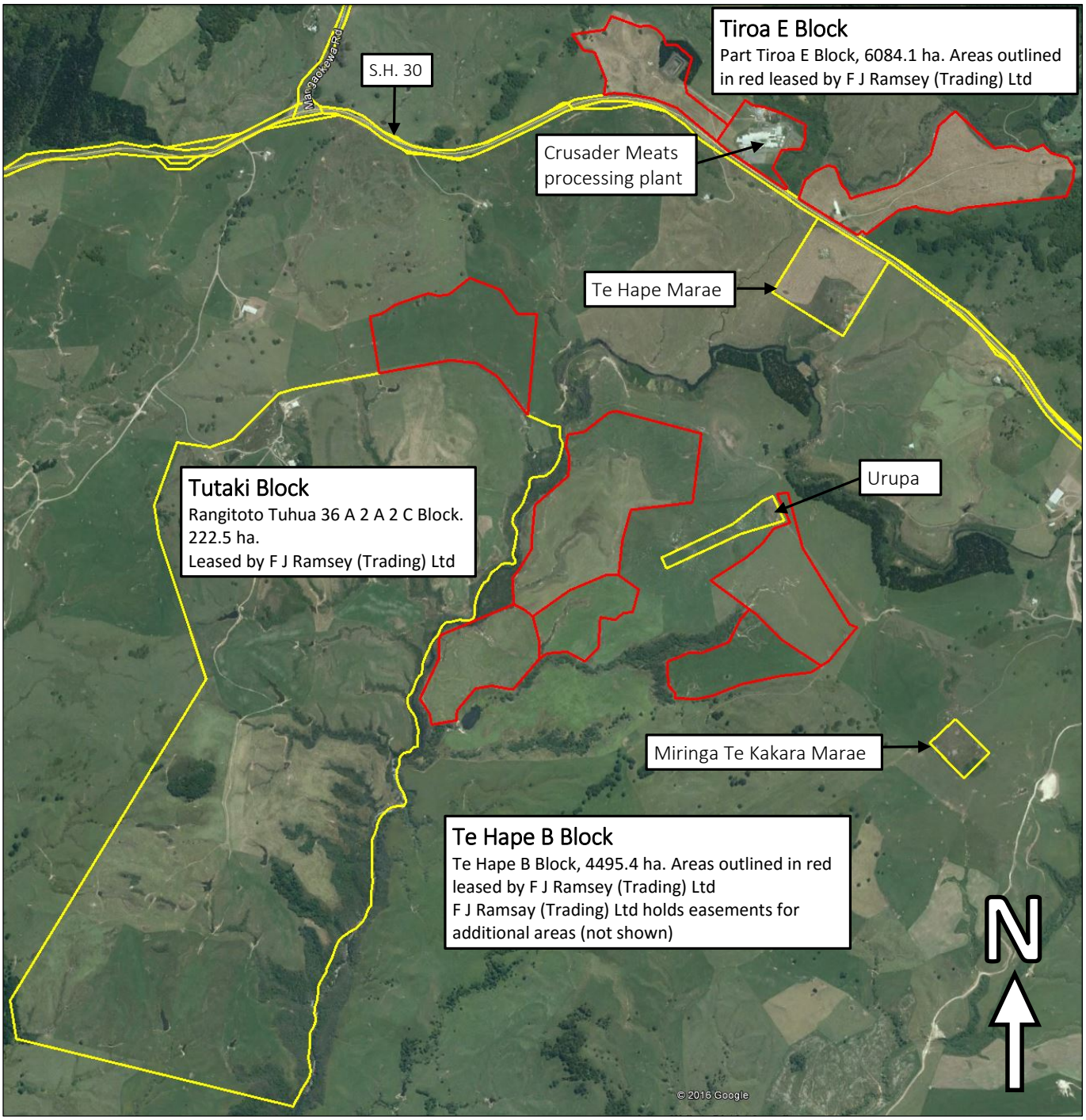
Proprietors
John Tutaki, David Seymour Hori Tamaki and Rosebud Waaka jointly, as Trustees

Interests
8133232.3 Status Order determining the status of the within land to be Maori Freehold Land - 16.4.2009 at 9:00 am

Identifier **474061**



Appendix 3. Property Plan



Appendix 4. Existing Consents 100696 and 100926

The Decisions

A. Discharge Permit 100696 and 100926

The Hearing Committee, acting under delegated authority under Section 34 of the Act, Grants **Discharge Permits 100696 and 100926** pursuant to Section 105(1)(b) of the Act to F J Ramsey Trading Ltd for the discharge of meatworks effluent onto and into land on the Te Hape B Block, Tiroa E Block and Tutaki Block for a term expiring on 22 May 2016, subject to the following conditions:

General

1. The maximum daily discharge of pond treated meat processing effluent and yard solids onto and into land depicted on Plan C100696 legally described as Te Hape B Block and Tiroa E Block and Tutaki Block shall not exceed 900 cubic metres ($900m^3$ per day).

2. The design, construction and maintenance of the necessary works associated with this permit shall be in accordance with the proposal as outlined in the application.

3. The design, construction and maintenance of the necessary works associated with this permit shall be carried out under the supervision of an appropriately experienced Engineer. This person shall be retained by the Permit Holder to ensure that the works are constructed in accordance with accepted engineering practice and are completed to a standard and condition to meet the requirements of this permit.

4. The Permit Holder shall employ best practicable option measures to ensure that occurrences of offensive or objectionable odours (from the treatment lagoon and/or the waste water effluent irrigation activities) beyond the property boundary are avoided.

Anaerobic Lagoon

5. The anaerobic lagoon shall be maintained and operated in a manner to ensure that the contents are fully retained in the lagoon at all times.

6. The anaerobic lagoon shall be provided with appropriate visual monitoring equipment that provides an immediate warning of any failure of the lining.

7. There shall be no offensive or objectionable odour beyond the property boundaries resulting from the operation of the anaerobic lagoon.

Effluent Irrigation

8. The effluent irrigation regime shall be managed according to an Effluent Irrigation Management Plan approved by **horizons.mw** with regard to the maintenance of buffer zones, riparian planting, stock management, storage pond capacity, daily and monthly monitoring of the irrigation system and water quality and soil testing.

9. The effluent irrigation system shall be constructed and managed so as to ensure a buffer zone of at least 20 metres is maintained between the disposal area (at the furthest throw of the sprinkler) and any streams, wetlands or low areas likely to flood in wet weather, drains and other natural surface waters.

10. No effluent spray-drift shall enter the Waimiha Stream or any of its tributaries.

11. Buffer zones adjacent to the permanent watercourses shall be fenced to exclude stock and planted with appropriate riparian vegetation. The type of riparian vegetation used shall be decided in consultation with the Team Leader Compliance, **horizons.mw**

12. There shall be no ponding as a result of irrigation and no surface run-off of effluent from the lagoons, pipelines, or disposal areas to any watercourse or wetland areas.

13. Sufficient effluent irrigation area, excluding buffer zones, shall be provided to ensure that the maximum hydraulic and nitrogen loading rates of 50 mm/day and 200 kg N /ha / year are not exceeded.

Emergencies

14. This permit does not authorise emergency discharges of effluent under any circumstances. The Permit Holder shall provide sufficient additional storage and/or have contingency management procedures in place to ensure unauthorised discharges of effluent do not occur due to wet weather surcharge flows, equipment malfunction or any other foreseeable cause.

15. The Permit Holder shall install and maintain an automatic shut-off valve that will stop the flow of effluent in the event of irrigation pipe rupture or significant leakage.

Monitoring

16. The Permit Holder shall keep an Environmental Log of the:

    a. Daily volumes of the effluent generated by the works and irrigated to land;
    b. Periods (times) and areas irrigated with effluent daily;
    c. Rainfall, wind direction and wind strength recorded on a daily basis;
    d. Any equipment malfunctions relating to the wastewater system (ie. pumps, lines, irrigators etc.) or pollution incidents and details of any repairs or actions taken to avoid environmental adverse effects.
    e. Any leaks identified at or around the pipe bridges (as identified under the inspections required under condition 22) and the action taken to remedy the leaks.

    This log shall be made available to **horizons.mw** staff on request.

17. The Permit Holder shall monitor:

    a. The water quality of the Waimiha Stream on a seasonal basis (once per month in the months January, May and September) at three sites; upstream, in the middle of and downstream of the irrigation area as shown on Plan C 100696 attached to and forming part of this Permit. The sites shall be established in consultation with **horizons.mw**'s Team Leader, Compliance. The samples shall be analysed by a suitably qualified laboratory for the following parameters:

    E. coli bacteria
    Suspended solids
    Nitrate and nitrite
    Total Kjeldahl nitrogen (TKN)
    Ammoniacal Nitrogen

b. The quality of the wastewater from the storage pond on a monthly basis. The sample shall be analysed by a suitably qualified laboratory for the following parameters:

Total Kjeldahl nitrogen (TKN)
Total chemical oxygen demand (COD)

In addition the following waste-water storage pond parameters shall be monitored once every six months

Total sodium
Calcium
Magnesium
Total Phosphorus
Total Potassium

The Applicant shall determine and record the effluent sodium adsorption ratio (SAR) based on these six monthly monitoring results.

c. Soil characteristics in the irrigation area. A soil-sampling programme is to be undertaken in November each year for the term of this permit. Three paddocks located in the effluent disposal areas and a control sample (a paddock not irrigated) shall be sampled. The paddocks sampled shall be varied in a rotation cycle each year to ensure that all paddocks receiving effluent are sampled over time. At least 20 cores shall be taken from each paddock at two depths, 0 - 10 and 10 – 20 cms. The samples shall be analysed for:

PH
Calcium
Phosphorus
Potassium
Sulphate-sulphur
Magnesium
Sodium
total nitrogen
base saturation

by a suitably qualified laboratory . The soil infiltration rate and the soil organic matter content shall also be measured in each of the paddocks sampled.

d. The results of the above analyses are to be supplied to **horizons.mw**'s Team Leader Compliance within two weeks of the completion of the analysis.

18. The Permit Holder shall prepare an annual report that includes the results of all monitoring of this resource consent and consents 100697, 100698 and 101365 and shall forward copies of the report to **horizons.mw**, Te Hape Marae and Miringi Te Kakara Marae by 30 June 2002 and by 30 June in every year thereafter for the term of this permit. The report shall include the following:

i. summary of the monitoring results;
ii. discussion of the implication of these results,
iii. any incidences of non-compliance; and
iv. any actual or proposed changes to the operational waste water storage and disposal procedures or Irrigation Management Plan.

19. Within one month of the release of the report required by Condition 18 of the Permit, the Permit Holder shall hold at least one public community meeting to discuss the contents and implications of the report.

Management Plan

20. An Effluent Treatment and Irrigation Management Plan shall form a part of this permit. The existing Management Plan for the operation of the irrigation system shall be updated to reflect the operational regime authorised by this permit and re-submitted to **horizons.mw**'s Team Leader Compliance by ~~1 June~~ 20 July 2001 for approval.

Review

21. **horizons.mw** may, under Section 128 of the Act, initiate a review of conditions of this permit in April 2002, April 2006, and April 2011. The reviews may be necessary to assess the effectiveness of conditions of this permit, in avoiding, remedying or mitigating adverse effects on the environment.

The review of conditions shall allow for:

i. deletion or changes to conditions of this permit; and
ii. addition of new conditions as necessary; or
iii. the adoption of the best practicable options to avoid, remedy, or mitigate any adverse effects on the environment.

22. All pipe bridges conveying effluent shall be inspected monthly by the Permit Holder for leaks and /or deterioration and appropriate action taken.

23. The Permit Holder shall maintain a complaints register. The register shall record:

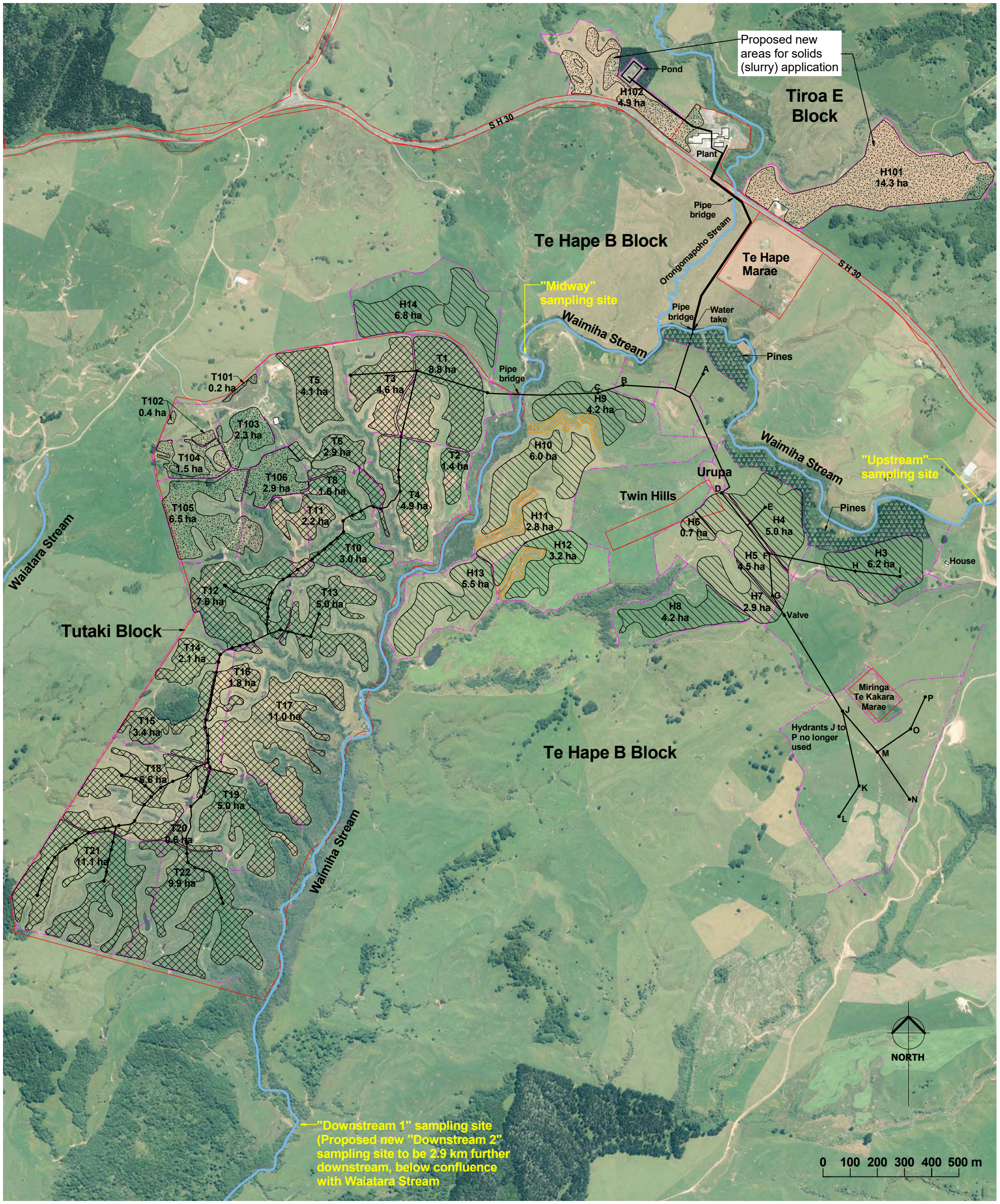
a. any public complaints it receives, and the time they were received;
b. weather conditions including wind direction at the time of complaint;
c. process operations and/or malfunctions at the time of complaint; and
d. remedial measures or other action taken as a result of the complaint.

The register shall be made available to **horizons.mw** staff on request.

24. Charges, set in accordance with Section 36(1)c of the Resource Management Act 1991, and Section 690 A of the Local Government Act 1974, shall be paid to **horizons.mw** for the carrying out of its functions in relation to the administration, monitoring and supervision of this resource consent and for the carrying out of its functions under Section 35 (duty to gather information, monitor, and keep records) of the Act.

[Note:Section 36(1)c of the Act provides that **horizons.mw** may from time to time fix charges payable by holders of resource consents. The procedure for setting administrative charges is governed by Section 36(2) of the Act and is currently carried out as part of the formulation of **horizons.mw**'s Annual Plan.]

Appendix 5. Irrigation Site Plan



Legend

- Major stream
- Property boundary
- Fenceline
- Irrigation main and hydrant
- Solids application area
- Irrigation Site - Te Hape Block
- Irrigation Site - Tutaki Block
- Wetland area to be fenced and planted

Crusader Meats Land Treatment System Site Plan

22 February 2016

ALBERT VAN OOSTROM & ASSOCIATES
WASTE MINIMISATION & TREATMENT SPECIALISTS

Appendix 6. Annual Monitoring Report 2015

Crusader Meats New Zealand Ltd

Annual Environmental Monitoring Report

K-Line irrigation system

June 2015

Contents

1. Introduction

This annual monitoring report has been prepared to fulfil the requirements of Condition 18 of F.J. Ramsey Trading Ltd.'s (Crusader Meats) Discharge Permit 100696 and 100926. This condition states:

> *"The permit holder shall prepare an annual report that includes the results of all monitoring of this resource consent [100696 and 100926] and consents 100697, 100698 and 101365, and shall forward copies of the report to horizons.mw, Te Hape Marae and Miringa Te Kakara Marae by 30 June 2002 and by 30 June in every year thereafter for the term of this permit. This report shall include the following:*
>
> *i. summary of the monitoring results;*
>
> *ii. discussion of the implication of these results;*
>
> *iii. any incidences of non-compliance; and*
>
> *iv. any actual or proposed changes to the operational waste and water storage and disposal procedures or irrigation Management Plan."*

Note: Consent 100697 (to discharge septic tank effluent to land) has been replaced by Consent 104518, which has no annual reporting requirements.

The information in this report covers the 12-month period to 31 May 2015. Historical data are also provided to show trends in the monitoring results.

2. Consent 100696 & 100926 – Effluent Irrigation

2.1 Changes to Irrigation Practices and Management Plan

In December 2014, the nine K-Line irrigation lines, each with 10 sprinkler pods, were divided in half – making 18 irrigation lines with 5 pods each. This change makes the irrigators easier to move and improves wastewater distribution in smaller areas.

2.2 Effluent Volume and Characteristics

Daily irrigation records are given in Appendix 1. Characteristics of the irrigated effluent are given in Appendix 2 and Figure 1.

For the period 1 June 2014 to 31 May 2015, the average effluent volume applied on irrigation days was 866 m^3. The maximum volume applied was 900 m^3, which complies with the maximum permitted daily volume of 900 m^3. The total volume of wastewater irrigated was 177,530 m^3.

The average TKN and COD concentrations in the effluent for this reporting period were 108 and 1182 g/m^3, respectively, and within the normal range for anaerobically treated meat processing effluent.

In October 2009 the plant began dry-salting skins as a means of preserving them for export. The process involves mixing dry salt (sodium chloride with 1% boric acid and 1% sodium metabisulphite) with the skins. Some salt unavoidably enters the effluent system. To monitor salt levels in the effluent and assess potential effects on soil quality (via the sodium adsorption ratio), we increased the frequency of effluent testing for dissolved sodium, potassium, calcium and magnesium from 6-monthly to monthly.

The median sodium adsorption ratio (SAR) of the effluent for the reporting period was 3.9. (Appendix 2 and Figure 1), which is well within permissible limits for irrigation water applied to soils with low clay content (*Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000*).

Magnesium and calcium concentrations in the effluent have increased along with the concentration of sodium (Figure 1). The increases in magnesium and calcium are beneficial as these cations lower the effluent SAR and counteract the effects of sodium in the soil. The source of the increased magnesium and calcium in the effluent may be bore water that has been used at the plant since January 2010, but this has not been verified. The increase in salt in the effluent from the skin salting process is very unlikely to adversely affect soil quality in the effluent irrigation areas.

