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Application to Taranaki Regional Council for Renewal of Resource Consents

Prepared for Remediation New Zealand Ltd

Revised in June 2020 to incorporate further information and response to submissions

Prepared For
Remediation New Zealand Limited

Prepared By
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QUALITY INFORMATION

Reference:	Application to Taranaki Regional Council for Renewal of Consents
Date:	26 June 2020
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Reviewed by:	Colin Kay
Client Review:	David Gibson
Version Number:	17 - FINAL

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1. INTRODUCTION

1.1 Background

Remediation (NZ) Ltd (RNZ) is a company specialising in organic fertiliser production and sales. The Vermicast (worm casting) and compost production capability supplies organic fertiliser to both organic and conventional farmers. RNZ processes and converts, via vermiculture and composting, a wide range of organic waste streams into marketable biological products that can be safely placed back on to agricultural and horticultural land as a beneficial fertiliser and soil conditioner. With the continued emphasis on waste minimisation and the resultant success of RNZ's fertiliser products, vermiculture and composting now offer a simple, sustainable and highly desirable alternative method for dealing with a range of unwanted organic waste streams that might otherwise require less favourable disposal methods, such as landfilling.

Compost produced at Uruti is only used on site as a soil conditioner and bunding activities.

The Uruti Composting facility has been in operation since December 2001 and holds six separate consents with the Taranaki Regional Council, comprising of approximately 90 conditions. Two of the consents for the site expired on 1 June 2018, and application was made to renew these in accordance with 124 (1)(d) of the RMA 1991. These applications were notified and submissions received.

Since receipt of submissions, TRC has requested further information in relation to the activities at the site. Accordingly, this AEE has been revised to include the additional information requested and to reflect changes in management that have been decided upon in light of the concerns expressed and the information sought.

1.2 About this Version

This version of the AEE is a revision of the original application, and is intended to address all s92 information, address submissions and provide an assessment that reflects the changes to the activity that have been developed in response to the s92 request, submissions on the notified consent application and ongoing discussions that have occurred since notification occurred.

Landpro have been engaged to prepare this final version.

1.3 The Applicant

1.3.1 About the Applicant

In 1996 the applicant commenced a worm farm and small composting operation at the Uruti Composting Facility. The benefits of applying vermicast & compost on pastures & crops were quickly evident and it was decided to take the organic products to the wider NZ Public.

The mission of the company is;

"To transform organic resources into valuable, marketable products through composting, vermiculture and quarrying, supported with quality service and innovation"

After 24 years, the business continues with composting, vermiculture and recycling or organic materials, working in the fields of landscaping and rural fertiliser supply. From their head office in New Plymouth, they operate composting sites in New Plymouth, Cambridge and Tauranga, with compost sold to farmers and horticulturalists. Worm farming operations are located in four North Island locations, with an estimated 15 million worms working 24 hours, seven days a week.

Additionally there are associated bagging and retail operations, landscape supplies and aggregate provision and provision of playground surfacing.

Over 100,000 tonnes of organic waste are diverted from landfill and recycled into rich organic compost annually. Each year the company supplies over 50,000 tonnes of compost and vermicast to the farming sector that promotes healthy biological activity in NZ soils.

1.3.2 Address for Service

Applicant Address and address for service: **Remediation (NZ) Limited**

P. O. Box 8045

New Plymouth 4342

2. DETAILS OF PROPOSAL & DESCRIPTION OF ACTIVITIES

2.1 Overview

Remediation (NZ) Ltd seeks to renew and update its two consents for discharges to land, water and air at the Uruti Composting Facility.

These renewals are applied for within the context of the continued growth of the recycling and zero waste industry, and where composting and "a worm driven waste management industry" are seen as viable alternatives to land fill.

2.2 Location

The site where the activities take place is located on State Highway 3 (1460 Mokau Road) approximately 2 kilometres south of the Uruti Village and lies within the catchment of the Haehanga Stream, which is a tributary of the Mimitangiatua River. The legal Description is Pt Sec 4 Blk 11 Upper Waitara SD. A copy of the title and a map of the property are included in **Appendix 'A'.**

Site location details are summarised in Table 1 below and the general location is shown in Figure 1.

Table 1. Site Location details

Land Location:	1460 Mokau Road, Uruti, 4379
Legal Description:	Pt Sec 4 Blk II Upper Waitara Survey District
Certificate of Title:	A1/1241
Site Area:	637ha

The natural existing surrounding environs inhibit any public visibility from SH3, and the closest neighbour is more than 2 kilometres away from the composting area.

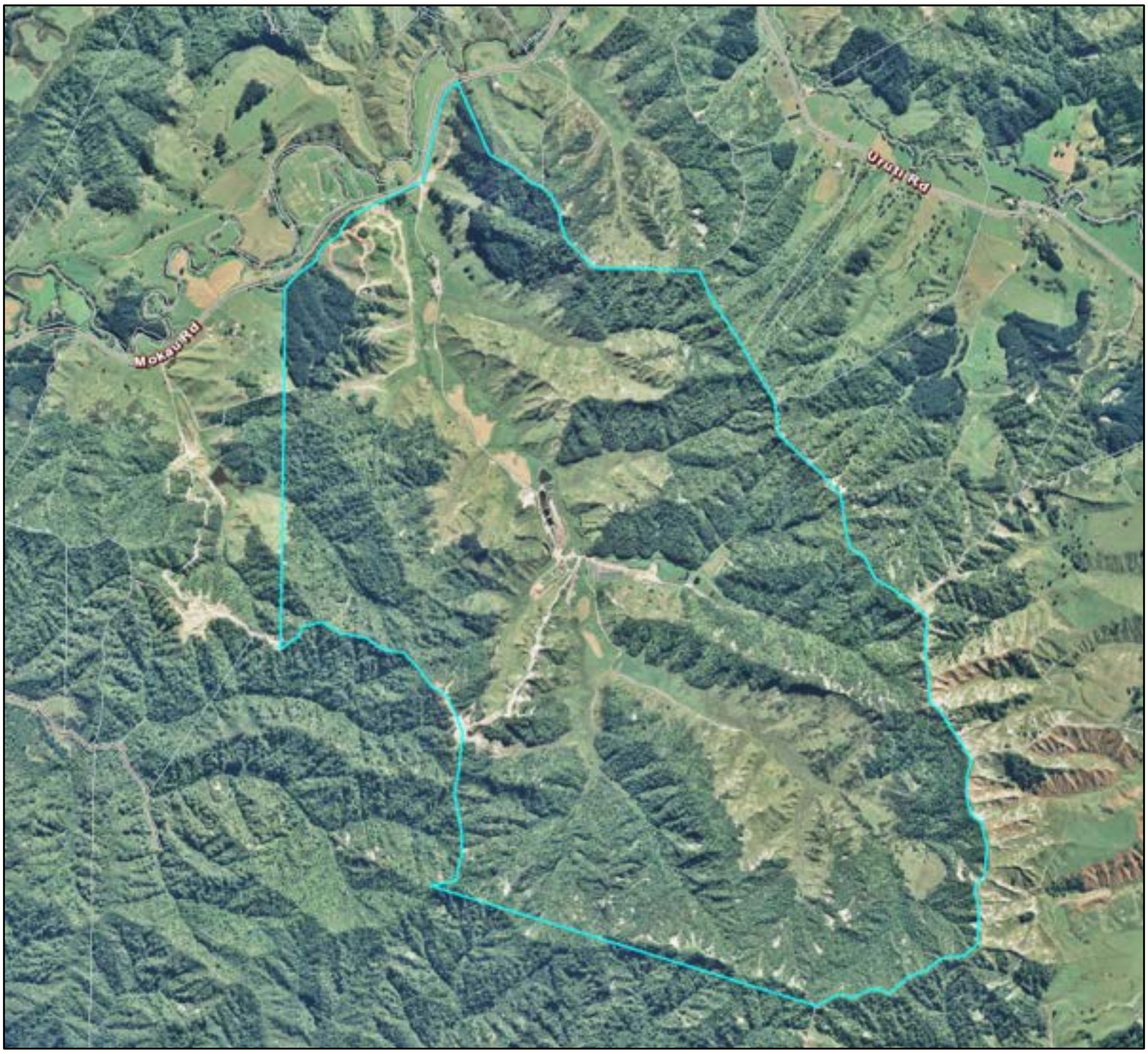

Figure 1: Location of Uruti Composting Site (Source TRC Maps 2020)

2.3 Description of the site and processing facilities

Figure 2 shows a detailed site process diagram showing all site processes. The general site layout is shown in

Figure 3.

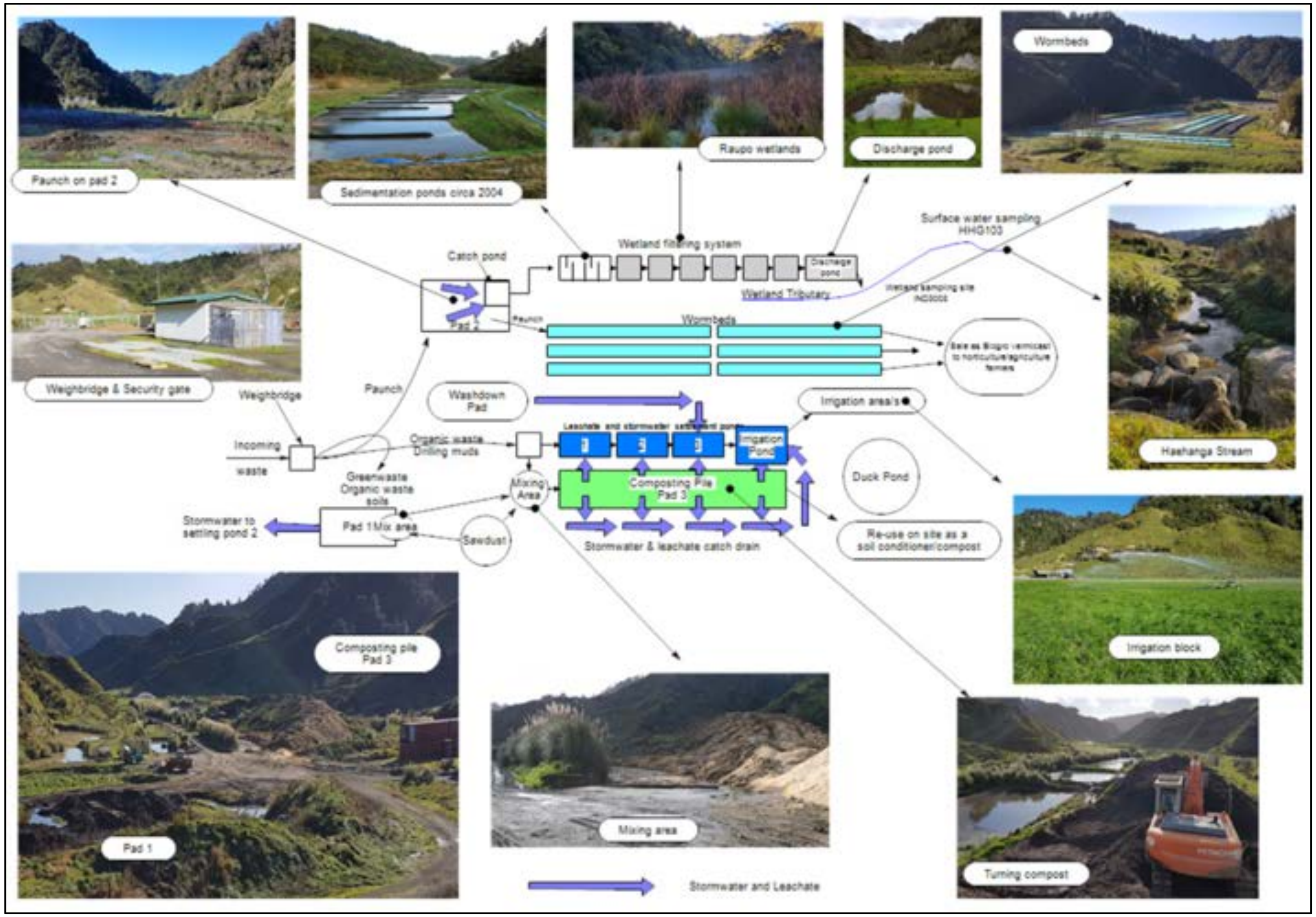

Figure 2. Process Diagram of the Uruti Composting and Vermiculture Facility (A larger version is provided as Appendix T)

Figure 3. General Site Layout

From Figure 2 and Figure 3Figure 2, it can be seen that the current site contains two processes that occur completely separate to one another;

1. Compost Process
2. Vermiculture Process

These two distinct processes are described in the following sections.

2.3.1 Compost Process

The compost process facilities involve two composting pads (Pads 1 and 3), a drill mud/composting mixing pad, and a series of remediation ponds used for liquid waste. Pad 1 is used for all materials listed inTable 2 except paunch and drilling by-products. Pad 3 is the drill mud/composting pad adjacent to the liquid settling/hydrocarbon separation ponds. The construction of these pads is detailed in section 2.4.

Each component received is described in section 2.5.4, however it is noted that flexibility to take other similar materials is provided in the current consent, and sought in the renewal of this consent via a TRC approval process.

Runoff from the process is directed to the irrigation pond, from where the irrigation water is applied to land.

The compost flow model for the compost processing at the Uruti site is shown in Figure 4 below. This shows the flow of material through the processes on the site.

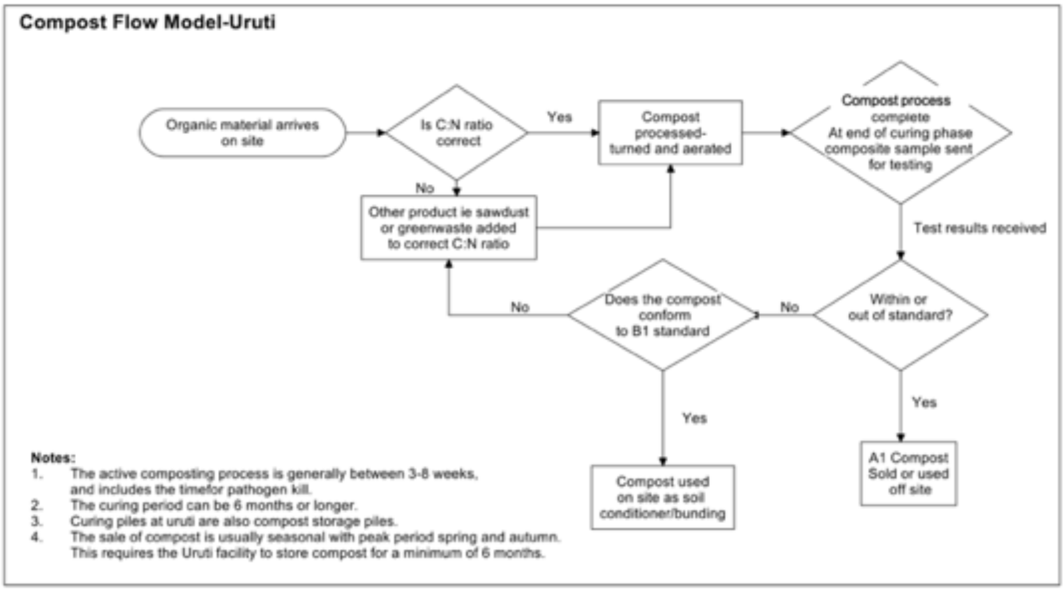

Figure 4. Compost Flow Model – Uruti

2.3.2 Description of the Processes involved in Composting

Composting is the controlled microbial transformation of organic materials under aerobic and thermophilic conditions into a soil conditioner and organic fertiliser. Organic material is blended with carbon rich products such as sawdust and green waste to achieve the required carbon to nitrogen ratios and then heaped into windrows using excavators. The composting process is carried out by a large number of micro-organisms and depending on the raw materials can take a number of months or in the case of drilling muds a number of years.

The composting process generates heat, and temperatures can be produced in excess of 60°C. Composting occurs in two phases, described below:

- Phase 1 "composting": signified by high temperatures and rapid decomposition. This is generally when time-temperature requirements are met to destroy pathogens[1] (within the first month or so). Typically, pile temperatures should be between 40°C and 65°C within the first three days. Optimally, composting is completed within the first 6 weeks.

- Phase 2 "curing": signified by lower temperatures and a slower rate of decomposition. Curing is required to create "mature" compost that can be applied to soils without causing any adverse effects on plants.

When composting is finished, the pile will no longer reheat upon remixing/ turning and the temperature will continue to fall. Immature compost should not be sold for use as a growth medium, as it could be harmful to plants.

Optimally, curing will take 6 months.

Mature compost qualities:

- Earthy smell, moist and cool, friable texture

- Will not reheat when turned/ remixed or wetted

- Looks like dark soil with original wastes not identifiable.

Immature compost qualities:

- Sour or ammonia smell

- Significant heat is generated when compost is turned, or dry compost is wetted

- Is light coloured and raw wastes (other than woodchips[2]) are still identifiable.

2.3.2.1 Potential Problems during Composting Operations

Problems that could be encountered in a composting operation are well understood by site operators, and include offensive odours, and problems with attracting vermin (including insects and rodents, small animals etc.). Unexpected drops in temperature are key indications that there is a problem with the composting process, and could be closely followed by odour generation and vermin attraction.

Generally speaking, the key to maintaining correct temperatures (signifying that the composting process is correctly maintained) is to ensure that the initial waste input mix is correct, particularly in terms of moisture content (40 to 50 percent) and that there is adequate airflow through the windrows. If odours are present then the windrow are turned to improve aeration. In the event that a breakdown in the process occurs, immediate steps are taken to measure moisture content, pH, temperature and take the necessary action as

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[1] Pathogens are micro-organisms that can cause diseases in plants or animals (including humans)
[2] Woodchips are likely to remain after composting, as carbon in this form is not easily broken down by micro-organisms. Typically, woodchip would be screened from the compost and reused as bulking agent

set out in the Standard.

There may also be public perceptions of risks from the release of airborne pathogens. Pathogens that may be present in compost include Legionella sp, Aspergillus fumigatus (a type of fungus), and other fungal spores. If significant quantities of animal dung are added to the compost, other potential pathogens may be present such as bacteria and viruses, although these are unlikely be carried into the air.

The main risk regarding pathogens is to the workers who are processing the compost (e.g. when the compost is being turned). The risk to workers is addressed in the sit OSH plan and is included in staff induction training. Neighbours are generally far enough away that the risk is negligible. However, good practice is required to provide "peace of mind" to neighbours.

"Vector attraction" problems (i.e. creating a pathway for pathogens between the compost and people, by way of animals), particularly the presence of insects, are generally associated with exposed wet wastes or ponding of stagnant water. Timely mixing of raw wastes and good control of water from drainage, runoff, and leaching will limit the opportunities for insect breeding and other vector attraction. Vermin traps can also be used as a back-up measure.

2.3.2.2 Details of the RNZ Composting Process

The Site Practices Plan (**Appendix D**), outlines the composting process and a series of Standard Work Place Instructions (SWPI's) describe in detail the tasks required to carry out the composting process.

RNZ's composting process uses a technique called "windrow composting". Windrows are long piles with a triangular cross-section. Typically the windrows are twice as wide as they are high and can be any length depending upon the available land area.

The windrows are turned on a regular basis to:

- Mix the material and ensure uniform conditions throughout the pile
- Increase airflow through the pile, ensuring that the pile remains aerobic and increasing the rate of decomposition
- Meet the requirements for destroying plant and animal pathogens.

RNS's composting process is based upon best practice guidelines provided within the New Zealand Composting Standard (NZS 4454). Based upon those requirements, the initial composting phase should be for at least 4 to 6 weeks, followed by an additional one month or more of curing time[3].

Increased odour, water vapour and aerosols are likely to be released during the turning of windrows, particularly in the early stages of processing. However, this temporary release of air emissions is generally offset by the advantages of windrow turning, which includes a faster composting process, a better mixed, more even product and, most importantly, reduces the risk of anaerobic pockets of material. Anaerobic conditions create objectionable odours, generally as a result of nitrogen, sulphuric and/ or methane compounds[4].

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[3] Source: Appendix K – Best Practice Guidelines for Composting Systems, *The New Zealand Standard for Compost, Soil Conditioners and Mulches (NZS 4454: 2005).*

[4] Ammonia and sulphurous gases are associated with sharp, pungent odours.

The time taken from beginning to end (i.e. the time take from receipt of material through to it complying with either A1 or B1 standards and being suitable for either sale off site, or use within the site as a soil conditioner under rule 29 of the RFWP) under this process is shown in Table 2.

Figure 5. Composting in Operation on Pad 3

It is proposed to take additional steps to optimise the composting process by establishing a sprinkler system so the windrows can be irrigated to maintain optimal moisture content.

Until the drilling by-products are completely through the system, this water will be taken from either the duck pond, or washwater pond. Ultimately it will be taken from the irrigation pond once there is no risk of cross contaminating the compost with material that has drilling origins.

2.3.2.3 Description of Pad 1 - Organic material - Operations

Pad 1 is 7,764 m^2 in size, material received (see Table 6) on this pad is blended with shredded greenwaste and untreated sawdust to achieve required carbon/nitrogen ratios, wedge piled and left for up to 4 weeks before being turned. The main purpose of this procedure is to mitigate as much as possible any odour at the beginning of the composting process. The compost is turned up to 5 times as it moves towards the back of the pad, where it is left to maturate. Untreated sawdust for the composting operation is also stored on this pad, over a 2,000m^2 area. Completed compost is stored on this pad in a 3,000m^2 area until disposal.

The release of the compost is controlled by the Release of Final Product protocols that outlines the selection standards required to be achieved, and the monitoring and sampling processes undertaken to certify release acceptability.

Material will typically be on pad 1 for 24 weeks, after which time it is composted. If, at the end of 24 weeks there is a shortage of room on the pad for the additional material coming through, the composted material can be removed off this pad to another area on site while it matures, prior to removal from site/sale.

The pond system to manage the leachate and stormwater from Pad 1 is shown in Figure 6 below. Ultimately, all potentially contaminated flows enter the irrigation pond and are managed via irrigation on site.

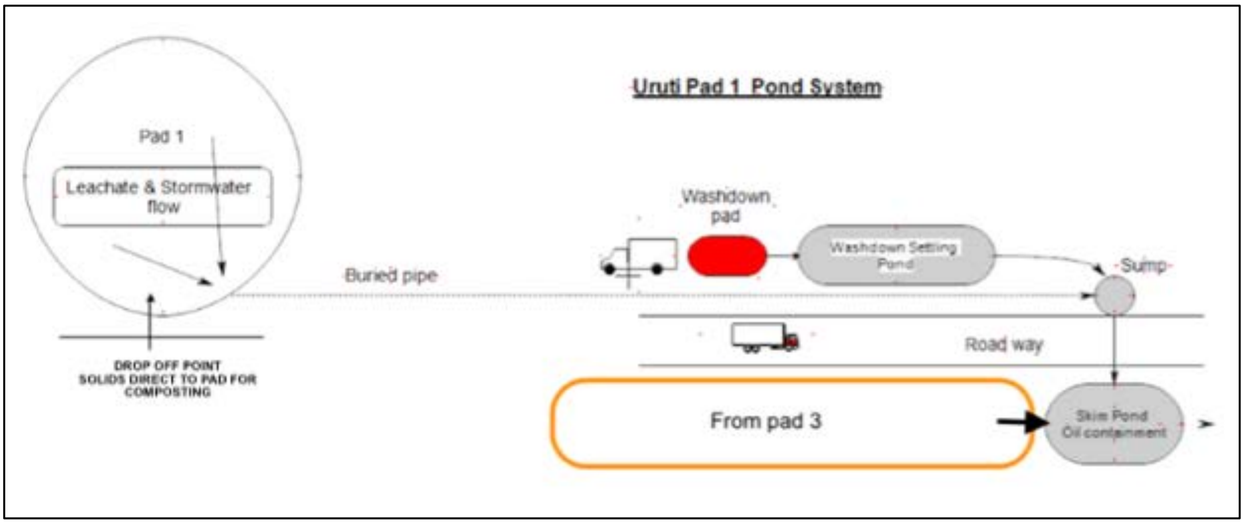


Figure 6. Pad 1 Pond System

2.3.2.4 Fate of Pad 1 material

Material from Pad 1 is expected to be sold offsite (and may be transferred to one of the applicants other facilities for blending, as required) once it achieves A1 criteria (See Appendix G1).

2.3.2.5 Description of Pad 3 - Drilling by-products/Organic - Operations

Pad 3 is 8,132m^2 in size.

From September 2017 until currently, drilling by-product and organic waste (see table 6) has been received in the dewatering and collection pond, from which the material was removed with a digger once the pond was full, and blended with shredded greenwaste, sawdust, other organic matter, and wood shavings on Pad 3 adjacent to the pond.