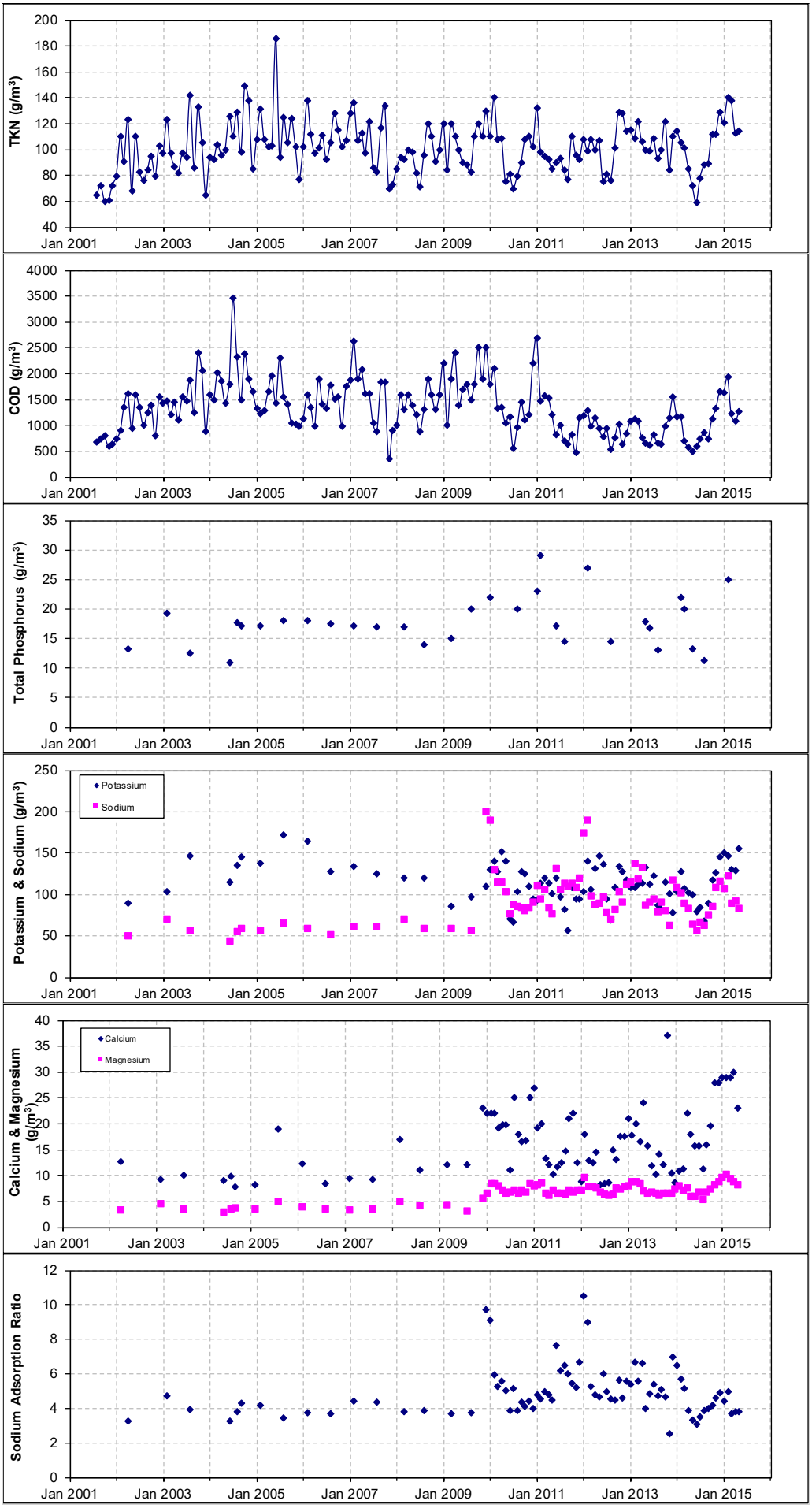


Figure 1.

Characteristics of irrigated effluent.

2.3 Nitrogen Loading Rate

The mass of nitrogen applied to each irrigation site is summarised in Appendix 3. During the reporting period, 19,091 kg of effluent nitrogen was applied to irrigation sites with a total area of 113.8 ha, giving an average nitrogen application rate of 168 kg per hectare. The maximum nitrogen application rate for any one site was 199 kg/ha, which complies with the consent limit of 200 kg/ha.

2.4 Weather and Soil Moisture Data

Weather and soil moisture data recorded as part of the Environmental Log (consent condition 16) are given in Appendix 4.

2.5 Complaints

No complaints were received during the reporting period.

2.6 Stream Water Monitoring

Waimiha Stream water quality monitoring results are given in Table 1.

Statistical analysis of the data using the Paired-Sample T-test (1-tailed) shows that average ammonia nitrogen, total Kjeldahl nitrogen and total oxidised nitrogen concentrations significantly increased (95% level of confidence) between the "Upstream" and "Midway" sites, and between the "Midway" and "Downstream" sites.

For *E. coli*, there was a significant increase between the "Upstream" and "Midway" sites and between the "Upstream" and Downstream" sites, but not between the "Midway" and downstream sites. This statistical analysis for *E. coli* was undertaken on log-transformed data.

Suspended solids concentrations were not significantly different between the sampling sites.

In all cases where the downstream concentration increase is statistically significant, the increases are very small and thus any environmental effects are minor.

The contribution of the effluent irrigation to the increase in stream nitrogen load is uncertain, as normal farming activities will also increase the nitrogen concentration in the stream over the 5.5 km distance between the Upstream and Downstream sampling sites.

The concentration of oxidised nitrogen at the Upstream sampling site has increased on average over the last 18 years (Figure 2). This increase is due to upstream activities as the effluent irrigation cannot affect water quality at the Upstream sampling site.

Table 1
Waimiha Stream monitoring results.

Sample date	Upstream					Midway					Downstream				
	TSS	NH_4N	TKN	NO_xN	*E. coli*	TSS	NH_4N	TKN	NO_xN	*E. coli*	TSS	NH_4N	TKN	NO_xN	*E. coli*
	g/m^3	g/m^3	g/m^3	g/m^3	/100 ml	g/m^3	g/m^3	g/m^3	g/m^3	/100 ml	g/m^3	g/m^3	g/m^3	g/m^3	/100 ml
06/09/01	5	<0.01	0.2	0.50	4	4	<0.01	0.2	0.64	17	<3	<0.01	0.2	0.69	23
05/02/02	6	<0.01	0.3	0.576		<3	<0.01	0.1	0.598		<3	<0.01	0.2	0.637	
25/05/02	11	<0.01	0.4	0.670		9	<0.01	0.4	0.672		11	0.03	0.4	0.651	
13/11/02		<0.01	0.2			3	<0.01	0.1	0.617		<3	<0.01	0.2	0.608	
15/01/13	3	0.02	0.3	0.464			0.04	0.2	0.484			0.02	0.3	0.513	
25/03/03					236					276					326
04/06/03	5	0.01	0.1	0.495		3	<0.01	0.2	0.488		<3	<0.01	0.3	0.545	
07/06/03*					727					2419					>2419
01/09/03	5	0.02	0.2	0.788	41	5	0.01	0.3	0.898	152	4	<0.01	0.3	0.907	238
08/10/03					3968					328					167
20/03/04					65					130					166
01/05/04					249					548					624
29/06/04	8	0.03	0.1	1.10	22	8	0.03	0.2	1.24	87	8	0.03	0.2	1.29	108
09/12/04	3	<0.01	0.3	0.577	47	3	0.01	0.3	0.688	89	<3	0.01	0.3	0.692	76
16/02/05	<3	<0.01	<0.1	0.552	228	<3	0.06	0.3	0.679	326	3	0.10	0.5	0.644	345
01/05/05	2	<0.01	0.1	0.505	186	3	0.01	0.3	0.605	209	3	0.10	0.4	0.622	216
06/10/05	8	<0.01	0.3	0.982	396	12	0.01	0.4	1.060	358	10	0.03	0.5	1.040	365
02/02/06	9	<0.01	0.3	0.681	328	4	<0.01	0.2	0.777	613	5	<0.01	0.3	0.777	488
21/06/06	6	<0.01	<0.1	1.080	40	4	0.02	0.3	1.140	64	5	0.08	0.4	1.190	42
11/11/07	<3	<0.01	<0.1	0.547	198	<3	0.04	0.3	0.616	206	19	0.08	0.4	0.648	215
11/07/07	19	0.03	0.4	1.04	120	19	0.03	0.3	1.11	98	19	0.03	0.3	1.10	127
12/09/07	9	<0.01	0.3	0.85		4	<0.01	0.5	1.10		4	0.07	0.4	1.12	
01/01/08	<3	<0.01	0.11	0.53	200	<3	<0.01	0.27	0.39	610	<3	<0.01	0.21	0.40	81
01/05/08	<3	<0.01	0.23	0.80	220	<3	<0.01	0.35	0.92	170	<3	<0.01	0.40	0.92	140
01/10/08	<3	<0.01	0.23	0.77	67	3.4	<0.01	0.12	1.10	150	3	<0.01	0.37	1.10	690
01/01/09	<3	<0.01	0.16	0.67	870	<3	0.013	0.32	0.63	460	<3	0.034	0.25	0.65	460
01/05/09	<3	<0.01	0.18	0.65	210	<3	0.01	0.28	0.64	190	<3	<0.01	0.40	0.68	120
01/01/10	4.1	<0.01	0.20	0.54	1600	<3	<0.01	0.33	0.53	2000	<3	0.015	0.25	0.50	
31/03/10	<3	0.0136	<0.10	0.61	1600	3.2	0.02	0.136	0.52	190	3.4	0.032	0.197	0.48	230
24/06/10	5	<0.010	0.22	1.24	58	5	<0.010	0.22	1.31	64	7	<0.010	0.25	1.32	53
23/09/10	9	<0.010	0.62	1.15	70	21	<0.010	0.34	1.18	110	25	<0.010	0.35	1.21	60
02/02/11	4	<0.010	0.30	0.63	200	<3	<0.010	0.25	0.72	290	3	<0.010	0.35	0.71	390
31/05/11	6	<0.010	0.22	1.07	51	5	<0.010	0.17	1.17	56	5	<0.010	0.18	1.19	100
23/09/11	<3	<0.010	0.15	0.67	70	<3	<0.010	0.14	0.84	87	<3	<0.010	0.16	0.85	70
31/01/12	<3	<0.010	0.17	0.62	200	<3	<0.010	0.19	0.72	440	<3	<0.010	0.19	0.73	210
15/06/12	<3	<0.010	<0.10	0.87	53	<3	<0.010	0.11	0.97	91	<3	<0.010	<0.10	0.94	54
15/02/13	<3	0.021	0.13	0.74	170	<3	0.032	0.30	0.61	520	<3	0.042	0.20	0.63	220
11/06/13	8	<0.010	0.27	0.89	72	5	<0.010	0.22	1.00	130	9	0.013	0.40	0.99	410
27/09/13	6	0.016	0.30	0.97	150	6	0.026	0.18	1.09	230	6	<0.010	0.25	1.17	190
14/01/14	<3	<0.010	0.12	0.59	250	<3	<0.010	0.26	0.59	690	<3	0.018	0.22	0.57	390
27/05/14	3	<0.010	0.16	0.53	140	<3	<0.010	0.34	0.53	150	3	<0.010	0.26	0.57	210
30/09/14	4	0.017	0.08	0.77	98	<3	0.013	0.11	0.95	160	<3	0.017	0.12	0.95	110
10/02/15	<3	<0.010	0.08	0.61	330	<3	<0.010	0.12	0.50	370	<3	0.024	0.16	0.50	2000
22/05/15	8	<0.010	0.33	0.73	330	7	0.012	0.30	0.85	820	8	0.011	0.36	0.88	1200
Mean	**4.7**	**0.009**	**0.200**	**0.738**	**365**	**4.3**	**0.013**	**0.241**	**0.799**	**366**	**4.5**	**0.023**	**0.282**	**0.811**	**360**
Median	**4.0**	**0.005**	**0.200**	**0.670**	**192**	**3.0**	**0.005**	**0.255**	**0.720**	**198**	**3.0**	**0.010**	**0.280**	**0.710**	**210**
PSTT**						**-**	**U**	**U**	**U**	**U**	**-**	**U,M**	**U,M**	**U,M**	**U**

* Stream in flood

** PSTT (Paired-Sample T-Test, 1-tailed). This tests whether the average downstream concentration is significantly higher (95% level of confidence) than the average upstream concentration for each parameter. "U" indicates a significant increase in concentration compared to the "Upstream" site and "M indicates a significant increase compared to the "Midway" site. "-" indicates no significant difference in concentration compared to upstream sampling site(s). For *E. coli* this test was undertaken on log-transformed data.

Note: Values reported as less than the analytical limit of detection (LOD) have been estimated as LOD/2.

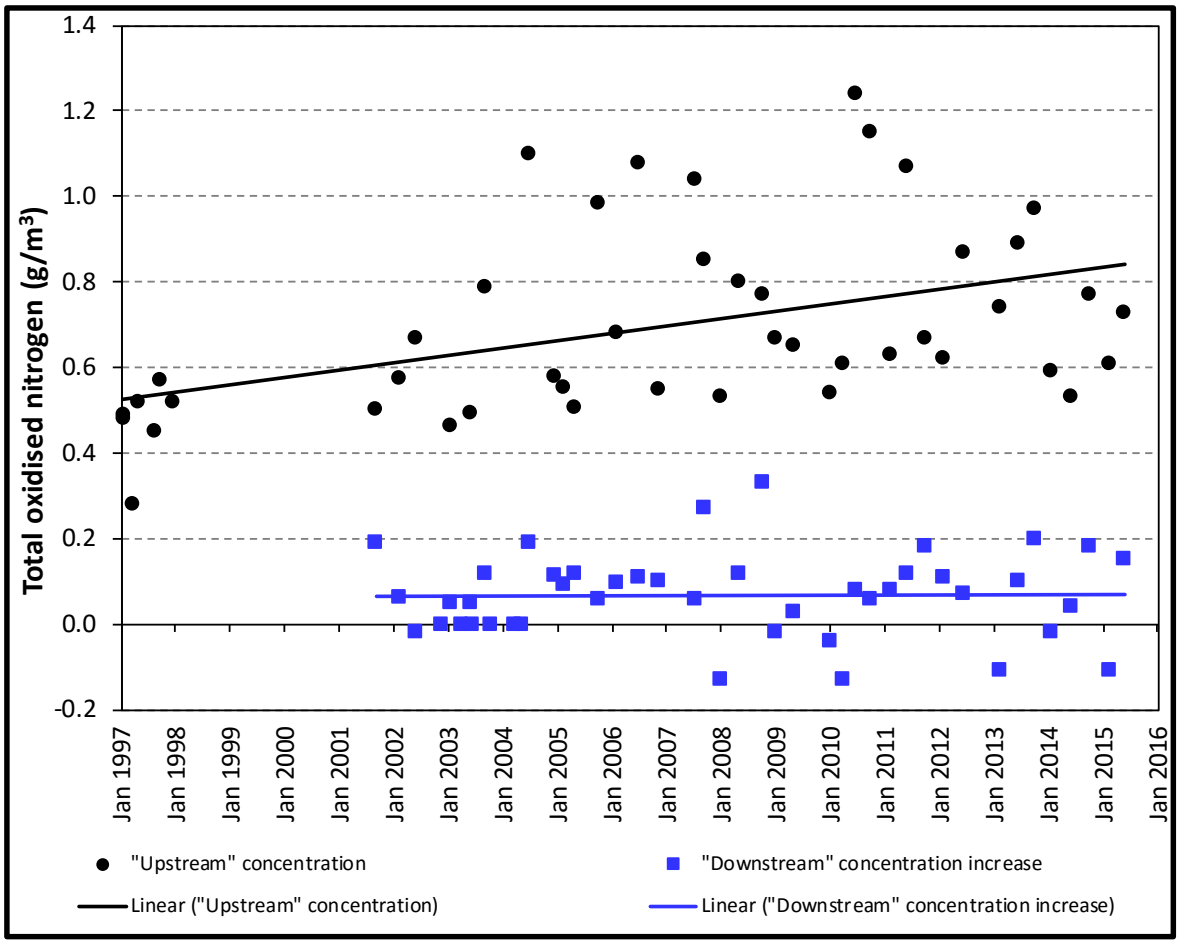


Figure 2.
Total oxidised nitrogen concentration in the Waimiha Stream at the Upstream sampling site (1997 to 2015) and the increase in concentration at the Downstream site (2001 to 2015).

2.7 Soil Monitoring

Soil sampling and soil infiltration measurements were undertaken on 19 and 20 November 2014. The report on this work is attached in Appendix 5.

Soil test results to date (Figure 3 and Figure 4) show trends that are beneficial to production, such as increases in soil nitrogen, phosphorus and organic matter. However, for most parameters no significant effects of the irrigation can be established with the available data. There is no indication that the effluent irrigation is having any adverse effects on soil quality.

The most notable effect of the irrigation is an increase in soil Olsen P levels. Phosphorus applied in excess of plant requirements tends to accumulate in the soil. The highest Olsen P levels are found in Te Hape block paddocks that had received effluent nitrogen loading rates of up to 800 kg N/ha.year prior to May 1993, and up to 400 kg N/ha.year from 1993 to 2000.

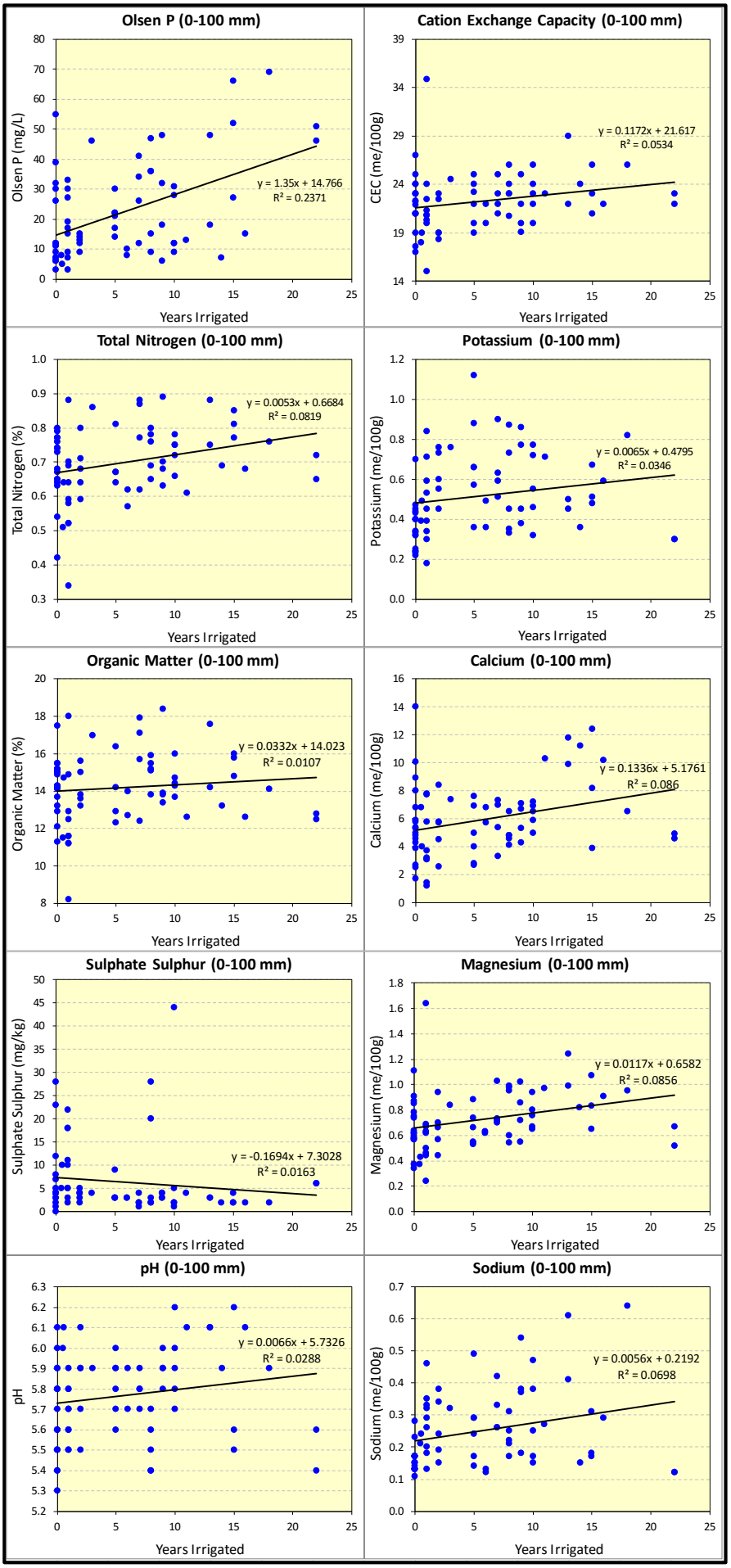


Figure 3.

Effect of the effluent irrigation on soil chemical properties (0-100 mm depth samples).

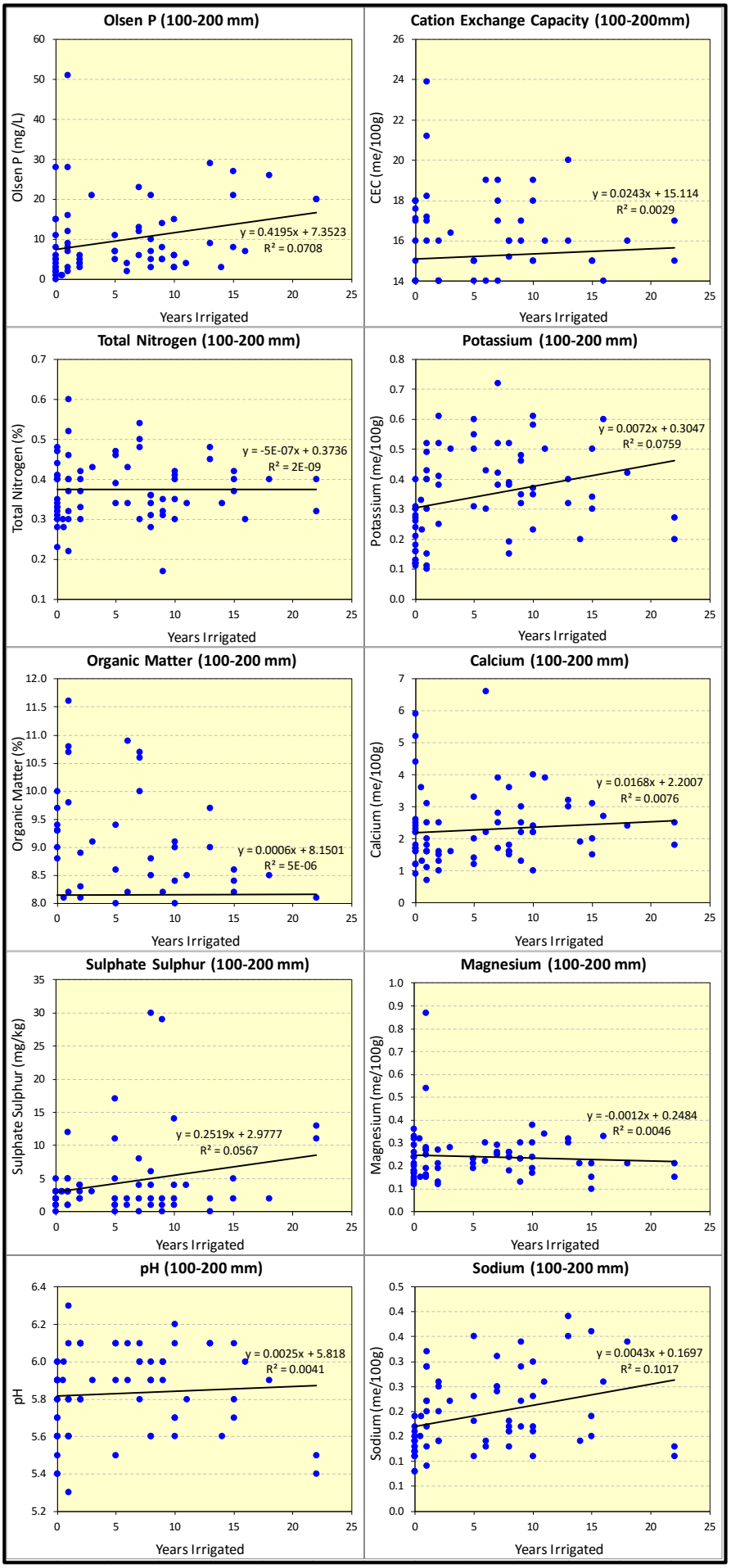


Figure 4.

Effect of the effluent irrigation on soil properties (100-200 mm depth samples).

2.8 Incidences of Non-Compliance

There were no incidences of non-compliance during the reporting period.

2.9 Regional Council Compliance Inspection Reports

A Regional Council Compliance Inspection report for the reporting period is given in Appendix 6.

3. Consents 100698 and 104934 – Water Take

3.1 New Water Source

Consent 104934 was granted on 7 September 2009 to take groundwater from a bore at rates of up to 72 m^3/hour, 1,500 m^3/day and 547,500 m^3/year. The new bore, which became operational in January 2010, improves water quality and security of supply, and provides for a possible future increase in production at the site.

3.2 Water Usage

Plant daily water take data for the reporting period are given in the table below. The maximum daily water take volume from the Waimiha Stream under consent 100698 was 139 m^3, which complies with the maximum permitted volume of 900 m^3.

The maximum daily abstraction rate for groundwater was 940 m^3, which complies with the maximum permitted volume of 1,500 m^3.

Crusader Meats New Zealand Ltd
Water Usage

Year: 2014-2015

Day	Jun		Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May	
	Bore	River	Bore	River	Bore	River	Bore	River	Bore	River	Bore	River	Bore	River	Bore	River	Bore	River	Bore	River	Bore	River	Bore	River
1	144	0	786	0.0	635	0.0	619	0	779	48.1	84	5.4	775	0.0	71	0.0	117		87	0	793	98	703	0
2	66	0	906	16.5	84	0.0	741	18	726	78.7	85	34.6	865	72.5	78	0.0	696		731	91	582	18	68	0
3	128	0	940	67.2	38	0.0	652	16	700	18.1	261	41.1	858	103.1	61	0.0	777		792	18	97	0	68	0
4	604	0.93	671	58.8	636	73.5	653	26	53	0.0	521	61.2	827	58.7	124	0.0	773		775	88	62	0	273	67
5	855	5.52	124	0.0	764	0.0	623	23	116	0.0	732	0.0	683	75.2	738	0.0	783		786	45	68	0	612	40
6	702	0	69	0.0	755	0.0	63	0	559	44.0	764	0.0	67	0.0	760	0.0	57		793	34	104	36	744	76
7	153	0	309	0.9	778	11.7	93	0	767	17.4	607	25.6	133	0.0	813	42.4	44		54	0	636	51	767	89
8	157	0	849	17.4	759	20.6	580	0	821	16.4	83	57.2	704	38.0	818	44.7	112		115	63	746	43	661	0
9	353	21.98	807	20.7	77	0.0	607	18	849	18.6	125	51.0	781	32.6	839	56.4	705		751	93	729	51	72	0
10	810	110.5	879	22.1	116	0.0	786	0	660	73.2	586	19.5	765	48.7	724	81.9	792		778	56	319	0	70	0
11	872	53.82	788	0.0	656	0.0	767	38	48	0.0	529	0.0	763	31.0	131	0.0	770		795	32	58	0	311	0
12	859	0.01	60	0.0	712	0.0	567	16	111	0.0	690	0.0	817	8.9	756	35.5	784		782	16	56	0	637	0
13	725	63.84	65	0.0	705	0.0	62	0	612	0.0	234	0.0	59	0.0	818	33.7	685		707	40	138	16	788	45
14	82	0	189	31.7	743	0.0	75	0	716	63.7	78	0.0	123	0.0	824	52.7	654		54	0	599	30	795	68
15	63	0	734	15.5	607	0.0	641	18	778	79.5	63	0.0	743	86.5	811	76.9	111		121	18	697	17	750	35
16	273	15.06	722	31.0	70	0.0	574	21	823	18.1	24	0.0	850	62.1	723	119.6	754		741	79	653	63	60	0
17	682	60.26	716	28.0	75	0.0	577	0	808	75.2	0	0.0	861	52.6	705	48.4	783		792	50	301	0	77	0
18	594	0	725	22.4	605	0.6	622	17	85	0.0	0	0.0	838	36.6	118	0.0	827	26	842	97	63	0	302	0
19	641	6.53	122	0.0	663	0.0	694	36	188	0.0	145	0.0	702	47.3	722	89.7	814	75	831	93	55	0	643	66
20	719	80.02	157	0.0	647	0.0	66	0	605	67.9	0	0.0	733	37.8	820	139.1	796	35	807	35	141	18	783	50
21	100	0	660	0.0	684	14.2	91	0	782	19.4	0	0.0	148	0.0	829	102.9	60	0	101	0	628	22	802	65
22	98	0	845	17.2	634	50.0	552	38	758	38.1	0	0.0	648	45.7	843	98.1	113	37	146	32	815	17	652	0
23	257	0	867	44.5	89	0.0	583	0	736	25.6	0	0.0	359	21.4	845	80.8	762	54	786	81	790	36	68	0
24	695	16.54	802	41.4	58	0.0	756	26	630	60.0	0	0.0	88	0.0	38	0.0	766	15	806	72	578	29	53	0
25	733	0	782	52.7	584	0.1	677	41	84	0.0	161	0.0	92	0.0	34	0.0	782	41	808	114	81	0	307	17
26	695	74.21	61	0.0	725	76.8	586	20	75	0.0	48	0.0	82	0.0	97	0.0	852	64	759	0	48	0	651	51
27	348	25.48	107	0.0	656	18.3	65	0	126	0.0	61	0.0	83	0.0	718	47.8	676	50	650	44	123	21	799	49
28	148	0	688	0.0	675	0.0	123	0	503	35.2	70	0.0	59	0.0	769	110.5	50	0	69	0	688	42	779	58
29	150	0	781	14.0	647	0.0	650	0	643	0.0	68	0.0	82	0.0	814	38.3			137	21	723	20	790	0
30	191	0	831	31.1	74	0.0	758	21	689	15.2	208	0.0	21	0.0	695	58.2			665	40	141	0	49	0
31			878	42.8	71	17.9			591	43.7				0.0	677	53.8			786	135			79	0
Total	12897	535	17920	576	15022	284	14903	393	16421	856	6227	296	14609	858	17813	1411	15895	397	17847	1487	11512	628	14213	776
Count	30	30	31	31	31	31	30	30	31	31	30	30	30	31	31	31	28	11	31	31	30	30	31	31
Mean	430	18	578	19	485	9	497	13	530	28	208	10	487	28	575	46	568	36	576	48	384	21	458	25
Max.	872	110	940	67	778	77	786	41	849	80	764	61	865	103	845	139	852	75	842	135	815	98	802	89

Appendix 1. Daily Irrigation Records

Crusader Meats NZ Ltd - Effluent Irrigation Records

Date	DoW	Start time	Hours pump	Volume pumped (m^3)	Total No. of Irrigators	Average flowrate (m^3/h)	Nit Conc. (g/m^3)	Irrigator 1		Irrigator 2		Irrigator 3		Irrigator 4		Irrigator 5		Irrigator 6		Irrigator 7		Irrigator 8		Irrigator 9		Irrigator 10		Irrigator 11		Irrigator 12		Irrigator 13		Irrigator 14		Irrigator 15		Irrigator 16		Irrigator 17		Irrigator 18	
								Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)
04/06/2014	Wed	12.30	17.5	887	9	50.7	59	T1	5.82	T1	5.82	T1	5.82	T1	5.82	T1	5.82	T1	5.82	T1	5.82	T1	5.82	T1	5.82																	
05/06/2014	Thu	11.50	17.5	879	9	50.2	59	T1	5.76	T1	5.76	T1	5.76	T1	5.76	T1	5.76	T1	5.76	T1	5.76	T1	5.76	T1	5.76																	
06/06/2014	Fri	10.40	17	889	9	52.3	59	T1	5.83	T1	5.83	T1	5.83	T1	5.83	T1	5.83	T1	5.83	T1	5.83	T1	5.83	T1	5.83																	
09/06/2014	Mon	12.30	17	887	9	52.2	59	T1	5.82	T1	5.82	T1	5.82	T1	5.82	T1	5.82	T1	5.82	T1	5.82	T1	5.82	T1	5.82																	
10/06/2014	Tue	12.50	17	879	9	51.7	59	T12	5.76	T12	5.76	T12	5.76	T12	5.76	T12	5.76	T13	5.76	T13	5.76	T13	5.76	T13	5.76																	
11/06/2014	Wed	11.00	17	876	9	51.5	59	T12	5.74	T12	5.74	T12	5.74	T12	5.74	T12	5.74	T13	5.74	T13	5.74	T13	5.74	T13	5.74																	
12/06/2014	Thu	10.45	17	877	9	51.6	59	T12	5.75	T12	5.75	T12	5.75	T12	5.75	T12	5.75	T13	5.75	T13	5.75	T13	5.75	T13	5.75																	
13/06/2014	Fri	10.25	17.5	898	9	51.3	59	T12	5.89	T12	5.89	T12	5.89	T12	5.89	T12	5.89	T12	5.89	T13	5.89	T13	5.89	T13	5.89																	
17/06/2014	Tue	10.40	17.5	886	9	50.6	59	T12	5.80	T12	5.80	T12	5.80	T12	5.80	T12	5.80	T12	5.80	T13	5.80	T13	5.80	T13	5.80																	
18/06/2014	Wed	12.50	17.5	877	9	50.1	59	T22	5.75	T22	5.75	T22	5.75	T22	5.75	T22	5.75	T22	5.75	T22	5.75	T22	5.75	T22	5.75																	
19/06/2014	Thu	11.25	18	893	9	49.6	59	T22	5.85	T22	5.85	T22	5.85	T22	5.85	T22	5.85	T22	5.85	T22	5.85	T22	5.85	T22	5.85																	
20/06/2014	Fri	11.00	18	889	9	49.4	59	T22	5.83	T22	5.83	T22	5.83	T22	5.83	T22	5.83	T22	5.83	T22	5.83	T22	5.83	T22	5.83																	
23/06/2014	Mon	12.00	18	896	9	49.8	59	T22	5.88	T22	5.88	T22	5.88	T22	5.88	T22	5.88	T22	5.88	T22	5.88	T22	5.88	T22	5.88																	
25/06/2014	Wed	10.00	17.5	879	9	50.2	59	T22	5.76	T22	5.76	T22	5.76	T22	5.76	T22	5.76	T22	5.76	T22	5.76	T22	5.76	T22	5.76																	
26/06/2014	Thu	2.50	18	898	9	49.9	59	T21	5.89	T21	5.89	T21	5.89	T21	5.89	T21	5.89	T21	5.89	T21	5.89	T21	5.89	T21	5.89																	
01/07/2014	Tue	2.20	18	896	9	49.8	78	T21	7.77	T21	7.77	T21	7.77	T21	7.77	T21	7.77	T21	7.77	T21	7.77	T21	7.77	T21	7.77																	
02/07/2014	Wed	10.25	17.5	891	9	50.9	78	T21	7.72	T21	7.72	T21	7.72	T21	7.72	T21	7.72	T21	7.72	T21	7.72	T21	7.72	T21	7.72																	
03/07/2014	Thu	2.35	17.5	887	9	50.7	78	T21	7.69	T21	7.69	T21	7.69	T21	7.69	T21	7.69	T21	7.69	T21	7.69	T21	7.69	T21	7.69																	
04/07/2014	Fri	11.10	17.5	879	9	50.2	78	T21	7.61	T21	7.61	T21	7.61	T21	7.61	T21	7.61	T21	7.61	T21	7.61	T21	7.61	T21	7.61																	
07/07/2014	Mon	12.45	18.5	886	9	47.9	78	T18	7.68	T18	7.68	T18	7.68	T18	7.68	T18	7.68	T18	7.68	T18	7.68	T18	7.68	T18	7.68																	
08/07/2014	Tue	12.30	19	893	9	47.0	78	T18	7.74	T18	7.74	T18	7.74	T18	7.74	T18	7.74	T18	7.74	T18	7.74	T18	7.74	T18	7.74																	
09/07/2014	Wed	11.35	19.5	899	9	46.1	78	T18	7.79	T18	7.79	T18	7.79	T18	7.79	T18	7.79	T18	7.79	T18	7.79	T18	7.79	T18	7.79																	
10/07/2014	Thu	12.30	19	899	9	47.3	78	T18	7.79	T18	7.79	T18	7.79	T18	7.79	T18	7.79	T18	7.79	T18	7.79	T18	7.79	T18	7.79																	
11/07/2014	Fri	9.30	20	896	9	44.8	78	T19	7.77	T19	7.77	T19	7.77	T19	7.77	T19	7.77	T19	7.77	T19	7.77	T19	7.77	T19	7.77																	
14/07/2014	Mon	11.00	19	855	9	45.0	78	T19	7.41	T19	7.41	T19	7.41	T19	7.41	T19	7.41	T19	7.41	T19	7.41	T19	7.41	T20	7.41																	
15/07/2014	Tue	10.15	19	857	9	45.1	78	T19	7.43	T19	7.43	T19	7.43	T19	7.43	T19	7.43	T19	7.43	T19	7.43	T19	7.43	T20	7.43																	
16/07/2014	Wed	1.30	10	442	9	44.2	78	T5	3.83	T5	3.83	T5	3.83	T5	3.83	T5	3.83	T5	3.83	T5	3.83	T5	3.83	T5	3.83																	
17/07/2014	Thu	9.50	20	890	9	44.5	78	T5	7.71	T5	7.71	T5	7.71	T5	7.71	T5	7.71	T5	7.71	T5	7.71	T5	7.71	T5	7.71																	
18/07/2014	Fri	10.25	10.5	459	9	43.7	78	T5	3.98	T5	3.98	T5	3.98	T5	3.98	T5	3.98	T5	3.98	T5	3.98	T5	3.98	T5	3.98																	
21/07/2014	Mon	11.10	19.5	881	9	45.2	78	T5	7.64	T5	7.64	T5	7.64	T5	7.64	T5	7.64	T5	7.64	T5	7.64	T5	7.64	T5	7.64																	
22/07/2014	Tue	2.00	18.5	895	9	48.4	78	T5	7.76	T5	7.76	T5	7.76	T8	7.76	T8	7.76	T10	7.76	T10	7.76	T11	7.76	T11	7.76																	
23/07/2014	Wed	11.00	18.5	899	9	48.6	78	T6	7.79	T6	7.79	T6	7.79	T8	7.79	T8	7.79	T10	7.79	T10	7.79	T11	7.79	T11	7.79																	
24/07/2014	Thu	10.10	21	880	9	41.9	78	T6	7.63	T6	7.63	T6	7.63	T8	7.63	T8	7.63	T10	7.63	T10	7.63	T11	7.63	T11	7.63																	
25/07/2014	Fri	10.45	21	874	9	41.6	78	T6	7.57	T6	7.57	T6	7.57	T6	7.57	T6	7.57	T10	7.57	T10	7.57	T11	7.57	T11	7.57																	
28/07/2014	Mon	2.30	20.5	886	9	43.2	78	T1	7.68	T1	7.68	T1	7.68	T1	7.68	T1	7.68	T10	7.68	T10	7.68	T4	7.68	T4	7.68																	
29/07/2014	Tue	11.50	17	891	9	52.4	78	T1	7.72	T1	7.72	T1	7.72	T1	7.72	T1	7.72	T1	7.72	T4	7.72	T4	7.72	T2	7.72																	
30/07/2014	Wed	12.15	17.5	894	9	51.1	78	T1	7.75	T1	7.75	T1	7.75	T1	7.75	T1	7.75	T1	7.75	T4	7.75	T4	7.75	T2	7.75																	
31/07/2014	Thu	10.00	17.5	894	9	51.1	78	T1	7.75	T1	7.75	T1	7.75	T1	7.75	T1	7.75	T1	7.75	T4	7.75	T4	7.75	T2	7.75																	
04/08/2014	Mon	10.20	17	893	9	52.5	88	T1	8.73	T1	8.73	T1	8.73	T1	8.73	T1	8.73	T1	8.73	T2	8.73	T2	8.73	T4	8.73																	
05/08/2014	Tue	10.00	17	893	9	52.5	88	T1	8.73	T1	8.73	T1	8.73	T1	8.73	T1	8.73	T1	8.73	T2	8.73	T2	8.73	T4	8.73																	
06/08/2014	Wed	12.10	17	884	9	52.0	88	T1	8.64	T1	8.64	T1	8.64	T1	8.64	T1	8.64	T1	8.64	T4	8.64	T4	8.64	T4	8.64																	
07/08/2014	Thu	12.00	17	893	9	52.5	88	T12	8.73	T12	8.73	T12	8.73	T12	8.73	T12	8.73	T14	8.73	T14	8.73	T14	8.73	T14	8.73																	
08/08/2014	Fri	1.15	17	884	9	52.0	88	T12	8.64	T12	8.64	T12	8.64	T12	8.64	T12	8.64	T14	8.64	T14	8.64	T14	8.64	T14	8.64																	
11/08/2014	Mon	12.10	17	881	9	51.8	88	T12	8.61	T12	8.61	T12	8.61	T12	8.61	T12	8.61	T14	8.61	T14	8.61	T14	8.61	T14	8.61																	
12/08/2014	Tue	1.15	18.5	899	9	48.6	88	T12	8.79	T12	8.79	T12	8.79	T12	8.79	T12	8.79	T14	8.79	T14	8.79	T14	8.79	T14	8.79																	
13/08/2014	Wed	11.10	18	886	9	49.2	88	T12	8.66	T12	8.66	T12	8.66	T12	8.66	T12	8.66	T14	8.66	T14	8.66	T14	8.66	T14	8.66																	
14/08/2014	Thu	10.30	18	884	9	49.1	88	T12	8.64	T12	8.64	T12	8.64	T12	8.64	T12	8.64	T14	8.64	T14	8.64	T14	8.64	T14	8.64																	
18/08/2014	Mon	10.50	18	893	9	49.6	88	T12	8.73	T12	8.73	T12	8.73	T12	8.73	T12	8.73	T14	8.73	T14	8.73	T14	8.73	T14	8.73																	
19/08/2014	Tue	10.15	18	886	9	49.2	88	T12	8.66	T12	8.66	T12	8.66	T12	8.66	T12	8.66	T12	8.66	T12	8.66	T12	8.66	T12	8.66																	
20/08/2014	Wed	12.10	19.5	889	9	45.6	88	T14	8.69	T14	8.69	T15	8.69	T16	8.69	T17	8.69	T17	8.69	T17	8.69	T17	8.69	T17	8.69																	
21/08/2014	Thu	10.35	20	898	9	44.9	88	T14	8.78	T14	8.78	T15	8.78	T16	8.78	T17	8.78	T17	8.78	T17	8.78	T17	8.78	T17	8.78																	
25/08/2014	Mon	11.10	20	900	9	45.0	88	T14	8.80	T14	8.80	T15	8.80	T16	8.80	T17	8.80	T17	8.80	T17	8.80	T17	8.80	T17	8.80																	
26/08/2014	Tue	10.50	20	900	9	45.0	88	T15	8.80	T15	8.80	T16	8.80	T16	8.80	T17	8.80	T17	8.80	T17	8.80	T17	8.80	T17	8.80																	
27/08/2014	Wed	11.00	20	896	9	44.8	88	T17	8.76	T17	8.76	T17	8.76	T17	8.76	T17	8.76	T17	8.76	T17	8.76	T17	8.76	T17	8.76																	
29/08/2014	Fri	10.10	19.5	879	9	45.1	88	T17	8.60	T17	8.60	T17	8.60	T17	8.60	T17	8.60	T17	8.60	T17	8.60	T17	8.60	T17	8.60																	
02/09/2014	Tue	1.10	17.5	877	9	50.1	89	T21	8.67	T21	8.67	T21	8.67	T21	8.67	T21	8.67	T21	8.67	T21	8.67	T21	8.67	T21	8.67																	
03/09/2014	Wed	10.15	17.5	882	9	50.4	89	T21	8.72	T21	8.72	T21	8.72	T21	8.72	T21	8.72	T21	8.72	T21	8.72	T21	8.72	T21	8.72																	
04/09/2014	Thu	9.55	17.5	877	9	50.1	89	T21	8.67	T21	8.67	T21	8.67	T21	8.67	T21	8.67	T21	8.67	T21	8.67	T21	8.67	T21	8.67																	
08/09/2014	Mon	11.00	17	840	9	49.4	89	T21	8.30	T21	8.30	T21	8.30	T21	8.30	T21	8.30	T21	8.30	T21	8.30	T21	8.30	T21	8.30																	
10/09/2014	Wed	10.00	17.5	872	9	49.8	89	T21	8.62	T21	8.62	T21	8.62	T21	8.62	T21	8.62	T21	8.62	T21	8.62	T21	8.62	T21	8.62																	
11/09/2014	Thu	9.50	17.5	861	9	49.2	89	T21	8.51	T21	8.51	T21	8.51	T21	8.51	T21	8.51	T21	8.51	T21	8.51	T21	8.51	T21	8.51																	
12/09/2014	Fri	9.25	17.5	858	9	49.0	89	T21	8.48	T21	8.48	T21	8.48	T21	8.48	T21	8.48	T21	8.48	T21	8.48	T21	8.48	T21	8.48																	
15/09/2014	Mon	12.15	18	887	9	49.3	89	T22	8.78	T22	8.78	T22	8.78	T22	8.78	T22	8.78	T22	8.78	T22	8.78	T22	8.78	T22	8.78																	
16/09/2014	Tue	12.25	18	882	9	49.0	89	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72																	
18/09/2014	Thu	12.00	18	882	9	49.0	89	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72																	
19/09/2014	Fri	12.00	18	882	9	49.0	89	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72	T22	8.72																	
22/09/2014	Mon	10.15	18	887	9	49.3	89	T18	8.78	T18	8.78	T18	8.78	T18	8.78	T18	8.78	T19	8.78	T19	8.78	T19	8.78	T19	8.78																	
23/09/2014	Tue	12.30	18	884	9	49.1	89	T18	8.74	T18	8.74	T18	8.74	T18	8.74	T18	8.74	T19	8.74	T19	8.74	T19	8.74	T19	8.74																	
24/09/2014	Wed	10.05	18	896	9	49.8	89	T18	8.86	T18	8.86	T18	8.86	T18	8.86	T18	8.86	T19	8.86	T19	8.86	T19	8.86	T19	8.86																	