It has been identified that significant nutrients are being lost from the composting process, and unnecessarily added to the irrigation pond due to this procedure, due to this direct discharge, and because the material begins to break down in the pond before it is removed and blended. This is confirmed in Figure 7 below which shows the Nitrogen levels in the irrigation pond increasing around this time, and fluctuation at a much higher levels than prior to this change.

As part of examining the data that form Figure 7, the applicant also reviewed records and confirmed that the volume of greenwaste received has remained largely unchanged over this time (while noting that the volume of drilling by-product discharged into the pond did fluctuate considerably depending on drilling campaigns).

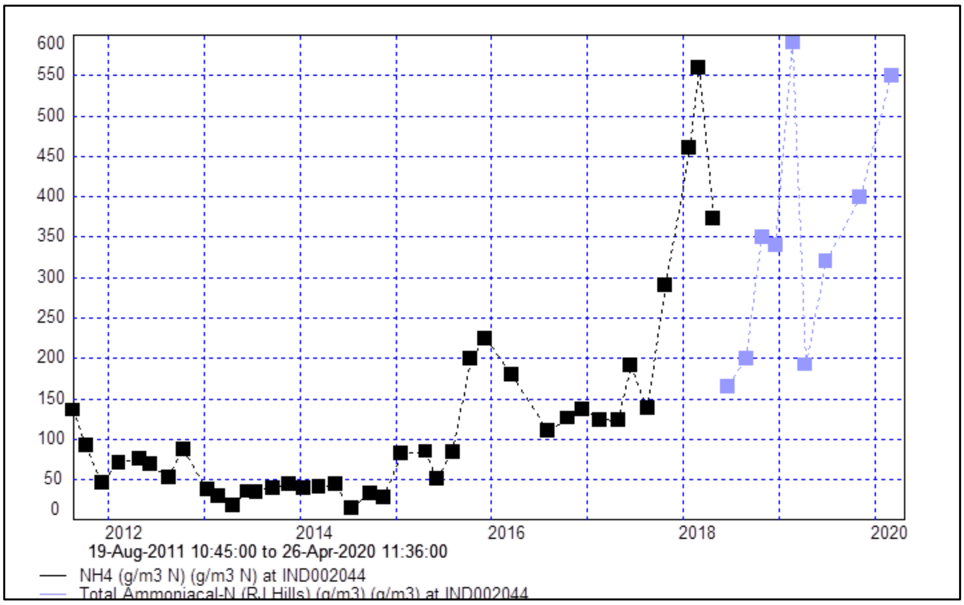


Figure 7. NH4 irrigation pond Uruti since August 2011 (Source. N Crook, TRC, note: last sample as 6 March 2020)

Odour was also being generated from this process of direct discharge to the pond.

As a result of this examination, material is no longer deposited in the pond unless it is liquid waste (most of the liquid waste is of drilling origin). All solid waste is now applied directly to Pad 1 or 3 (Pad 1 receiving material that does not have drilling origins and pad 3 receiving drilling by-products and bulking agents as required to effectively compost it), where it is blended directly. After blending, it is then rowed up for composting as previously. It was originally proposed to extend the concrete receiving area in front of the receiving pond to accommodate this new procedure, however RNZ has determined that this is not required, with the deposit of material directly onto the first stage of the receiving pad working well and avoiding the need for double handling.

Liquid run off from the compost pads (and stormwater from the pads) passes through a series of ponds where any hydrocarbons are separated (hydrocarbons are skimmed off and removed from site, and disposed of at an appropriate facility) and is finally discharged (via irrigation) to one of the predefined irrigation areas. Irrigation management is detailed in section 2.7 and the pond system is described in section 2.3.3.

Well managed composting facilities should not generate leachate, however if there is any leachate from the stockpiles, this will enter the water treatment system.

Once drilling materials are no longer received at the site (this material will not be received from 31 December 2020), the compost material on Pad 3 will be gradually removed and ultimately Pad 3 will also be available for use for the main greenwaste streams. This provides more capacity for composting organic material in the future, enabling more organic material to be received to offset the removal of the drilling by-products, which is an important economic consideration for the ongoing viability of the operation once receipt of drill waste ceases. Essentially the applicant will substitute drill waste with foodscraps and other similar materials.

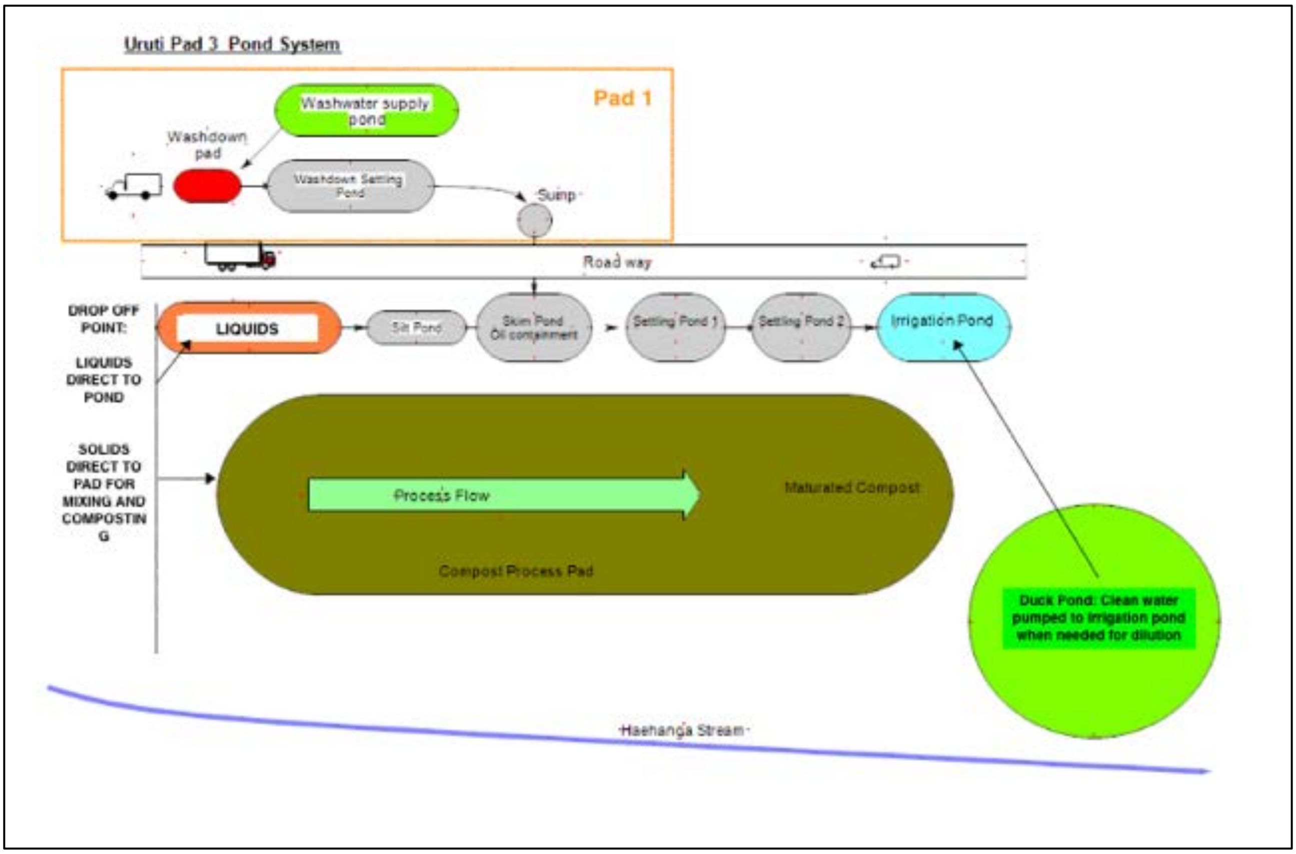


Figure 8. Pad 3 Pond System

It is noted that some of the material on pad 3 (related to drilling by-products) does not comply with the standards for B1 material (as defined in Appendix G1) after what is estimated to be 5 years. As a result of this concern being raised by the TRC, the applicant has examined the reasons this may have occurred, and the reasons for this are believed to be related to;

- Ineffective turning of the material and not turning it frequently enough;
- Poor composting procedures at the time it was originally received due to large volumes of drill waste being received on site at the time;
- The compost potentially did not achieve optimal moisture, with parts of the pile being very dry; and,
- The addition of fresh drilling by-products material to partially composted material may also have played a role (and is related to the second bullet point).

To address this concern, these stockpiles have been turned recently and have been reformed into shorter windrows to maximise breakdown of the contaminants within them. From 31 December 2020, the applicant does not propose to accept any more of the waste that has caused the problems on pad 3.

This pad 3 material may also be irrigated (along with other pads) to achieve optimal moisture content and accelerate the composting of the material.

2.3.2.6 Fate of Pad 3 materials containing drilling by-products

There is a large volume of material being effectively stockpiled on Pad 3, as this has been unable to be sold offsite due to its association with drilling. Additionally, any further drilling related material needs to be managed. The fate of this material is discussed in the following paragraphs.

2.3.2.6.1 Ongoing receipt of Drilling By-products to Cease

The constraints that the acceptance of drilling by-products has placed on this site are acknowledged, and while this has been considered a safe and essential service to the oil and gas exploration and production sector in Taranaki, the applicant has made the decision to cease receipt of drilling material. This will be achieved by giving 6 month's notice (required under contracts) to affected parties, which is in progress. No material will therefore be received after 31 December 2020. This decision will reduce the barriers to removal of future material from the site for sale to the public, with the intention being that drilling waste free compost will be able to be produced from Pad 1 and sold into the applicants existing markets, and the legacy drill waste compost on Pad 3 is gradually used throughout the site (described in more detail below in section 2.3.2.6.2.

There will accordingly be a transitional period – firstly until the last drilling by-products are received (31 December 2020) and secondly as this material makes its way through the composting process (approximately 3 years) and is managed through pad 3.

During this transition period, the existing compost on Pad 3 will be re-treated where necessary by re-adding additional greenwaste/bulking agent and triggering further composting, and reforming the stockpiles into smaller windrows to maximise breakdown. Once it achieves B1 grade (confirmed via testing) it will be used on site to improve soils on the new irrigation area, and for site bunding as described below. Even when the drill-waste compost has been fully addressed, there will be an ongoing requirement for bunding material, and potentially also soil conditioners. The applicant is committed to continuing treating and reprocessing this material until it complies with the standards for application to land under Rule 29 of the RFWP. This is discussed in detail in section 4.1.1.

With the decision to stop receiving drilling by-products from 31 December 2020, there is now a known quantity of this material to be dealt with. It is estimated that a further 2000t of drilling related waste would be received between the date of this revised application, and 31 December 2020 and added to pad 3, in addition to the existing 20,000 t stockpiled (a total of 22,000 t).

2.3.2.6.2 Fate of Material containing drilling by-products

Ideally the applicant would sell this material and it would be removed from site. RNZ continue to investigate options for this to occur and this is the preferred option, while noting some compost is used for valuable purposes around the site to support growth, enhance the Anthropic, High Risk soils in the Upper Irrigation Blocks and enhance the bunds.

Whether the material is sold, or used on site for any purpose (bunds, cold air bunds or application as a soil conditioner), the relevant application criteria and the sampling methods described in Appendix G1, and discussed in section 3.1 will be complied with before the material is removed from the stockpiles.

To achieve the required levels, this material will be mixed with green waste or other compost, and the composting process continued until sample analysis confirms compliance.

On the assumption that the material is unable to be sold, it is proposed that this material will be treated to B1 grade (see Appendix G1) and utilised as follows onsite (volumes are approximate):

- Increase the cold air drainage bund – 10,000 tonnes, Q1 2020
- Top up/enhancement of existing irrigation area bunds – 1000 tonnes Q1 & Q2 2020
- Already applied to irrigation areas as soil conditioner – 4000 tonnes (January 2020)

- Ongoing application to irrigation areas – 500 tonnes per year commencing Q2 2020, potentially increasing to 1000 tonnes per year, to gradually remove the remaining material.

These uses are described below.

2.3.2.6.3 Use for cold air bunding

10,000 tonnes will be used to create additional bunds for cold air drainage within the next 12 months. Bunding of cold air drainage prevents odours travelling offsite in inversion/cold air drainage conditions.

TRC has questioned the impact of the Nitrogen in these bunds on the environment – i.e. the potential of N losses from these bund areas. Essentially, the cold air bund is another stockpile of the material, albeit likely to be a permanent one. In this regard it is noted that:

- The cold air bunds are not irrigated, therefore not exposed to the risk of leaching from regular irrigation nor the added nitrogen in irrigation water.

- The bunds are high and deep, meaning material in the middle of the bunds is not exposed to leaching and the breakdown of the organic nitrogen within the bunds will be very slow due to the lack of oxygen and microbial activity that is required for this process.

- The cold air bunds are shaped so that water flows off them, rather than soaking through them, again, reducing drainage/leaching from these bunds when it rains.

- The Total Nitrogen levels in the composted material that will be bunded (0.61%) are similar to the Total Nitrogen levels in typical Taranaki topsoils and therefore not considered excessive. Topsoil could be used instead of compost to form these bunds, and would have the same Nitrogen Loading effect on the environment as the compost proposed.

2.3.2.6.4 Use of current material for top up of existing site bunds

Once within B1 criteria (see Appendix G1 for the testing and criteria to ascertain this), Pad 3 material is used beneficially to create and enhance bunds surrounding the irrigation areas on the site. The purpose of these bunds is to guarantee no overland flow (including surface water runoff during rainfall events when the area is not being irrigated) enters the Haehanga Stream, which is a condition of the TRC discharge consent for the site. It is also noted that the High Risk Soils identified in the Upper Irrigation area are classified as high risk as there is elevated risk that these soils, when irrigated, will see overland flow or overland run-off. These bunds further mitigate this risk.

The bunds have been formed from papa more recently, to enable the new irrigation areas to be established and developed with urgency. These papa clay bunds will require cover with compost material to allow vegetation to establish on them and it is noted that if the Pad 3 material was all sold off site, the applicant would still use composted material from the process to enhance the bunds in this way. This is discussed below.

Material will also be used to increase the height of bunds in some areas (providing these are no closer than 25m to the waterways, in order to comply with Rule 29 of the RFWP) to improve their retention capacity. Approximately 1000 tonnes will be required for this purpose in 2020 and it is possible more will be required for this purpose in the future. These bunds are not irrigated, and the compost will be placed over the existing papa to promote plant growth in the same way topsoil could be used for this purpose. It is noted that Total Nitrogen levels in the compost is similar to topsoil (see section 7.7), and anticipated that the nitrogen present will be taken up by the plants established on the bunds. As the bunds are not receiving irrigation water, there is also no nitrogen introduced from this source.

2.3.2.6.5 Use of current material as soil conditioner application to irrigation areas

One off application during establishment of irrigation areas

During the earthworks required for the new irrigation areas shallower soils result in a papa base that needs soil conditioning to develop a top soil. Topsoil is re-spread, but the compost is ideal for this purpose and will enable the new irrigation area to be established and brought into service quickly. This process essentially creates a fertile topsoil immediately. The importance of the compost in this process is highlighted by the findings of the recent soil investigation on site, with the recent, upper irrigation blocks being deemed

This process of application to land started in late 2019 with testing confirmed by the TRC and approximately 4,000 t of material was approved and applied.

Ongoing application to add condition to the soil

500 tonnes per year of this Pad 3 material (once within criteria) will be applied to the irrigation areas, as recommended by the report in **Appendix AA**. Application at this rate will start this year (2019) and continue indefinitely as part of site management. The report in **Appendix AA** also indicates that the volume of material applied to the irrigation areas may be able to be increased if the levels in Nitrogen in the irrigation water are able to be reduced, however for the purposes of this assessment, it is assumed that only 500 tonnes per year is applied. The compost application of both 500 tonnes & 1000 tonnes per year compost application is included in the new OVERSEER® model (**Appendix AA**), and the N losses from compost application are discussed in the overall N loss discussion from the site.

The compost material will add organic matter to the soils in the irrigation areas, and improve their capacity to grow pasture, retain and disperse moisture. The more pasture that can be grown, the greater the yield of cut and carry crops (baleage) and the greater removal of Nitrogen is possible. Good quality soil also holds more moisture and results in less drainage (by improving dispersion), which also reduces leaching and overland flows.

If Nitrogen levels in the irrigation pond respond as expected to the removal of direct inputs, then it is likely that the application of compost to the irrigation areas could be increased within the proposed Nitrogen application thresholds (see section 7.4.6). This would enable the remaining material from pad 3 to be managed more quickly.

2.3.2.6.6 Alternative options for management of pad 3 material

TRC has requested information about the fate of this material if it was unable to be applied to land under Rule 29 of the regional Freshwater Plan (see section 4). Essentially, this material would continue being processed on the site, by regular turning and management, and adding of more bulking agent if necessary, until such time as it meets the criteria for B1 Grade material (see Appendix G1). B1 Grade material complies with Rule 29 of the RFWP.

If this Grade B1 material was still unable to be sold offsite due to its drilling origins, and for some unforeseen reason was not able to be applied to the land onsite, the worst case scenario with this material is that it is stockpiled securely (i.e. revegetated and stabilised) within this site, and applied to land as a soil treatment at the end of the site's life when the site ceases operation and is reinstated.

It may also be cost effective to continue to mix and compost this material so that it complies with the standards for A1 material (See Appendix G1 for these standards).

The applicant is still actively pursuing options for sale of this material. Options include roadside revegetation projects and quarry reinstatement. It is a valuable, highly fertile material and has many beneficial uses (including use within the site).

2.3.2.7 Leachate Management

Leachate may be produced as excess rainwater runs through and out of the compost. This leachate contains nutrients, organic matter and may include ammonia. If leachate is discharged into streams it can affect water quality, aquatic animals and plants. If excessive leachate soaks into the ground it can contaminate groundwater. To mitigate the latter possibility, all composting pads at Uruti are based on an impervious papa pad. The low permeability of these papa pads means that there is a barrier preventing leachate transmission to groundwater. The impervious barrier means that leachate will flow through the compost piles, hit the barrier, and flow out of the bottom of the pile into surface collection systems.

Leachate and stormwater from both Pads 1 and 3 flow through to the irrigation pond (as shown in Figure 6 and Figure 8), from where the stored liquid is aerated and irrigated to land. Irrigation is carried out taking into consideration likely rain, N2 loading and the ability of the soil to accept irrigation water without runoff, and this process is detailed in section 2.7.

Leachate/water from the irrigation pond may be irrigated onto the composting windrows to maintain moisture levels to within the guidelines set out in the composting standard[5].

2.3.3 Description of the Pad 1 & 3 Pond System

The pad 1 and 3 pond system is the water treatment system associated with the site composting processes, and comprises three separate ponds;

1. Washdown settling pond

2. Pad 1 & 3 treatment ponds comprising:

- Dewatering and settling pond
- Silt collection pond
- Skim pond
- Settling ponds 1 & 2
- Irrigation pond

3. The Firefighting/contingency pond/'Duck Pond'

These are discussed below.

All ponds on site are managed via the Pond Management Plan. This is described below.

[5] *NZS4454:2005 Composts, Soil Conditioners and Mulches*

2.3.3.1 Washdown settling pond

The washdown pad is used to clean trucks after they have dumped their load of organic waste. Wash water is pumped from the washdown supply pond. Runoff liquids from the wash are collected in the washdown settling pond and the pond overflow flows to the collection sump and then into the skim pond. In terms of regular maintenance of this pond, every six months site operators scoop out sediment and deposit into dewatering and collection pond. This pond discharges into the skimmer pond, and material flows from there to the irrigation pond.

2.3.3.2 Pad 1 & 3 treatment ponds

Surplus liquids from pad 1 and 3 are collected in the dewatering and collection pond. Liquids flow into a series of settling and treatment ponds and eventually flow into the Irrigation pond. The pond levels are maintained by a series of T weirs at the pond discharge (T weirs are designed to stop any solid material from overflowing from one pond to the other).

This pond systems are illustrated in Figure 6 (Pad 1) and Figure 8 (Pad 3).

The characteristics of the fluid in the irrigation pond are detailed in section 2.6.2.

As mentioned earlier in this document, it is proposed to make changes to the way waste is received, with the concrete receiving pad being extended, and compostable material being applied directly to the compost areas and mixed with greenwaste/bulking agent instead of being discharged into the pond, where the nutrients can be lost into the irrigation water, instead of being captured in the compost.

2.3.3.3 Firefighting/contingency pond/'Duckpond'

This pond – often referred to as the 'duck pond' - maintains its level by rain water and some ground soakage. Water from this pond is pumped into the irrigation pond during dry conditions to maintain dilution levels in the irrigation liquid (reducing N^2 & Cl^2 levels) and to the washdown supply pond to maintain minimum pond levels to provide washdown water during dry conditions.

This pond seldom requires desludging, so identification of the need for desludging occurs visually, and the work occurs as required.

Concerns about the levels of contamination in the groundwater bore adjacent to this pond (GND003009) have been raised, and recent results indicate possible surface water/groundwater interaction between this pond and the bore, and possibly the Haehanga Stream (though it is difficult to draw conclusions from the surface water monitoring results in HHG000115).

The need for this pond is currently being reviewed, and potential causes of the elevated NH3 and NH4 levels in particular, is currently being examined. A dam is under construction upstream in the catchment (at the time of this report, only the spillway is left to complete), and water from this dam may be able to provide the clean water necessary for dilution, washwater and fire water supply, negating the need for the duck pond. The other aspect being considered is whether dilution is going to be required in the future, given the proposed changes to the management of and inputs to the irrigation pond. The applicant proposes to monitor the performance of the new dam and the use of this pond over the next two summers, at the end of which an assessment will be made on whether it is retained. Concurrently, the engineering integrity of the pond will be assessed and where possible, improvements made. A decision on whether the pond is retained will be made in March 2022, and if the pond is retained, the integrity of it and need for it will be demonstrated.

The applicant is agreeable to a condition of consent that requires removal of this Duck Pond before 1 June 2022, unless, prior to this date, it is demonstrated to the satisfaction of the TRC that the ponds is not resulting in adverse effects on the environment.

2.3.3.4 Pond Management Plan

2.3.3.4.1 Purpose of the Plan

Within the Site Practices Plan is the Pond Management Plan, and part of the plan describes the role of each pond system and provides instructions for the operation and maintenance for each system. The key aspects of the Pond Management Plan are discussed in the following sections.

2.3.3.4.2 Pond system inspection

Each pond is inspected daily to ensure the pond levels are maintained and there is no unplanned liquid overflow and the solids or sediment in each pond are below the planned maximum levels.

2.3.3.4.3 Operational and Maintenance Measures for the Dewatering and Settling Pond System

The routine maintenance that is carried out on the Dewatering and Settling Pond system are listed below:

- **Dewatering and Collection Pond**
    - Monthly - Scoop out sediment from the pond and deposit onto the compost pile
- **Silt Pond**
    - Monthly – scoop out and deposit into the dewatering and collection pond
- **Skim Pond**
    - Monthly – skim hydrocarbons from the pond and deposit into the hydrocarbon collection tank
    - Annually – Scoop out sediment and deposit into dewatering and collection pond
- **Settling pond 1 & 2**
    - Annually – Scoop out sediment and deposit into dewatering and collection pond
- **Irrigation pond**
    - Annually – Scoop out sediment and deposit into dewatering and collection pond

2.3.3.5 Permeability of site ponds

All ponds have a natural papa base, and constructed side walls are also made of compacted papa clay. Papa is recognised as being highly impermeable, and it compacts well. TRC have raised concerns in relation to the integrity of the duck pond, and the incident (triggering an abatement notice) in July highlighted the importance of using compacted papa in the bunds and ensuring their integrity. This is discussed further in section 3.8.5.7

below).

The TRC's Dairy Effluent Pond Guidelines (Tonkin and Taylor) are available via this link:

https://www.trc.govt.nz/assets/Documents/Plans-policies/SoilWaterPlanReview/DraftFLMP-rptDEPguidelinesRevA3Jul13.pdf)

and describe Taranaki soil zones, associated soil types and permeabilities in Table 1 (see Page 7 of this document). In the dissected hill country where the subject site is located the brown/grey dissected mudstone/siltstone (papa clay) is identified as having a permeability range of 1 x 10^{-6} to 1 X 10^{-9}. The guidelines identify that dairy effluent ponds require permeability of less that 1 X 10^{-9} (and this standard is adopted by many regional councils around NZ) and it would be expected that similar requirements would be applied at the RNZ site. Naturally occurring and compacted Papa are able to achieve the impermeability required and are much easier to manage than lined pits for an operation such as that occurring at RNZ.

2.3.4 Pad 2 – Paunch Pad Pond

Pad 2 is the Paunch Pad. Paunch is stored here prior to application onto the vermiculture beds. Runoff water from this pad does not enter the irrigation system but is instead collected in a separate pond and pumped to the top of the wetland. The wetland discharges directly into the Haehanga stream. This pond is de-sludged on an 'as required' basis, with the sludge material applied to the compost pile on pad 1.