Crusader Meats NZ Ltd - Effluent Irrigation Records

Date	DoW	Start time	Hours pump	Volume pumped (m^3)	Total No. of Irrigators	Average flowrate (m^3/h)	Nit Conc. (g/m^3)	Irrigator 1		Irrigator 2		Irrigator 3		Irrigator 4		Irrigator 5		Irrigator 6		Irrigator 7		Irrigator 8		Irrigator 9		Irrigator 10		Irrigator 11		Irrigator 12		Irrigator 13		Irrigator 14		Irrigator 15		Irrigator 16		Irrigator 17		Irrigator 18	
								Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)
25/09/2014	Thu	2.10	18.5	888	9	48.0	89	T18	8.78	T18	8.78	T18	8.78	T18	8.78	T18	8.78	T19	8.78	T19	8.78	T19	8.78	T19	8.78																
29/09/2014	Mon	11.15	18.5	886	9	47.9	89	T18	8.76	T18	8.76	T18	8.76	T18	8.76	T18	8.76	T19	8.76	T19	8.76	T19	8.76	T19	8.76																
30/09/2014	Tue	1.50	19	899	9	47.3	89	T18	8.89	T18	8.89	T18	8.89	T18	8.89	T18	8.89	T18	8.89	T18	8.89	T18	8.89	T18	8.89																
01/10/2014	Wed	11.10	18.5	897	9	48.5	112	T18	11.17	T18	11.17	T18	11.17	T18	11.17	T18	11.17	T18	11.17	T19	11.17	T19	11.17	T19	11.17																
02/10/2014	Thu	2.00	18	900	9	50.0	112	T18	11.20	T18	11.20	T18	11.20	T18	11.20	T18	11.20	T18	11.20	T4	11.20	T4	11.20	T4	11.20																
03/10/2014	Fri	3.00	15	722	9	48.1	112	T18	8.98	T18	8.98	T18	8.98	T18	8.98	T18	8.98	T18	8.98	T4	8.98	T4	8.98	T4	8.98																
06/10/2014	Mon	3.30	18	862	9	47.9	112	T18	10.73	T18	10.73	T1	10.73	T1	10.73	T1	10.73	T1	10.73	T4	10.73	T4	10.73	T4	10.73																
07/10/2014	Tue	11.00	18.5	882	9	47.7	112	T10	10.98	T10	10.98	T1	10.98	T1	10.98	T1	10.98	T1	10.98	T4	10.98	T4	10.98	T4	10.98																
08/10/2014	Wed	12.55	17.5	893	9	51.0	112	T10	11.11	T10	11.11	T10	11.11	T10	11.11	T11	11.11	T1	11.11	T4	11.11	T4	11.11	T4	11.11																
09/10/2014	Thu	11.00	17.5	891	9	50.9	112	T10	11.08	T10	11.08	T10	11.08	T10	11.08	T11	11.08	T2	11.08	T2	11.08	T4	11.08	T4	11.08																
10/10/2014	Fri	10.10	17	884	9	52.0	112	T10	11.00	T10	11.00	T10	11.00	T10	11.00	T11	11.00	T2	11.00	T2	11.00	T4	11.00	T4	11.00																
13/10/2014	Mon	2.00	17	891	9	52.4	112	T10	11.09	T10	11.09	T10	11.09	T10	11.09	T11	11.09	T1	11.09	T1	11.09	T1	11.09	T1	11.09																
14/10/2014	Tue	10.50	17	881	9	51.8	112	T10	10.96	T10	10.96	T10	10.96	T10	10.96	T11	10.96	T1	10.96	T1	10.96	T1	10.96	T1	10.96																
15/10/2014	Wed	1.00	9	439	9	48.8	112	T3	5.47	T3	5.47	T3	5.47	T3	5.47	T3	5.47	T3	5.47	T3	5.47	T5	5.47	T5	5.47																
16/10/2014	Thu	10.40	18.5	888	9	48.0	112	T3	11.05	T3	11.05	T3	11.05	T3	11.05	T3	11.05	T3	11.05	T3	11.05	T5	11.05	T5	11.05																
20/10/2014	Mon	9.30	18.5	888	9	48.0	112	T3	11.05	T3	11.05	T3	11.05	T3	11.05	T3	11.05	T3	11.05	T3	11.05	T5	11.05	T5	11.05																
21/10/2014	Tue	9.30	18.5	881	9	47.6	112	T3	10.96	T3	10.96	T3	10.96	T3	10.96	T3	10.96	T3	10.96	T3	10.96	T3	10.96	T3	10.96																
22/10/2014	Wed	1.30	18	893	9	49.6	112	T8	11.11	T8	11.11	T10	11.11	T10	11.11	T10	11.11	T13	11.11	T13	11.11	T13	11.11	T13	11.11																
23/10/2014	Thu	12.15	19.5	883	9	45.3	112	T8	10.99	T8	10.99	T10	10.99	T10	10.99	T10	10.99	T13	10.99	T13	10.99	T13	10.99	T13	10.99																
24/10/2014	Fri	12.00	19	878	9	46.2	112	T8	10.92	T8	10.92	T10	10.92	T10	10.92	T10	10.92	T13	10.92	T13	10.92	T13	10.92	T13	10.92																
27/10/2014	Mon	12.30	17	780	9	45.9	112	T8	9.71	T8	9.71	T21	9.71	T21	9.71	T21	9.71	T13	9.71	T13	9.71	T13	9.71	T13	9.71																
29/10/2014	Wed	10.30	19.5	899	9	46.1	112	T8	11.19	T8	11.19	T21	11.19	T21	11.19	T21	11.19	T13	11.19	T13	11.19	T13	11.19	T13	11.19																
30/10/2014	Thu	12.30	19	889	9	46.8	112	T21	11.07	T21	11.07	T21	11.07	T21	11.07	T21	11.07	T21	11.07	T21	11.07	T21	11.07	T21	11.07																
03/11/2014	Mon	9.50	19	880	9	46.3	112	T21	10.95	T21	10.95	T21	10.95	T21	10.95	T21	10.95	T21	10.95	T21	10.95	T21	10.95	T21	10.95																
05/11/2014	Wed	9.30	18.5	895	9	48.4	112	T21	11.14	T21	11.14	T21	11.14	T21	11.14	T21	11.14	T21	11.14	T21	11.14	T21	11.14	T21	11.14																
06/11/2014	Thu	11.00	18.5	890	9	48.1	112	T21	11.07	T21	11.07	T21	11.07	T21	11.07	T21	11.07	T21	11.07	T21	11.07	T21	11.07	T21	11.07																
07/11/2014	Fri	9.20	18.5	860	9	46.5	112	T21	10.71	T21	10.71	T21	10.71	T21	10.71	T21	10.71	T21	10.71	T21	10.71	T21	10.71	T21	10.71																
10/11/2014	Mon	14.45	18.5	882	9	47.7	112	T22	10.98	T22	10.98	T22	10.98	T22	10.98	T22	10.98	T22	10.98	T22	10.98	T22	10.98	T22	10.98																
11/11/2014	Tue	12.30	2	99	9	49.7	112	T22	1.24	T22	1.24	T22	1.24	T22	1.24	T22	1.24	T22	1.24	T22	1.24	T22	1.24	T22	1.24																
12/11/2014	Wed	9.30	18	893	9	49.6	112	T22	11.11	T22	11.11	T22	11.11	T22	11.11	T22	11.11	T22	11.11	T22	11.11	T22	11.11	T22	11.11																
13/11/2014	Thu	10.00	18	895	9	49.7	112	T22	11.13	T22	11.13	T22	11.13	T22	11.13	T22	11.13	T22	11.13	T22	11.13	T22	11.13	T22	11.13																
02/12/2014	Tue	3.00	19	802	18	42.2	129	T17	5.75	T17	5.75	T17	5.75	T17	5.75	T17	5.75	T17	5.75	T17	5.75	T17	5.75	T17	5.75	T17	5.75	T17	5.75	T17	5.75	T17	5.75	T17	5.75	T17	5.75	T14	5.75	T14	5.75
03/12/2014	Wed	9.00	20	870	18	43.5	129	T17	6.24	T17	6.24	T17	6.24	T17	6.24	T17	6.24	T17	6.24	T17	6.24	T17	6.24	T17	6.24	T17	6.24	T17	6.24	T17	6.24	T17	6.24	T17	6.24	T17	6.24	T14	6.24	T14	6.24
04/12/2014	Thu	2.00	15	353	10	23.5	129	T17	4.55	T17	4.55	T17	4.55	T17	4.55	T17	4.55	T17	4.55	T17	4.55	T17	4.55	T17	4.55	T17	4.55														
08/12/2014	Mon	9.30	20	872	18	43.6	129	T17	6.25	T17	6.25	T17	6.25	T17	6.25	T17	6.25	T17	6.25	T17	6.25	T17	6.25	T17	6.25	T17	6.25	T17	6.25	T17	6.25	T17	6.25	T17	6.25	T17	6.25	T14	6.25	T14	6.25
09/12/2014	Tue	7.30	20	894	18	44.7	129	T17	6.41	T17	6.41	T17	6.41	T17	6.41	T17	6.41	T17	6.41	T17	6.41	T17	6.41	T17	6.41	T17	6.41	T17	6.41	T17	6.41	T17	6.41	T17	6.41	T17	6.41	T14	6.41	T14	6.41
10/12/2014	Wed	10.30	19	878	18	46.2	129	T17	6.29	T17	6.29	T17	6.29	T17	6.29	T17	6.29	T17	6.29	T17	6.29	T17	6.29	T17	6.29	T17	6.29	T17	6.29	T17	6.29	T17	6.29	T17	6.29	T17	6.29	T14	6.29	T14	6.29
12/12/2014	Fri	1.30	20	880	18	44.0	129	T17	6.31	T17	6.31	T17	6.31	T17	6.31	T17	6.31	T17	6.31	T17	6.31	T17	6.31	T17	6.31	T17	6.31	T17	6.31	T17	6.31	T17	6.31	T17	6.31	T17	6.31	T14	6.31	T14	6.31
15/12/2014	Mon	3.00	20	888	18	44.4	129	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T3	6.36	T3	6.36	T3	6.36	T3	6.36
16/12/2014	Tue	10.00	18	895	18	49.7	129	T1	6.41	T1	6.41	T1	6.41	T1	6.41	T1	6.41	T1	6.41	T1	6.41	T1	6.41	T1	6.41	T1	6.41	T1	6.41	T1	6.41	T1	6.41	T3	6.41	T3	6.41	T3	6.41	T3	6.41
17/12/2014	Wed	12.30	17	893	18	52.5	129	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T3	6.40	T3	6.40	T3	6.40	T3	6.40
18/12/2014	Thu	11.00	17	898	18	52.8	129	T1	6.43	T1	6.43	T1	6.43	T1	6.43	T1	6.43	T1	6.43	T1	6.43	T1	6.43	T1	6.43	T1	6.43	T1	6.43	T1	6.43	T1	6.43	T3	6.43	T3	6.43	T3	6.43	T3	6.43
19/12/2014	Fri	11.00	18	887	18	49.3	129	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T3	6.36	T3	6.36	T3	6.36	T3	6.36
22/12/2014	Mon	11.00	18	887	18	49.3	129	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T1	6.36	T3	6.36	T3	6.36	T3	6.36	T3	6.36
23/12/2014	Tue	1.00	19	893	18	47.0	129	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T1	6.40	T3	6.40	T3	6.40	T3	6.40	T3	6.40
24/12/2014	Wed	7.30	18	884	18	49.1	129	T1	6.33	T1	6.33	T1	6.33	T1	6.33	T1	6.33	T1	6.33	T1	6.33	T1	6.33	T1	6.33	T1	6.33	T1	6.33	T1	6.33	T1	6.33	T3	6.33	T3	6.33	T3	6.33	T3	6.33
05/01/2015	Mon	11.00	18	898	18	49.9	121	T12	6.04	T12	6.04	T12	6.04	T12	6.04	T2	6.04	T2	6.04	T2	6.04	T5	6.04	T5	6.04	T5	6.04	T5	6.04	T5	6.04	T5	6.04	T5	6.04	T5	6.04	T5	6.04	T5	6.04	T5	6.04
06/01/2015	Tue	1.00	18	896	18	49.8	121	T12	6.03	T12	6.03	T12	6.03	T12	6.03	T2	6.03	T2	6.03	T2	6.03	T5	6.03	T5	6.03	T5	6.03	T5	6.03	T5	6.03	T5	6.03	T5	6.03	T5	6.03	T5	6.03	T5	6.03	T5	6.03
08/01/2015	Thu	9.30	17	870	18	51.2	121	T12	5.85	T12	5.85	T12	5.85	T12	5.85	T2	5.85	T2	5.85	T2	5.85	T5	5.85	T5	5.85	T5	5.85	T5	5.85	T5	5.85	T5	5.85	T5	5.85	T5	5.85	T5	5.85	T5	5.85	T5	5.85
09/01/2015	Fri	10.00	17	852	18	50.1	121	T12	5.73	T12	5.73	T12	5.73	T12	5.73	T2	5.73	T2	5.73	T2	5.73	T2	5.73	T2	5.73	T2	5.73	T2	5.73	T2	5.73	T2	5.73	T2	5.73	T2	5.73	T2	5.73	T2	5.73	T2	5.73
10/01/2015	Sat	12.00	18	880	18	48.9	121	T3	5.92	T3	5.92	T3	5.92	T3	5.92	T3	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92
12/01/2015	Mon	12.00	18	880	18	48.9	121	T3	5.92	T3	5.92	T3	5.92	T3	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92	T4	5.92
13/01/2015	Tue	10.00	18	862	18	47.9	121	T3	5.80	T3	5.80	T3	5.80	T3	5.80	T4	5.80	T4	5.80	T4	5.80	T4	5.80	T4	5.80	T4	5.80	T4	5.80	T4	5.80	T4	5.80	T4	5.80	T4	5.80	T4	5.80	T4	5.80	T4	5.80
14/01/2015	Wed	12.00	18	857	18	47.6	121	T3	5.76	T3	5.76	T3	5.76	T3	5.76	T4	5.76	T4	5.76	T4	5.76	T4	5.76	T4	5.76	T4	5.76	T4	5.76	T4	5.76	T4	5.76	T4	5.76	T4	5.76	T4	5.76	T4	5.76	T4	5.76
16/01/2015	Fri	11.30	17	898	18	52.8	121	T3	6.03	T3	6.03	T3	6.03	T3	6.03	T4	6.03	T4	6.03	T4	6.03	T4	6.03	T4	6.03	T4	6.03	T4	6.03	T4	6.03	T4	6.03	T4	6.03	T4	6.03	T4	6.03	T4	6.03	T4	6.03
17/01/2015	Sat	12.00	17	882	18	51.9	121	T3	5.93	T3	5.93	T3	5.93	T3	5.93	T4	5.93	T4	5.93	T4	5.93	T4	5.93	T4	5.93	T4	5.93	T4	5.93	T4	5.93	T4	5.93	T4	5.93	T4	5.93	T4	5.93	T4	5.93	T4	5.93
20/01/2015	Tue	9.00	17	886	18	52.1	121	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95	H14	5.95
22/01/2015	Thu	12.30	16	611	18	38.2	121	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11	H14	4.11
23/01/2015	Fri	9.00	18	869	18	48.3	121	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84	H14	5.84
24/01/2015	Sat	11.00	18	877	18	48.7	121	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89	H14	5.89
27/01/2015	Tue	11.00	18	884	18	49.1	121	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94	H14	5.94
28/01/2015	Wed	11.30	20	870	18	43.5	121	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85	H14	5.85
29/01/2015	Thu	1.00	20	886	18	44.3	121	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96	H14	5.96
30/01/2015	Fri	1.00	20	854	18	42.7	121	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74	H14	5.74
31/01/2015	Sat	8.00	20	862	18	43.1	121	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79	H14	5.79
02/02/2015	Mon	11.00	18	868	18	48.2	140	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75	H14	6.75
03/02/2015	Tue	12.00	20	876	18	43.8	140	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81	H14	6.81
04/02/2015	Wed	12.00	20	892	18	44.6	140	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94	H14	6.94
05/02/2015	Thu	12.00	20	878	18	43.9	140	H14	6.83	H14	6.83	H14	6.83	H14	6.83	H14	6.83	H14	6.83	H14	6.83	H14	6.83	H4	6.83	H4	6.83	H4	6.83	H4	6.83	H4	6.83	H4	6.83	H4	6.83	H4	6.83	H4	6.83	H4	6.83

Crusader Meats NZ Ltd - Effluent Irrigation Records

Date	DoW	Start time	Hours pump	Volume pumped (m^3)	Total No. of Irrigators	Average flowrate (m^3/h)	Nit Conc. (g/m^3)	Irrigator 1		Irrigator 2		Irrigator 3		Irrigator 4		Irrigator 5		Irrigator 6		Irrigator 7		Irrigator 8		Irrigator 9		Irrigator 10		Irrigator 11		Irrigator 12		Irrigator 13		Irrigator 14		Irrigator 15		Irrigator 16		Irrigator 17		Irrigator 18	
								Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)	Site	N (kg)
10/02/2015	Tue	8.30	20	864	18	43.2	140	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72
11/02/2015	Wed	9.30	20	900	18	45.0	140	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00	H4	7.00
13/02/2015	Fri	3.00	20	892	18	44.6	140	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94	H4	6.94
16/02/2015	Mon	11.00	18	864	18	48.0	140	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72	H4	6.72
17/02/2015	Tue	10.30	20	882	18	44.1	140	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86	H4	6.86
18/02/2015	Wed	12.00	19	876	18	46.1	140	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81	H4	6.81
19/02/2015	Thu	11.00	20	896	18	44.8	140	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97	H4	6.97
20/02/2015	Fri	2.00	19	868	18	45.7	140	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75	H3	6.75
23/02/2015	Mon	11.00	20	864	18	43.2	140	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72	H3	6.72
24/02/2015	Tue	8.30	20	862	18	43.1	140	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70	H3	6.70
25/02/2015	Wed	11.00	21	888	18	42.3	140	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91	H3	6.91
26/02/2015	Thu	11.00	21	884	18	42.1	140	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88	H3	6.88
27/02/2015	Fri	11.00	20	860	18	43.0	140	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69	H3	6.69
02/03/2015	Mon	3.30	18	860	18	47.8	138	H3	6.60	H3	6.60	H3	6.60	H3	6.60	H3	6.60	H3	6.60	H3	6.60	H3	6.60	T6	6.60	T6	6.60	T6	6.60	T6	6.60	T6	6.60	T6	6.60	T6	6.60	T6	6.60	T6	6.60
03/03/2015	Tue	3.00	19	899	18	47.3	138	H3	6.89	H3	6.89	H3	6.89	H3	6.89	H3	6.89	H3	6.89	H3	6.89	H3	6.89	T6	6.89	T6	6.89	T6	6.89	T6	6.89	T6	6.89	T6	6.89	T6	6.89	T6	6.89	T6	6.89
04/03/2015	Wed	3.30	19	899	18	47.3	138	H3	6.89	H3	6.89	H3	6.89	H3	6.89	H3	6.89	H3	6.89	T6	6.89	T6	6.89	T6	6.89	T6	6.89	T6	6.89	T8	6.89	T8	6.89	T8	6.89	T6	6.89	T6	6.89	T6	6.89
05/03/2015	Thu	3.00	19	895	18	47.1	138	T11	6.86	T11	6.86	T6	6.86	T11	6.86	T6	6.86	T6	6.86	T6	6.86	T6	6.86	T6	6.86	T6	6.86	T6	6.86	T8	6.86	T8	6.86	T8	6.86	T8	6.86	T8	6.86	T8	6.86
06/03/2015	Fri	3.00	19	897	18	47.2	138	T11	6.88	T11	6.88	T11	6.88	T6	6.88	T6	6.88	T6	6.88	T6	6.88	T6	6.88	T6	6.88	T6	6.88	T6	6.88	T8	6.88	T8	6.88	T8	6.88	T8	6.88	T8	6.88	T8	6.88
10/03/2015	Tue	2.00	19	868	18	45.7	138	T11	6.66	T11	6.66	T11	6.66	T6	6.66	T6	6.66	T6	6.66	T6	6.66	T6	6.66	T6	6.66	T6	6.66	T6	6.66	T6	6.66	T6	6.66	T6	6.66	T6	6.66	T8	6.66	T8	6.66
11/03/2015	Wed	2.30	19	866	18	45.6	138	T11	6.64	T11	6.64	T11	6.64	T11	6.64	T11	6.64	T11	6.64	T11	6.64	T11	6.64	T6	6.64	T6	6.64	T6	6.64	T6	6.64	T6	6.64	T6	6.64	T6	6.64	T8	6.64	T8	6.64
12/03/2015	Thu	2.30	19	861	18	45.3	138	T11	6.60	T11	6.60	T11	6.60	T11	6.60	T11	6.60	T11	6.60	T11	6.60	T11	6.60	T6	6.60	T6	6.60	T6	6.60	T6	6.60	T6	6.60	T6	6.60	T6	6.60	T8	6.60	T8	6.60
13/03/2015	Fri	2.30	20	896	18	44.8	138	T11	6.87	T11	6.87	T11	6.87	T11	6.87	T11	6.87	T11	6.87	T22	6.87	T22	6.87	T22	6.87	T22	6.87	T22	6.87	T22	6.87	T22	6.87	T22	6.87	T19	6.87	T19	6.87	T19	6.87
16/03/2015	Mon	12.30	19	865	18	45.5	138	T11	6.63	T11	6.63	T11	6.63	T11	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T19	6.63	T19	6.63	T19	6.63
17/03/2015	Tue	2.30	20	890	18	44.5	138	T11	6.82	T11	6.82	T11	6.82	T11	6.82	T22	6.82	T22	6.82	T22	6.82	T22	6.82	T22	6.82	T22	6.82	T22	6.82	T22	6.82	T22	6.82	T22	6.82	T19	6.82	T19	6.82	T19	6.82
19/03/2015	Thu	2.00	20	878	16	43.9	138					T11	7.57	T11	7.57	T22	7.57	T22	7.57	T22	7.57	T22	7.57	T22	7.57	T22	7.57	T22	7.57	T22	7.57	T22	7.57	T22	7.57	T19	7.57	T19	7.57	T19	7.57
20/03/2015	Fri	2.30	20	894	18	44.7	138	T11	6.85	T11	6.85	T11	6.85	T11	6.85	T22	6.85	T22	6.85	T22	6.85	T22	6.85	T22	6.85	T22	6.85	T22	6.85	T22	6.85	T22	6.85	T22	6.85	T19	6.85	T19	6.85	T19	6.85
23/03/2015	Mon	3.30	21	893	18	42.5	138	T22	6.84	T22	6.84	T22	6.84	T22	6.84	T22	6.84	T22	6.84	T22	6.84	T22	6.84	T22	6.84	T22	6.84	T22	6.84	T22	6.84	T22	6.84	T22	6.84	T19	6.84	T19	6.84	T19	6.84
24/03/2015	Tue	3.00	20	872	18	43.6	138	T22	6.69	T22	6.69	T22	6.69	T22	6.69	T22	6.69	T22	6.69	T22	6.69	T22	6.69	T22	6.69	T22	6.69	T22	6.69	T22	6.69	T22	6.69	T22	6.69	T19	6.69	T19	6.69	T19	6.69
25/03/2015	Wed	2.00	21	880	18	41.9	138	T22	6.75	T22	6.75	T22	6.75	T22	6.75	T22	6.75	T22	6.75	T22	6.75	T22	6.75	T22	6.75	T22	6.75	T22	6.75	T22	6.75	T22	6.75	T22	6.75	T19	6.75	T19	6.75	T19	6.75
26/03/2015	Thu	1.00	21	865	18	41.2	138	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T22	6.63	T19	6.63	T19	6.63	T19	6.63
27/03/2015	Fri	2.00	21	872	18	41.5	138	T22	6.68	T22	6.68	T22	6.68	T22	6.68	T22	6.68	T22	6.68	T22	6.68	T22	6.68	T22	6.68	T22	6.68	T22	6.68	T22	6.68	T22	6.68	T22	6.68	T19	6.68	T19	6.68	T19	6.68
30/03/2015	Mon	4.00	21	888	18	42.3	138	T22	6.81	T22	6.81	T22	6.81	T22	6.81	T22	6.81	T22	6.81	T22	6.81	T22	6.81	T22	6.81	T22	6.81	T22	6.81	T22	6.81	T22	6.81	T22	6.81	T19	6.81	T19	6.81	T19	6.81
31/03/2015	Tue	5.00	21	878	18	41.8	138	T22	6.73	T22	6.73	T22	6.73	T22	6.73	T22	6.73	T22	6.73	T22	6.73	T22	6.73	T22	6.73	T22	6.73	T22	6.73	T22	6.73	T22	6.73	T22	6.73	T19	6.73	T19	6.73	T19	6.73
01/04/2015	Wed	2.00	20	892	18	44.6	113	T22	5.60	T22	5.60	T22	5.60	T22	5.60	T22	5.60	T22	5.60	T22	5.60	T22	5.60	T22	5.60	T22	5.60	T22	5.60	T22	5.60	T22	5.60	T22	5.60	T19	5.60	T19	5.60	T19	5.60
02/04/2015	Thu	2.30	20	878	18	43.9	113	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51	T21	5.51
03/04/2015	Fri	2.30	20	874	18	43.7	113	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49	T21	5.49
07/04/2015	Tue	1.00	19	859	18	45.2	113	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39	T21	5.39
08/04/2015	Wed	1.00	19	868	18	45.7	113	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45	T21	5.45
10/04/2015	Fri	1.30	19	870	18	45.8	113	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46	T21	5.46
13/04/2015	Mon	12.00	19	866	18	45.6	113	T21	5.44	T21	5.44	T21	5.44	T21	5.44	T21	5.44	T21	5.44	T19	5.44	T19	5.44	T19	5.44	T18	5.44	T18	5.44	T18	5.44	T18	5.44	T18	5.44	T18	5.44	T18	5.44	T18	5.44
14/04/2015	Tue	3.00	19	857	18	45.1	113	T21	5.38	T21	5.38	T21	5.38	T21	5.38	T21	5.38	T21	5.38	T19	5.38	T19	5.38	T19	5.38	T18	5.38	T18	5.38	T18	5.38	T18	5.38	T18	5.38	T18	5.38	T18	5.38	T18	5.38
15/04/2015	Wed	12.00	20	892	18	44.6	113	T21	5.60	T21	5.60	T21	5.60	T21	5.60	T21	5.60	T21	5.60	T19	5.60	T19	5.60	T19	5.60	T18	5.60	T18	5.60	T18	5.60	T18	5.60	T18	5.60	T18	5.60	T18	5.60	T18	5.60
16/04/2015	Thu	3.00	20	884	18	44.2	113	T21	5.55	T21	5.55	T21	5.55	T21	5.55	T21	5.55	T21	5.55	T19	5.55	T19	5.55	T19	5.55	T18	5.55	T18	5.55	T18	5.55	T18	5.55	T18	5.55	T18	5.55	T18	5.55	T18	5.55
20/04/2015	Mon	8.00	20	882	18	44.1	113	T21	5.54	T21	5.54	T21	5.54	T21	5.54	T21	5.54	T21	5.54	T19	5.54	T19	5.54	T19	5.54	T18	5.54	T18	5.54	T18	5.54	T18	5.54	T18	5.54	T18	5.54	T18	5.54	T18	5.54
21/04/2015	Tue	1.30	20	888	18	44.4	113	T21	5.57	T21	5.57	T21	5.57	T21	5.57	T21	5.57	T21	5.57	T19	5.57	T19	5.57	T19	5.57	T18	5.57	T18	5.57	T18	5.57	T18	5.57	T18	5.57	T18	5.57	T18	5.57	T18	5.57
22/04/2015	Wed	9.00	20	890	18	44.5	113	T21	5.59	T21	5.59	T21	5.59	T21	5.59	T21	5.59	T21	5.59	T19	5.59	T19	5.59	T19	5.59	T18	5.59	T18	5.59	T18	5.59	T18	5.59	T18	5.59	T18	5.59	T18	5.59	T18	5.59
23/04/2015	Thu	2.30	19	868	18	45.7	113	T21	5.45	T21	5.45	T21	5.45	T18	5.45	T18	5.45	T18	5.45	T18	5.45	T18	5.45	T18	5.45	T18	5.45	T18	5.45	T18	5.45	T18	5.45	T18	5.45	T18	5.45	T18	5.45	T18	5.45
24/04/2015	Fri	3.00	19	870	18	45.8	113	T21	5.46	T21	5.46	T21	5.46	T18	5.46	T18	5.46	T18	5.46	T18	5.46	T18	5.46	T18	5.46	T18	5.46	T18	5.46	T18	5.46	T18	5.46	T18	5.46	T18	5.46	T18	5.46	T18	5.46	T18	5.46
28/04/2015	Tue	3.00	21	893	18	42.5	113	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60	T13	5.60
29/04/2015	Wed	1.30	19	859	18	45.2	113	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39	T13	5.39
30/04/2015	Thu	3.00	19	866	18	45.6	113	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44	T13	5.44
01/05/2015	Fri	3.00	19	865	18	45.5	114	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48	T13	5.48
06/05/2015	Wed	2.30	20	886	18	44.3	114	T13	5.61	T13	5.61	T13	5.61	T13	5.61	T13	5.61	T13	5.61	T13	5.61	T13	5.61	T13	5.61	T13	5.61	T13	5.61	T16	5.61	T16	5.61	T16	5.61	T16	5.61	T16	5.61	T16	5.61	T16	5.61
07/05/2015	Thu	8.00	19	895	18	47.1	114	T13	5.67	T13	5.67	T13	5.67	T13	5.67	T13	5.67	T13	5.67	T13	5.67	T13	5.67	T13	5.67	T13	5.67	T13	5.67	T16	5.67	T16	5.67	T16	5.67	T16	5.67	T16	5.67	T16	5.67	T16	5.67
12/05/2015	Tue	10.30	18	859	18	47.7	114	T15	5.44	T15	5.44	T15	5.44	T15	5.44	T15	5.44	T15	5.44	T15	5.44	T15	5.44	T15	5.44	T15	5.44	T15	5.44	T16	5.44	T16	5.44	T16	5.44	T16	5.44	T16	5.44	T16	5.44	T16	5.44
13/05/2015	Wed	10.30	18	857	18	47.6	114	T15	5.43	T15	5.43	T15	5.43	T15	5.43	T15	5.43	T15	5.43	T15	5.43	T15	5.43	T15	5.43	T15	5.43	T15	5.43	T16	5.43	T16	5.43	T16	5.43	T16	5.43	T16	5.43	T16	5.43	T16	5.43
14/05/2015	Thu	2.00	19	868	18	45.7	114	T15	5.50	T15	5.50	T15	5.50	T15	5.50	T15	5.50	T15	5.50	T15	5.50	T15	5.50	T15	5.50	T15	5.50	T15	5.50	T15	5.50	T15	5.50	T15	5.50	T16	5.50	T16	5.50	T16	5.50	T16	5.50
15/05/2015	Fri	2.00	19	870	18	45.8	114	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51	T15	5.51
19/05/2015	Tue	2.30	20	862	18	43.1	114	T15	5.46	T15	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46
20/05/2015	Wed	2.30	21	899	18	42.8	114	T15	5.69	T15	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69	T17	5.69
21/05/2015	Thu	8.00	20	862	18	43.1	114	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46
22/05/2015	Fri	2.30	20	886	18	44.3	114	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61	T17	5.61
25/05/2015	Mon	10.00	21	888	18	42.3	114	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63
26/05/2015	Tue	2.00	21	876	18	41.7	114	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55	T17	5.55
27/05/2015	Wed	11.00	21	874	18	41.6	114	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53	T17	5.53
28/05/2015	Thu	2.00	21	888	18	42.3	114	T16	5.63	T16	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63	T17	5.63
29/05/2015	Fri	3.00	20	862	18	43.1	114	T16	5.46	T16	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46	T17	5.46

Appendix 2. Characteristics of Irrigated Effluent

Characteristics of irrigated effluent.										
Month	Monthly tests		Six-monthly tests						12-mth average	
	TKN	COD	TP	K	Na	Ca	Mg	SAR	TKN	COD
	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³		g/m³	g/m³
Aug 2001	65	673								
Sep 2001	72	743								
Oct 2001	60	792								
Nov 2001	60.5	596								
Dec 2001	72.3	642								
Jan 2002	79.5	734								
Feb 2002	110	903								
Mar 2002	91	1350								
Apr 2002	123	1610	13.3	89.4	50.5	12.7	3.4	3.2		
May 2002	68	938							80	898
Jun 2002	110	1590								
Jul 2002	83	1350								
Aug 2002	76	998								
Sep 2002	84	1250								
Oct 2002	95	1400								
Nov 2002	79	792								
Dec 2002	103	1560								
Jan 2003	97	1440								
Feb 2003	123	1470	19.3	103	70.6	9.3	4.5	4.7		
Mar 2003	97	1200								
Apr 2003	87	1450								
May 2003	82	1100							93	1300
Jun 2003	97	1550								
Jul 2003	94	1470								
Aug 2003	142	1880	12.5	146	56.9	10	3.5	3.9		
Sep 2003	86	1250								
Oct 2003	133	2400								
Nov 2003	105	2060								
Dec 2003	65	885								
Jan 2004	94	1590								
Feb 2004	92	1490								
Mar 2004	104	2020								
Apr 2004	96	1850								
May 2004	100	1440							101	1657
Jun 2004	126	1790	10.9	115	44.2	9	3	3.3		
Jul 2004	110	3460								
Aug 2004	129	2320	17.7	135	55.5	9.9	3.6	3.8		
Sep 2004	98	1490	17.2	145	58.9	7.9	3.8	4.3		
Oct 2004	149	2390								
Nov 2004	138	1890								
Dec 2004	85	1660								
Jan 2005	108	1340								

Characteristics of irrigated effluent.										
Month	Monthly tests		Six-monthly tests						12-mth average	
	TKN	COD	TP	K	Na	Ca	Mg	SAR	TKN	COD
	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³		g/m³	g/m³
Feb 2005	131	1220	17.1	138	56.8	8.2	3.6	4.2		
Mar 2005	108	1280								
Apr 2005	102	1650								
May 2005	103	1960							116	1871
Jun 2005	186	1440								
Jul 2005	94	2310								
Aug 2005	125	1550	18	172	65	19	5	3.4		
Sep 2005	105	1420								
Oct 2005	124	1050								
Nov 2005	102	1020								
Dec 2005	77	990								
Jan 2006	102	1130								
Feb 2006	138	1600	18	164	59	12.2	4	3.7		
Mar 2006	112	1360								
Apr 2006	97	986								
May 2006	101	1900							114	1396
Jun 2006	111	1410								
Jul 2006	92	1340								
Aug 2006	105	1780	17.5	128	50.8	8.5	3.6	3.7		
Sep 2006	128	1520								
Oct 2006	115	1560								
Nov 2006	102	992								
Dec 2006	107	1760								
Jan 2007	128	1870								
Feb 2007	136	2620	17.1	134	62	9.4	3.4	4.4		
Mar 2007	107	1890								
Apr 2007	113	2080								
May 2007	97	1620							112	1704
Jun 2007	122	1610								
Jul 2007	86	1040								
Aug 2007	83	889	17	125	61.8	9.3	3.5	4.4		
Sep 2007	117	1840								
Oct 2007	134	1830								
Nov 2007	70	350								
Dec 2007	73	910								
Jan 2008	85	1000								
Feb 2008	94	1600								
Mar 2008	92	1300	17	120	70	17	5.0	3.8		
Apr 2008	100	1600								
May 208	98	1400							96	1281
Jun 2008	82	1200								
Jul 2008	71	880								
Aug 2008	96	1300	14	120	59	11	4.1	3.9		
Sep 2008	120	1900								
Oct 2008	110	1600								

Characteristics of irrigated effluent.										
Month	Monthly tests		Six-monthly tests						12-mth average	
	TKN	COD	TP	K	Na	Ca	Mg	SAR	TKN	COD
	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³		g/m³	g/m³
Nov 2008	91	1300								
Dec 2008	100	1600								
Jan 2009	120	2200								
Feb 2009	84	1000								
Mar 2009	120	1900	15	86	59	12	4.3	3.7		
Apr 2009	110	2400								
May 2009	100	1400							100	1557
Jun 2009	90	1700								
Jul 2009	88	1800								
Aug 2009	83	1500	20	97	57	12	3.2	3.8		
Sep 2009	110	1800								
Oct 2009	120	2500								
Nov 2009	110	1900								
Dec 2009	130	2500		110	200	23	5.6	9.7		
Jan 2010	110	1800	22	130	190	22	6.5	9.1		
Feb 2010	140	2100		140	130	22	8.5	6.0		
Mar 2010	108	1330		128	115	22	8.5	5.3		
Apr 2010	109	1350		152	115	19.2	8.0	5.6		
May 2010	75	1050		140	103	19.8	7.3	5.0	106	1778
Jun 2010	81	1170		71	77	19.7	6.5	3.8		
Jul 2010	70	560		66	88	11	6.8	5.1		
Aug 2010	79	960	20	104	86	25	7.3	3.9		
Sep 2010	90	1450		128	85	18	6.6	4.4		
Oct 2010	108	1110		125	80	16.6	7.2	4.1		
Nov 2010	110	1200		110	85	16.8	6.8	4.4		
Dec 2010	102	2200		95	91	25	8.4	4.0		
Jan 2011	132	2700	23	93	111	27	8.1	4.8		
Feb 2011	98	1480	29	114	95	19.1	8.3	4.6		
Mar 2011	95	1580		120	106	20	8.7	5.0		
Apr 2011	92	1540		113	85	13.2	6.5	4.8		
May 2011	85	1200		101	77	12.1	6.2	4.5	95	1429
Jun 2011	90	820	17.1	120	131	10.3	7.3	7.6		
Jul 2011	93	1010		97	106	11.6	6.5	6.2		
Aug 2011	84	710	14.4	82	114	12.5	6.7	6.5		
Sep 2011	77	630		57	110	14.8	6.4	6.0		
Oct 2011	110	830		109	114	21	7.2	5.5		
Nov 2011	96	480		94	109	22	6.8	5.2		
Dec 2011	92	1150		94	120	12.4	7.3	6.7		
Jan 2012	108	1180		104	174	8.8	7.3	10.5		
Feb 2012	99	1290	27	140	190	17.9	9.6	9.0		
Mar 2012	108	980		106	98	12.9	7.9	5.3		
Apr 2012	100	1140		131	88	12.5	7.9	4.8		
May 2012	107	950		147	89	14.6	7.7	4.7	97	931
Jun 2012	75	780		137	97	8.3	6.9	6.0		
Jul 2012	81	940		94	78	8.5	6.3	4.9		

Characteristics of irrigated effluent.										
Month	Monthly tests		Six-monthly tests						12-mth average	
	TKN	COD	TP	K	Na	Ca	Mg	SAR	TKN	COD
	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³	g/m³		g/m³	g/m³
Aug 2012	76	530	14.5	69	71	8.6	6.1	4.5		
Sep 2012	101	760		109	82	15.0	6.3	4.5		
Oct 2012	129	1020		134	104	13.1	7.6	5.7		
Nov 2012	128	640		127	91	17.5	7.4	4.6		
Dec 2012	114	840		118	112	17.6	7.8	5.6		
Jan 2013	115	1080		108	115	21	8.0	5.4		
Feb 2013	109	1130		109	138	17.7	8.9	6.7		
Mar 2013	122	1090		112	119	20	8.8	5.6		
Apr 2013	106	770		114	133	16.6	8.4	6.6		
May 2013	100	670	17.9	132	87	24	7.0	4.0	105	854
Jun 2013	99	620	16.8	112	91	15.7	6.5	4.9		
Jul 2013	109	820		122	94	11.8	6.9	5.4		
Aug 2013	93	660	13.0	87	79	10.3	6.5	4.7		
Sep 2013	100	640		82	91	14.1	6.2	5.1		
Oct 2013	122	990		115	81	12.0	6.6	4.7		
Nov 2013	84	1150		101	63	37	6.5	2.5		
Dec 2013	110	1550		78	117	10.4	6.6	7.0		
Jan 2014	114	1170		103	108	8.6	7.5	6.5		
Feb 2014	105	1170	22	128	102	10.8	8.1	5.7		
Mar 2014	101	700	19.9	107	90	11.2	7.2	5.2		
Apr 2014	85	580		102	83	22	7.6	3.9		
May 2014	72	500	13.3	99	64	17.9	5.9	3.3	100	879
Jun 2014	59	590		79	57	15.8	5.9	3.1		
Jul 2014	78	740		84	66	15.7	6.8	3.5		
Aug 2014	88	870	11.3	68	63	11.2	5.4	3.9		
Sep 2014	89	740		90	76	16	6.9	4.0		
Oct 2014	112	1120		117	86	19.6	7.4	4.2		
Nov 2014	112	1320		126	108	28	8.2	4.6		
Dec 2014	129	1650		145	116	28	8.8	4.9		
Jan 2015	121	1640		151	107	29	9.7	4.4		
Feb 2015	140	1930	25	147	122	29	10.3	4.9		
Mar 2015	138	1230		130	90	29	9.4	3.7		
Apr 2015	113	1080		129	92	30	8.9	3.8		
May 2015	114	1270		155	83	23	8.2	3.8	108	1182