This process is outlined in the Wetland Treatment System Management Plan, refer to **Appendix E1**.

2.3.5 Site Vermiculture Process

Pad 2 is called the 'Paunch Pad'. Paunch is the only product on site used in Vermicast production. It is pre-composted on the back of Pad 2, and any associated leachate is processed through the wetland system. The lower section of Pad 2 is used as a worm breeding bed.

2.3.5.1 Description of Pad 2 - Paunch Pad

Pad 2 is 8,132 m^2 in size. Paunch (partly digested grass from a cattle beast's stomach at slaughter) is the only product received on this pad. Once received it is left for up to 6 months after which it is removed and fed to worm beds at Uruti and Brixton.

The construction of the pads onsite is detailed in section 2.4.

Once processed by the worms it becomes vermicompost and finally vermicast. The vermicast beds are covered so as to ensure optimum conditions for the worms to remediate the paunch grass.

2.3.5.2 Vermiculture Process

Vermiculture is the decomposition of organic material by earthworms.

Paunch (partly digested grass from a cattle beast's stomach at slaughter) is spread out into vermiculture rows approximately 3 meters wide and 0.5 meter high. The beds are raked and then the beds are covered, as can be seen in photo 7 below. The worms within the beds digest the paunch and convert it into vermicompost and finally to vermicast.

Figure 9. Vermiculture/worm beds

Vermicast, apart from suppling nutrients to plants, improves soil structure leading to an increase in water and nutrient holding capacities of soil.

Once the input materials have been transported to Pad 2, they are fed into small windrows ready for processing by the worms to form vermicast. A typical windrow is shown in Figure 10 below.

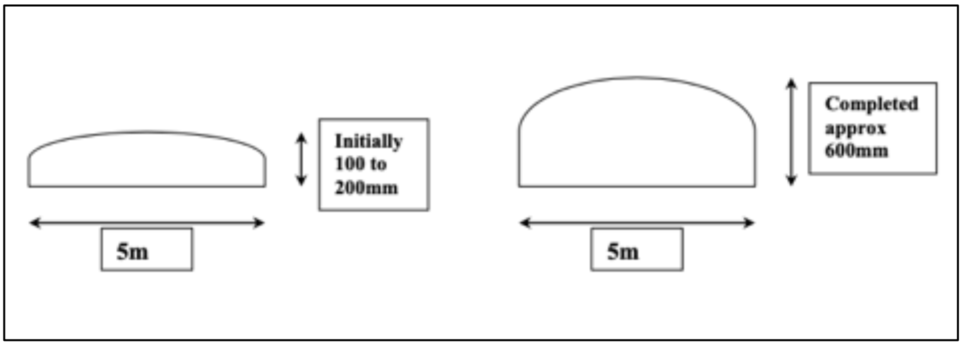


Figure 10. Typical Vermiculture Windrow (Source: *Remediation (NZ) Organic Protocols - Compost and Vermiculture - Biogro, see Appendix J*).

The process involves an extended period of standard aerobic composting conditions over a minimum of 35-40 days. The temperatures for worm processing are a lot lower than that of Greenwaste composting and should range between 20° – 30° Celsius. The process is as follows;

- The windrows are covered with mats to retain moisture and reduce the effects of wind.
- During the natural vermiculture process the worms will aerate the windrows, however approximately every 30 days the windrows will need to be manually aerated, to ensure the whole windrow is digested and that the environment is kept aerobic. Anaerobic conditions will kill the worms and enhance pathogen production, so this must be avoided.

- The worms act as a catalyst in this environment. The digestion of the soil provides an aerated environment as well as increases the soil surface area. This larger surface area allows viricidal enzymes, actinomycetes, and a host of critical bacteria to have access to more compost at any given time. With a correct time period in this process the compost can be completely turned over ensuring maximum pathogenic degradation.

- The period range for this procedure is 80-120 days to obtain total pathogenic mitigation. This is a time frame that can be altered to suit the waste line to ensure total disinfection.

- The beds (Vermicast) are harvested on a four monthly basis. A base of at least 50mm remains to ensure no topsoil/clay is collected, eliminating the potential for contamination.

- The Vermicast is then prepared for sale by drying it and either mixing, selling as is, bagging or making it into liquid Vermicast products.

- The vermicast is sampled annually for a wide range of analytes, in accordance with strict organic certification procedures.

As the vermiculture processes are certified organic, these occur under the procedures in **Appendix J**. Other activities on this site are not currently certified organic, however in the future, once the drilling by-products are fully processed, and trials with food scraps are undertaken, this may be possible. Please therefore note that the procedures in **Appendix J** apply to vermiculture only.

2.3.6 The Wetland

The Wetland, shown in Figure 11 below, receives stormwater and leachate from pad 2, the Paunch Pad. The wetland system has an initial sediment retention pond, followed by seven terraces. Each terrace is planted with various species of plants to deal with varying nutrient levels of leachate. Once the leachate has passed through the wetland system it is collected in a 1,000 m^3 capacity pond before discharge to an un-named tributary of the Haehanga Stream.

The wetland was cleaned out and areas replanted with Raupō in early 2019, after RNZ identified that there had been little management and maintenance of the wetland since its installation. This will increase the retention time within the wetland, and will ensure the ongoing good performance of the wetland system.

Figure 11. RNZ Wetland

2.4 Pad Construction

All pads have been constructed of a 1 metre deep compacted layer of papa and bunded on the perimeter to contain organic material and stormwater within the area. The papa prevents downward migration through the soil profile as it is impervious.

Figure 12. Pad 1 construction

This papa base underlying pad 1 can be seen in Figure 12 above.

Exclusion drains have also been cut to divert stormwater from the surrounding catchments, preventing stormwater running through the pad areas and entraining contaminants. These exclusion drains eventually carry the clean, diverted stormwater into the Haehanga Stream. See Figure 13.

Figure 13. Exclusion Drain (right) diverts clean water around the 'duck pond'

2.4.1.1 Changes to receiving pond

It is proposed to make changes to the way waste is received, with the concrete receiving pad being extended, and compostable material being applied directly to the compost areas and mixed with greenwaste/bulking agent instead of being discharged into the pond, where the nutrients can be lost into the irrigation water, instead of being captured in the compost.

2.5 Organic material Inputs and Capacity

2.5.1 Overview of Organic Inputs and Capacity

The Uruti site accepts a range of organic material and drilling by-products and through the process of composting and vermiculture converts these inputs into a soil conditioner and organic fertiliser.

The majority of the material accepted on site comprises of green wastes, paunch grass, chicken mortalities, fish waste, drilling by-products, carbon compounds (sawdust) and manures.

The acceptance of products onto site are guided by the resource consent conditions as listed in the Uruti site resource consent 5838-2.2 and the Waste Acceptance Plan (**Appendix M**). The current consent (5838-2.2. condition 2) provides for a process with the TRC, that enables inputs not specifically listed on the consent to be approved for composting at the facility if it will have similar effects to materials listed. As a result there is a wide range of product on the acceptable waste list, from a wide range of sources, but all is organic in origin and beneficial in terms of nutrients, and composting this material avoids it going to landfill for disposal.

2.5.2 Volume of Material

Until the drilling by-products are no longer accepted on site, it is proposed to accept up to 8,000 t of organic product to compost per annum as listed in Table 6 (this figure includes the material listed as commercially sensitive). Additionally, 4000 t of paunch will be processed through the paunch pad (pad 2).

These numbers are based on the volumes received on the site under the current consents, and also based on the volumes anticipated from the NPDC Food Waste Collection and other contractual arrangements.

It is also known through the experience of the applicant that during the compost process generally 50% of the mass of the incoming material is lost which leaves 4,000t of product for removal as compost. 3,000t of this product is expected to be A1 grade compost and will be removed from site. The remainder of product is likely to be B1 grade and will be used on site for bunding and applied to land as a soil conditioner. Should there be a surplus of B1 product this will be blended with composting material and reprocessed until it meets A1 grade and is exported.

Existing compost on site is to be tested[6] and may be reprocessed repeatedly until it meets the A1 or B1 standard as defined in **Appendix G1.**

A1 Material and B1 Material, and means of confirmation of compliance with these standards, are described in section 3 of the Release of Final Product Procedure (**Appendix G1**). A1 grade compost is fully compliant with NZS4454:2005 Composts, Soil Conditioners and Mulches. This compost is able to be used off site.

B1 grade compost is compost that can be used around site for bunding. This material is then covered with top soil or A1 grade material. The discharge of B1 grade compost on site will be compliant with Rule 29 of

[6] See Release of Final Product:(RU-650-0900) Appendix G

the Taranaki Regional Council Regional Freshwater Plan.

In addition to the 8000 t of organic product proposed to be accepted, a further 3,800 t of drilling by-products may be accepted until drilling by-products are phased out (31 December 2020). This is based on the volumes allowed for under existing contracts. All of this material will continue to be mixed with appropriate bulking agents and processed through pad 3.

Once the drilling by-products is a) no longer received and b) stockpiled material is completely removed, it would be possible to process up to 30,000 tonnes of organic material through the site each year.

2.5.3 Volume of material currently onsite

At 1 October 2019 there are currently the following volumes 'in progress' on site:

- Pad 1 2,000 Tonnes
- Pad 2 1,000 Tonnes
- Pad 3 20,000 Tonnes
- Stockpiled 1,000 Tonnes (fully composted organic material)

The 20,000 t on Pad 3 is the composted drilling by-products material which has been unable to be sold, and which, when appropriate levels are reached, will be applied to land under Rule 29 of the Regional Freshwater Plan. This material has essentially been stockpiled over a number of years and is now being re-formed into wind-rows and more actively managed to achieve more rapid breakdown.

In a letter dated 19 September 2019, the TRC requested further information about the activities under section 92 of the RMA. TRC requested that a full description of all waste streams, including the proposed annual volumes be provided, which is this intention of Table 2 below.

Table 2. Anticipated Waste Streams Uruti Composting Facility

Description	Frequency	Amount T/annum	Receiving Area	On site process	Time to process (months)	Final fate of material	Notes
Paunch	Daily (during season)	4,000	Pad 2 (Paunch Pad)	Vermiculture	12	Vermicast – sold off site	Stored pad 2 until fed to worms then exported as vermicast
Composted Product							
Poultry industry waste (eggshells, yolks, macerated chicks, chicken mortalities, sausage waste)	Daily	Commercially sensitive	Pad 1	Composted	12	Compost-on & off site	Stored on site pending final usage
Greenwaste (Bulking agent)	Daily	3,000	Pad 1	Composted	12	Compost-on & off site	Added to the food scrap matrix
Sawdust (untreated)	Weekly	500	As required throughout Pad 1 and 3	Compost matrix	12	Compost-on & off site	Food scrap matrix
Molasses	Occasionally	50	Pad 3	Composted	12	Compost-on & off site	
Dairy industry waste (including but not limited to cheese, milk	Occasionally	Commercially sensitive	Pad 3	Composted	12	Compost-on & off site	

Description	Frequency	Amount T/annum	Receiving Area	On site process	Time to process (months)	Final fate of material	Notes
powder, cream, milk whey)							
Food/household scraps/greenwaste	Daily	3,000	Pad 1	Composted	12	Compost-on & off site	NPDC collection, food and drink manufacturing, commercial/hospitality food waste. (some of the NPDC waste collection may not be food per se, but may be household greenwaste like cut flowers/plants)
Palm Kernel/Grain or other stock feed	Occasionally	300	Pad 3	Composted	12	Compost-on & off site	
Grease Trap Waste	Occasionally	50	Pad 3	Composted	12	Compost-on & off site	
Tello	Occasionally	50	Pad 3	Composted	12	Compost-on & off site	
Pea Fat	Occasionally	50	Pad 3	Composted	12	Soil conditioner-on & off site	
Water treatment sludge	Occasionally	300	Pad 3	Composted	12	Soil conditioner-on & off site	
Soil Remediation	Occasionally	Commercially sensitive	Pad 1	Composted	12	Compost-on & off site	

Description	Frequency	Amount T/annum	Receiving Area	On site process	Time to process (months)	Final fate of material	Notes
Pulp and Paper Residue	Occasionally	Commercially sensitive	Pad 1	Composted	12	Compost-on & off site	
Prolick	Occasionally	100	Pad 3	Composted	12	Compost-on & off site	
Canteen waste (food scraps) specifically from Powerco and Fonterra	Weekly	50	Pad 3	Composted	12`	Compost -on & off site	
Diatomaceous earth mix (Fonterra Kapuni, Todd aquatic centre)	Occasionally	50	Pad 3	Composted	12	Compost-on & off site	
Animal Manure from meat processing plant stock yards, stock truck effluent collection and dairy farm oxidation pond solids;	Occasionally	50	Pad 1	Composted	12	Compost-on & off site	
Vegetable waste solids (being processed by-products);	Occasionally	50	Pad 1	Composted	12	Compost-on & off site	
Fish skeletal and muscle residue post filleting (free from offal);	Occasionally	50	Pad 1	Composted	12	Compost-on & off site	

Description	Frequency	Amount T/annum	Receiving Area	On site process	Time to process (months)	Final fate of material	Notes
Estimated other waste streams agreed with TRC	Occasionally	300	Pad 1	Composted	12-36	Compost -on & off site	
Total Composted		**8,000t**				3000t offsite (A1) 1000t onsite (B1)	**After composting 4,000t for disposition (losses in process)**
Oil Industry Product		**T anticipated during phasing out (until 31 December 2020)**					
Drill mud-WBM	Occasionally	1,000	Pad 3	Composted	36	Soil conditioner-on & off site	Until 31 December 2020
Drill mud-SBM	Occasionally	1,000	Pad 3	Composted	36	Soil conditioner-on & off site	Until 31 December 2020
Dirty water-	Occasionally	1,000	Pad 3	Composted	36	Soil conditioner-on & off site	Until 31 December 2020
Produced water	Occasionally	300	Pad 3	Composted	36	Soil conditioner-on & off site	Until 31 December 2020

Description	Frequency	Amount T/annum	Receiving Area	On site process	Time to process (months)	Final fate of material	Notes
Hydrocarbon contaminated soil	Occasionally	500	Pad 3	Composted	36	Soil conditioner-on & off site	Until 31 December 2020
Total		**3,800**				Likely Onsite – B1 Alternatives are however being investigated.	**2,000t product to be used for bunds or soil conditioner once processed.**

2.5.4 Description of Material

The TRC request for further information dated September 2019 suggests that the applicant should assume that there will be no allowance for material not specified in the application.

It is understood that TRC seek certainty and assurance, however the applicant wishes to retain a similar mechanism to that provided in condition 2 of the existing consent 5838-2.2 which states;

The acceptance of other materials shall occur only if the Chief Executive, Taranaki Regional Council advises in writing that he is satisfied on reasonable grounds that the other materials will have minimal effects beyond those materials above. [With 'above' being reference to the list of 'accepted wastes' in the current consent].

The reason for seeking that such a provision be retained is because there have been occasions where the councils themselves have needed a facility such as that offered by the applicant for the management of waste materials in emergencies or unforeseen situations. Similarly, there are circumstances when the material that is proposed to be received does not fit easily into one or another category (the NPDC Food Waste example being one of these, being a mixture of many of the other components), and rather than having to vary the consent every time a slightly different waste type is proposed, the applicant seeks the flexibility to request approval from the TRC for the material, and if the TRC is satisfied, enable it to be composted. Other waste streams that could foreseeably be composted at this location include brewery waste, vegetable processing waste, commercial/hospitality food waste.

The different inputs are discussed in the following sections, and all are on the current approved waste list, approved by TRC either under the current consent provisions directly, or via the mechanism for approval allowed for under the current consent.

2.5.4.1 Paunch Grass

Paunch Grass is grass from the gut of animals which is recovered at the abattoir during slaughter. This material still contains nutrients and beneficial organic matter, and is ideal for vermiculture and composting. As a by-product of the meat industry, a compost facility such as that provided by RNZ provides a more appropriate disposal option than landfilling.

2.5.4.2 Poultry industry waste (eggshells, yolks, macerated chicks and chicken mortalities)

Similar to fish waste, the poultry industry generates a waste stream that is difficult to manage in ways other than composting, with odour being a key concern. Again, alternatives such as landfilling are considered inappropriate, and this waste provides excellent nutrients to the compost.

2.5.4.3 Green vegetative wastes;

Green waste (waste from vegetation, such as lawn clippings, tree prunings etc) is an essential part of the composting process, and receipt of this material enables a sustainable disposal method while benefiting the process. Greenwaste is the main bulking agent, as it has the correct Carbon to Nitrogen ratio for optimal composting.

This material is sourced from the applicants other Greenwaste collection services in Taranaki, Brixton (96 Waitara Road) and the Colson Road Transfer Station. The applicant is confident that this will always be available because of their long standing contracts for this material.

2.5.4.4 Sawdust

Untreated sawdust is also used on occasions as a bulking agent, predominantly for the drilling by-products streams, however it will also be used as an additive to ensure the correct carbon/nitrogen ratio is achieved for the composting of food scraps. This is untreated sawdust from Taranaki Pine. The applicant is confident that their supply of untreated sawdust is secure until the end of the drill waste contracts (31 December 2020) and does not expect any difficulties securing sawdust beyond this time.

2.5.4.5 Molasses

Molasses waste comes to the site on occasions, and is out of spec material from stock feed or molasses manufacturing plants.

2.5.4.6 Dairy industry waste (including but not limited to cheese, milk powder, cream, milk whey)

Composting of waste dairy products is a valuable service offered by the site. This waste can be liquid or solid and may include cheese, milk powder, cream, whey, casein or other dairy extracts.

2.5.4.7 Food scraps from domestic household and commercial restaurant collection

Food scraps are proposed to be received from the New Plymouth kerbside collection which the NPDC council will commence in 2019. The purpose of this collection is to remove food waste from landfill, reducing leachate, transport costs and reducing the amount of landfill taken up with compostable materials.

The TRC has raised concerns about the potential for non-compostable inputs to be received in this waste. The applicant has a contract with the NPDC specifying the nature of this waste, placing the onus on them to ensure the waste received is as described – food waste. This is largely achieved with instructions on the bins, as shown in Figure 14 below. The NPDC undertakes audits of its bins periodically, and provides the findings to the public.

Figure 14. NPDC Food Waste Bins – instructions for users

Non-compostable items that arrive onsite with the foodwaste will be addressed in the same way as non-compostable items that currently arrive on site are addressed; they are removed by hand as they appear through the composting process. Typically, as the piles are turned, non compostable items are brought to the surface. They also typically show up as bright colours in the natural coloured soil as the compost matures. Some may also be intercepted at the time they arrive at the site.

The food waste is similar in nature to other materials that are already accepted on site, albeit it comes from a public collection service as opposed to an industrial or commercial source (such as the Canteen waste received).

2.5.4.8 Palm Kernel/Grain or other stock feed

Palm Kernel that is out of spec, contaminated or otherwise unable to be sold is composted at the site.

2.5.4.9 Grease trap waste (from food service industries)

Grease trap waste is delivered from grease trap maintenance/emptying firms after cleaning out the grease traps associated with restaurants and other service industries that are required to trap grease prior to discharging their waste to the municipal sewer. This is a vital service for keeping the municipal wastewater treatment plant functioning well. This waste is high in fat/oil content, which is broken down very effectively in the composting process.

2.5.4.10 Tallow

Tallow is a rendered form of beef or mutton fat.

2.5.4.11 Pea Fat

Pea Fat is a waste fat from freezing works/abattoir activities.

2.5.4.12 Water Treatment Sludge

Water treatment sludge is the sludge from the water settling ponds at the municipal water supply.

2.5.4.13 Soil Remediation

'Soil Remediation' is used to describe small batches of soil that is, or is alleged, to be contaminated. There are strict controls around the levels of contaminants in this waste if it is to be received at the site.

2.5.4.14 Mechanical pulping pulp and paper residue (excluding pulping wastes that have been subject to chemical pulping or treated or mixed with any substance of material containing chlorine or chlorinated compounds);

Untreated mechanical pulp and paper residue comes from the pulp and paper industry. This too provides important components to the composting process, with the wood fibres adding carbon to the process.

2.5.4.15 Prolick

Prolick is an animal feed/supplement, and waste from this process is out of spec product, or product that cannot be sold for some reason.

2.5.4.16 Canteen waste (food scraps) specifically from Powerco and Fonterra

Usually in small amounts, and similar in nature to the NPDC Food Waste, the canteen food waste from Fonterra and Powerco is specifically listed as it is an approved material.

2.5.4.17 Diatomaceous earth mix

Diatomaceous earth mix is used in the water filtration at both the NPDC Todd Energy Aquatic Centre and Fonterra Kapuni. Diatomaceous earth is a naturally occurring rock often used for filtration. It requires replacement periodically in order to be effective and the used earth from the filters requires disposal.

2.5.4.18 Animal Manure from meat processing plant stock yards, stock truck effluent collection facilities and dairy farm oxidation pond solids;

Similar to paunch, manure collected at meat processing facilities in their yards and ponds requires appropriate disposal and management, and the meat processing sites themselves are often too constrained in area to provide this adequately onsite, or there are health concerns associated with doing so. Stock-truck effluent collection facilities also need to manage the collected effluent, and occasionally dairy farm oxidation pond solids require disposal offsite. Offsite disposal at RNZ allows the nutrients to be recovered and re-used and is considered a sustainable option for management.

2.5.4.19 Vegetable waste solids (being processed by-products)

Vegetable waste solids are similar to paunch material in that they may otherwise go to landfill or municipal waste. Composting these is more sustainable and beneficial to the environment.

2.5.4.20 Fish skeletal and muscle residue post filleting (free from offal)

The fish industry generates a waste stream that is difficult to manage in ways other than composting, with odour being a key concern. Again, alternatives such as landfilling are considered inappropriate, and fish waste provides excellent nutrients to the compost.

2.5.4.21 Solid Drill Cuttings, Water based and synthetic based drilling fluids and produced water from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0% total petroleum hydrocarbon (TPH) within 3 days of being received onsite

Drill cutting's from hydrocarbon exploration are predominantly made up of ground rock encountered in the formation during drilling, with a small percentage of adhered drilling fluids.

Water based and synthetic based fluids and produced water from hydrocarbon exploration are able to be incorporated with the compost waste stream, providing effective remediation and treatment in a sustainable and contained way. This is seen to be more sustainable than other disposal options for the industry, including landfarming and / 'mix-bury-cover'. Water based fluids and produced water can have elevated chloride contents, which are diluted in the process. Synthetic based fluids have elevated Total Petroleum Hydrocarbons, which are broken down effectively during the composting process. Within 3 days of being received onsite, this material is blended to achieve a level of less than 5% TPH, which is required by condition 3 of consent 5938-2. It is then further blended through the compost turning process.

Drilling by-products are sampled before they are used in the composting process, under condition 3 of the existing consent.

Table 3. Typical drilling mud volume received on site

Volume of Drilling Muds Received on Site(Tonnes)													
	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Total
SBM & WBM	818.11	533.86	390.15	1017.36	274	36	0	146.1	90.5	145.17	39.84	247.68	3738.77
SBF	237.88	555.51	71.76	160.37	295.64	252.88	405.82	264.71	383.07	619.46	561.38	665.16	4473.64
Total	1055.99	1089.37	461.91	1177.73	569.64	288.88	405.82	410.81	473.57	764.63	601.22	912.84	8212.41
SBM	Synthetic based mud												
WBM	Water based mud												
SBF	Synthetic based fluid												

The above table shows the drilling by-products received on site Dec 16 through to end Nov 2017. This mud has been added to organic waste and is currently on pad 3, within the composting process on the site. Once this product meets the Module 4-Tier 1 Soil Screening Criteria[7] and the NZ Compost & Soil Conditioner Standard it is used on site.

It is the intention of the consent holder to discontinue the acceptance of drilling cuttings and fluids at the site. Current contracts require 6 months notice to be given to the companies who use the facility. This notice is in progress and accordingly this material will not be received after 31 December 2020.

2.5.4.22 Biosolids (sewage sludge is no longer taken)

It is noted that the current consent lists biosolids (from municipal sewage sludge) in the Acceptable Wastes to be composted (condition 2). This will be removed as it is not acceptable to Ngati Mutunga, and these wastes have not been received for many years.

2.5.4.23 Other Materials in Emergency Situations

Recent events such as poultry shed fires, and the COVID19 outbreak has proven the essential nature of a facility such as that provided in Uruti. Waste meat, poultry and tannery hides all required disposal as NZ's borders were closed. At all times the applicant seeks that consents allow for the receipt of organic material at the facility to deal with these emergencies, with approval from the TRC.

2.5.5 Managing the Quality of Material Received - Waste Acceptance Procedures

The 'Uruti Waste Acceptance Plan' (**Appendix M**) outlines the process of accepting the various streams of material that come into the site, including the approval of new waste, monitoring and sampling of the waste products and the waste reception protocol.

In essence if material is not a consented product, application to accept the material is made to the TRC prior to delivery on site. An updated list of approved inputs is kept at the Uruti site office.

[7] Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Soils in New Zealand August 1999 (Revised 2011) Ministry for the Environment

A series of Standard Work Place Instructions (SWPI's) describe in detail how the tasks required to carry out the acceptance of waste products onto site is carried out.

When the original application was made to TRC it was anticipated that the current input volumes of raw organic material at the composting site will remain similar over the coming years. The majority of the material would comprise of green wastes; paunch grass, chicken mortalities, fish waste, drilling by-products, food scraps, carbon compounds (sawdust) and manures as these materials provide the balance of carbon to nitrogen needed for effective composting.

With the proposed removal of drilling by-products, the removal of biosolids from the accepted wastes list, and the move to food waste recycling by the NPDC, there is the opportunity to change the composition of the waste received, with more greenwaste and food type wastes being brought in to offset the removal of the drill waste from the process. This is reflected in Table 6.

2.6 Description of Discharges – Discharges of Contaminants to Land (Irrigation)

2.6.1 Characteristics of the discharge

The majority of the contaminants contained in Stormwater, if any, will be in the "first flush" of water leaving the site. The concentration of contaminants will therefore be potentially higher in lower rainfall events due to less dilution.

2.6.2 Discharge from Irrigation Pond

This discharge for which consent is sought is the culmination of collection of all potentially contaminated stormwater flows and leachate in the irrigation pond, and the discharge of this material onto and into land via surface irrigation.

2.6.2.1 Location of discharge

The discharge occurs to 13.18 ha of land, in the areas as shown in Figure 16.

2.6.2.2 Volume of discharge from Irrigation Pond

The average monthly irrigation volumes are shown in Table 4 below. These show the strong seasonal influences on irrigation volume.

Table 4. Average Monthly Irrigation Volumes (August 2016 to March 2020)

	Volume pumped to irrigation m^3
Jan	805
Feb	1720
Mar	2090
Apr	1595
May	2610
Jun	1570
Jul	1755
Aug	2620
Sep	2020
Oct	1475
Nov	1160
Dec	1030

2.6.2.2.1 Management of Stormwater and Leachate Inputs

Clean water is diverted around areas where it could become contaminated, to avoid unnecessary loading on the irrigation pond and treatment system.

Discussed in more detail in section 2.8 below, the volume of runoff/stormwater generated within the active site areas is dependent on the catchment size, moisture content of the soils on the site, runoff characteristic of the site and intensity of the rain. The combined impacts of these variables on stormwater flows and behaviour is well understood.

Stormwater is likely to be generated immediately after rain events. It is also likely that there may be some drainage (leachate) from the windrows and sawdust storage piles onsite for a period of time once the rain has stopped, as the windrows act like sponges, slowly releasing moisture as well as absorbing it.

Cut off drains, bunds and diversions are in place to prevent clean stormwater from areas surrounding the active operational site becoming entrained in the treatment system. The drains and Stormwater flows from pads 1 and 3, the truck washdown area and any other areas on the site that may become contaminated (i.e. may be exposed to compost, contain leachate form the wind-rows, or run across active site areas) are directed into the pond system for treatment through the process at various points. This is shown in Figure 15 below, with the yellow arrows and lines depicting the controlled, potentially contaminated flows and the black lines showing clean stormwater that is diverted around active areas. Once collected through the system, the discharge of treated stormwater and leachate occurs to land, via. irrigation.

There are two stages that require specific management;

- The management of the pond system to ensure there is no overflow, and
- The management of the irrigation process to ensure application does not result in adverse effects.

The management of both clean and potentially contaminated stormwater on the site is detailed in the Leachate and Stormwater Management Plan in **Appendix F**. The two are combined, because the contaminated stormwater and leachate are managed together in the same system, and irrigated to land.

Within this management plan are specific plans to manage the pond system, and irrigation.

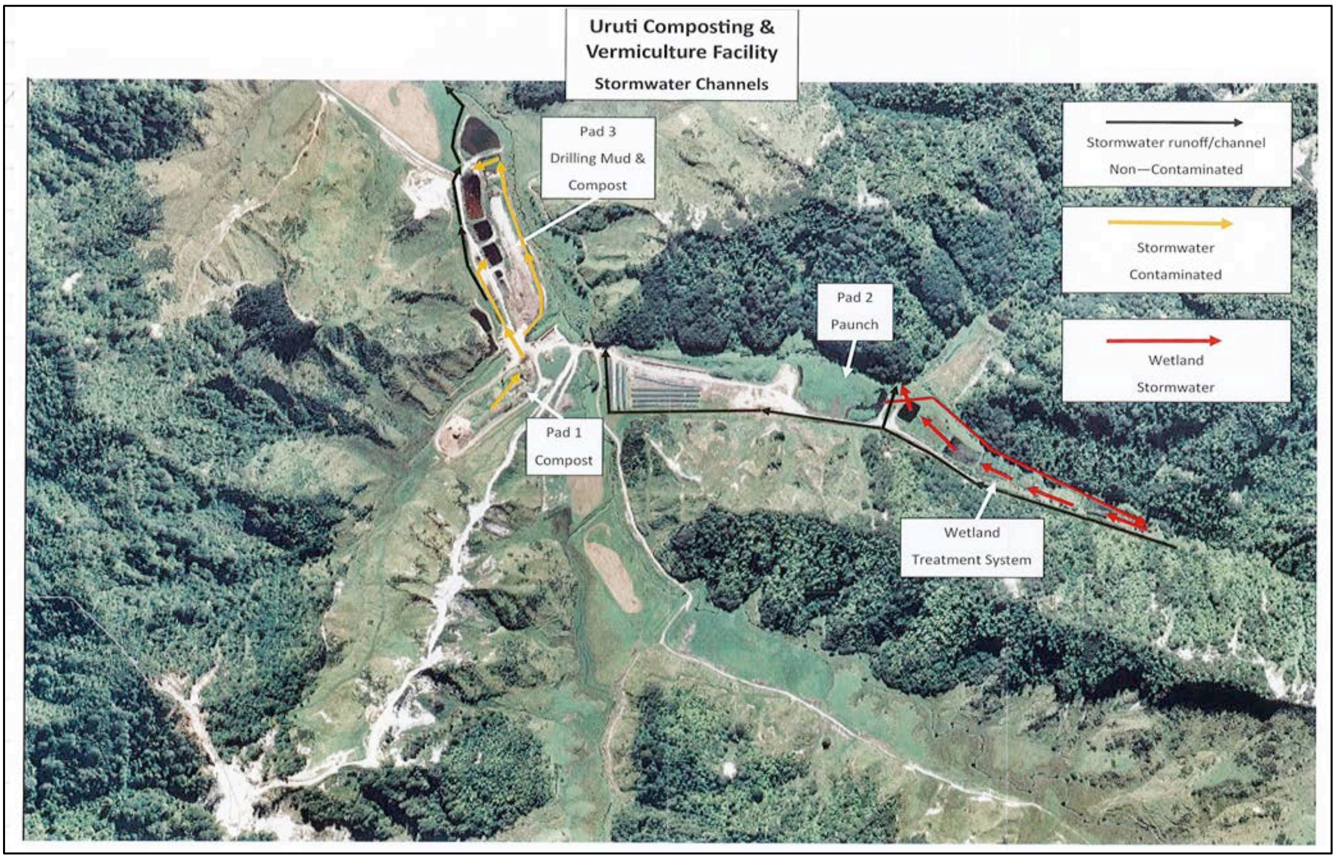


Figure 15. Plan showing stormwater channels and flows at Uruti Composting and Vermiculture Facility

2.6.2.3 Chemistry of discharge

Results of monitoring at site IND2044 on 6 March 2020 are shown in Table 5 below. Full results for the irrigation pond over all sampling are included in **Appendix X**.

Table 5. TRC Sample Results - IND2044 (Irrigation Pond), 6 March 2020

ANALYTE	UNITS	SITE: IND002044 06-Mar-2020 7:58 am
Free Ammonia as N	g/m3 at Client Temperature	22
pH	pH Units	8.0
Electrical Conductivity (EC)	mS/m	1,183
Electrical Conductivity (EC)	µS/cm	11,830
Total Suspended Solids	g/m3	-
Sample Temperature	°C	19.5
Dissolved Arsenic	g/m3	0.075
Dissolved Barium	g/m3	0.37
Acid Soluble Barium	g/m3	0.48
Total Barium	g/m3	0.77

ANALYTE	UNITS	SITE: IND002044 06-Mar-2020 7:58 am
Dissolved Cadmium	g/m3	< 0.0003
Total Calcium	g/m3	280
Dissolved Chromium	g/m3	0.030
Dissolved Copper	g/m3	0.005
Dissolved Lead	g/m3	0.0017
Acid Soluble Lead	g/m3	0.007
Total Magnesium	g/m3	56
Dissolved Mercury	g/m3	< 0.00008
Dissolved Nickel	g/m3	0.093
Total Potassium	g/m3	1,210
Total Sodium	g/m3	540
Sodium Absorption Ratio (SAR)	(mmol/L)0.5	7.7
Dissolved Zinc	g/m3	0.008
Chloride	g/m3	2,700
Total Nitrogen	g/m3	580
Total Ammoniacal-N	g/m3	550
Nitrate-N + Nitrite-N	g/m3	0.009
Total Kjeldahl Nitrogen (TKN)	g/m3	580
Dissolved C-Biochemical Oxygen Demand (CBOD5)	g O2/m3	-
Carbonaceous Biochemical Oxygen Demand (cBOD5)	g O2/m3	300
Benzene	g/m3	0.071
Toluene	g/m3	0.69
Ethylbenzene	g/m3	0.0077
m&p-Xylene	g/m3	0.052
o-Xylene	g/m3	0.0195
Total Petroleum Hydrocarbons in Water		
C7 - C9	g/m3	0.6
C10 - C14	g/m3	< 1.0
C15 - C36	g/m3	10
Total hydrocarbons (C7 - C36)	g/m3	11

Condition 10 of consent 5838-2.2 requires that the wastewater irrigated to land shall not have a Sodium Absorption Ratio greater than 18, or be greater than 5% hydrocarbons, which are complied with.

The total nitrogen and ammoniacal nitrogen levels in this sample have been noted as elevated, and it is noted that there had been very little rain leading up to the sample being taken, therefore the pond contents were concentrated. This is typical in dry, summer months, as can be seen in the graphs in Appendix X and earlier in Figure 7. Further discussion on the implications of this is made in discussions on N loading.

2.7 Management of Irrigation and Irrigation Blocks

Irrigation activities are managed in accordance with procedures documented in the Irrigation Block Management Plan. This is included in the Leachate & Stormwater Management Plan (**Appendix F**), and outlines the irrigation process and a series of Standard Work Place Instructions (SWPI's) describe in detail the tasks required to carry out the irrigation process so that the environmental effects are mitigated. Staff operating the irrigation system are also trained in these processes and the environmental reasons why the processes must be followed.

2.7.1 Irrigation Block Management Plan

Irrigation of the irrigation pond water to land is controlled by the Irrigation Block Management Plan. The purpose of the Irrigation Block Management Plan is to outline how the water from the pond system that treats leachate generated from the compost pile and contaminated stormwater from pads 1 and 3 and the Truck Washdown area is managed.

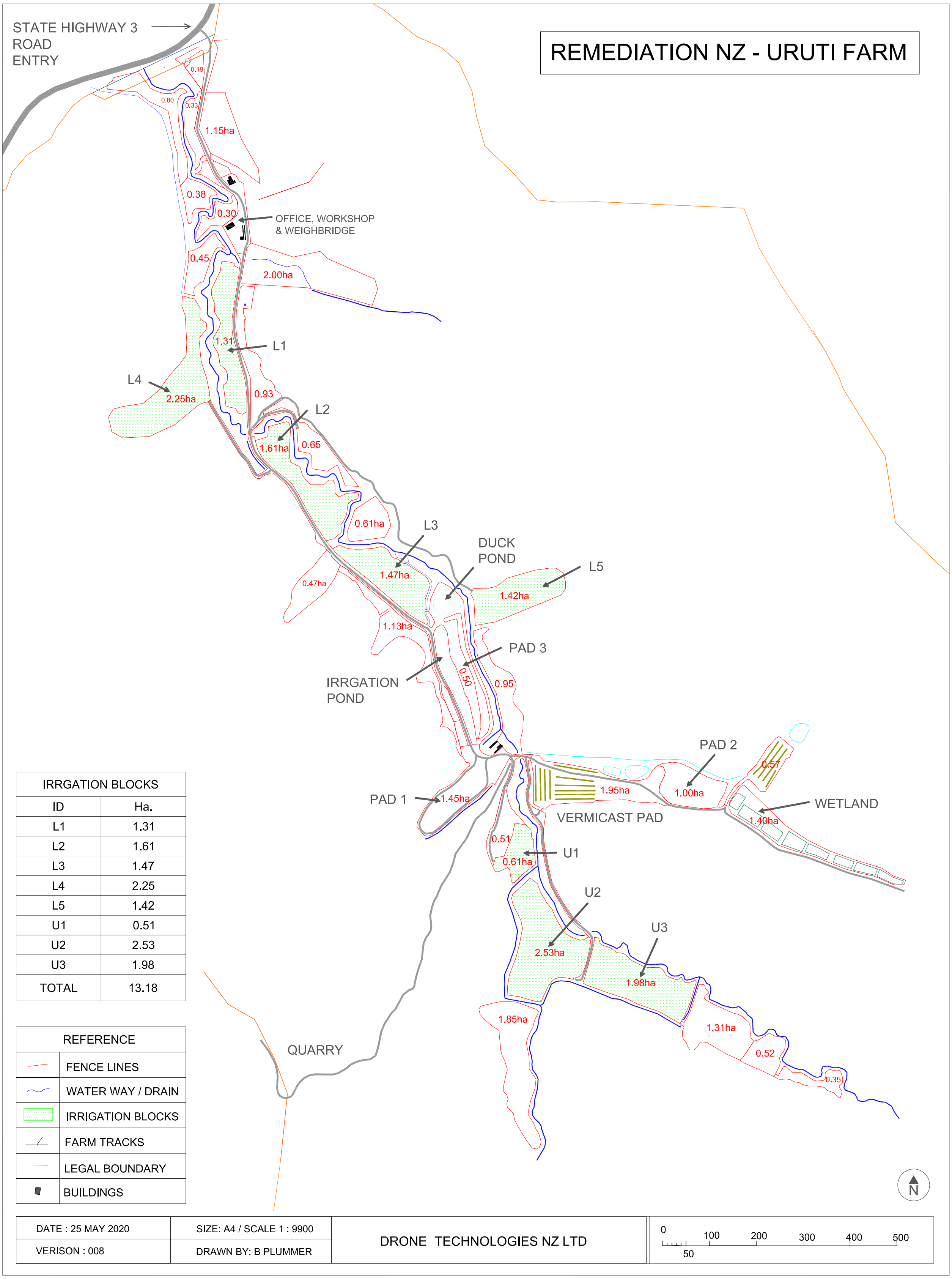
The purpose of the Irrigation Block Management Plan is to provide the methodology and procedures to ensure the waste water collected in the Irrigation Pond is irrigated onto the irrigation block in compliance with consent conditions, ensuring environmental effects are avoided, remedied or mitigated.

Detailed instructions for undertaking irrigation from the pond are provided in the Standard Workplace Instruction for Irrigation from the Irrigation Catchment Pond, which is included in **Appendix F**.

2.7.2 Irrigation area

As a result of investigations into N losses, total irrigation area has been increased from 7 ha to 13.18 ha. All irrigation blocks have been established and are in use.

The locations of the irrigation areas are shown below in Figure 16.



IRRGATION BLOCKS	
ID	Ha.
L1	1.31
L2	1.61
L3	1.47
L4	2.25
L5	1.42
U1	0.51
U2	2.53
U3	1.98
TOTAL	13.18

Figure 16. Plan showing current irrigation areas

2.7.3 Irrigation Block Soils

The nature of the soil in the irrigation blocks governs the capacity of the soil to handle irrigation, and influence the rate, timing and frequency of irrigation. The nature of the soils and an assessment of whether they are high or low risk (as defined in the Farm Dairy Effluent Design Code of Practice[8]) is provided below. A detailed report on the High and Low risk soils at the RNZ site has been prepared, and is included as **Appendix AB**.

2.7.3.1 About High and Low Risk Soils

"Risk" in the context of high and low risk soils relates to the risk of surface runoff or subsurface drainage occurring from the soil, which is where the key concerns relating of the environmental effects of irrigation of effluent lie.

High risk soils comprise:

- **Coarse textured soils** – example sandy soils where soil water is not readily held in the soil profile and rapidly drains.
- **Soils with fine textured soils** – example soils with high clay content in which soil cracks may occur as result of the wetting and drying cycles. Soil water favours movement down these cracks when the soil is draining. This is called preferential flow or commonly referred to as bypass flow.
- **Soils with subsurface drainage**.
- **Soils with impeded drainage or low infiltration rate**.
- **Soils with slope exceeding 7°.**

Irrigation onto high risk soils should occur only when there is a soil moisture deficit. This is referred to as deficit irrigation and is recognised as the key means of mitigating the risk posed by these soils (while also noting in this case that the bunds created around the irrigation areas also mitigate the key risk in this case, which is overland flow).

Low risk soils comprise all other soils. In low risk soils soil water flows through the soil profile under the influence of gravity. Soil water tends to drain through the soil profile in a relatively even manner, wetting the whole soil profile, and is termed matrix flow. This is often referred to as a piston flow effect where soil surface inputs displace and drain water situated deeper in the soil profile.

When designing the irrigation system for a low risk soil, an Irrigation Designer will calculate the water holding capacity of the soil and restrict the volume of applied irrigation so that the water or effluent will remain in the plant root zone. This will allow suitable residence time in the root zone to attenuate the potential contaminants. Deficit irrigation is not required for low risk soils because there is low risk of preferential flow in low risk soils (hence the term 'low risk') and the soils ability to hold water in the root zone can be relied upon.

2.7.3.2 Lower Effluent Blocks

The soils in the Lower effluent blocks (L1-L5) were classified by BTW Company in the June 2015 report as Orthic brown soils from the Whangamomona Complex loams. A field survey by BTW Company using soil

[8] Farm Dairy Effluent Design Code of Practice Version 3, Dairy NZ, September 2015. https://www.dairynz.co.nz/publications/environment/farm-dairy-effluent-design-standards-and-code-of-practice/

augers identified the topsoil as light brown grey silty clay and the subsoil as light grey silty clay. This has subsequently been confirmed (C. Kay, May 2020).

The soil texture was assessed by feel (undertaken in general accordance with methodology described in 'Soil Description Handbook' Milne et al. (1995), during the KCL[9] site) visit as a silty loam as shown in Figure 17.

Figure 17*.* Photo showing soil test pit.

The assessment of the soils in the test pits indicated the top 300 mm of the soil profile consisted of 300 mm of a silty loam and are moderately well drained. This was confirmed in the site investigation undertaken to inform the assessment in **Appendix AB**.

These soils meet the definition of Low Risk Soils when considering irrigation, and the impact this has on the volume of storage required and are managed as such.

2.7.3.3 Upper Effluent Blocks

It is noted that the soils in the upper irrigation areas (U1-3) are similar in nature to those in the lower irrigation areas, and will be enhanced with the application of compost to help establish a deep topsoil layer. The compost is adding organic matter to the soil which increases its ability to absorb water, and as vegetation becomes more established, the cycle of creating topsoil via organic matter formation will increase.

At the current time however, the soils in the upper irrigation blocks are assessed as being Anthropic. Anthropic soils categorise soils constructed by or drastically disturbed by human activity, which is consistent with the major development of these areas in 2019. This involved stripping off the topsoil and levelling the area by spreading fill across the area. The test pit showed the soil profile had limited topsoil over a subsoil comprising a mixture of brown soils and papa. The subsoil showed a compacted soil structure and was assessed as having a low infiltration rate. There is therefore risk of ponding and overland flow, and while this is mitigated by the bunding around the irrigation areas, the soil should be assessed as high risk and accordingly these soils are managed as High Risk Soils in terms of irrigation. (For completeness it is noted at this point that the implications of this are addressed in the Irrigation Model detailed in section 2.7.6 relating to pond storage capacity, and this soil information has also been fed into updated Nutrient Budgets for the blocks) .

[9] Kay Consulting Limited

2.7.4 Irrigation Management

As discussed above, the specifics of Irrigation onsite is managed via the Leachate and Stormwater Management Plan, within which is the Irrigation Block Management Plan and the Site Work Procedures to manage activities. This is included as **Appendix F** and has been updated to reflect the additional information and procedures relating to soil risk. The paragraphs below discuss the irrigation management philosophies for Low and High Risk soils.

2.7.4.1 Low Risk Soils

The principle applied to irrigation of low risk soils is that it is important that the volume of material applied during each application does not exceed the water holding capacity of the soil in the plants root zone (otherwise ponding will occur). The soil's Profile Available Water in the top 30 cm ($PAW_{30)}$ describes the maximum amount of water that can be held in the soil that is extractable by plants (i.e. plant available water).

The report in Appendix AB finds for the low risk soils (section 2.3) that:

> *The soils PAW_{30} was calculated for the RNZ Uruti site using the methodology from the Farm Dairy Effluent Design Code of Practice FDEDCOP at 60 mm.*
>
> *Industry good management practice is to restrict irrigation depth to less than 50% of PAW_{30} .*
>
> *Therefore, the maximum application depth for the RNZ Uruti site is 30 mm.*
>
> *As the irrigator at the site does not distribute effluent evenly over the entire wetted area, in order to prevent over irrigating, the application depth is reduced by the distribution uniformity coefficient (DU). The FDEDCOP requires irrigators to achieve a DU of 1.25.*
>
> *Using a DU of 1.25 this gives an adjusted maximum application depth* ***(Dt) of 25.0 mm.***

These findings have informed the recommendations in the report (**Appendix AB**), and these in turn have been incorporated into the Irrigation Model and relevant management plans.

2.7.4.2 High Risk Soils

Irrigation onto high risk soils should occur only when there is a soil moisture deficit. This is referred to as deficit irrigation and is recognised as the key means of mitigating the risk posed by these soils.

Soils dry out via a process referred to as evapotranspiration (ET) being a combination of evaporation from the soil surface and transpiration from the plants. In summer ET can be as high as 5mm per day. This means that on high risk soils the irrigation of, for example, 10mm must be delayed by two days after heavy rainfall.

The report in Appendix AB finds (section 3.3) that:

> *The maximum application depth for high risk soils was calculated using the methodology from the FDE Design Code of Practice as:*
>
> *The maximum application depth using a high rate irrigator (Travelling Irrigator)* ***(Dt) = 10 mm***
>
> *The maximum application depth using a low rate irrigator (Sprinkler pods)* ***(Dt) = 25 mm***

These findings too have informed the recommendations in the report (**Appendix AB**), and incorporated into the Irrigation Model and relevant management plans.

2.7.5 Application Rate

The FDEDCOP states that the maximum application rate must not exceed the soil infiltration rate. If effluent is applied at a rate greater than the soils infiltration capacity, effluent will pond on the soil surface and there is a risk of run off into surface water ways. Application rate refers to the volume of water applied to 1 ha of land in any given time period and is usually expressed in mm/hr. The application rate for the high and low risk soils has been established, and is discussed below.

2.7.5.1 Low Risk Soils

The soil infiltration rate was calculated using the methodology from the FDE Design Code of Practice at 15 mm/hr when using a watering time of 20 minutes.

This gives a system design application rate **Ra = 15.00 mm/hr.**

2.7.5.2 High Risk Soils

The soil infiltration rate for the subject site was calculated using the methodology from the FDE Design Code of Practice at 10 mm/hr.

The application depth for areas assessed as high risk should not exceed Ra **= 10.00 mm/hr**

2.7.6 Irrigation Model

The Irrigation Model (**Appendix F2**) is designed to proactively manage the pond levels so that there is sufficient capacity with in the pond to accommodate the stormwater flows from a minimum of a 1:10 year 60 minute storm event. RNZ receive predicted 14-day rainfall data from a professional Weather Forecaster (WeatherWatch) on a weekly basis. RNZ receive this data on Monday mornings and using the predicted rainfall data calculate the volume of stormwater that is predicted to arrive in the irrigation pond during the following week i.e. days 8 to 14. The irrigation plan is updated each Monday morning to account for this predicted volume and the pond level is reduced during the week by irrigation to a level at the end of the week where the pond will have sufficient capacity to cope with the following weeks predicted rainfall.