Appendix 3. Nitrogen Loading Rate Summary

Effluent nitrogen applied to land for the 12 months ending 31/05/2015

Irrigation Site	Area (ha)	Annual N loading (kg)			N Load kg/ha	Comment
		Allowed	Used	Unused		
H1	-	0	0	0		Area no longer used
H2	-	0	0	0		Area no longer used
H3	6.2	1240	881	359	142	
H4	5.0	1000	933	67	187	
H5	4.5	900	0	900	0	
H6	0.7	140	0	140	0	
H7	2.9	580	0	580	0	
H8	4.2	840	0	840	0	
H9	4.2	840	0	840	0	
H10	6.0	1200	0	1200	0	Riparian fencing required before commencing irrigation
H11	2.8	560	0	560	0	
H12	3.2	640	0	640	0	
H13	5.5	1100	0	1100	0	
H14	6.8	1360	1343	17	198	
H15	11.6	2320	0	2320	0	Emergency use only
T1	8.5	1700	1393	307	164	
T2	1.2	240	236	4	197	
T3	4.5	900	694	206	154	
T4	4.4	880	797	83	181	
T5	4.0	800	484	316	121	
T6	2.9	580	577	3	199	
T7			0			Site joined with T6
T8	1.6	320	317	3	198	
T9			0			Site joined with T6
T10	2.4	480	419	61	175	
T11	2.2	440	421	19	192	
T12	7.6	1520	633	887	83	
T13	5.0	1000	849	151	170	
T14	2.1	420	370	50	176	
T15	3.4	680	362	318	106	
T16	1.8	360	232	128	129	
T17	11.0	2200	1829	371	166	
T18	6.6	1320	1300	20	197	
T19	5.0	1000	864	136	173	
T20	0.6	120	15	105	25	
T21	11.1	2220	2183	37	197	
T22	9.9	1980	1958	22	198	
Total	**159.4**	**31880**	**19091**	**12789**		
Te Hape	**63.6**	**12720**	**3157**	**9563**		
Tutaki	**95.8**	**19160**	**15934**	**3226**		

Appendix 4. Weather and Soil Moisture Data

Crusader Meats New Zealand Ltd
Daily Rainfall

Year: 2014-2015

Day	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	0	37	0	7	0		11				0	0
2		28	6	3	0		5.5		34	0		
3	0	14	31	0	8	20	0		20	0		
4	0	3	9	0	9	3	0		2.5	0		1
5	0	4	2	0	5	0	4	27	1	0		0
6	0	6	1		16	11		0		0		0
7		0	3		9	2					3	0
8		0	11	4	0		2	0			1	55
9	1	0	7		14		0	10	14	33		
10	28	0	0	0	0	0	0	0	2	0.5	20	
11	25	0	2	0	12	0			0	0		0
12	37	3	38	0	0	22	23	0	0	8		5
13	2		16	7	10	14		0	0	3.5	57	29
14	0	45	16	30	0	1		0	0		29	2
15		1	18	3	0		19	0			0	26
16		0	0	9	0		0	0	0	8	0	
17	19	0	0			28	0	0	0	0		
18	8	0	0			18	13		0	0		14
19	10	0	0			0	4		0	0		0
20		0	4		16	6		0	0	1	27	0
21		6	7		0	1		0			0	2
22		8	0	78	0		7	0			0	24
23		0			2		0	0	4.5	0	0	
24		0		4	2	4	0		2	0	0	
25	22	0	0	0		4			0	0		20
26	13		0	0		1			0	0		0
27	5		0	0	5	34		0	0	0	50	1
28	13	0	0	0	43	1.5		0				0
29	0	0	0	0	9		0	5.5			13	0
30	0	10	0	6	14		15	0		22	12	
31		1	0	0			0	1.5		4.5		
Total	183	166	171	151	174	170.5	103.5	44	80	80.5	212	179
YTD	183	349	520	671	845	1015.5	1119	1163	1243	1323.5	1535.5	1714.5

Crusader Meats New Zealand Ltd
Wind Strength and Direction

Year: 2014-2015

Day	June		July		August		September		October		November		December		January		February		March		April		May	
	Str	Dir	Str	Dir	Str	Dir	Str	Dir	Str	Dir	Str	Dir	Str	Dir	Str	Dir	Str	Dir	Str	Dir	Str	Dir	Str	Dir
1	mod	SW	0		light	NW	0		0				0								0	0	0	0
2			light	NW	light	NE	light	N	light	NW			0				0		0					
3	0		0		mod	NW	0		light	S	mod	E	0				0		0					
4	0		0		light	N	light	N	mod	S	0		0				light	W	0				0	0
5	0		light	SW	light	S	light	E	str	S	0		0		0		strong	W	0				0	0
6	0		0		light	S			mod	SE	0				0				light	east			0	0
7			0		light	S			mod	SE	0										0	0	mod	west
8			light	NE	mod	SW	light	S	0				0		0						0	0	0	0
9	light	NE	mod	NE	0				0				0		0		0		0					
10	light	N	mod	E	light	SW	0		0		light	SW	0		0		0		light	east	0	0		
11	mod	NE	mod	E	light	NW	mod	S	light	W	light	E					mod	E	0				0	0
12	0		mod	E	light	N	light	NE	0		mod	E	0		light	S	0		0				strong	west
13	light	N			light	W	mod	N	0		light	E			0		0		0		light	west	0	0
14	0		0		mod	SW	mod	N	light	NW	light	E			0		0				0	0	mod	west
15			light	SE	0		light	SW	light	SW			mod	W	0						0	0	light	west
16			0		light	SW	light	NE	mod	NE			mod	W	light	S	0		mod	east	0	0		
17	0		light	S	0						light	E	str	W	0		0		0					
18	light	N	0		0						light	E	str	W			0		0				0	0
19	light	W	0		light	SW					light	E	0				0		0				0	0
20			light	S	light	NW			light	N	light	E			0		0		0		0	0	0	0
21			light	S	light	S			0		mod	E			light	W					0	0	0	0
22			0		0		mod	S	0				light	W	light	W					0	0	mod	west
23			0				light	SW	0				light	W	0		0		0		0	0		
24			0				light	SW	light	W	0		0				0		0		0	0		
25	light	SW	0		0		light	E			0						0		0				strong	west
26	0				0		light	W			mod	E					0		0				strong	south
27	0				0		light	NW	mod	SW	mod	E			0		0		0		0	0	0	0
28	mod	SE	0		0		light	S	light	N	0				0								0	0
29	0		0		light	SW	light	SE	0				0		light	E					0	0	0	0
30	mod	SW	0		mod	NE	light	SE	mod	SW			0		light	E			0		strong	west		
31			light	NW	mod	N							0		0				0					

Crusader Meats New Zealand Ltd
Air Temperatures

Year: 2014-2015

Day	June		July		August		September		October		November		December		January		February		March		April		May	
	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
1	-4	25	6	12	8	17	5	15	2	26			4	18							2	26	-3	11
2			4	11	9	20	7	10	0	24			0	15			16	31	4	36				
3	0	27	-2	7	6	14	2	27	6	16	6	20	1	22			15	22	10	35				
4	1	21	0	10	9	16	8	20	5	14	2	18	1	22			10	25	7	44			-1	20
5	-3	21	1	12	1	10	10	18	1	9	0	23	10	18	7	36	11	26	9	33			4	24
6	0	18	0	11	3	14			3	14	3	17			7	30			14	37			6	21
7			-1	11	1	11			4	13	0	16									2	30	8	21
8			1	12	5	10	0	26	4	20			8	22	10	29					11	25	14	17
9	1	18	3	10	-4	9			7	14			10	30	10	36	1	30	7	33				
10	9	13	7	12	-5	12	-1	23	2	19	-2	26	10	20	12	28	12	28	7	23	14	20		
11	8	10	8	13		12	3	11	5	24	9	20					6	35	4	30			2	18
12	8	12	8	14	8	11	7	20	10	25	6	16	10	20	8	29	9	32	5	32			7	17
13	6	13			0	12	3	15	0	27	4	12			8	34	10	34	7	20	7	24	4	12
14	0	22	4	15	2	10	5	16	9	22	3	16			8	34	8	38			3	13	4	17
15			2	21	-1	6	4	17	6	19			4	25	11	31					-4	12	11	12
16			-5	14	1	11	8	15	7	26			8	30	14	38	8	38	7	39	-2	18		
17	-3	21	-2	15	-5	15					6	17	3	21	12	30	7	38	8	24				
18	10	16	-7	12	-3	21					8	13	10	18			8	35	5	23			-1	12
19	5	12	-5	15	0	18					5	23	12	20			4	34	5	19			4	15
20			0	15	5	11			8	24	6	12			8	30	4	29	-2	27	-2	19	-2	21
21			2	12	7	23			5	17	7	11			4	30					8	29	3	14
22			-5	13	-5	12	0	16	6	24			7	29	8	32					8	25	8	13
23			-6	9			-1	10	10	21			7	27	9	38	10	39	3	35	10	26		
24			-4	11			6	14	7	20	9	22	10	32			10	31	8	21	3	30		
25	0	19	1	15	-4	21	8	18			14	22					10	36	8	29			4	18
26	8	12			4	20	6	20			9	22					8	33	7	30			3	9
27	8	14			-2	15	4	19	-4	20	7	24			7	41	6	32	8	27	1	22	0	10
28	5	11	-6	9	0	19	5	16	7	12	11	20			10	32							-6	14
29	-1	14	-3	17	1	21	6	18	8	20			8	33	9	35					6	11	-6	19
30	5	11	4	13	2	15	2	21	6	18			13	28	14	42			9	35	7	14		
31			8	16	6	16							13	25	15	33			10	18				
Low/high	-4	27	-7	21	-5	23	-1	27	-4	27	-2	26	0	33	4	42	1	39	-2	44	-4	30	-6	24

Crusader Meats New Zealand Ltd
Soil Moisture

Year: 2014-2015

Day	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	damp	wet	damp	wet	dry		wet				wet	wet
2		wet	wet	wet	dry		wet		wet	dry		
3	dry	damp	wet	damp	wet	wet	damp		wet	dry		
4	dry	damp	wet	dry	wet	wet	damp		wet	dry		damp
5	dry	wet	wet	dry	wet	damp	wet	dry	med	dry		damp
6	dry	wet	wet		wet	wet		dry		dry		damp
7		wet	wet		wet	wet					dry	damp
8		damp	wet	damp	wet		dry	dry			damp	wet
9	damp	dry	wet		wet		dry	wet	wet	wet		
10	wet	dry	damp	dry	damp	dry	dry	damp	med	med	wet	
11	wet	dry	damp	dry	wet	dry			dry	med		wet
12	wet	damp	wet	dry	damp	wet	wet	damp	dry	wet		wet
13	wet		wet	wet	wet	wet		dry	dry	wet	wet	wet
14	damp	wet	wet	wet	damp	wet		dry	dry		wet	wet
15		damp	wet	wet	dry		wet	dry			wet	wet
16		dry	wet	wet	dry		damp	dry	dry	wet	damp	
17	wet	dry	dry			wet	damp	dry	dry	med		
18	wet	dry	dry			wet	wet		dry	med		wet
19	wet	dry	dry			wet	wet	dry	dry	med		wet
20		dry	wet		wet	wet		dry	dry	med	wet	damp
21		wet	wet		wet	wet		dry			wet	wet
22		wet	damp	wet	dry		damp	dry			wet	wet
23		damp		wet	damp		damp	dry	med	med	damp	
24		dry		damp	wet	damp	dry		med	med	damp	
25	wet	dry	dry	dry		wet			dry	dry		wet
26	wet		dry	dry		wet			dry	dry		wet
27	wet		dry	dry	wet	damp		dry	dry	dry	wet	wet
28	wet	dry	dry	dry	wet	wet		dry				damp
29	wet	dry	dry	damp	wet		dry	wet			wet	damp
30	wet	wet	dry	dry	wet		wet	damp		wet	wet	
31		wet	dry				damp	damp		wet		

Appendix 5. Soil Monitoring Report

ALBERT VAN OOSTROM & ASSOCIATES
WASTE MINIMISATION & TREATMENT SPECIALISTS

28 November 2014

Crusader Meats New Zealand Ltd
State Highway 30
RD 7
TE KUITI 3987

Attention: Anne Kelly

Dear Anne

Soil monitoring results for discharge permit 100696

Please find attached the results of soil analyses and infiltration tests for three irrigated paddocks and one non-irrigated paddock. This testing was undertaken to fulfil the requirements of Condition 17c of discharge permit 100696. The soil sampling and infiltration testing were undertaken on 19 and 20 November 2014.

The paddocks sampled were as follows:

Paddock*	NZTM Coordinates**	Status	Soil analyses	
			Sample No.	Sample depth
T02	E1813880 N5734711	Irrigated 16 years	T02 0-100 19/11/2014	0-10 cm
			T02 100-200 19/11/2014	10-20 cm
T105	E1812909 N5734544	Not irrigated	T105 0-100 19/11/2014	0-10 cm
			T105 100-200 19/11/2014	10-20 cm
H03	E1815362 N5734350	Irrigated 22 years	H03 0-100 20/11/2014	0-10 cm
			H03 100-200 20/11/2014	10-20 cm
H04	E1815045 N5734525	Irrigated 22 years	H04 0-100 20/11/2014	0-10 cm
			H04 100-200 20/11/2014	10-20 cm

* Paddock names are as per the irrigation site plan.

** Site of infiltration testing within the paddock. The soil samples were generally collected within a 100 m radius of this site.

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web www.albert.co.nz

Soil analyses

As with previous soil test results, the current results show no any adverse effects of the irrigation on soil quality.

Infiltration tests

The infiltration test results are variable but generally similar to those measured previously at the site. There is no evidence that the effluent irrigation is adversely affecting soil infiltration rate.

Regards

Albert van Oostrom
Principal

ALBERT VAN OOSTROM & ASSOCIATES
WASTE MINIMISATION & TREATMENT SPECIALISTS

28 November 2014

Soil Infiltration Test Results

Client

Crusader Meats New Zealand Ltd
State Highway 30
RD 7
TE KUITI 3987

Test locations

Three irrigated and one non-irrigated paddock in the Tutaki and Te Hape blocks. The test site within a paddock was located by GPS. Infiltration tests were undertaken on flat ground within a 15 m radius of each test site.

Test Method

Single ring infiltrometer (500 mm diameter). Four measurements per paddock. Water depth: 5-20 mm.

Results

Steady-state infiltration rate (mm/hour)				
Block:	Tutaki	Tutaki	Te Hape	Te Hape
Paddock:	T02	T105	H03	H04
Years irrigated:	16	0*	22	22
Test date:	19/11/2014	19/11/2014	20/11/2014	20/11/2014
Test site coordinates: (NZTM2000)	E1813880 N5734711	E1812909 N5734544	E1815362 N5734350	E1815045 N5734525
Test 1	136	16	77	134
Test 2	55	45	28	82
Test 3	48	23	50	82
Test 4	42	13	55	52
Median:	**52**	**20**	**53**	**82**

* Not irrigated, but sheep yard solids have been applied to this paddock.

Albert van Oostrom
Principal

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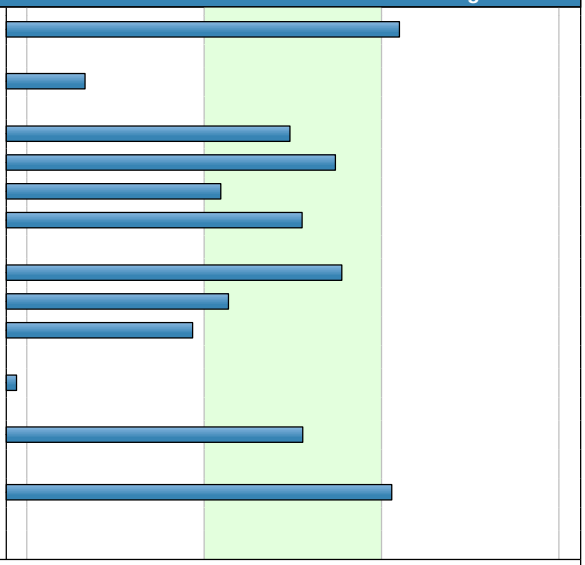
ANALYSIS REPORT

Client:	Albert van Oostrom and Associates	**Lab No:**	1354821 shpv1
Address:	21 Dawson Street Hamilton East HAMILTON 3216	**Date Registered:**	22-Nov-2014
		Date Reported:	28-Nov-2014
		Quote No:	
		Order No:	
		Client Reference:	Crusader Meats
Phone:	07 856 8367	**Submitted By:**	Mr A van Oostrom

Sample Name: T02 0 - 100 **Lab Number:** 1354821.1
Sample Type: SOIL Mixed Pasture, Pumice (Dry Stock) (S84)

Analysis		Level Found	Medium Range
pH	pH Units	6.1	5.8 - 6.0
Olsen Phosphorus	mg/L	15	35 - 45
Potassium	me/100g	0.59	0.40 - 0.80
Calcium	me/100g	10.2	5.0 - 12.0
Magnesium	me/100g	0.91	0.80 - 2.00
Sodium	me/100g	0.29	0.15 - 0.40
CEC	me/100g	22	12 - 25
Total Base Saturation	%	54	50 - 80
Volume Weight	g/mL	0.49	0.50 - 0.70
Sulphate Sulphur	mg/kg	2	10 - 12
Organic Matter*	%	12.6	7.0 - 17.0
Total Carbon	%	7.3	
Total Nitrogen*	%	0.68	0.30 - 0.60
Soil Sample Depth*	mm	0-100	



Base Saturation %	K 2.7	Ca 46	Mg 4.1	Na 1.3
MAF Units	K 6	Ca 6	Mg 10	Na 7

The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information. IANZ Accreditation does not apply to comments and interpretations, i.e. the 'Range Levels' and subsequent graphs.