RNZ also receive a 3-monthly forecast which predicts the weather to be wetter than normal, normal or wetter than normal. The average rainfall data is entered into the model and multiplied by a correction factor to account for 3-month prediction e.g. normal = 0, wetter than normal + 10% and drier than normal = -10%.

The full irrigation model is attached in Appendix F, and is shown below in Figure 18.

Section	Row	Type	May	June	July	August	September	October	November	December	January	February	March	April	April	Total
Uruti Irrigation Model v2.0		Month	May	June	July	August	September	October	November	December	January	February	March	April	April	
	Days in Month		28	28	28	28	28	28	28	28	28	28	28	28	28	364
Uruti Virtual Climate Station	Evaporation mm	Average	31.12	21.41	25.43	39.04	57.48	85.05	109.32	126.01	134.46	107.97	88.65	52.65	52.65	878.60
	Rain mm/day		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(878.60)
13 Month Calendar			**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**1**	**2**	**3**	**4**	**5**	
Predicted Rainfall	Week 1	Predicted	0.95	11.46	28.48	35.90	19.35	16.50	26.92	37.68	1.63	7.55	3.20	8.93	4.06	
	Week 2	Predicted	32.30	0.00	3.34	29.15	3.41	18.30	10.53	17.33	12.55	3.80	13.86	0.00	19.92	
	Week 3	Predicted	25.74	37.71	20.19	26.02	26.08	11.11	9.23	51.22	0.00	3.99	12.12	37.56	17.23	
	Week 4	Predicted	9.68	23.60	48.98	22.75	30.23	12.32	1.07	19.64	2.30	13.07	15.38	17.75	8.02	
		Predicted	68.67	72.77	100.99	113.82	79.07	58.23	47.75	125.87	16.48	28.41	44.56	64.24	49.23	870.09
			68.67	72.77	100.99	113.82	79.07	58.23	47.75	125.87	16.48	28.41	44.56	64.24	49.23	870.09
Rainfall falling onto the pads & ponds	Week 1		68.42	168.53	330.63	401.30	243.67	216.53	315.77	418.26	74.90	131.28	89.85	144.43	98.04	2,701.63
	Week 2		367.02	59.38	91.19	337.01	91.85	233.67	159.67	224.43	178.91	95.57	191.38	59.38	249.10	2,338.56
	Week 3		304.54	418.54	251.67	307.20	307.77	165.19	147.29	547.22	59.38	97.38	174.81	417.12	223.48	3,421.59
	Week 4		151.57	284.15	525.89	276.06	347.30	176.72	69.57	246.44	81.28	183.86	205.86	228.43	135.76	2,912.89
			891.55	930.60	1,199.38	1,321.58	990.60	792.11	692.29	1,436.35	394.46	508.09	661.91	849.35	706.39	11,374.67
Less evaporation = Amount to be irrigated																-
	Week 1		(105.76)	(142.83)	(300.12)	(354.46)	(174.70)	(114.46)	(184.59)	(267.04)	86.45	(1.72)	16.52	(81.25)	(34.86)	(1,658.81)
	Week 2		(329.68)	(33.68)	(60.67)	(290.17)	(22.88)	(131.61)	(28.48)	(73.22)	(17.55)	34.00	(85.01)	3.81	(185.92)	(1,221.06)
	Week 3		(267.20)	(392.85)	(221.16)	(260.36)	(238.80)	(63.13)	(16.10)	(396.00)	101.98	32.19	(68.44)	(353.93)	(160.30)	(2,304.09)
	Week 4		(114.23)	(258.46)	(495.37)	(229.21)	(278.32)	(74.65)	61.62	(95.22)	80.07	(54.29)	(99.49)	(165.25)	(72.58)	(1,795.39)
																(6,979.36)
			(816.87)	(827.83)	(1,077.32)	(1,134.19)	(714.70)	(383.85)	(167.55)	(831.49)	250.95	10.19	(236.41)	(596.63)	(453.66)	(6,979.36)
	Planned irrigation	Month	1,860.00	1,860.00	1,833.00	1,745.00	1,823.00	1,806.00	1,453.00	1,413.00	861.00	1,060.00	919.00	1,557.00	1,557.00	19,747.00
		Week	465.00	465.00	458.25	436.25	455.75	451.50	363.25	353.25	215.25	265.00	229.75	389.25	389.25	4,936.75
Volume irrigated	Week 1	Entered	105.76	142.83	300.12	354.46	174.70	114.46	184.59	267.04	(86.45)	1.72	(16.52)	81.25	34.86	1,658.81
	Week 2	Entered	329.68	33.68	60.67	290.17	22.88	131.61	28.48	73.22	17.55	(34.00)	85.01	(3.81)	185.92	
	Week 3	Entered	267.20	392.85	221.16	260.36	238.80	63.13	16.10	396.00	(101.98)	(32.19)	68.44	353.93	160.30	
	Week 4	Entered	114.23	258.46	495.37	229.21	278.32	74.65	(61.62)	95.22	(80.07)	54.29	99.49	165.25	72.58	
			816.87	827.83	1,077.32	1,134.19	714.70	383.85	167.55	831.49	(250.95)	(10.19)	236.41	596.63	453.66	6,979.36
Pumping hours required per week	Week 1	Pumping	**3.5**	**4.8**	**10.0**	**11.8**	**5.8**	**3.8**	**6.2**	**8.9**	**(2.9)**	**0.1**	**(0.6)**	**2.7**	**1.2**	
	Week 2	Pumping	**11.0**	**1.1**	**2.0**	**9.7**	**0.8**	**4.4**	**0.9**	**2.4**	**0.6**	**(1.1)**	**2.8**	**(0.1)**	**6.2**	
	Week 3	Pumping	**8.9**	**13.1**	**7.4**	**8.7**	**8.0**	**2.1**	**0.5**	**13.2**	**(3.4)**	**(1.1)**	**2.3**	**11.8**	**5.3**	
	Week 4	Pumping	**3.8**	**8.6**	**16.5**	**7.6**	**9.3**	**2.5**	**(2.1)**	**3.2**	**(2.7)**	**1.8**	**3.3**	**5.5**	**2.4**	
			27.2	**27.6**	**35.9**	**37.8**	**23.8**	**12.8**	**5.6**	**27.7**	**(8.4)**	**(0.3)**	**7.9**	**19.9**	**15.1**	232.65
Actual pumping hours		30	37.00	65.00	76.00	65.50	91.00	66.50	24.00	34.00	19.00	29.00	22.00	33.00	59.00	621.00
Actual pumping volume m3			1,110.00	1,950.00	2,280.00	1,965.00	2,730.00	1,995.00	720.00	1,020.00	570.00	870.00	660.00	990.00	1,770.00	18,630.00
Pond freeboard storage (M^3) at 1st day of month																
Surplus liquid			1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	
Pond vol at end of month			-	-	-	-	-	-	-	-	-	-	-	-	-	
Pond vol per metre			1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	
Pond depth (at beginning of month)			1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	1,300.0	
Pond depth (at end of 4 week month)			-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	
			-0.769	-0.769	-0.769	-0.769	-0.769	-0.769	-0.769	-0.769	-0.769	-0.769	-0.769	-0.769	-0.769	
			6	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**1**	**2**	**3**	**4**	**5**	

Figure 18. Irrigation Model (Updated May 2020)

It is emphasised that the applicant has significant local knowledge gained from operating this site for over 17 years, with staff onsite very familiar with the weather patterns, and the microclimate of the Uruti Valley. Staff are constantly monitoring the weather forecast as this influence activities on the site day by day, and at certain times of the year, hour by hour. The irrigation model is an important tool which staff are familiar with using, however it cannot replace this local knowledge entirely.

2.8 Management of Storage Volume/Capacity

2.8.1 Stormwater Volume

The frequent low intensity storm events at this site have the potential to generate high contaminant concentrations, and therefore a 1 in 10-year 60 minute storm is considered appropriate to evaluate likely discharges from the site. In a 1 in 10-year 60 minute storm the figure of 43mm of rainfall per hour is utilised in the assessments below. This is a very conservative figure as values for the top 30 rain occurrences range from 8.0 to 15mm with the average being 9.4mm (refer Table 6).

Runoff of the falling rain will be influenced by the site's runoff coefficient. This has been calculated to be 0.25 as per MBIE Verification Method E1/VM1 (1 January 2017). Remediation (NZ) Ltd considers this coefficient to be a conservative runoff coefficient as the composting material provides a very high degree of permeability. Compost requires 40-60% moisture for the composting process to be effective.

By providing for a very conservative scenario, the applicant ensures that the site is prepared for a scenario that generates significantly higher runoff than what typically occurs.

The peak flow calculations for the ponds on the site are shown in Table 6.

2.8.2 Pad 1 & 3 (shared stormwater collection system) stormwater capacity

Stormwater leaving catchment area of pads 1 and 3 is channelled and directed to a single discharge point via a series of ponds. This potentially results in a less concentrated discharge compared to non-point source discharges, but means that the system has to be designed to accommodate the flows of the larger catchment.

The calculated flow rate of water leaving the catchment area is approximately 122L/s. This is a very conservative value and would only be observed in 1 in 10 year 60 minute duration storm events. It should also be noted that this is calculated as an instantaneous runoff and does not take into account the lag time for water to flow from one end of the composting pad and the uptake of water into the windrows in favourable conditions.

Based on a site area of 1.4 ha (Pad 1 & 3), a rainfall intensity of 43 mm/hr (i.e. 7 mm in 10 mins = 42 mm in 1 hour), and the above coefficients, the estimated runoff flow rate from Pad 1 and 3 will be 438m^3/hr. This is an extremely conservative estimate and is likely to overestimate the volume to be actually discharged from the composting pad 1 & 3 during this 1 in 10 year 60 minute storm event. The pond level is maintained to ensure that there is enough capacity should a 43mm/hr rain event occur, with 652m^3 provided, which equates to 0.769m 'freeboard' in the pond. In reality is managed simply, by ensuring there is always 1m freeboard in the pond, and when this freeboard is filled due to a rain event, ensuring the irrigation is irrigated as quickly as possible to return the pond to the required level. It is further noted that the low risk soils make the management of the pond much simpler, as it is not necessary to wait until there is a soil moisture deficit to enable safe irrigation of the lower effluent blocks.

The Pond Management Plan is included in the Leachate & Stormwater Management Plan, refer to **Appendix F**, and outlines the process required to manage the pond level.

As can be seen from Table 7 the potential discharge characteristics are such that any discharge of leachate is likely to be contained and/or assimilated, without any impact on resultant receiving groundwater or surface water quality.

2.8.3 Pad 2 stormwater capacity

Stormwater and leachate from this pad (pad 2 – Paunch Pad) is collected in a 200,000-litre capacity pond, from where it pumped to a wetland system which has sediment retention pond and seven terraces. Each terrace is planted with various species of plants to deal with varying nutrient levels of leachate. Once the leachate has passed through the wetland system it is collected in a 1,000 m^3 capacity pond before discharge to an un-named tributary of the Haehanga Stream.

Based on a site area of 1ha, a rainfall intensity of 43 mm/hr (i.e. 7 mm in 10 mins = 42 mm in 1 hour), and the above coefficients, the estimated runoff flow rate from Pad 2 will be 153m^3/hr. This is an extremely conservative estimate and is likely to overestimate the volume to be actually discharged from the composting pad during this 1 in 10 year 10 minute storm event. Pad 2 drainage area is maintained to ensure that there is enough capacity should a 43mm/hr rain event occur, with 1000m^3 capacity provided at all times.

Table 6. Stormwater Peak Flow Calculation

	Stormwater Peak Flow and Volume Calculation, Revital Uruti Site			
	Calculations based on a 1 in 10yr event			
Pad 1	(Organic)			
	Run-off Coefficient, C=	0.25	bush, gardens, lawns-MBIE Table 1 Run-off Coefficients	
	10 year ARI, 60 min duration storm rainfall intensity, I=	43.3	mm/hr ie HIRDS v3 increased for climate change 2 degrees	
	Run-off Area, A=	0.7764	ha	
	Run-off flow Q=CIA=	0.023	m3/s	(from LMNO Engineering calc page www.LMNOeng.com)
	Equivalent volume required for duration time, V=1.5(Q) d	124.2	m3	leachate pond volume required for Pad 1
		Volume always available in leachate pond is 652m3 therefore OK		
Pad 3	(Drill mud/organic)			
	Run-off Coefficient, C=	0.25	bush, gardens, lawns-MBIE Table 1 Run-off Coefficients	
	100 year ARI, 60 min duration storm rainfall intensity, I=	43.3	mm/hr ie HIRDS v3 increased for climate change 2 degrees	
	Run-off Area, A=	0.8132	ha	
	Run-off flow Q=CIA=	0.0242	m3/s	(from LMNO Engineering calc page www.LMNOeng.com)
	Equivalent volume required for duration time, V=1.5(Q) d	130.68	m3	leachate pond volume required for Pad 3
		Volume always available in leachate pond is 652m3 therefore OK		
Settling Ponds	(Pad 3 settling ponds)			
	Run-off Coefficient, C=	1	Ponds	
	100 year ARI, 60 min duration storm rainfall intensity, I=	43.3	mm/hr ie HIRDS v3 increased for climate change 2 degrees	
	Run-off Area, A=	0.43	ha	
	Run-off flow Q=CIA=	0.051	m3/s	(from LMNO Engineering calc page www.LMNOeng.com)
	Equivalent volume required for duration time, V=1.0(Q) d	183.6	m3	pond volume required for Pad 3
		Volume always available in leachate pond is 652m3 therefore OK		
	Total	438.48	m/3	capacity required in irrigation pond
Pad 2	(Paunch)			
	Run-off Coefficient, C=	0.25	Stormwater peak flow calcs 130618	
	100 year ARI, 60 min duration storm rainfall intensity, I=	43.3	mm/hr ie HIRDS v3 increased for climate change 2 degrees	
	Run-off Area, A=	0.9534	ha	
	Run-off flow Q=CIA=	0.0284	m3/s	(from LMNO Engineering calc page www.LMNOeng.com)
	Equivalent volume required for duration time, V=1.5(Q) d	153.36	m3	pond volume required for Pad 2
		Volume always available in Pad 2 settlement pond is 1,000m3 therefore OK		

2.8.4 Adaptive Management

If the pads are increased (or decreased) in size, RNZ is able to adapts accordingly and recalculate the runoff expected. The applicant is therefore agreeable to a condition of consent that requires RNZ to ensure that catchment ponds on the site have capacity to accommodate a 1 in 10 year event of 60 minutes duration at all times.

2.8.5 Description of Nitrogen Losses/leaching

The TRC has raised a concern about the potential for Nitrogen leaching/Losses through the soil profile at the site and more work has therefore been undertaken to better understand the potential N losses from the activities for which consent is sought.

2.8.5.1 Nitrogen inputs

The nitrogen applied to the irrigation areas comes from the irrigation water, and in the relevant scenarios, from the compost applied as a soil conditioner. No nitrogen is applied as fertiliser.

The report in Appendix AA sumarises that:

Nitrogen concentrations in the irrigation pond have been monitored on a regular basis since 2014. The major form of nitrogen recorded in the pond is Ammoniacal nitrogen (NH_4) with levels ranging between 17.6 to 590 g/m^3 with the average concentration being 226.7 g/m^3.

For the purposes of this report the Ammoniacal nitrogen sampling results between August 2016 to March 2020 were used to calculate the Nitrogen applied as fertiliser to the irrigation blocks. The Nitrogen application rate, kg N/ha, was calculated by multiplying the volume pumped by the Ammoniacal nitrogen concentration and divided by the total irrigation area. The sampling data was grouped into seasons ie Summer, Autumn, Winter.

The rates of NH4 applied are summarised in section 4.3 of the report in Appendix AA, and are provided in Table 7 for the purposes of confirming the rates of N inputs - i.e. application to land in Irrigation water.

Table 7. Seasonal and Average NH4 concentration in Irrigation Effluent

		Volume pumped	Concentration	Total	Application rate
		m3	g/m3	Kg	Kg N/ha
Jan	Summer	805	341.8	275.2	20.9
Feb	Summer	1720	341.8	588.0	44.7
Mar	Autumn	2090	305.8	639.1	48.6
Apr	Autumn	1595	305.8	487.8	37.1
May	Winter	2610	159.8	416.9	31.7
Jun	Winter	1570	159.8	250.8	19.1
Jul	Winter	1755	159.8	280.4	21.3
Aug	Winter	2620	159.8	418.5	31.8
Sep	Spring	2020	126.0	254.5	19.3
Oct	Spring	1475	126.0	185.9	14.1
Nov	Summer	1160	341.8	396.5	30.1
Dec	Summer	1030	341.8	352.1	26.8
TOTAL		**20450m3**	**-**	**4545.6 KG N/year**	**-**
AVERAGE		**1704 m3/Month**	**239.2 g/m3 NH4**	**378.8 kg/month**	**345.6 KG N/ha/year**

From the data above, the seasonal averages below are what has been used in OVERSEER® to model N losses. This is detailed in the report in Appendix AA.

2.8.5.2 Nitrogen Export

Nitrogen is currently lost from the site (i.e. removed) via stock grazing of the pasture, and removal of plant growth in the irrigation areas via harvesting (i.e a hay or baleage crop).

2.8.5.3 Nitrogen Losses to groundwater

In Mid 2019, the applicant commissioned AECOM to model the likely N losses form the soil using OVERSEER®. The resulting report is included in **Appendix Z** for completeness, but is now superceded. This model took into account:

- The nature of the effluent applied;
- The volume and frequency of application (including the type of irrigator);
- The soil conditions and nutrient status (based on actual soil sampling);
- Meteorological conditions;
- Riparian setbacks; and,
- Fertiliser application, stock rotation, cropping, cut and carry and any imported stock feed that may influence N levels.

The results of this modelling showed elevated N losses and the applicant immediately took on board recommendations in the AECOM report, and engaged their local advisors to develop additional options to reduce N losses. Many of the mitigation measures identified were easily put in place and have been implemented.

As a result the AECOM Model that was prepared in September 2019 no longer reflected site practices, and a further OVERSEER® model has been prepared by RNZ's local adviser, which models the actual site activities, and the changes implemented to address the concerns originally raised by AECOM. This is attached as Appendix AA.

Table 8. Summary of N losses from the Root Zone of the irrigation areas (From report in Appendix AA)

Total Nitrogen leached from the Irrigation Areas		Kg/ha/yr No compost	Kg/ha/yr With compost
Leached from the Upper Irrigation Area	5.12 ha	79	129
Leached from the Lower Irrigation Area	8.05ha	76	178
Total Nitrogen leached from the root zone		77	159

To put this in perspective, average N losses from farms in Taranaki range from 23 kg N/Ha/year (sheep and beef) to 55kg/N/ha/year (Dairy Grazing)[10] on a whole farm basis. Effluent paddocks on typical dairy farms will be significantly higher than the average - and while there is no data provided in the report cited on the effluent blocks in particular, a level of 77 kg N/Ha year would not be considered unusual for an effluent block, and while 159 kg N/ha/year would be considered higher than average, this needs to be weighed up against the long term benefits of the compost application and the potential effects on the environment.

Further discussion on the effects of the N losses are considered in section 7 of this report, along with a

[10] Assessment of the agricultural economic impacts of DIN limit proposal in Essential Freshwater package in Taranaki Report prepared for Taranaki Regional Council, October 2019, LWP Ltd. Table 2.

number of mitigation measures that are currently, and are able to be applied. The applicant intends to implement the recommendations outlined in the full report, if they have not been implemented already.

2.8.6 Description of Chloride Losses/leaching

Monitoring of groundwater and receiving water identifies that chloride levels are reaching trigger levels in some areas. Chloride levels in compost have not been tested, however due to the mobility of the chloride it is expected that most chloride in the received wastes ends up in the irrigation water as opposed to the compost.

2.8.6.1 Chloride inputs

Chloride is associated with the drilling by-products received, which contain high levels of chloride either as produced water from saline drilling formations or in the chloride based drilling muds that are used in the drilling process.

2.8.6.2 Chloride export

Chloride is not taken up significantly by plants (a small amount is required), therefore is not exported from the site in any quantity. Instead it is typically lost from soil via leaching due to its mobile nature. This is discussed below.

2.8.6.3 Chloride losses to Groundwater

OVERSEER® does not model Chloride losses, and instead it is assumed that the chloride applied to the land will eventually leach to groundwater, as it is not exported or attenuated.

The key means of reducing chloride losses to groundwater are to reduce the amount of chloride applied to the soil in irrigation water. The source of the chloride in irrigation water is drilling by-products and the cessation of this waste stream will address this concern. The effects of chloride losses are discussed in section 7.

2.9 Description of Discharges - Discharges to Water

In addition to the discharge of material and irrigation waters to land, consent 5838-2 authorises the discharge directly from the wetland system into the Haehanga Stream. This is described below.

2.9.1 Discharge from Wetland (Paunch Pad)

Runoff from the paunch pad is pumped through the wetland described in 2.3.6 and the discharge from the wetland to the Haehanga Stream is monitored. Results of monitoring since April 2018 are shown in Table 9 below.

Table 9. Results of monitoring of the wetland discharge since April 2018 (TRC data)

Date	BODCF	Chloride	Conductivity	NH4	NH3	pH	SS	Temperature
	g/m^3	g/m^3	mS/m@20C	g/m^3 N	g/m^3 N		g/m^3	Deg C
26/4/18	<0.5	13.8	24.4	1.51	0.00589	7.2	11	11.1
21/06/18	<2	13.1	18.5	1.04	<0.010	7.4	11	9.4
28/08/18	<1.0	11.5	17.3	1.1	0.0027	7	6	11.1
20/12/18	<1.0	9.4	24.1	0.051	0.00038	7.3	5	18.2
22/02/19	<1.0	12	24.2	0.189	0.00082	7.1	11	18.2
07/3/19	<1.0	10.8	27	0.056	0.00034	7.3	6	16.1
21/03/19	<1.0	10.7	28.9	0.067	0.0051	7.4	5	17.3
12/4/19	<1.0	9.4	15.3	0.023	0.00007	7.1	29	13.8
06/11/19	<1.0	11.1	22.4	0.057	0.00035	7.3	5	15.5
03/03/20	<1.0	13.1	25.7	0.088	0.0003	7.1	8	15.3
08/05/20	<1.0	17.3	19.2	0.51	0.00109	7.0	7	11.3
CONSENT LIMITS	**2**	**150**	-	**2.3**	**0.025**	-	**100**	-

These results confirm that the discharge has complied with the consent limits for the last two years, and a review of older data suggests no issues with compliance since June 2017 where a spike of NH4 was recorded (this is thought to be from natural phenomena, and is discussed in section 7.6).

2.10 Description of Discharges to Air

Operations on the site have the potential to create odour and dust discharges.

Discharges of odour can occur from all aspects of the site; however, experience has shown that the key sources of odour are;

- the main receiving pond/area when material is placed there, and;
- the compost piles when the compost is turned.

Site management processes have been developed and implemented to minimize and/or mitigate the production of odour from the site operation and can viewed in the Site Practices Plan. In summary the processes employed to minimize odour are; Identifying odorous materials arriving on site and if they are not to be processed immediately, covering them with sawdust.

- Turning the windrows on a regular basis to ensure the rows do not turn anaerobic.
- Turning the windrows when weather conditions limit the drift of odour towards the Northern boundary.

Discharges of dust from vehicles using the access track have been observed by site staff and management but the effects are localised, and no dust has been observed drifting beyond the boundary.

The Site Practices Plan (**Appendix D**), outlines the management processes required to mitigate the effects of air discharges. The plan consists of management techniques such as covering any likely odorous material with sawdust, and the turning of windrows when wind is blowing away from any neighbours. Relevant sections in this plan include:

- Incoming material – management of incoming material to prevent odour
- Composting process – management of the composting process to avoid or mitigate odour and dust, including timing of works to be down wind of any receptors
- Vermiculture process – management of this process to avoid or mitigate odour emissions
- Dust – overall dust management at the site to avoid or mitigate offsite dust emissions
- Contingency for air discharge – steps to remedy the effects if there is a discharge

2.10.1 Odour Emissions

There have been incidents of odour discharges from the facility in the past, however the applicant has made changes to operations to avoid and mitigate odour emissions, including ceasing the receipt of the material that was causing the odour complaints, and making changes to site operational procedures to ensure work that has a higher likelihood of generating odours is undertaken at times when down-wind receptors will not be exposed.

The cessation of receipt of drilling muds will assist reduce odour emissions by removing the source of any hydrocarbon type odours. This has been noted by the TRC in the past.

There have been no verified odour complaints since 2nd April 2010.

The effects of discharges to air is further covered in section 5.6 of this AEE.