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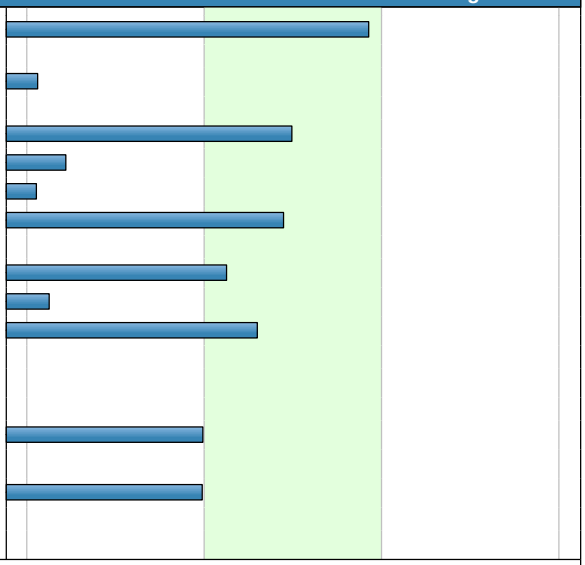
ANALYSIS REPORT

Client:	Albert van Oostrom and Associates	**Lab No:**	1354821 shpv1
Address:	21 Dawson Street Hamilton East HAMILTON 3216	**Date Registered:**	22-Nov-2014
		Date Reported:	28-Nov-2014
		Quote No:	
		Order No:	
		Client Reference:	Crusader Meats
Phone:	07 856 8367	**Submitted By:**	Mr A van Oostrom

Sample Name: T02 100 - 200 **Lab Number:** 1354821.2
Sample Type: SOIL Mixed Pasture, Pumice (Dry Stock) (S84)

Analysis		Level Found	Medium Range
pH	pH Units	6.0	5.8 - 6.0
Olsen Phosphorus	mg/L	7	35 - 45
Potassium	me/100g	0.60	0.40 - 0.80
Calcium	me/100g	2.7	5.0 - 12.0
Magnesium	me/100g	0.33	0.80 - 2.00
Sodium	me/100g	0.26	0.15 - 0.40
CEC	me/100g	14	12 - 25
Total Base Saturation	%	28	50 - 80
Volume Weight	g/mL	0.56	0.50 - 0.70
Sulphate Sulphur	mg/kg	< 1	10 - 12
Organic Matter*	%	6.9	7.0 - 17.0
Total Carbon*	%	4.0	
Total Nitrogen*	%	0.30	0.30 - 0.60
Soil Sample Depth*	mm	0-200	
Base Saturation %		K 4.4 Ca 19	Mg 2.4 Na 1.9
MAF Units		K 7 Ca 2	Mg 4 Na 7



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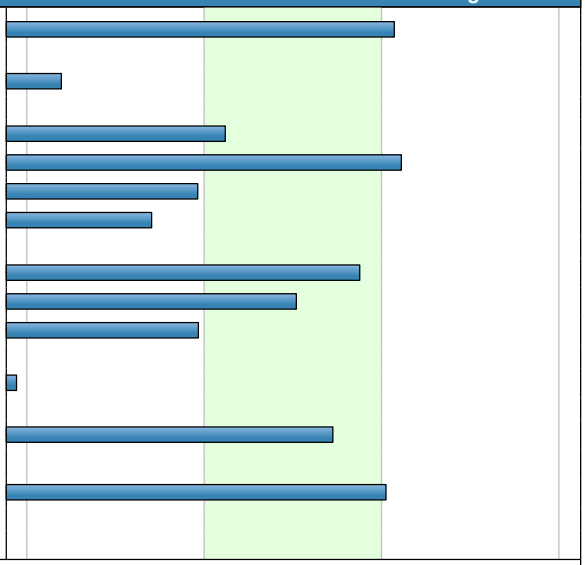
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Albert van Oostrom and Associates	**Lab No:**	1354821 shpv1
Address:	21 Dawson Street Hamilton East HAMILTON 3216	**Date Registered:** **Date Reported:** **Quote No:** **Order No:** **Client Reference:**	22-Nov-2014 28-Nov-2014 Crusader Meats
Phone:	07 856 8367	**Submitted By:**	Mr A van Oostrom

Sample Name: T105 0 - 100 **Lab Number:** 1354821.3
Sample Type: SOIL Mixed Pasture, Pumice (Dry Stock) (S84)

Analysis		Level Found	Medium Range
pH	pH Units	6.1	5.8 - 6.0
Olsen Phosphorus	mg/L	11	35 - 45
Potassium	me/100g	0.45	0.40 - 0.80
Calcium	me/100g	14.0	5.0 - 12.0
Magnesium	me/100g	0.78	0.80 - 2.00
Sodium	me/100g	0.11	0.15 - 0.40
CEC	me/100g	23	12 - 25
Total Base Saturation	%	66	50 - 80
Volume Weight	g/mL	0.50	0.50 - 0.70
Sulphate Sulphur	mg/kg	1	10 - 12
Organic Matter*	%	14.3	7.0 - 17.0
Total Carbon	%	8.3	
Total Nitrogen*	%	0.64	0.30 - 0.60
Soil Sample Depth*	mm	0-100	
Base Saturation %		K 1.9 Ca 60	Mg 3.3 Na 0.4
MAF Units		K 5 Ca 9	Mg 9 Na 2



The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information. IANZ Accreditation does not apply to comments and interpretations, i.e. the 'Range Levels' and subsequent graphs.

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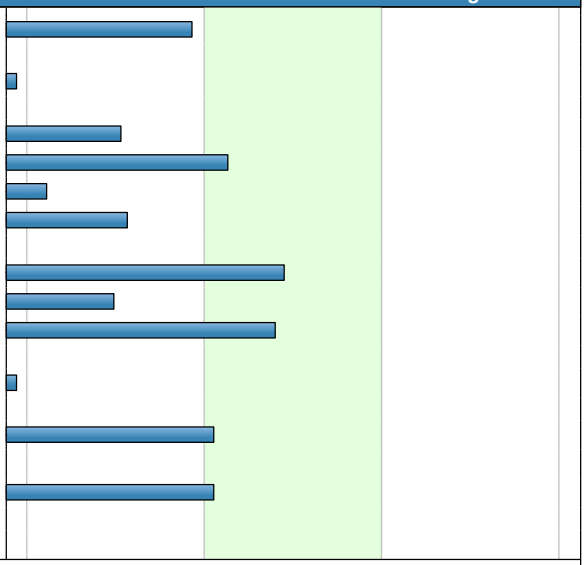
ANALYSIS REPORT

Client:	Albert van Oostrom and Associates	**Lab No:**	1354821 shpv1
Address:	21 Dawson Street Hamilton East HAMILTON 3216	**Date Registered:** **Date Reported:** **Quote No:** **Order No:** **Client Reference:**	22-Nov-2014 28-Nov-2014 Crusader Meats
Phone:	07 856 8367	**Submitted By:**	Mr A van Oostrom

Sample Name: T105 100 - 200 **Lab Number:** 1354821.4
Sample Type: SOIL Mixed Pasture, Pumice (Dry Stock) (S84)

Analysis		Level Found	Medium Range
pH	pH Units	5.7	5.8 - 6.0
Olsen Phosphorus	mg/L	5	35 - 45
Potassium	me/100g	0.28	0.40 - 0.80
Calcium	me/100g	5.9	5.0 - 12.0
Magnesium	me/100g	0.36	0.80 - 2.00
Sodium	me/100g	0.08	0.15 - 0.40
CEC	me/100g	18	12 - 25
Total Base Saturation	%	37	50 - 80
Volume Weight	g/mL	0.58	0.50 - 0.70
Sulphate Sulphur	mg/kg	1	10 - 12
Organic Matter*	%	7.5	7.0 - 17.0
Total Carbon*	%	4.4	
Total Nitrogen*	%	0.32	0.30 - 0.60
Soil Sample Depth*	mm	0-200	
Base Saturation %		K 1.6 Ca 33 Mg 2.0 Na 0.5	
MAF Units		K 3 Ca 4 Mg 5 Na 2	



The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information. IANZ Accreditation does not apply to comments and interpretations, i.e. the 'Range Levels' and subsequent graphs.

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

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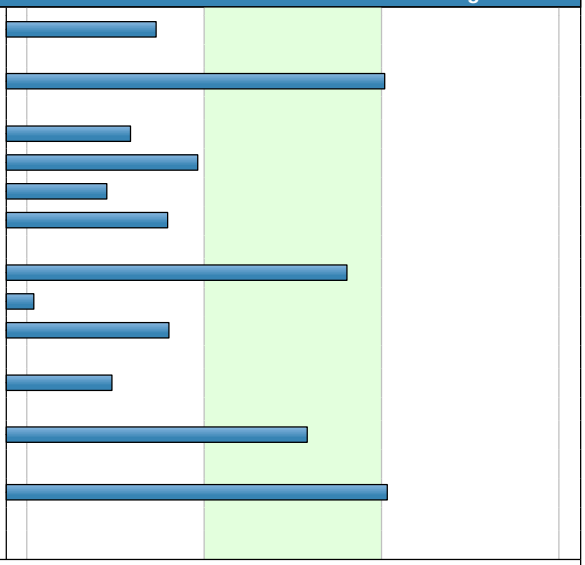
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Albert van Oostrom and Associates	**Lab No:**	1354821 shpv1
Address:	21 Dawson Street Hamilton East HAMILTON 3216	**Date Registered:** **Date Reported:** **Quote No:** **Order No:** **Client Reference:**	22-Nov-2014 28-Nov-2014 Crusader Meats
Phone:	07 856 8367	**Submitted By:**	Mr A van Oostrom

Sample Name: H03 0 - 100 **Lab Number:** 1354821.5
Sample Type: SOIL Mixed Pasture, Pumice (Dry Stock) (S84)

Analysis		Level Found	Medium Range
pH	pH Units	5.6	5.8 - 6.0
Olsen Phosphorus	mg/L	46	35 - 45
Potassium	me/100g	0.30	0.40 - 0.80
Calcium	me/100g	4.9	5.0 - 12.0
Magnesium	me/100g	0.52	0.80 - 2.00
Sodium	me/100g	0.12	0.15 - 0.40
CEC	me/100g	22	12 - 25
Total Base Saturation	%	26	50 - 80
Volume Weight	g/mL	0.48	0.50 - 0.70
Sulphate Sulphur	mg/kg	6	10 - 12
Organic Matter*	%	12.8	7.0 - 17.0
Total Carbon	%	7.4	
Total Nitrogen*	%	0.65	0.30 - 0.60
Soil Sample Depth*	mm	0-100	



Base Saturation %	K 1.3	Ca 22	Mg 2.3	Na 0.5
MAF Units	K 3	Ca 3	Mg 6	Na 3

The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information. IANZ Accreditation does not apply to comments and interpretations, i.e. the 'Range Levels' and subsequent graphs.

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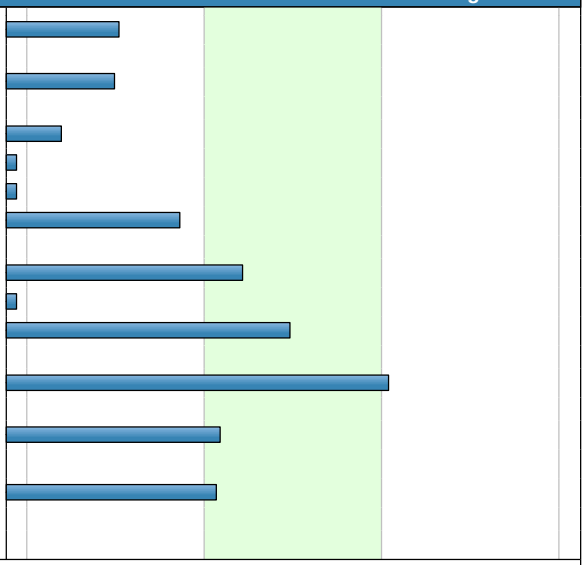
Phone:	07 856 8367	**Submitted By:**	Mr A van Oostrom

Sample Name: H03 100 - 200 **Lab Number:** 1354821.6
Sample Type: SOIL Mixed Pasture, Pumice (Dry Stock) (S84)

Analysis		Level Found	Medium Range
pH	pH Units	5.4	5.8 - 6.0
Olsen Phosphorus	mg/L	20	35 - 45
Potassium	me/100g	0.20	0.40 - 0.80
Calcium	me/100g	1.8	5.0 - 12.0
Magnesium	me/100g	0.15	0.80 - 2.00
Sodium	me/100g	0.13	0.15 - 0.40
CEC	me/100g	15	12 - 25
Total Base Saturation	%	15	50 - 80
Volume Weight	g/mL	0.60	0.50 - 0.70
Sulphate Sulphur	mg/kg	14	10 - 12
Organic Matter*	%	7.9	7.0 - 17.0
Total Carbon	%	4.6	
Total Nitrogen*	%	0.32	0.30 - 0.60
Soil Sample Depth*	mm	0-200	



Base Saturation %	K 1.3	Ca 12	Mg 1.0	Na 0.9
MAF Units	K 2	Ca 1	Mg 2	Na 4

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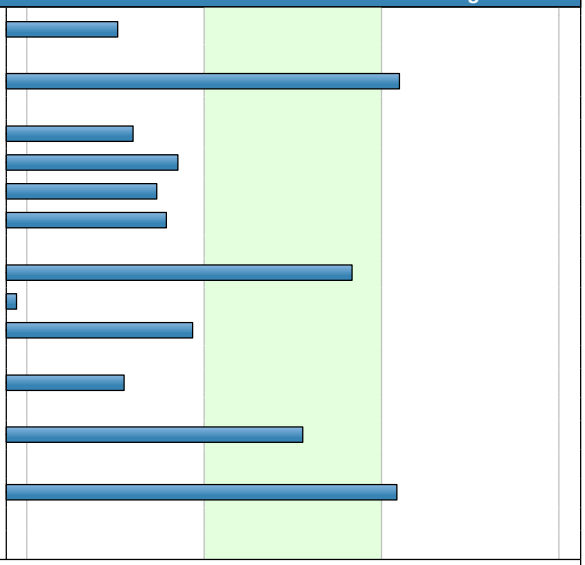
ANALYSIS REPORT

Client:	Albert van Oostrom and Associates	**Lab No:**	1354821 shpv1
Address:	21 Dawson Street Hamilton East HAMILTON 3216	**Date Registered:** **Date Reported:** **Quote No:** **Order No:** **Client Reference:**	22-Nov-2014 28-Nov-2014 Crusader Meats
Phone:	07 856 8367	**Submitted By:**	Mr A van Oostrom

Sample Name: H04 0 - 100 **Lab Number:** 1354821.7
Sample Type: SOIL Mixed Pasture, Pumice (Dry Stock) (S84)

Analysis		Level Found	Medium Range
pH	pH Units	5.4	5.8 - 6.0
Olsen Phosphorus	mg/L	51	35 - 45
Potassium	me/100g	0.30	0.40 - 0.80
Calcium	me/100g	4.6	5.0 - 12.0
Magnesium	me/100g	0.67	0.80 - 2.00
Sodium	me/100g	0.12	0.15 - 0.40
CEC	me/100g	23	12 - 25
Total Base Saturation	%	25	50 - 80
Volume Weight	g/mL	0.49	0.50 - 0.70
Sulphate Sulphur	mg/kg	6	10 - 12
Organic Matter*	%	12.5	7.0 - 17.0
Total Carbon	%	7.3	
Total Nitrogen*	%	0.72	0.30 - 0.60
Soil Sample Depth*	mm	0-100	
Base Saturation %		K 1.3 Ca 20	Mg 2.9 Na 0.5
MAF Units		K 3 Ca 3	Mg 7 Na 3



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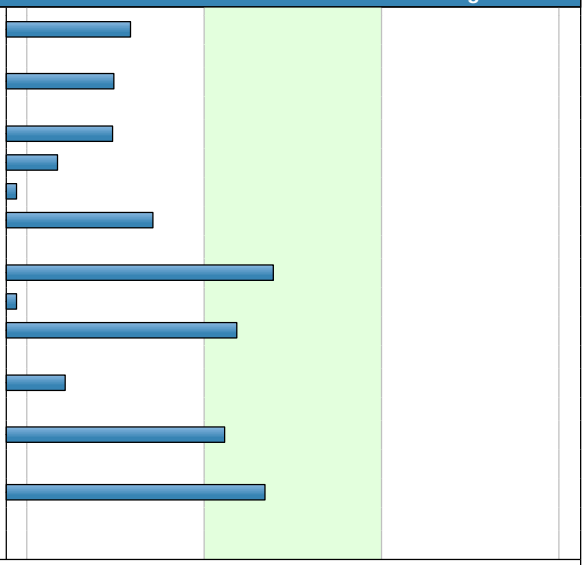
Phone:	07 856 8367	**Submitted By:**	Mr A van Oostrom

Sample Name: HO4 100 - 200 **Lab Number:** 1354821.8
Sample Type: SOIL Mixed Pasture, Pumice (Dry Stock) (S84)

Analysis		Level Found	Medium Range
pH	pH Units	5.5	5.8 - 6.0
Olsen Phosphorus	mg/L	20	35 - 45
Potassium	me/100g	0.27	0.40 - 0.80
Calcium	me/100g	2.5	5.0 - 12.0
Magnesium	me/100g	0.21	0.80 - 2.00
Sodium	me/100g	0.11	0.15 - 0.40
CEC	me/100g	17	12 - 25
Total Base Saturation	%	18	50 - 80
Volume Weight	g/mL	0.54	0.50 - 0.70
Sulphate Sulphur	mg/kg	4	10 - 12
Organic Matter*	%	8.1	7.0 - 17.0
Total Carbon	%	4.7	
Total Nitrogen*	%	0.40	0.30 - 0.60
Soil Sample Depth*	mm	0-200	



Base Saturation %	K 1.6	Ca 15	Mg 1.2	Na 0.6
MAF Units	K 3	Ca 2	Mg 3	Na 3

The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information. IANZ Accreditation does not apply to comments and interpretations, i.e. the 'Range Levels' and subsequent graphs.

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Analyst's Comments

Samples 1-8 Comment:
The medium range guidelines shown in the histogram report relate to sampling protocols as per Hill Laboratories' crop guides and are based on reference values where these are published. Results for samples collected to different depths than those described in the crop guide should be interpreted with caution.
For pastoral soils, the medium ranges are specific for a 75mm sample depth, but if a 150mm sampling depth is used the nutrient levels measured may appear low against these ranges, as nutrients are typically more concentrated in the top of the soil profile. These soil profile differences are altered upon cultivation or contouring.

Samples 1-8 Comment:
While soil Mg MAF levels of 8-10 are sufficient for pasture production, soil levels of 25-30 are required to ensure adequate Mg content in pasture for animal health (greater than 0.22%).

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Sample Registration*	Samples were registered according to instructions received.	-	1-8
Soil Prep (Dry & Grind)*	Air dried at 35 - 40°C overnight (residual moisture typically 4%) and crushed to pass through a 2mm screen.	-	1-8
pH	1:2 (v/v) soil:water slurry followed by potentiometric determination of pH.	0.1 pH Units	1-8
Olsen Phosphorus	Olsen extraction followed by Molybdenum Blue colorimetry.	1 mg/L	1-8
Sulphate Sulphur	0.02M Potassium phosphate extraction followed by Ion Chromatography.	1 mg/kg	1-8
Potassium (MAF)	1M Neutral ammonium acetate extraction followed by ICP-OES.	1 MAF units	1-8
Calcium (MAF)	1M Neutral ammonium acetate extraction followed by ICP-OES.	1 MAF units	1-8
Magnesium (MAF)	1M Neutral ammonium acetate extraction followed by ICP-OES.	1 MAF units	1-8
Sodium (MAF)	1M Neutral ammonium acetate extraction followed by ICP-OES.	2 MAF units	1-8
Organic Matter*	Organic Matter is 1.72 x Total Carbon.	0.2 %	1-8
Total Carbon	Dumas combustion.	0.1 %	1, 3, 5-8
Total Carbon*	Determined by NIR, calibration based on Total Carbon by Dumas combustion.	0.1 %	2, 4
Total Nitrogen*	Determined by NIR, calibration based on Total N by Dumas combustion.	0.04 %	1-8
Potassium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.01 me/100g	1-8
Calcium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.5 me/100g	1-8
Magnesium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.04 me/100g	1-8
Sodium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.05 me/100g	1-8
Potassium (Sat)	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.1 %BS	1-8
Calcium (Sat)	1M Neutral ammonium acetate extraction followed by ICP-OES.	1 %BS	1-8
Magnesium (Sat)	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.2 %BS	1-8
Sodium (Sat)	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.1 %BS	1-8

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		Quote No:	
		Order No:	
		Client Reference:	Crusader Meats
Phone:	07 856 8367	**Submitted By:**	Mr A van Oostrom

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
CEC	Summation of extractable cations (K, Ca, Mg, Na) and extractable acidity. May be overestimated if soil contains high levels of soluble salts or carbonates.	2 me/100g	1-8
Total Base Saturation	Calculated from Extractable Cations and Cation Exchange Capacity.	5 %	1-8
Volume Weight	The weight/volume ratio of dried, ground soil.	0.01 g/mL	1-8

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

W.M.Homewood

Wendy Homewood
Operations Support - Agriculture Division

Appendix 6. Compliance Inspection Report

5 May 2015

F J Ramsey Ltd
State Highway 30
RD 7
TE KUITI 3987

File ref: 9/1/RTL
100696, 100926, 104518,
104934 & 105267
SGS:YKS

Attention Anne Kelly

Dear Anne

MARCH 2015 ROUTINE COMPLIANCE INSPECTION REPORT

A routine site visit of the Crusader Meats processing plant was carried out on 5 March 2015. The purpose of the routine inspection was to assess how Crusader Meats was complying with relevant resource consent conditions.

As a result of this assessment Crusader Meats has been given an overall **Comply - Full** for consents 100696, 100926, 104518, 104934 and 105267. Please note that since Crusader Meats is at the time of this invoice complying with the conditions of its resource consents, the compliance monitoring charges are 70 per cent of the full charge as detailed in the attached cost sheet.

Please find attached a copy of the compliance report and Horizons Regional Council's Compliance Assessment Guidelines for your reference.

If you have any queries about the attached report, please contact me via email stuart.standen@horizons.govt.nz or on 0508 800 800.

Kind regards

Stuart Standen
CONSENTS MONITORING OFFICER

COMPLIANCE REPORT

CRUSADER MEATS

Consent

100696, 100926, 104518, 104934 & 105267

Reporting Period

5 March 2015

horizons
regional council

May 2015

horizons
regional council

EXECUTIVE SUMMARY

On 5 March 2015 a routine site inspection was carried out at the Crusader Meats processing plant. The purpose of the inspection was to assess how Crusader Meats was complying with relevant resource consent conditions. This assessment does not contain an assessment of the Crusader Meats 2015 annual report. This assessment will be carried out at a later date.

As a result of this inspection the overall compliance grading of this report is **Comply – Full.** This is because Crusader Meats was complying with relevant consent conditions at the time of the inspection.

Mike Ramsey enquired about resource consent requirements to compost paunch waste material on site. This activity would require resource consent under Rule 14-30 of Horizons One Plan. HRC would likely set potential consent conditions around compost leachate, odour, and nutrient loading rates of applied compost to land. Feel free to contact me if you wish to discuss the consenting requirements further.