2.11 Site Management

2.11.1 The Three-Tier Response Management System

The BTW company report Uruti Composting Facility Management Plan (undated – **Appendix H**) developed a framework based on a three-tier decision tree which guides site operations in response to trigger levels of soil contaminants. The tiered response was developed because of its simplicity but also allows increased monitoring efforts and reviews of site performance to minimise risks from drainage to groundwater and accumulation of hydrocarbon constituents within the soil.

Condition 14 of 5838-2.2 required the following:

Condition 14 *Before 30 November 2015 the holder shall review and update the Uruti Composting Facility management Plan supplied in support of application 5838-2.2 and any changes shall be submitted for approval to the TRC. The plan shall be adhered to and reviewed on an annual basis (or as required) and any changes shall be submitted to the TRC. The plan shall include but not limited to;*

a) Trigger limits for the three tier management system tiers set out in section 3.1 of the Uruti Composting Facility Management Plan

b) Monitoring frequencies of soil and groundwater in Tiers one, two, and three.

c) Remediation options for Tier three irrigation areas;

d) Riparian planting of irrigation areas;

e) Stormwater improvements at the site;

f) Water storage for dilution and remediation; and,

g) Soil and ground water analysis.

The plan in Appendix H satisfied this requirement, and it is a requirement of consent 5538-2 that the Three Tier Response system developed by BTW Company Limited (detailed in **Appendix H**) be implemented at the site. This provides one of the key management tools within the site in terms of responding to the results of monitoring.

The three-tier framework is summarised inTable 10 below.

Table 10. Three Tier response guidelines

Tier	**Operation Status of irrigated area**
One	Surveillance or normal operation of site
Two	Alert or increased level of monitoring with deferred irrigation
Three	Action or remediation options initiated and irrigation ceases

The trigger or threshold values and actions required are listed in the BTW company report-full report attached **Appendix H**. Essentially, soil monitoring occurs on the site in accordance with consent conditions, the results are compared to the threshold values for each of soil chemistry, irrigation pond fluids and groundwater chemistry, and this dictates the appropriate management response within the irrigation areas.

The threshold values are summarised in the following sections.

2.11.1.1 Soil Chemistry

For simplicity in the irrigation blocks, there are three main constituents that are monitored closely, and these are summarised in Table 11. These form a 'quick reference' guide as these analytes act as 'indicators' for others.

Table 11. Summary of the Three Tier threshold values for soil chemistry

Tier Level	Chloride	Total Petroleum Hydrocarbons (TPH)	SAR
	mg/kg	mg/kg	
One	0 – 700		0 – 6
Two	700 – 1,800	<20,000	6 – 18
Three	>1,800	>20,000	>18

The full suite of soil triggers are included below.

Table 12. Three Tier Framework for soil quality in the irrigation blocks

Tier	Receptor	Target or Trigger	Monitoring frequency	Timeline for change
One	Soil	Chloride – 0 to 700 mg/l (based on the surrender criteria for NZ land farms criteria) Sodium Absorption Ratio 0 - 6	Monthly	N/A as standard operation phase
		TPH (Total Hydrocarbons) C7 – C9 <2700mg/kg C10 – C14 <58mg/kg C15 – C36 <4000mg/kg	3 Monthly	N/A as standard operation phase
Two	Soil	Chloride –700 to 1800 mg/kg Sodium Absorption Ratio 6 - 18	Monthly	If the Chlorides within the soil stay within this tier for 6 months, consider moving to Tier 3 Consider clean water irrigation to allow recovery from elevated SAR
		TPH (Total Hydrocarbons) TPH <20,000mg/kg	Monthly	Upper limit for bioremediation to be effective for hydrocarbons, leachate fluid to contain no TPH
Three	Soil	Chloride – >1800 mg/kg Sodium Absorption Ratio >18	Monthly	Initiate soil remediation measures (refer to section 5) of the BTW report) alongside clean water irrigation
		TPH (Total Hydrocarbons) >20,000mg/kg	Monthly	Initiate soil remediation measures (see section 5)

2.11.1.2 Irrigation Pond

The trigger and target levels for the irrigation pond material are shown below in Table 13.

Consideration has been given to developing a tiered system for Nitrogen, however this has not been implemented due to the difficulties in obtaining timely information to inform irrigation decisions.

Table 13. Three Tier Framework for fluid in the irrigation pond

Tier	Receptor	Target or Trigger	Monitoring frequency	Timeline for change
One	Leachate Fluid (Irrigation pond)	Chloride – 0 to 2000 mg/l results in an Areal Loading of approximately up to 17,600mg/m^2/day	Weekly	N/A as standard operation phase
		TPH (Total Hydrocarbons) 0 – 2,500 mg/l (Half of 5% TPH consent limit)	Monthly	N/A as standard operation phase
Two	Leachate Fluid (Irrigation pond)	Chloride –2,000 to 10,000 mg/l	Monthly	If rainfall and soil moisture are expected to increase, irrigation can continue, however, if drier periods are forecast, irrigation should cease especially over summer months.
		TPH (Total Hydrocarbons) 2,500 – 3,000mg/l	Monthly	
Three	There are no tier 3 levels for the irrigation pond material. Irrigation is ceased at level 2.			

2.11.1.3 Groundwater Bores

The three-tier response is also applied to the groundwater bores on the site. The trigger levels are shown in Table 14 below.

Table 14. Three Tier Framework for ground water quality in the monitoring bores

Tier	Receptor	Target or Trigger	Monitoring frequency	Timeline for change
One	Groundwater	Chloride – 0 to 1000 mg/l and Conductivity – <350 uS/m	Bimonthly	N/A as standard operation phase
		TPH (Total Hydrocarbons) All fractions of hydrocarbons under detectable levels	Biennially	N/A as standard operation phase

Tier	Receptor	Target or Trigger	Monitoring frequency	Timeline for change
		(essentially background level)		
Two	Groundwater	Chloride –1000 to 2000 mg/l and Conductivity – 350 to 700 uS/m	Monthly	All irrigation to cease in this zone.
Three	Groundwater	Chloride – >2,000 mg/l and Conductivity – >700 uS/m	Monthly	Initiate groundwater remediation measures (refer to section 5 of the BTW report)

2.11.1.4 Performance of Facility in relation to three tier thresholds

The results of monitoring in relation to the three tier thresholds for the appropriate areas indicate that seldom do contaminants reach tier 3 level. On those occasions where tier 3 is reached, results indicated that management changes that occur as a result of the actions triggered address the problems, with levels returning to within tier 1 or 2 on the following sampling occasion.

See Appendix X for a summary of performance.

2.11.2 Leachate and Stormwater Management Plan

The three tier response system is reflected in the Leachate and Stormwater Management Plan (**Appendix H**). This plan describes how the pond system that treats leachate generated from the compost pile and contaminated stormwater from pads 1 and 3 and the Truck Washdown area is managed. This plan also satisfies the requirements of condition 20 of consent 5838-2.2, which states:

20 *The consent holder shall prepare a Pond Treatment System Management Plan which details management practices undertaken to maximise treatment capabilities of the system. The plan shall be submitted for approval to the TRC, within one month of the commencement date of this consent.*

The Management Plan shall address but not necessarily be limited to, the following matters:

- *a) How the build-up of sediment and/or sludge will be managed within the entire system, how the level of build-up will be monitored including factors that will trigger management, and the frequency of undertaking the identified measures or procedures;*
- *b) How overloading of the system will be prevented; and*
- *c) How any offensive or objectionable odours at or beyond the boundary will be avoided in accordance with condition 13 of consent 5839-2*

Condition 21 of the consent also requires that operations on site be undertaken in accordance with the Plan, approved.

This plan in particular addresses how irrigation is managed to avoid overloading, and to ensure there is capacity in the irrigation pond to accommodate peak rainfall events. It sets out how the irrigation model is used onsite.

2.11.3 The Site Practices Plan

This plan is included as **Appendix D**, and outlines the vermiculture and composting processes on site and includes a series of Standard Work Place Instructions (SWPI's) describe in detail the tasks required to carry out the processes. Items in this plan relevant to the discharges to land include:

- Site security and upkeep
- Internal roads and tracks
- Site Management
    - Composting Process
    - Vermiculture Process
- Monitoring
- Community liaison
- Incident notification

2.11.4 Farm Environmental Management Plan

A Farm Environmental Management Plan (FEMP) has been developed (**Appendix O**) to ensure the operation of the Uruti farm is managed using recognised good management practices[11]. A major focus of this plan is to avoid, remedy or mitigate the loss of nitrogen to surface water and ground water from irrigated wastewater onto the irrigation blocks. This plan identifies the risk areas for nutrient losses, and then identifies the actions to be taken to reduce or prepare for the risk.

3. Permitted activities

3.1 Use of existing compost stockpiles within the site in compliance with Rule 29

3.1.1 Background

It is the intention to utilise existing composted material around the Uruti site as cold air drainage bunding, and as a soil conditioner. From the date of this revision, the majority of compost will be used for cold air drainage, with 500 tonnes per year used as a soil conditioner and some used to top up other bunds around the site as necessary. This compost has been composted under existing consents, and is present in two separate composted stockpiles on the subject site:

- Composted Waste Stream 1 – Pad 3 – Drilling Mud Pad; and
- Composted Waste Stream 2 – Pad 1 – Greenwaste Pad.

In order to ensure appropriate analysis of the drilling mud pad (Pad 3) and greenwaste pad (Pad 1)

[11] For example, Good Management Practices on Dairy Farms, Dairy NZ, 2016.

independent testing has been carried out by the Taranaki Regional Council.

This part of the AEE document details the methodology to undertake sampling of the two separate stockpiled composted waste streams at the facility to confirm compliance with Rule 29.

Composted waste stream 1 (Drilling Mud Pad – Pad 3): Comprises drilling mud and drilling fluid primarily, most likely in the form of water and synthetic based mud, produced water (though the fluid component is likely to have been irrigated through the process to land). More recently an organic component has been added to this compost waste stream in the form of dead chickens (poultry waste, eggs). The proposed material to sample from this waste stream compost is most likely of drilling origin which is expected to be within 3-4 years of age. Note that vegetative waste solids, grease trap waste (and when they were disposed of here, biosolids from raw water treatment sludge) are also contained within this compost waste stream, later also cheese waste and cream.

Composted waste stream 2 (Greenwaste Pad – Pad 1): Material derived from the following: Green waste (mainly garden cuttings). Some flare pit material and contaminated (petroleum and heavy metal) soil from various locations over the years, including road sweepings. Recently chickens have been composted in this area.

Pad 1 material will be composted to A1 grade (See Appendix G1), removed from site, blended as appropriate for the end customer and sold.

It is proposed that Pad 3 material be discharged under the permitted standards, terms and conditions of TRC Freshwater Plan Rule 29, which is permitted if the discharge can meet the standards prescribed in the rule 29 (Table 1), the breadth of analytes is aimed at demonstrating compliance in this instance. **The material from both of these pads is generated onsite and will not leave this site, and accordingly is compliant with Rule 29.**

TRC Rule 29 states that the discharge of contaminants from industrial and trade premises onto or into land, excluding those provided for under rules 22,23 and 42 is a permitted activity providing the following standards, terms and conditions are met**:**

- Only waste generated on the subject property shall be discharged;
- The discharge shall not result in surface ponding or run-off of any contaminant into a surface water body;
- The discharge shall not be within 25m of a surface water body;
- The discharge shall not be within 50 m of any existing bore, well or spring used for water supply;
- The discharge shall not, either directly or indirectly, cross the boundaries of the subject property;
- The discharge shall not be noxious, dangerous, offensive or objectionable to such an extent that is has or is likely to have a significant effect on the environment**.**

TRC Rule 29 includes a footnote detailing how compliance with the standard requiring that the discharge shall not be noxious, dangerous, offensive or objectionable can be demonstrated. As the guidelines/standards referred to in the footnote are not relevant to the activities at the site, the TRC has chosen to modify the foot note in Remediation's specific case. To demonstrate that the discharge shall not be noxious, dangerous, offensive or objectionable to such an extent that it has or is likely to have a significant effect on the environment, analysis is undertaken to demonstrate compliance with the following:

- The Draft Guidelines for the beneficial use of organic material on production land 2017.
- The Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Revised 2011).
- New Zealand Standard (NZS4454:2005) Composts, Soil Conditioners and Mulches.
- Land application of wastes from oil and gas wells: Landcare Research 2015.

3.1.1.1 Aim of sampling

The aim of the sampling in the first instance is to assess each composted windrow with a view of understanding the degree of heterogeneity or homogeneity which exists across the composted windrows. This is important for future analysis of compost windrows and will allow the variation, if any, to be understood. Secondly, the potential contaminates of concern within the compost streams have been remediated to a point where a decision about the future use of this material can be undertaken. Thirdly, some pathogen analysis is undertaken so as to gain a preliminary understanding of the likely pathogens of concern.

As the consent holder we need to understand the quality of these two compost waste streams as they would (in the case of compost stream 1) be used for cold air bunding and landscaping purposes around the Uruti site. In the case of composting stream 2, the intention is to use this material as a soil conditioner on our newly developed irrigation paddocks.

3.1.1.2 Sampling method

The method used to assess windrows of compost through a composite sampling method is shown in Figure 1. The compost windrow is divided into two sections, which is slightly modified from Figure 3 below. Each of the two sections or halves will then be spilt into three zones, shallow, mid-pile, base.

Five point samples are collected from each zone as defined in Figure 2. To collect the sample a trowel and/or a corer is used. All three zones within the half are composited to form one sample. This produces two samples per windrow which are submitted for analysis. Note that only chemical analysis is performed on the composited samples. One spot sample is also collected from each windrow, this being submitted for pathogenic analysis. Thus in total three samples have been submitted per windrow, two chemical, one pathogen.

This reflects that the material is to be utilised for two different purposes on site. Pad 3 will be used for cold air bunding and general site bunding . The pathogenic analysis proposed is to provide an indication of potential pathogens of concern, this material is not for sale and will remain within the confines of the Uruti site. The proposed bunding will be sealed with topsoil and planted out, as well as being fenced and sufficient distance from water courses. The Pad 1 greenwaste and contaminated soil is proposed to be mixed to provide soil conditioner properties on the consent holder's irrigation paddocks. These paddocks are fenced off to prevent any stock access. Neither assessed compost streams Pad 1 and Pad 3 are to be sold or moved off site and pathogens are therefore less of a concern.

One QA/QC sample (blind duplicate) is collected and is assessed for contaminates only. Thus in total for Compost Stream 1 there are seven contaminant samples and three pathogen samples.

In compost stream 2, one large windrow is analysed. This will be manipulated into two windrows to allow for samples to be collected as per the same method as above. One QA/QC sample (blind duplicate) will be collected, this will be analysed for contaminants and herbicides only.

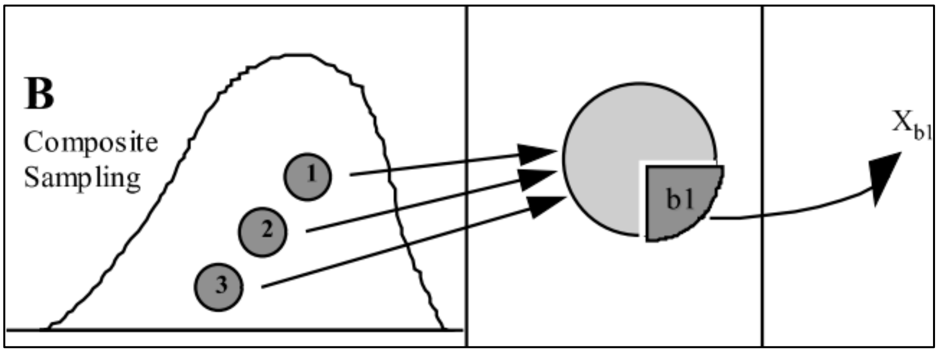


Figure 19. ***Composite sampling method for compost (image USEPA Field sampling of compost materials Fig 02.01-A2)***

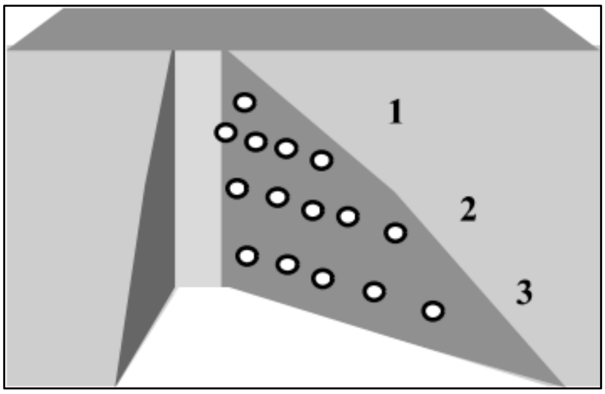


Figure 20. An example of three zone point samples (5 per zone) which will then be composited to form one sample (image USEPA Field sampling of compost materials Fig 02.01-B2)

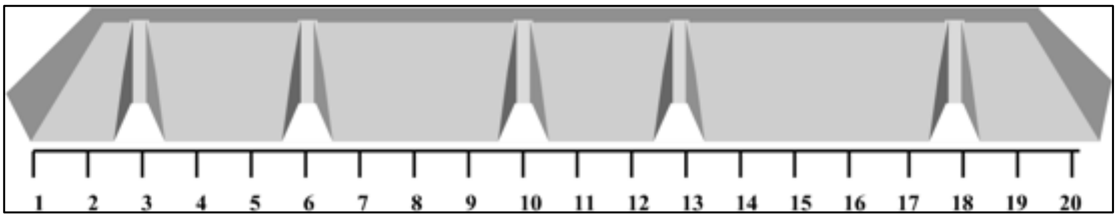


Figure 21. ***Hypothetical sample collection cut out of compost windrow (Image USEPA Field sampling of compost materials Fig 02.01-B1)***

The compost from Pad 3 is not proposed to be sold or given to a third party unless it is ultimately treated so that it is able to meet the standards for A1 Product (defined in Appendix G1). It will be treated to B1 standard (see Appendix G1) and used on site. Public exposure to pathogens is therefore not an exposure pathway.

As per the *Beneficial Use of Organic Materials on Production Land Volume 1 Guide* ('The Guide'), the product must undergo a stabilisation process. The accepted process is detailed in the guide. These includes the following:

1. There is a requirement for a documented quality assurance system.
    - This is currently under development by the consent holder.
2. There is also a requirement for a pathogen reduction process.
    - The consent holder undertakes windrow composting (Figure 22). The material has been in storage post composting for longer than 3 years. (Note that under the standard, storage can be viewed either as an adjunct to other pathogen reduction or VAR methods, or a treatment in its own right, particularly when further drying tales place)[12]. It is however noted that where sampling indicates it is necessary, this material will be reformed into windrows, mixed with green waste or other compost material and processed until the B1 standards are complied with.

Organic materials	Composting[1] Either: (i) In-vessel: T ≥ 55°C for ≥ 3 days, or (ii) Windrow: T ≥ 55°C for ≥ 15 days with a minimum of 5 turnings during this period (5 x 3 days at T ≥ 55°C plus time periods to reach 55°C after each turning). All compost must have at least 30 days maturation pre-use.

Figure 22. ***Extracted from Beneficial Use of Organic Materials on Production Land Volume 1 Guide Table 5-2 (Pathogen reduction process)***

3. There is a requirement for a Vector Attraction Reduction Method (Figure 23)
    - The material has been composted and stored for over three years. The Pad 3 material will be put to land as bunding, covered and planted out should the pathogenic analysis determine elevated pathogens in the indicative sampling method.

[12] Section 5.2.1 Beneficial Use of Organic Material on Production Land

Maintaining a minimum temperature of 40° C for a minimum of 14 days, with an average minimum temperature of 45° C or greater	Compost products

soil incorporation is undertaken as soon as practicable and within at least 24 hours of the product discharge. Where liquids are injected below the soil surface there shall be no significant amount of material visible after 1 hour.	Partially stabilised or unstabilised slurries or sludges

Figure 23 *Extracted from Beneficial Use of Organic Materials on Production Land Volume 1 Guide Table 5-3 (Vector attraction reduction techniques)*

3.1.2 Pathogen Standards

The proposed pathogen analysis standards to achieve Grade A1 are provided below in Figure 24. It is not intended to achieve grade A, given the proposed use of the material, however taking a preliminary assessment to gain an indicative idea of the likely pathogens contained within the compost streams. Further samples would be required to achieve Grade A.

Figure 24 Product pathogen standards - Beneficial Use of Organic Material on Production Land

Pathogen	**Standard**
E-coli	(less than 100 MPN/g)
Campylobacter	(less than 1/25g)
Salmonella	(less than <2MPN/g)
Human adenovirus	(less than 1PFU/0.25g)
Helminth ova	(less than 1/4g)

3.1.2.1 Contaminant content sampling

Contaminant sampling is undertaken to assess the compost streams. The testing regime has been expanded as the proposed compost streams may contain petroleum origins in the case of drilling mud, contaminated soil, and transformer oil, (noting the transformer oil was tested for PCBs prior to acceptance at Uruti and was found not to contain PCBs). Emerging contaminants of concern was omitted from the testing regime as the proposed analytes are not tested by RJ Hill lab. Acid herbicides are included to the Pad 1 material as this is of greenwaste origin.

The overall objective of this sampling is to ascertain what the likely pathogens and chemical contaminates levels are within these waste streams. No prescreening analysis has been performed on the Pad 3 material.

The limits from the various guidelines are summarised in Table 15.

Table 15. Summary of Guideline Limits on Contaminants

Parameter	Concentration Limit (mg/kg dry weight)	Source	Compost Stream
Arsenic	30	Beneficial Use of Organic Materials on Production Land Volume 1 Guide Table 5-5	Pad 1 and Pad 3
Cadmium	10		
Chromium	1500		
Copper	1250		
Lead	300		
Mercury	7.5		
Nickel	135		
Zinc	1500		
Boron Total nitrogen	<200	NZS4454:2005	Pad 1 and Pad 3
TPH- C7-C9	120	Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand Module 4 – Tier 1 Soil Screening Criteria	Pad 1 and Pad 3
TPH C10-C14	58		
TPH C15-C36	4000		
TPH C7-C36			
Polycyclic aromatic			
hydrocarbons (PAH's)			
Naphthalene	7.2		
Pyrene	160		
Benzo (a) pyrene	0.027		
Mono cyclic aromatic hydrocarbons (MAH's) Benzene Toluene Ethylbenzene Xylenes	1.1 68 53 48		
Potassium Sodium Barium Conductivity Soluble salts	460 10000 1.9 dS/m 2500	Land application of wastes from oil and gas wells: Landcare research 2015.	Pad 1 and Pad 3
Trace acid herbicides			Pad 1

3.1.2.2 *Results of Compost Sampling by TRC*

Results of compost sampling undertaken by the TRC for Pad 1 are reproduced inTable 16 below, and show that the composted material from Pad 1 was suitable for use within the Uruti Remediation site and complied with Rule 29 at the time of sampling.

Table 16. Sampling of compost piles on site – from TRC Report Ref:2296522

Compost stream 2: Greenwaste pad 1					Windrow three				Windrow four		
Sample Type: Mature Compost						Duplicate		Patho gen			Patho gen
	Sample Name:	Draft guidelines for the beneficial use of organic material on production land 2017	MfE Module 4 - Tier 1 NZ 2011	Land application of wastes from oil and gas wells: Implications for food safety and animal welfare: 2015	W3A_1 20619 12-Jun-2019 12:10 pm	W3B_1 20619 12-Jun-2019 12:15 pm	QC02_1 20619 12-Jun-2019	W3_1 20169 12-Jun-2019 12:20 pm	W4A_1 20169 12-Jun-2019 12:30 pm	W4B_1 20169 12-Jun-2019 12:45 pm	W4_1 20619 12-Jun-2019 12:50 pm
Viable pathogenic helminth ova	per 4 g	<1/4g			-	-	-	1	-	-	< 1.0
Total Recoverable Sodium	mg/kg dry wt			460	620	520	480	-	520	550	-
Benzo[a]pyrene (BAP)	mg/kg dry wt		0.027		0.041	0.031	0.02	-	< 0.017	< 0.017	-
TPH C_{10} - C_{14}	mg/kg dry wt		58		< 30	29	24	-	100	118	-

These results were presented in a report prepared by the TRC on 19 July 2019, and commentary from TRC Report #2296522 notes that;

> *'Compost Stream 2: The assessment of the greenwaste pad 1 material indicated the following parameters were marginally above guideline values for viable pathogenic helminth ova, total recoverable sodium, benzo (a) pyrene and TPH C10-C14 as defined in Table 2 (sic).*
>
> *The consent holder intends to action this material under regional fresh water plan rule 29. Some portions of the assessed compost piles were noted to be below guideline values, while other portions were noted to be slightly above the guideline values. Thus the consent holder requested whether this material may be blended together and then utilised as a soil conditioner on a newly developed irrigation paddock.*

Discussion from the report are as follows;

> *Blending of product is an acceptable way of diluting contaminant levels1. In the case of compost stream 1 (drilling mud pad 3) the consent holder intends to further blend this material and recompost it, with a view to diminish the TPH and the BaP. This will also further dilute the elevated salts which were identified in the sample analysis. This will be further assessed in 6-9 months' time.*
>
> *In the case of compost stream 2 (greenwaste pad 1) the consent holder intends to blend both windrows (note windrows 3 and 4 identified by samples 3A, 3B, 4A, 4B) together. The guideline exceedances, as defined in Table 2 (sic), indicated that sodium is the main parameter which was slightly above the guideline. There were similar marginal exceedances in two of five samples for mid-range TPH C10-C14 and BaP.*
>
> *Thus blending will likely bring these concentrations down to below the guideline value in the case of TPH and BaP. The sodium will likely reduce through soil leaching thus exclusion set back will prevent this from*

migrating to surface water. The addition of lime has been utilised in the region to mitigate an elevated sodium value in soil. It is also noted that one of the two pathogen samples (W3) indicated a detectable viable pathogen helminth ova. Thus soil incorporation2 of this material with an exclusion period including setbacks3, fencing and soil monitoring, prior and post incorporation is proposed. This will monitor for natural die of pathogens in the soil.

It is proposed that background soil e-coli levels be collected prior to land application and post (after 6 months) to monitor for die off of pathogens. It is also noted that the application area is to be fenced off with setbacks of 20 meters from watercourses.

The area where the application of this material is proposed (Figure 2) will be used as an irrigation water sequestration area for the consent holder's composting operations. Whereby the fluid component of the drilling mud and greenwaste pad leachate is irrigated to land. The irrigation areas will be planted out with grass post incorporation and this grass will be cut into hay, which in turn is fed to the worm beds within the consent holder's property. No grazing animals will be present in any of the irrigation areas'.

Results for pad 3 showed elevated levels of some contaminants, and therefore further composting is required before this material would be suitable for application to land. Sampling of the material therefore continues and this material is not applied to land under Rule 29 until compliance with the criteria are demonstrated.

3.2 Taking of water

Water is 'taken' from the duck pond at the site for truck wash activities and dilution (if required).

The Taranaki Regional Freshwater Plan allows for this as a permitted activity providing the rate of abstraction for the property (which is held under one certificate of title) does not exceed;

- 1.5l/s; or 5l/s for not more than 30 mins/day for temporary taking and use of surface water;
- exceed 50m^3 in any one day;
- 25% of the instantaneous flow, measured at the point of abstraction .

The point of abstraction has been clarified by the TRC as the place in the duck pond where water is pumped from. There is no instantaneous flow, however a very small percentage of the total pond volume is pumped at any one time (well below 10%).

The pump used to move the water is small, with a maximum rate of approximately 5L/sec. This is used infrequently for filling the small truck wash pond during dry weather (it is usually filled by rainfall) and may be run, if required for this purpose, for 5-10 minutes.

Dilution of the irrigation pond has not been required for the last 12 months, and as discussed elsewhere in this report, the applicant is considering whether this pond is still required. However if being used to dilute the irrigation pond, the applicant will restrict the pumping rate to 1.5L/second and run the pump for approximately 8 hours.

4. DESCRIPTION OF EXISTING ENVIRONMENT

4.1 General

The composting and vermiculture operation take's place on river flats that run alongside the Haehanga Stream and its tributaries, as shown in Figure 25 and Figure 26 below. The composting operation is carried out approximately 1 km from the Uruti road boundary to the north. The surrounding hill contours are steep, with a mixture of grass cover, scrub and regenerating native bush (a significant area of the farm has been fenced off from stock grazing so as to encourage native bush regeneration).

Figure 25: Uruti Composting Site in relation to Haehanga Stream and Mimi River (Source: TRC Maps 2020)

A photo of the composting site is shown in Figure 26.

Figure 26: Photo of Uruti Composting Site, viewed from the top of the site down the valley towards the Mimitangiatua River (Source: Client)

The applicant is assisting the regeneration of the surrounding hillsides by planting manuka. Prior to conversion to the composting facility, the site was a marginal sheep grazing block.

4.2 Climate

The climate in the Uruti Valley is generally mild and temperate. Rainfall is high, even in the driest months of the year, compared to other parts of the region (See Tables 2 & 3). The temperature average is between 13 and 14 Degrees C.

Rainfall is measured and recorded daily from a weather station situated at the site (see Figure 27). Information from the on site weather station is available in real time providing information to site management of potential issues with stormwater drainage.

Figure 27.Weather station situated on the southern side of the weighbridge hut

Rainfall is one of the key climate factors that influence site management, and the localised nature of rainfall events is well understood at this site.

Climatic data provided by National Institute of Water and Atmospheric Research (NIWA) and Taranaki Regional Council shows relevant monthly rainfall and maximum rainfall intensities over 10 minute intervals (overlapping) typical for this site. The closest relevant meteorological station is located at Kaka Road.

The top thirteen rain events from the meteorological station at Kaka Road taken from the 6 years prior to the original application being lodged in 2018 are tabulated below Table 17.

Table 17. Kaka Road Extreme Rainfall Events – 2011-2017

Rainfall Events, Uruti at Kaka Road-6 year period	
Date	mm/24hr
24-Jan-11	155
15-May-12	101
16-Jul-12	104
11-Dec-14	85.5
9-Apr-15	95
21-Jun-15	169
26-Aug-15	70
16-Nov-15	58
18-Jan-16	45
24-Jul-16	62
3-Feb-17	87.5
5-Apr-17	119.5
10-Aug-17	73

The data in Table 17 shows that high intensity rainfall events are common. These are of most interest to the operation, as they significantly affect site management, in particular the management of pond levels.

Rainfall data from the NIWA High Intensity Rainfall System V3 has therefore also been produced for the Uruti site, and has been used for modelling storm water events. These results are included below in Table 18.

Table 18. Intensity-duration-frequency results for the site (based on the nearest available meteorological station), and also models a 2-degree change in climate to determine the effects this would have on the high intensity rainfall events. Prepared by NIWA.

High Intensity Rainfall System V3											
Intensity-Duration-Frequency results (produced on Tuesday 17th of October 2017)											
Site name: **Uruti Composting Facility**											
Coordinate system: NZMG											
Easting: 2642119											
Northing: 6247112											
Rainfall intensities (mm/h)											
					Duration						
ARI(y)	aep	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.633	53.4	39	32.4	23.6	15.7	8.3	5.5	3.7	2.3	1.8
2	0.5	57.6	42	35	25.4	16.9	8.9	5.9	4	2.5	1.9
5	0.2	73.2	53.1	44.2	32.2	21.4	11.2	7.4	4.9	3.1	2.3
10	0.1	85.2	62.1	51.8	37.7	24.9	13	8.6	5.7	3.6	2.7
20	0.05	99	72.3	60.2	43.8	28.9	15	9.9	6.5	4.1	3.1
30	0.033	108	78.9	65.6	47.8	31.5	16.3	10.7	7.1	4.4	3.4
40	0.025	115.2	83.7	69.6	50.8	33.5	17.2	11.3	7.5	4.7	3.6
50	0.02	120.6	87.9	73	53.2	35	18	11.9	7.8	4.9	3.7
60	0.017	125.4	91.2	75.8	55.3	36.4	18.7	12.3	8.1	5.1	3.8
80	0.012	133.2	96.9	80.6	58.8	38.6	19.8	13	8.5	5.4	4.1
100	0.01	139.2	101.7	84.4	61.6	40.4	20.7	13.6	8.9	5.6	4.2
Coefficients											
c1	c2	c3	d1	d2	d3	e	f				
0.0003	-0.0053	0	0.5433	0.4165	0.325	0.2088	3.1601				
log(h(D))											
10m	20m	30m	60m	2h	6h	12h	24h	48h	72h		
1.792	1.099	0.693	0	-0.693	-1.792	-2.485	-3.178	-3.871	-4.277		
Standard errors (mm/h)											
					Duration						
ARI(y)	aep	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.633	7.2	3.6	2.4	1.3	0.6	0.2	0.1	0.1	0	0
2	0.5	7.2	3.7	2.5	1.3	0.7	0.2	0.1	0.1	0	0
5	0.2	7.3	3.8	2.6	1.4	0.7	0.3	0.2	0.1	0.1	0
10	0.1	7.6	4.1	2.9	1.7	0.9	0.4	0.2	0.2	0.1	0.1
20	0.05	8.2	4.7	3.5	2.1	1.1	0.5	0.3	0.2	0.2	0.1

30	0.033	8.7	5.2	4	2.5	1.3	0.7	0.4	0.3	0.2	0.1	
40	0.025	9.3	5.7	4.5	2.9	1.5	0.8	0.5	0.4	0.2	0.2	
50	0.02	9.8	6.2	4.9	3.2	1.6	0.8	0.5	0.4	0.3	0.2	
60	0.017	10.3	6.6	5.3	3.5	1.7	0.9	0.6	0.5	0.3	0.2	
80	0.012	11.1	7.4	5.9	3.9	2	1	0.6	0.5	0.3	0.2	
100	0.01	11.9	8	6.5	4.4	2.1	1.1	0.7	0.6	0.4	0.3	
Extreme rainfall assessment with climate change												
Projected temperature change: 2.0 degree Celsius												
Rainfall intensities (mm/h)												
					Duration							
ARI (y)	aep	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h	
1.58	0.633	61.8	45	37	26.8	17.6	9.2	6.1	4	2.5	1.9	
2	0.5	66.6	48.6	40	28.8	19.1	9.9	6.5	4.3	2.7	2	
5	0.2	85.2	61.2	50.8	36.8	24.2	12.5	8.3	5.5	3.4	2.6	
10	0.1	99	71.7	59.6	43.3	28.6	14.8	9.7	6.4	4	3	
20	0.05	114.6	84	69.6	50.5	33.4	17.2	11.3	7.5	4.7	3.5	
30	0.033	125.4	91.5	76	55.4	36.5	18.9	12.4	8.2	5.1	3.9	
40	0.025	133.8	97.2	80.8	58.9	38.8	20	13.2	8.7	5.4	4.1	
50	0.02	139.8	102	84.6	61.7	40.6	20.9	13.8	9.1	5.7	4.3	
60	0.017	145.2	105.9	88	64.1	42.1	21.7	14.3	9.4	5.9	4.5	
80	0.012	154.8	112.5	93.4	68.2	44.8	23	15.1	9.9	6.2	4.7	
100	0.01	161.4	117.9	98	71.5	46.9	24.1	15.8	10.3	6.5	4.9	
In preparing this table, all reasonable skill and care was exercised using best available data & methods. Nevertheless, NIWA does not accept any liability, whether direct, indirect or consequential, arising out the use of HIRDSV3. (c)2017 NIWA												

Table 18 shows the intensity-duration-frequency results for the site (based on the nearest available meteorological station). It also models a 2-degree change in climate which has been used to determine the effects that a high intensity rainfall events would have on the composting site.

The above tables have been used in calculating peak flow and volume for the Uruti composting site.

Thirty years of rainfall and evaporation data from NIWA virtual Climate Station -38.975, 174.525 is summarised in Table 19 below.

Table 19. NIWA Virtual Climate Station 30-year data for a site near Uruti Site

Uruti	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Rainfall	120.0	107.0	119.2	151.2	181.2	189.5	181.8	178.0	175.4	188.4	149.4	149.0	1890.0
Evaporation	134.5	108.0	88.6	52.7	31.1	21.4	25.4	39.0	57.5	85.1	109.3	126.0	878.6

This data, along with extensive local knowledge, is used to guide management of the irrigation areas on site.

4.3 Soils and geology

Based on information provided by BTW Uruti Composting Facility Management Plan (section 2.3 see **Appendix H**) the soils in the area are classified as Orthic brown soils from the Whangamomona Complex loams, which have a high clay content (NZ Soil Classification, V4). Profiles indicated shallow soil with varying coarse to fine sandy / clay horizons with a papa clay base.

This has been confirmed by site investigations, as shown in Figure 28 and described in the report on High and Low Risk soils in **Appendix AB**.

Figure 28. Excavated test pit showing soil profile.

4.4 Site Hydrology

4.4.1 Surface Hydrology

The site has been constructed to control and manage stormwater flows with the intention to divert clean stormwater flows from the upper catchment around the site activities, and minimise the amount of clean water that becomes entrained in the process and site ponds.

The pre-composting area within the facility is bounded by a constructed drain / stream on the Northeast that discharges to the Mimitangiatua River which is to the northwest. At the closest point, the Haehanga stream is 10m from the composting pad and this area is 3500m upstream of the confluence with the Mimitangiatua River, with no other permanent or major watercourses in the locality.

Flows that are not controlled run via drains to the Haehanga Stream.

During dry periods, the flows in the Haehanga can become very low, and in extreme dry weather the stream can completely dry up. This has been observed by staff on site on a number of occasions and is one of the reasons for the installation of the dam in the upper catchment.

4.4.2 Groundwater Hydrology

A groundwater investigation has been undertaken and a model has been produced for the site. The full report is attached as **Appendix 'U'** (2 July 2015 BTW Company). This report finds that;

- the clay soils form a semi-impervious shallow groundwater table overlain by more porous silty loamy-clays and the shallow groundwater table is in almost constant interaction with the more porous loamy silty- clays.
- Highest groundwater levels were recorded in winter and spring
- There is a close hydraulic connection between the Haehanga Stream and shallow groundwater.
- Ground water is close to surface, with water levels of approx. 0.28 and 1.2 m below ground level.

The BTW report notes that:

No deep groundwater information has been sourced for this assessment and it is considered the upward movement of shallow groundwater would restrict downward movement of surface water from the catchment area. There are no deep groundwater bores located between this composting pad and the Mimitangiatua River.

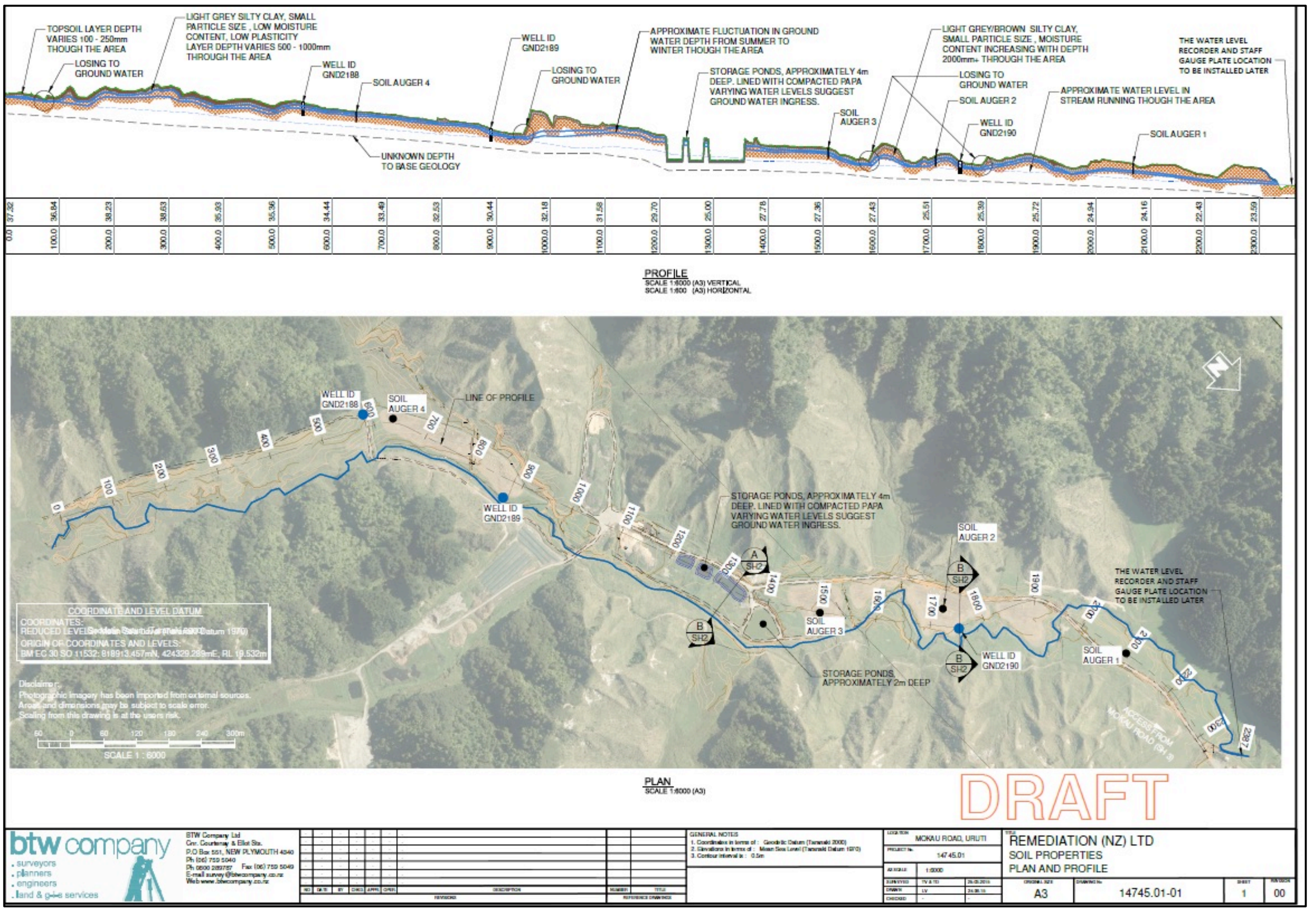


Figure 29. Uruti Site Ground Water Model (Source: Uruti Composting Facility Management Plan BTW section 2.3 see Appendix H)

4.5 Groundwater Quality

Monitoring of groundwater has occurred on the site for bores GND 2188, GND 2189 and GND 2190 (installed as a condition of the original consent) and more recently the first samples have been taken from the four new bores installed on the site in conjunction with the extended irrigation areas (consented in 2015). One of the new bores is shown in Figure 30 below.

The results of this monitoring are discussed further in section 7 which assesses the environmental effects of the activities. By comparing the analyses in the up-gradient bores to the analyses in the bores down-gradient of the operations, the results show that the composting and discharge of irrigation water has had only minor effect on the groundwater under the discharges authorised by the current consents.

Figure 30. Recently installed groundwater monitoring bore.

4.6 Surface Water Quality

Monitoring of surface water in the catchment has been occurring for a number of years under the existing consents for the site, and the results are presented in section 7 of this AEE. By comparing water quality upstream of the site to that downstream of the site, it is shown that the composting operation has had only minor effect on surface water quality while operating under the current consents.

Monitoring of the Mimitangiatua River upstream and downstream of the Haehanga confluence was also undertaken on the 2nd of May 2018 for the purposes of providing supporting information to this consent application. The analysis of the water quality both above and below the Haehanga Stream confluence at the time indicate that the Remediation NZ site is having little or no effect on the water quality of the Mimitangiatua.

Figure 31. Mimitangiatua and Haehanga Stream Confluence

The lab results of this monitoring are attached as **Appendix 'W'** and summarised in Table 20 below.

Table 20. Results of monitoring of Mimitangiatua Stream, 2 May 2018

Sample Type: Aqueous						
	Sample Name:	Lower Mimi 02-May-2018 2:00 pm	Upper Mimi 02-May-2018 2:00 pm			
	Lab Number:	1974595.1	1974595.2			
Individual Tests						
pH	pH Units	7.2	7.0	-	-	-
Electrical Conductivity (EC)	mS/m	14.5	13.6	-	-	-
Total Suspended Solids	g/m³	< 15 [#1]	< 15 [#1]	-	-	-
Chloride	g/m³	13.0	12.6	-	-	-
Free Ammonia	g/m³ at 20°C	< 0.010	< 0.010	-	-	-
Total Ammoniacal-N	g/m³	0.043	0.044	-	-	-
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	g O_2/m³	< 2	In Progress	-	-	-
Escherichia coli	MPN / 100mL	142 [#2]	122 [#2]	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.06	< 0.06	-	-	-
C10 - C14	g/m³	< 0.2	< 0.2	-	-	-
C15 - C36	g/m³	< 0.4	< 0.4	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	< 0.7	-	-	-

These results would be considered typical of lowland Taranaki streams with silty substrate.

4.7 Air Quality

Remediation (NZ) acknowledges that there have been odour complaints from neighbours in the past. Odour complaints have been taken seriously with the problem identified, and as a result Remediation (NZ) no longer takes the product that caused this issue.

The existing air quality is expected to be very good, due to the relatively undeveloped rural area characterised by low intensity farming surrounding the site, and indigenous bush inland.

Existing air emissions in the area are very limited and will have only localised effects (e.g. motor vehicles using the existing SH3; domestic heating emissions, if any, from the residential houses nearby and intermittent discharges from farming activities). There could be minor influences associated with salt spray in the area. Further information on air quality discharge is contained in section 7 of this AEE. There have been no substantiated odour complaints since 2nd April 2010.

4.8 Existing Consents

The site is operated under the following consents which form part of the existing environment:

Consent 5838-2.2 (subject to this application for renewal)

To discharge:

a) waste material to land from a composting operation

b) treated stormwater and leachate from a composting operation; onto and into land in circumstances where contaminants may enter water in the Haehanga Stream catchment and directly into an unnamed tributary of the Haehanga Stream

Consent 5839-2 (subject to this application for renewal)

To discharge emissions to air, namely odour and dust from composting operations between (NZTM) 1731704E-5685796N, 1733127E-5684809N, 1732277E-5685101N, 173245E-5684624N and 1732056E-5684927N.

In addition to the two consents that require renewal, Consent 16063-1.0 allows discharge of stormwater from a quarry site into an unnamed tributary of the Haehanga Stream, Consent 5938-2.2 and 6212-1 are for the installation of culverts on the site, and consent 6211-1 is to divert a stream.

4.9 Compliance With Existing Consents and Environmental Performance

The applicant has been focusing on improving performance at the site, and this is reflected in the most recent TRC Technical Monitoring report (2018-19) which notes an 'improvement required' level of performance. The report notes however that significant riparian work and fencing had occurred in the monitoring period, with more planned. The installation of a new culvert on the site to give more operating area and lessen flooding potential was also noted by the TRC in this latest report, and the commissioning of the new irrigation area.

Historic incidents and complaints are acknowledged by RNZ. In preparing this application, these have been examined, causes identified and steps taken to prevent re-occurrence. Since 2015, a number of experts have been engaged to provide advice and input into better understanding the operation and its impacts, and improving site management. The recommendations of these experts have been, or are currently are being acted upon. Some of these are reflected in the latest TRC monitoring report discussed above, however more are identified in this AEE, including;

- Further expansion of the irrigation area to a total of 13.18 ha (for completeness it is noted that this has been confirmed by way of a drone survey, and the areas provided excludes any are dedicated to bunds, and the offset zones required from waterways);

- Steps to manage the compost that has been unable to be sold off site due to it being associated with drilling activities;

- Changes to the site operations to reduce nutrient and contaminant loads in the irrigation pond;

- Detailed understanding of the N cycle on this site, and steps to mitigate N losses/leaching; and,

- The significant decision to cease receiving drill cuttings and fluids. Parties using the facility for this purpose are currently being advised.

The most recent non-compliance involved an abatement notice issued in March 2019, relating to elevated levels of contaminants in the small unnamed tributary of the Haehanga Stream adjacent to the waste storage pads. RNZ was required to engage a suitably qualified expert to investigate and report on the incident, including any remedial work required to ensure the integrity of the receiving pond and pad 3. This occurred and the report was provided to TRC.

As a result, the earthen bund located between pad 3/the receiving pond and the unnamed tributary was removed and replaced with an impervious layer of compacted papa rock. It is anticipated that this will resolve the concerns, and RNZ has committed to ongoing monitoring of the tributary to confirm this. If the sampling results indicate that contaminants are continuing to enter the unnamed tributary, RNZ has committed to engage a Geotechnical Engineer to carry out an investigation into the integrity of pad 3 and the receiving pond.

It is intended that this AEE and application demonstrate the commitment to improvement at the highest levels within the company.

5. ACTIVITY CLASSIFICATION

5.1 Consents Sought

Under the Resource Management Act 1991 and the Taranaki Regional Council (TRC) 2001 Regional Fresh Water Plan, resource consent is deemed necessary for the Uruti Composting facility to allow for the discharge of leachate and stormwater to land (rules 21-44) and emissions to air. These activities are deemed to be discretionary.

The application by Remediation (NZ) Ltd to the Taranaki Regional Council is to renew the following discharge permits:

Consent 5838-2.2 - To discharge of a) waste material to land for composting; and b) treated stormwater and leachate, from composting operations; onto and into land in circumstances where contaminants may enter water in the Haehanga Stream catchment and directly into an unnamed tributary of the Haehanga Stream at Grid Reference (NZTM) 1731656E-5686190N, 1733127E-5684809N, 1732277E-568510N, 1732658E-5684545N & 1732056E-5684927N.