GENERAL CONDITIONS APPLICABLE TO CRUSADER MEATS

Resource Consent 100696/1 and 100926 Discharge up to 900 Cubic Metres of Pond Treated Effluent and Yard Solids to Land

Anaerobic Lagoon

The anaerobic wastewater lagoon and witness drainage pipe was inspected during the visit. The wastewater level within the lagoon was managed well below full capacity to ensure wastewater is retained within the lagoon at all times. The pond level was low thus allowing for storage of wastewater during periods when irrigation cannot be carried out. There were no signs effluent had discharged beyond the lagoon and the witness drainage pipe was dry. Yard solids were thinly spread out to land well away from streams and other sensitive areas. **Comply – Full**

Effluent Irrigation

Effluent was irrigated to the Tutaki Block at the time of the inspection. This block remains leased by Crusader Meats for farming at the time of the inspection. Effluent was irrigated to land via K-Line pod irrigators. The appropriate buffer distances to waterways, gullies and wetlands from the furthest throw of the pod irrigator were being observed. The Waimiha Stream remains fenced in sections associated with the irrigation paddocks. There were no signs of ponding or run-off at the time of the inspection in the paddock that was currently being irrigated. **Comply – Full**

The annual nitrogen loading rate and monitoring results will be assessed when the 2015 annual report is submitted to HRC.

Emergencies

As discussed with Mike Ramsey during the site visit there has been no emergency or accidental discharge of wastewater since the 25 June 2013 incident. **Comply – Full**

Resource Consent 104934 Take Groundwater up to 1,500 Cubic Metres Per Day

Daily groundwater abstraction volumes are sent to HRC via the telemetry system. These records show the above consent limit has not been breached over the period 19 February 2014 (previous site inspection) to date. **Comply – Full**

Resource Consent 104518 Discharge Domestic Wastewater to Land

Septic Tanks and Disposal Field Management

The disposal field and septic tank above ground pods were inspected during the routine visit. The field remains fenced and was dry with no signs of ponding or grass die back while there were no signs of effluent discharge from the above ground pods to the surrounding land. The flow meter is read by an Crusader Meats employee on a weekly basis with records kept in a dedicated log book. The records were inspected where weekly discharge volume (excluding Christmas shutdown) ranged from 11 cubic metres to 41 cubic metres. This complies with the consented daily discharge maximum of 12 cubic metres. Based on the weekly discharge volumes the wastewater loading rates equates to 2.5 millimetres per square metre per day. The system is serviced on a three monthly schedule by Sewage System Services Ltd with service records retained in the Crusader Meats office. These records show the last service occurred on 21 January 2015. **Comply – Full**

Resource Consent 105267 Discharge Contaminants to Air from the Oil Fired Boiler

As observed during the site inspection the boiler chimney remains unchanged with the discharge positioned vertically and unobstructed by cowls. The boiler was operating at the time of the inspection and the discharge gases from the chimney were clear with no signs of black smoke or particulates. Monthly fuel records are kept by the boiler fitter which show 14,000L of oil is used per month. The boiler was last serviced on 17 November 2014 by Advanced Boiler Services Ltd. Fuel is supplied by Waste Petroleum Combustion Ltd and supply documents show sulphur weight of fuel oil is less than 0.48 % on a weight basis. This sulphur content complies with the consent limit. Anne Kelly advised no air or odour complaints have been received in relation to the operation of the boiler. **Comply – Full**

CONCLUSION

The overall compliance grading of the 5 March 2015 routine inspection is **Comply – Full.** This is because Crusader Meats were complying with relevant consent conditions at the time of the inspection.

RECOMMENDATIONS

Mike Ramsey enquired about resource consent requirements to compost paunch waste material on site. This activity would require resource consent under Rule 14-30 of Horizons One Plan. HRC would likely set potential consent conditions around compost leachate, odour, and nutrient loading rates of applied compost to land. Feel free to contact me if you wish to discuss the consenting requirements further.

If you have any queries about the attached report, please contact me via email stuart.standen@horizons.govt.nz or on 0508 800 800.

Kind regards,

Stuart Standen

CONSENTS MONITORING OFFICER

horizons regional council

Appendix 7. Briefing Paper

Crusader Meats
Renewal of Resource Consents 100696, 100926 and 100698

Briefing Paper for Interested Parties

28 September 2015

Introduction

F J Ramsey Trading Limited and Crusader Meats New Zealand Limited (collectively known as "Crusader Meats") own and operate a modern meat processing plant on State Highway 30, approximately 10 km east of Benneydale. The plant's resource consents are held by F J Ramsey Trading Limited. The two companies are wholly owned subsidiaries of F J Ramsey Limited, owned by John Ramsey, whose other business operations include:

- Three deer farms
- Kiwifruit
- Tourism operations

Crusader Meats currently processes around 600,000 sheep and lambs, 16,000 goats and 40,000 bobby calves annually. Livestock are sourced locally and from the wider North Island.

Figure 1 Crusader Meats plant

The plant produces a variety of chilled and frozen cuts of lamb, mutton, veal and goat meat, supplying overseas markets under the LANZ Supreme, LANZ Finest and King Country Meats brands.

Renderable material, blood, washed hides and skins, and salted skins are further processed off-site.

Crusader Meats employs 180 people at peak. Approximately 31% of the staff live in Benneydale, 21% in Te Kuiti, 14% in Mangakino, 12% in Tokoroa and 12% in Taumarunui. The plant is one of the biggest employers in the area, paying around $8.8 million per year in wages and salaries. The plant also contributes to the regional economy through payments to contractors, farmers and other suppliers. Total annual operating expenditure (including livestock purchases) is approximately $83 million.

The plant was established in 1992 by King Country Lamb Limited, which went into receivership in 1995. Crusader Meats purchased the plant from the receivers in late 1995. Over the years, Crusader Meats has invested substantially in upskilling workers and upgrading the processing facilities, utilities and wastewater treatment - developing the plant into an economically viable and environmentally responsible business with a current estimated capital value of around $20 million.

Crusader Meats wishes to work with key stake holders and obtain appropriate resource consents to enable the plant to continue operating, and as a result, to maintain the plant's contribution to the local economy. We seek a consent term of 35 years to enable long-term investment in the site.

Current Resource Consents

The company holds two resources consents (100696 and 100926) with Horizons Regional Council to discharge wastewater onto land and another consent (100698) to take water from the Waimiha Stream (see Table 1). These permits were granted on 22 May 2001 and expire on 22 May 2016. An application to replace these consents must be lodged 6 months before expiry (i.e. by 22 November 2015) for the plant to continue operating under the existing consents until new consents are granted.

Table 1

Resource consents due for replacement.

Number	Type	Authorised activity	Expires
100696 & 100926	Discharge to land	Discharge meatworks effluent onto and into land on the Te Hape B Block, Tiroa E Block and Tutaki Block.	22 May 2016
100698	Surface water take	Take water from the Waimiha Stream.	22 May 2016

Consents 100696 and 100926 authorise the discharge of processing wastewater and yards' solids to the Te Hape B/Tiroa E and Tutaki properties, respectively. Both consents contain a comprehensive set of operational, monitoring and reporting conditions, including the following:

- The volume of wastewater applied to land shall not exceed 900 cubic metres per day.
- The nitrogen application rate shall not exceed 200 kg per hectare per year.
- The wastewater application depth shall not exceed 50 mm per day.
- There shall be no ponding as a result of the irrigation.
- There shall be no runoff of effluent into any watercourse or wetland area.
- No effluent spray-drift shall enter the Waimiha Stream or any of its tributaries.
- Wastewater shall not be applied within 20 m of any streams and wetlands.
- There shall be no objectionable odour beyond the property boundaries.
- Water quality in the Waimiha Stream shall be tested at three locations three times a year.
- Soil testing is required annually.

- An annual report of the monitoring results shall be prepared and distributed to specified interested parties.

Consent 100698 permits Crusader Meats to take up to 900 cubic metres of water per day from the Waimiha Stream at a rate of up to 11 litres per second. This consent requires that the daily volumes of water taken are recorded and that this information be included in the annual monitoring report.

The plant also holds several resource consents with Horizons Regional Council that are not due to expire for several years, and therefore are not part of the current consents application (Table 2).

Table 2

Resource consents not currently due for renewal.

Number	Type	Authorised activity	Expires
104518	Discharge to land	Discharge a maximum of 12 cubic metres per day of secondary treated domestic wastewater from a meat processing factory to land.	2 October 2025
104934	Groundwater take	Take a maximum of 1,500 cubic metres per day of groundwater from Well Number 654001 for use within a meat works.	1 July 2026
105267	Discharge to air	Discharge contaminants including particulates to air associated with the operation of a 2.9 megawatt oil fired boiler.	1 July 2035

Wastewater Treatment

Wastewater from the plant is screened to remove large particles and pumped to a storage pond (Figure 2) with an operating volume of 5000 m³. The pond provides anaerobic treatment of the wastewater and enables effluent to be stored during wet weather when soil conditions are not suitable for irrigation. The pond enables effluent to be stored for up to 5.5 days at the maximum effluent production rate of 900 m³ per day.

Figure 2 Wastewater storage pond, installed in 1999.

The pond is lined with a heavy duty plastic membrane. Beneath the liner is a leak detection system which is regularly inspected.

Wastewater from the pond is pumped via a network of pipelines to the irrigation areas on the Tutaki and Te Hape B Blocks. A map of the irrigation areas is attached in Appendix 1.

The total area of irrigable land available for wastewater application is 159.4 ha, with 95.8 ha on the Tutaki Block, and 63.6 ha on the Te

Hape B and Tiroa E blocks. An additional 13.5 ha of land on the Tutaki block is used exclusively for spreading yards' solids and excess solids from the storage pond.

The wastewater is irrigated using K-Line pod irrigators (Figure 3). This irrigation method is ideally suited to the rolling and undulating terrain of many of the irrigation areas. The free-draining soil together with the extremely low application rate of around 2 mm per hour enables the wastewater to be irrigated year-round under all but the wettest of soil conditions without runoff or ponding.

Operating procedures for the effluent treatment system are detailed in Crusader Meats' Environmental Management Manual. A copy of the manual is available to interested parties on request.

Unlike the many meat processing companies in New Zealand that rely on a river-discharge for disposal of at least some of their wastewater, Crusader Meats irrigates of all of its wastewater to land – which minimises any effects on waterways.

The irrigation also makes beneficial use of the nutrients in the wastewater, increasing the productivity of the land.

The nitrogen application rate is currently limited to 200 kg per hectare per year, which ensures that very little of the applied nitrogen will leach into groundwater.

Figure 3 K-Line irrigation system.

In the 12 months to 30 May 2015, 19100 kg of wastewater nitrogen was applied to irrigation sites with a total area of 113.8 ha, giving an average nitrogen application rate of 168 kg per hectare. The plant has fully complied with all wastewater application conditions for the duration of the existing consents.

The current land area available for wastewater irrigation is sufficient for the plant's current and anticipated future needs.

Improvements made to the irrigation system over the past 15 years include the following:

- Rain gun irrigators have been replaced with low-rate K-Line irrigators, greatly reducing the risk of wastewater runoff into waterways.
- Pipe bridges and sections of buried pipeline have been upgraded to reduce the risk of pipe leakages and spillages into waterways.
- The buried pipeline network has been extended into the back paddocks of Tutaki Block.
- A pipeline pressure monitoring system has been installed to automatically shut down the irrigation pump in the event of a major pipeline failure.

Water Take

Consent 100698 permits Crusader Meats to take up to 900 cubic metres of water per day from the Waimiha Stream. The maximum permitted abstraction rate of 11 litres per second is less than 4% of the estimated one-in-five-year low flow in the stream.

Consent 104934 was granted on 7 September 2009 to take groundwater from a bore at flows of up to 72 m^3/hour, 1,500 m^3/day and 547,500 m^3/year. The new bore, which became operational in January 2010, improves water quality and security of supply, and provides for possible future increases in production at the site.

Crusader Meats no longer relies on the Waimiha Stream for most of its water needs, but wishes to retain the ability to take up to 900 m^3 of water from the stream for non-potable use on a daily basis, and as a contingency in the event of a breakdown with the bore supply.

The Proposal

An application to renew consents 100696, 100926 and 100698, with a detailed assessment of environmental effects, will be lodged with Horizons Regional Council on or before 22 November 2015. Crusader Meats seeks to achieve the following outcomes:

- New consents are granted with conditions that are practicable and ensure that any adverse effects on the environment remain minor or less then minor.
- The plant is able to continue to operate with certainty.
- The consents are granted for a term of 35 years to enable long-term investment in the plant.
- Key stakeholders are engaged in the consent renewal process.

Crusader Meats proposes only minor changes to the conditions of the existing consents, as follows:

- An increase in the maximum daily irrigation volume to 1,500 m^3 to match the permitted bore water take volume, and for increased operational flexibility.
- An increase in the maximum annual nitrogen application rate to paddocks in which silage is harvested and the silage fed off-site. The weight and nitrogen content of silage removed from each paddock would be recorded. The allowable nitrogen application rate to each harvested paddock would increase by the amount of nitrogen removed in the silage from that paddock. This change enables increased productivity and operational flexibility without increasing the risk of nitrogen leaching.
- Allow for the spreading of yards' solids on land leased by Crusader Meats around the plant and effluent pond, north of the highway. This new application site (H102) is shown on the map in Appendix 1. It is also proposed that yards' solids and excess pond solids be applied to irrigation site H15 (renamed to H101 for solids application) in the Tiroa E Block (see Appendix 1). This area has been available for contingency wastewater irrigation, but has not been needed for this purpose.

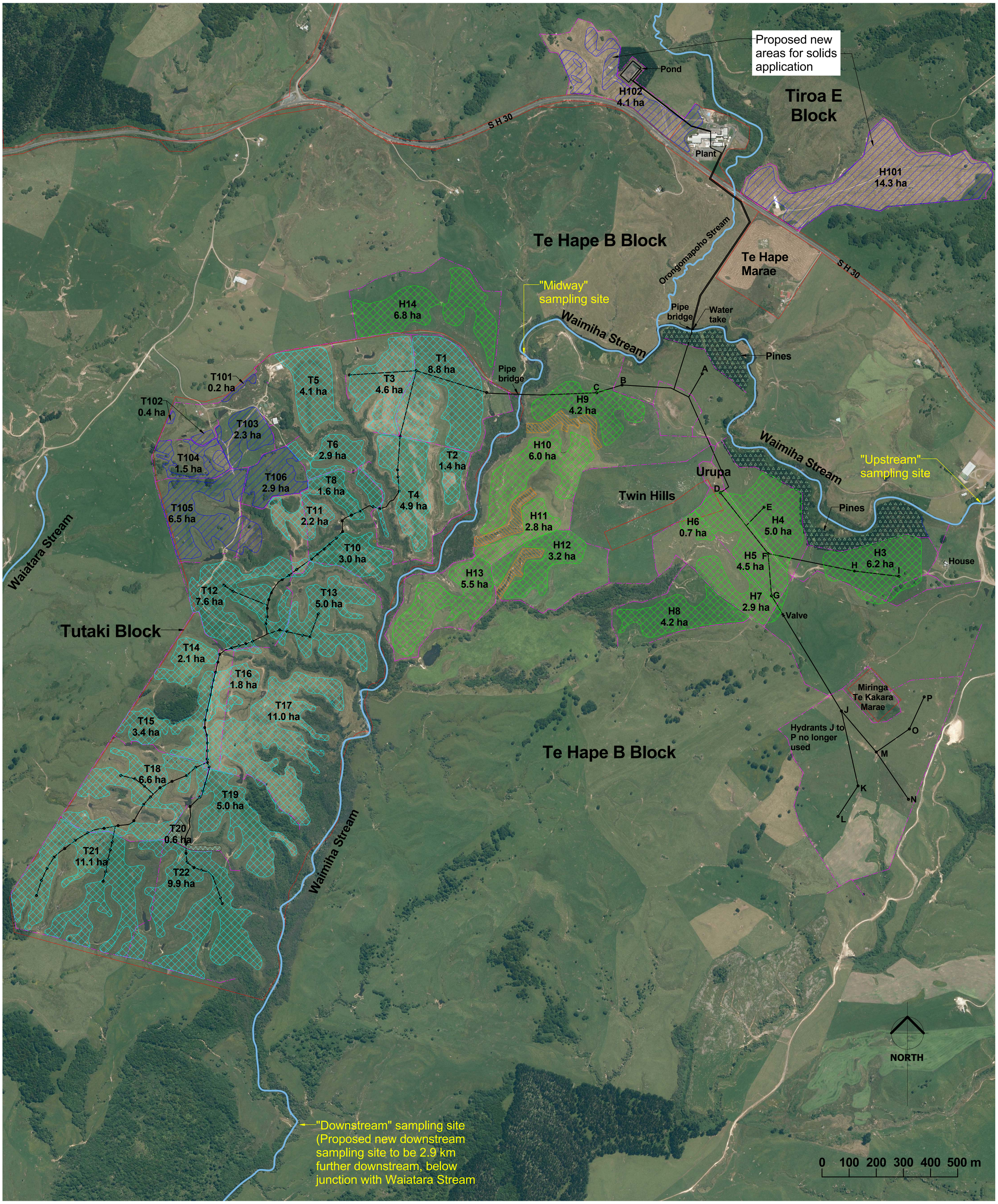
- Specific conditions are proposed for the application of excess pond solids to land. A 2-year running average nitrogen application rate limit of 200 kg N/ha/year is proposed with a maximum of 400 kg N/ha in any one application. Most of the nitrogen in the pond solids is in an organic slow-release form, allowing higher but less frequent applications (than for wastewater) without risk of excessive nutrient leaching.

- We propose to change the location of the "downstream" water quality monitoring site in the Waimiha Stream to a few metres downstream of where the Waiatara Stream enters the Waimiha. Part of the Tutaki Block is in the Waiatara stream catchment. This new monitoring site will improve the monitoring of any effects on the Waimiha stream from the entire land treatment area.

- Removal of the requirement for annual monitoring of soil infiltration rate. The monitoring to date shows high variability in the results and no trend of reduced infiltration. With the change to low-rate irrigation, such testing is no longer justified.

- Improvements to soil sampling methodology. It is proposed that the soil in eight irrigated paddocks be monitored with four of the paddocks sampled each year. Sampling of defined transects is also proposed. Non-irrigated paddocks would no longer be sampled. These changes will reduce the variability in test results and provide better information about the effects of the irrigation on soil quality in both the short and long term. No change is proposed to sampling depths or the total number of soil samples required to be taken.

Appendix 1. Map of Land Treatment Areas



Legend

- Major stream
- Property boundary
- Fenceline
- Irrigation main and hydrant
- Solids application area
- Irrigation Site - Te Hape Block
- Irrigation Site - Tutaki Block
- Wetland area to be fenced and planted

Crusader Meats Land Treatment System Site Plan

28 September 2015

ALBERT VAN OOSTROM & ASSOCIATES
WASTE MINIMISATION & TREATMENT SPECIALISTS

Appendix 8. Written Approvals

Crusader Meats
New Zealand Ltd

Postal: R.D.7, Te Kuiti 3987
Offices: State Highway 30, Benneydale
Phone: 07 878 7077
Fax: 07 878 7080

6th November 2015

Tutaki Family
9 Maniaiti Rd
BENNEYDALE 3987

To whom it may concern

Renewal of Resource Consents Expiring 22 May 2016

- 100696 & 100926 – Discharge meatworks effluent onto and into land on the Te Hape B Block, Tiroa E Block and Tutaki Block
- 100698 – Take water from the Waimiha Stream

As you may be aware we held a Consultation Meeting on Saturday 17th of October 2015. Our records show that no-one from the family was in attendance.

To enable us to continue operating, we must have our application in 6 months prior to the expiry date which is 22nd November 2015.

As an 'Interested Party' we would like to know whether you are willing to sign off your approval for these consents.

If you are willing we would appreciate you completing the bottom of this letter and returning it to us as soon as possible.

If you are not willing to sign off your approval please contact us so we may address any queries / questions / concerns you may have.

Kind Regards

Anne Kelly
General Manager

.....

I hereby advise that I am willing to sign off approval for the abovementioned consents.

Dion Tutaki ....

Name Signature:

to emailed Molly 13/11/15

Department of Conservation
Te Papa Atawhai

23 OCT 2015

File ref: SAR -05

20 October 2015

General Manager
Crusader Meats NZ Ltd
RD 7
Te Kuiti
3987

Attn: Anne Kelly,

Dear Anne

APPLICATION FOR APPROVAL: S95E RMA – RENEWAL OF RESOURCE CONSENTS 100696, 100926, 100698.

I have considered the above application for approval in terms of s95E RMA and am pleased to advise that I grant approval on behalf of the Department of Conservation, as an affected party of the application being considered on a without notice basis.

My approval is on the basis that the proposal is as described, and for the purposes described, and will have no more than the minor effects on the Department's interests. This approval is based upon the description of the activity within documentation supplied for respective consents: Notification of resource consent renewal briefing paper dated 9 October 2015 and 2015 Annual Environmental Monitoring Report - Horizons Regional Council reporting period at 5 March 2015.

This approval is limited to the likely adverse effects of the proposal on the Department's interests and should not be interpreted as approval to effects on the environment generally.

This approval is specific to the above application and is for the purposes of s95E RMA only. It is not indicative of any associated concession or other statutory approval which may be required from this Department in regard to this proposal.

This approval will be rendered null and void if the proposal to which it refers is changed between the date of this approval and its consideration by the consent authority without referral back to the Department for further assessment.

Thank you for having regard to the interests of the Department. Please forward this approval to the appropriate local authority being Horizons Regional Council.

Yours sincerely,

N Hayward.

Natasha Hayward
Conservation Partnerships Manager – Taupo- King Country District

Department of Conservation *Te Papa Atawhai*
Te Kuiti Office
PO Box 38, Te Kuiti 3940
www.doc.govt.nz