Consent 5839-2 - To discharge emissions into the air, namely odour and dust, from composting operations between (NZTM) 1731704E-5685796N, 1733127E-5684809N, 1732277E-5685101N, 1732451E-5684624N and 1732056E-5684927N.

The original application for consents was lodged in November 2017, in accordance with section 124 (1) (d) of the RMA. Accordingly, the applicant may continue to operate under the existing consents until such time as a decision is made on these applications under section 124(3) of the RMA.

This revised assessment of environmental effects (AEE) is submitted to address the further information request made by the TRC under s92 of the RMA on 1 February 2018, 27 March 2019 (Food waste) and 19 September 2019, and is intended to provide the consent authority, as well as any interested and / or affected parties with the information required to understand the proposed activity including any effects it may have on their interests or on the local and wider environment.

Remediation (NZ) Limited seeks a renewal period of 24 years.

It is also sought to amend some consent conditions as part of the renewal process to better reflect site activities and controls. This is discussed below.

5.2 Changes to Conditions sought during this renewal process

5.2.1 Consent 5838-2.2

Changes to the current consent conditions of consent 5838-2.2 are sought to address the following;

- Autumn spikes in wetland-Analysis has shown a spike in Nitrogen levels in the wetlands discharge that is consistent with plant die back. This is a naturally occurring event.
- Biosolids removed -Remediation (NZ) does not require a consent for remediating biosolids and this can be removed.
- Changes to frequency of sampling for groundwater and soil monitoring to make this more manageable for staff onsite and to reflect the findings of sampling to date.
- The specific inclusion of food scraps as a compost ingredient.
- The specific inclusion of other waste products that are deemed to be compostable.

Table 21 below details the changes sought.

Table 21. Changes to consent conditions sought.

Condition No.	Existing Consent condition wording	Proposed consent condition wording	Discussion
2	The raw materials accepted onsite shall be limited to the following: Paunch Grass; Animal Manure from meat processing plant stock yards and dairy farm oxidation pond solids; Green vegetative wastes; Biosolids wastes including, but not limited to, pellets from wastewater	The raw materials accepted onsite shall be limited to the following: Paunch Grass; Poultry industry waste (eggshells, yolks, macerated chicks, chicken mortalities; and processed chicken meat/sausage waste); Greenwastes (bulking agent);	Biosolids removed Domestic and commercial food scraps added This list reflects the information in Table 6. It is noted that the applicants seeks flexibility to accept small, one off loads of compostable organic material (up to

	treatment plants; Mechanical pulping pulp and paper residue (excluding pulping wastes that have been subject to chemical pulping or treated or mixed with any substance of material containing chlorine or chlorinated compounds; Solid drilling cuttings from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0% total petroleum hydrocarbon within 3 days of being received onsite; Water based and synthetic based drilling fluids from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0% total petroleum hydrocarbon within 3 days of being received onsite; Produced water from hydrocarbon exploration; Vegetable waste solids (being processed by-products); Grease trap waste (from food service industries); Fish skeletal and muscle residue post filleting (free from offal); and, Poultry industry waste (eggshells, yolks, macerated chicks and chicken mortalities). The acceptance of any other materials shall occur only if the Chief Executive, Taranaki Regional Council advises in writing that he is satisfied on reasonable grounds that the other materials will have minimal effects beyond those materials listed above.	Sawdust (untreated); Molasses; Dairy industry wastes including but not limited to cheese, milk powder, cream, milk whey); Food scraps/household scraps/greenwaste from domestic household and commercial restaurant collection (including canteen waste from PowerCo and Fonterra); Palm Kernel waste; Grease trap waste (from food service industries); Tallow; Pea Fat; Water Treatment Sludge; Soil Remediation; Mechanical pulping pulp and paper residue (excluding pulping wastes that have been subject to chemical pulping or treated or mixed with any substance of material containing chlorine or chlorinated compounds; Prolick; Diatomaceous Earth mix (Fonterra Kapuni, Todd Energy Aquatic Centre). Animal Manure from meat processing plant stock yards, stock truck effluent collection and dairy farm oxidation pond solids; Vegetable waste solids (being processed by-products); Fish skeletal and muscle residue post filleting (free from offal);	$5m^3$) at the site.

		Solid drilling cuttings from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0% total petroleum hydrocarbon within 3 days of being received onsite*; Water based and synthetic based drilling fluids from hydrocarbon exploration provided they are blended down to a maximum hydrocarbon content of 5.0% total petroleum hydrocarbon within 3 days of being received onsite*; Produced water from hydrocarbon exploration*; Sump waste contaminated by hydrocarbons from interceptor tanks*. Up to 5m^3 of compostable material at the discretion of the consent holder (full description of product able to be supplied to TRC on request). The acceptance of any other materials shall occur only if the Chief Executive, Taranaki Regional Council advises in writing that he or she is satisfied on reasonable grounds that the other materials will have minimal effects beyond those materials listed above. *No drilling by-products will be received after 31 December 2020.	
12	Representative soil samples shall, be taken from each irrigation area at intervals not exceeding 6 months and analysed for total petroleum hydrocarbons, benzene, toluene, ethylbenzene, and xylene.	Representative soil samples shall, be taken from each irrigation area at intervals not exceeding 12 months and analysed for total petroleum hydrocarbons, benzene, toluene, ethylbenzene, and xylene	Monitoring to date shows that there will be only minor changes detected at 6 monthly intervals and 12 months will provide more useful data and be more cost effective.
13	Representative soil samples shall be taken from each irrigation area at intervals not exceeding 3 months and analysed for chloride, sodium, magnesium, calcium, potassium,	Representative soil samples shall be taken from each irrigation area at intervals not exceeding 12 months and analysed for chloride, sodium, total, soluble salts, and conductivity.	As above

	total, soluble salts, and conductivity.		
19	Groundwater samples shall be collected from all monitoring wells required under condition 15 at intervals not exceeding 3 months by a suitably qualified person using a method approved by the Chief Executive, Taranaki Regional Council and analysed for; chloride, sodium, magnesium, calcium, total soluble salts, and conductivity.	Groundwater samples shall be collected from all monitoring wells required under condition 15 at intervals not exceeding 6 months by a suitably qualified person using a method approved by the Chief Executive, Taranaki Regional Council and analysed for; chloride, sodium, total soluble salts, and conductivity.	6 monthly testing is considered appropriate for these contaminants, and is more cost effective for the consent holder, particularly given the increase in the number of bores to be sampled. Monitoring to date does not suggest any significant adverse effects

5.2.2 Consent 5839-2

No changes to the conditions of the air discharge consent are sought.

6. NOTIFICATION & CONSULTATION

Remediation (NZ) Ltd has consulted with local Iwi-namely Ngati Mutunga and property neighbours.

Consultation with Ngati Mutunga commenced with a site visit and discussion on the 28th September 2017. RNZ consultants Kathryn Hooper and Colin Kay met Paul, Marlene and Anne-Marie on 18 April 2018 and 17 May 2018 to discuss progress with the consent application and the CIA. Ngati Mutunga representatives visited the site on 8 June 2018.

Meetings and discussion with all immediate neighbours commenced October 12th 2017. A copy of a letter given to all neighbours is attached –see **Appendix V**.

The application has been notified to affected parties and submissions received. This revised AEE reflects changes that the applicant has made in response to submissions and concerns.

7. ASSESSMENT OF ENVIRONMENTAL EFFECTS

In addition to the application being made in the prescribed forms and manner, Section 88 of the RMA also requires that every application for consent includes an assessment of the effects of the activity on the environment as set out in Schedule 4 of the RMA.

7.1 Assessment of Alternatives

7.1.1 Alternative Location and Methods

Section 1 (b) of the Fourth Schedule of the Resource Section 1 (b) of the Fourth Schedule of the Resource Management Act, 1991 requires that *"where it is likely that an activity will result in significant adverse effect on the environment, that the applicant provide a description of any possible alternative locations or methods for undertaking the activity."*

7.1.1.1 Alternative Location

Improvements in the management practices employed at the Remediation (NZ) Ltd sites have continued to develop and improve demonstrating that well-managed and operated compost and vermiculture facilities can present a sustainable and environmentally acceptable method for managing a range of unwanted organic waste streams. The Resource Management Act, 1991 requires that '*where it is likely that an activity will result in significant adverse effect on the environment that the applicant provides a description of any possible alternative locations or methods for undertaking the activity".*

Effects associated with the operation of the Uruti facility are considered to be both well anticipated and understood. Well-managed and operated composting and vermiculture facilities have demonstrably resulted in effects that can be considered no more than minor in nature and for these reasons, it is not considered necessary to consider further alternate locations.

7.1.1.2 Alternative methods

The utilisation of organic waste streams for the production of compost and vermicast represents a simple, yet innovative method of reusing a waste stream that might otherwise require safe residual methods, such as landfilling. Whilst methods such as landfilling represent an alternate method for dealing with a range of unwanted organic waste streams, the production of compost and vermicast represents a sound and desirable waste treatment, rather than waste disposal option.

7.1.1.3 Options Assessment

To discharge Stormwater from Composting and Vermicast pre-processing operations the following options have been considered by the applicant.

7.1.1.3.1 Total Containment with No Discharge

Large holding ponds could be constructed with contained water being irrigated back over the composting pads. Remediation (NZ) Ltd believes this to be impractical due to stormwater volumes that would need to be discharged.

7.1.1.3.2 Containment and Pre-treatment to Surface Discharge

Stormwater could be directed, contained and treated via a number of methods to remove potential contaminants including suspended and organic material. Options include the use of various settling ponds, irrigation, biological treatment and wetland development.

7.1.2 Recommended Option

It is recommended to continue to operate the wetland system for treatment of leachate and stormwater from Pad 2. Stormwater and leachate from Pad 1 and 3 will continue to be treated through the settling pond and irrigation system.

7.2 Effects from Stormwater and Leachate Discharges

The potential and / or likely environmental impacts arising from composting and vermiculture production are considered to be both well anticipated and understood. Environmental effects which are relevant to the consents sought from the Taranaki Regional Council and that may be expected to arise from this activity, primarily relate to the potential discharge of leachate and /or stormwater to land and emissions of odour and dust to air.

The composting operation has the potential to generate contaminants, in particular from stormwater flow and leaching of organic nutrient from the windrow piles. The following covers the management of Stormwater from the composting pads.

The actual effects on the environment of the activity for which consent is sought have been monitored by the Taranaki Regional Council for seventeen years and the results are available to the public, and this is discussed below to provide assurance in relation to effects and how they are mitigated.

Potential effects associated with the renewal of the two consents sought for operation of the facility include contamination of surface water and associated effects on instream flora and fauna, effects on groundwater and soil quality, and adverse effects on air quality. These are discussed in more detail below.

7.2.1 Effects of discharges on Water Quality

The uncontrolled discharge of the leachate from compost piles and contaminated stormwater from the active site areas can have adverse effects on water quality, and associated instream flora, fauna and habitat. There are also potential effects on the amenity and cultural values of the waterway, and the suitability of the waterway for Mahinga Kai gathering and suitability of the water to drink.

Overloading of the irrigation areas can also result in discharge to waterways, via shallow groundwater, or overland flows.

7.2.1.1 Existing Mitigation Measures – Water Quality

There are a number of mitigation measures established and in place on the site which are intended to avoid, remedy and mitigate potential effects on water quality. These are summarised in the following sections:

- Managing irrigation and soil loading capacity.
- Monitoring and reporting.
- Management of onsite infrastructure – sediment and silt traps, bunds, treatment systems, and clean water diversion systems.
- Management of ponds and solids levels

These are discussed in detail below.

7.2.1.2 Managing Effluent Storage

An irrigation model is used to ensure that the pond system on site has sufficient capacity to hold the effluent that needs to be irrigated. This model is designed to ensure that the system can hold the runoff from a 1 in 10 year event occurring onsite for a period of 60 minutes . Thirty-year Rainfall and evaporation data from a NIWA virtual Climate Station located near the site was used in the model. This model, along with the extensive local knowledge of the immediate climate at the site, is used as a basis for pond management for the irrigation pond that receives the runoff from pads 1 and 3. This pond system is described in detail in section 2.3.3.

The irrigation model is shown in Figure 18.

The model is designed to ensure that enough is irrigated from the pond in the week before a predicted rain event to maintain a minimum of 0.769 m freeboard in the pond at all times. Most of the time the freeboard is more than this – at around 1 m, as this is a more convenient measure when assessing pond levels in the field.

A similar approach is provided for the pond associated with Pad 2, and this is described in section 2.3.4.

7.2.1.3 Managing Irrigation and the Loading capacity of soils

The applicant has undertaken a detailed investigation into the loading capacity of the soils (refer to Irrigation Block Management Plan in the Leachate and Stormwater Management Plan and associated procedures in **Appendices F1, 2 and 3,** and the report on Irrigating High and Low Risk Soils in **Appendix AB)**, the frequency of application, and impact of rainfall events on both the pond storage levels (see above) and ability to irrigate.

The loading capacity of the soil is well understood, and this is reflected in site management to ensure that:

- The soil is not over irrigated, or irrigated in inappropriate conditions, causing surface water runoff or leaching through the soil profile; and,
- The nutrients applied to the soil with the irrigated effluent are absorbed in the soil and not leached into ground and surface water.

The applicant has recently purchased the low application rate sprinklers (K-Line pods) which means the site manager can irrigate low applications more frequently instead of using the travelling irrigator which irrigates at a higher rate. This removal of reliance on the large travelling irrigator has greatly improved irrigation management on the site.

The irrigation areas are surrounded by bunds to prevent any overland flows (either through irrigation, which should not occur, or runoff from the irrigation areas during rainfall events that may carry contaminants washed off the pasture) reaching surface water.

The riparian management plan for the site (Appendix

This is particularly important in the Upper Irrigation blocks, (U1-3) which are relatively recent, and on which the soil is currently deemed to be at high risk from overland flows when used for irrigation. This is due to the anthropic nature of the soil, reflecting that the areas have been excavated and formed so they are suitable for irrigation. Over time, the application of compost and drainage treatment of the soil will convert it to low risk. The characteristics and implications of high and low risk soils and their locations on the site are described in section 2.7.3.

To ensure that the mitigation measures implemented on the site for the discharges to land are effective, and effects are avoided, remedied and mitigated, a programme of both surface and ground water monitoring is undertaken.

7.2.1.4 Riparian Management

Riparian planting and stock exclusion improves water quality by filtering overland flows, and providing shade over the stream which reduces temperature and enhances instream habitat.

Condition 26 of consent 5838.2 requires that *The consent holder shall maintain the areas of riparian planting, undertaken in accordance with option 1 of riparian management plan RMP383, by ensuring the ongoing replacement of plants which do not survive, the eradication of weeds until the plants are well established, and the exclusion of stock from the planted areas.*

The applicant is agreeable to maintaining this condition when the consent is renewed. Recently this has been given priority, and RNZ has invested significantly in fencing and planting in order to give effect to the riparian management plan that has been established with the TRC for the site. The latest copy of the riparian management plan, showing the completed areas and further planting & fencing areas, is included as **Appendix K**.

7.2.1.5 Surface water sampling and monitoring programme

There has been considerable monitoring of the discharges from the site over the last 17 years. Data from the TRC site monitoring for the past 8 years have been tabulated and graphed, and is included in **Appendix X**.

7.2.1.5.1 Background

Sampling of the Haehanga Stream and a number of unnamed tributaries commenced in February 2011, and a number of sampling sites have been added since then as the operations on the Uruti site have changed.

The current surface water monitoring sites are:

HHG 090	Haehanga Stream above the new upper irrigation block
HHG 093	Haehanga stream at culvert above irrigation area G
HHG 097	Above the Wetland on the Wetland tributary
HHG 098	Dam tributary before the junction with the Wetland tributary
HHG 099	Southern tributary before junction with Haehanga stream
HHG 100	Up stream of the worm beds on the Haehanga Stream
HHG 103	Downstream of wetland discharge point on the Wetland tributary
HHG 106	Above Pad 3 (Mud pad) on the Pad1 tributary at the confluence with Haehanga Stream
HHG 109	Abeam the duck pond on Haehanga Stream

HHG 115 25 m downstream of the duck pond and swale collection area on Haehanga Stream

HHG 150 30 m downstream of RNZ irrigation area on Haehanga Stream (Twin culvert Crossing)

HHG 190 50 m upstream of SH3 bridge on Haehanga Stream

IND2044 Irrigation pond

IND3008 Wetland discharge

These sites are sampled by TRC on their regular sampling program.

7.2.1.5.2 Consent limits

Consent limits are provided in Resource Consent 5838-2.2 (see Appendix B for this consent). The conditions relating to surface water quality are;

Irrigation

9. *There shall be no direct discharge to water as a result of irrigating wastewater to land. This includes, but is not necessarily limited to, ensuring the following:*

    - *No irrigation shall occur closer than 25 metres to any surface water body;*
    - *The discharge does not result in surface ponding;*
    - *No spray drift enters surface water;*
    - *The discharge does not occur at a rate at which it cannot be assimilated by the soil/ pasture system; and*
    - *The pasture cover within irrigation areas is maintained at all times.*

10. *Treated wastewater discharged by irrigation to land shall not have a hydrocarbon content exceeding 5% total petroleum hydrocarbon or a sodium adsorption ratio exceeding 18.*

11. *Discharges irrigated to land shall not give rise to any of the following adverse effects in the Haehanga Stream, after a mixing zone extending 30 metres from the downstream extent of the irrigation areas;*

    a) a rise in filtered carbonaceous biochemical oxygen demand of more than 2.00 gm-3;

    b) a level of unionised ammonia greater than 0.025 gm-3;

    c) an increase in total recoverable hydrocarbons;

    d) chloride levels greater than 150 g/ m3;

    e) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;

    f) any conspicuous change in the colour or visual clarity;

g) *any emission of objectionable odour;*

h) *the rendering of fresh water unsuitable for consumption by farm animals; and*

i) *any significant adverse effects on aquatic life.*

Wetland Discharge to Haehanga Stream

24. *The discharge from the Wetland Treatment System shall meet the following standards (at monitoring site IND003008):*
    a) *the suspended solids concentration shall not exceed 100 g/ m3; and*

    b) *the pH shall be between 6.0 and 9.0.*

25. *Discharges from the Wetland Treatment System shall not give rise to any of the following effects in the unnamed tributary of the Haehanga Stream, after a mixing zone of 40 metres, at established monitoring site HHG000103 (at or about grid reference 1732695E-5685050N):*
    a) *a rise in filtered carbonaceous biochemical oxygen demand of more than 2.00 gm-3;*

    b) *a level of unionised ammonia greater than 0.025 gm-3;*

    c) *the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;*

    d) *any conspicuous change in the colour or visual clarity;*

    e) *any emission of objectionable odour;*

    f) *the rendering of fresh water unsuitable for consumption by farm animals; and*

    g) *any significant adverse effects on aquatic life.*

Compliance with these conditions is monitored at site HHG00103 and the results of water sampling under the current consent are detailed in section 2.9.1.

7.2.2 Commentary on surface water sampling results

Figure 32 below summarises the water quality monitoring on the site until May 2020, and is a summary of the detailed analysis performed on the data which is provided in Appendix X.

Highlighted are some individual spikes in the data above consent limits, which have triggered enforcement action from TRC on occasions, however in general, the discharges are compliant. The non compliances are discussed below.

Surface water sampling results from the routine sampling program carried out by Taranaki Regional Council (TRC) 12th April 2019 show all sampling results from the monitoring sites are below the target or trigger analyte levels. Two events associated with earthen bund breaches on pad 3 in February 2019 and March 2019 resulted in spikes in chloride and ammonia levels above the trigger levels. Subsequent earthworks to repair the bunds appear to have been successful and the April sampling results show levels returning to historical low levels.

Sampling results from the irrigation pond (IND2044) show the levels are within the tier 1 or 2 thresholds for the 3-tier framework.

Graphing of the surface water sampling results (See Appendix X) enables comparison of surface water sampling on water entering the site (HHG093) and ultimately exiting the site (HHG190) near SH3.

The majority of the time, the surface water results are well within consent limits. A number of spikes above consent limits have been highlighted in this data, some of which are visible making their way through the catchment. This analysis of the specific events that have led to breaches of consent and abatement notices by the applicant has enabled management changes to be implemented to avoid re-occurrence. The most significant of these management changes – the cessation of receipt of drilling by-products - is in relation to consent breaches (and general elevated levels) relating to chloride, and their link to the receipt of material from the drilling process.

TPH monitoring at site HHG 150 (below the irrigation areas) has consistently recorded levels below 0.7 g/m3 (below the detection limit).

7.2.3 Summary of effects on Surface Water

Monitoring carried out under consents to date has indicated that there have been breaches of consent limits at times. These breaches, where not attributable to natural phenomena as in the case of nitrogen release from the wetland, are all generally attributable to site maintenance and management.

For this reason, RNZ, as part of the renewal of these consents has invested significantly in new management systems for the site. This has included ongoing training, and providing more detailed work instructions which have been incorporated into position descriptions for onsite staff where applicable. If these management systems are followed and adhered to, and the identified actions taken at the times specified in the management plans, then the site is able to operate in a manner whereby the effects are able to be managed so that they are no more than minor.

It is also note that RNZ has implemented a significant portion of its riparian management plan, fencing off and planting areas of the Haehanga Stream. Over time this too will improve water quality in the stream, and will also improve the cultural values of the waterway.

Discharges to groundwater and their potential to impact surface water are discussed in further sections below.

7.3 Effects on Soil Quality

Effects on soil can include effects on soil structure, nutrient status and balance, and the effectiveness of the soil to support pasture cover. Poor quality soil can exacerbate leaching potential, so is closely linked to groundwater quality. The application of inappropriate materials, or materials in concentrations that are too high for the soil to assimilate, can result in soils becoming unsafe for stock to graze, as during grazing stock ingest soil particles.

During rainfall, exposed soils can also become entrained in stormwater flows, directly impacting on surface water quality. This too is exacerbated when soil conditions are wet/overloaded.

7.3.1 Soil monitoring

Soils in the irrigation blocks are monitored by taking soil core samples. Irrigation blocks SOL 193 and SOL 000 (new code to be allocated by TRC) have been added to the sampling program in 2018 and 2019. The blocks are sampled by TRC on their regular sampling program.

7.3.2 Resource Consent 5838-2.2

Resource Consent 5838-2.2 contains three conditions that relate to soil quality.

Condition 12 states that soil samples be taken from the irrigation blocks every 6 months and analyzed for petroleum hydrocarbons, benzene, toluene, ethylbenzene and xylene.

Condition 13 states that soil samples be taken from the irrigation blocks and analyzed for chloride, sodium, magnesium, calcium, potassium, total soluble salts and conductivity

Condition 14 states that the Uruti Composting Facility Management Plan shall include the 'Three Tier Framework' – this system is described in section 2.11.1.

These conditions have been complied with and the data obtained from soil sampling is discussed below.

7.3.3 Commentary on soil sampling results and specific concerns raised by TRC

Soil sampling under the current consent provides evidence of the effects of the activities on soil quality. The results are summarised in Figure 32 below.

Two new irrigation areas have been added to the sampling program recently, being the new lower irrigation area and the new upper irrigation area.

The TRC have also added a new analyte – Barium - to the sampling program, due to Barite being one of the main constituents of drilling mud.

Barite is a form of barium (barium sulphate) which is practically insoluble and therefore environmentally benign, unlike other barium salts (barium chloride or nitrate). Significant research into the effects of barium and the potential for it to enter the food chain, and effect on animal health (as one of a number of contaminants associated with landfarming) has been undertaken in relation to landfarming activities in the Taranaki Region given its wide use in the drilling industry. Reports on this subject are referred to by the TRC in monitoring reports for landfarming activities in the region. Once drilling byproducts are no longer received, the inputs of barium at the site will cease, and it may be possible to cease sampling of this analyte.

Soil sampling results from the routine sampling program carried out by TRC to 12th April 2019 show:

- Chloride levels in the middle irrigation area is in the yellow tier two zone with the other three sites being in the green tier one zone.

- Sodium Adsorption Ratio (SAR) and Total Petroleum Hydrocarbons (TPH) sampling results are within the green Tier One zone

- TRC commented in an email dated 21-5-2019:

    - "of note is the significant increases in calcium and magnesium. The chloride in the middle (old lower) SOL000177 is elevated. Also note the elevated barium as a process of your irrigation."

It is noted that the additional irrigation area proposed will increase the total area to 13.18 ha, dispersing chloride over a larger area. Ultimately, Chloride levels will decrease with the removal of drilling by-products from the system.

TRC soil monitoring data is provided in Figure 32. The key point to note about the information presented in this table is that the last 3 sampling runs (those on 22/6/18, 2/11/18 and 12/4/19) were analysed by Hill Laboratories, with previous results provided by the TRC internal laboratory. It is apparent that the change in laboratory has led to very different results for sodium, magnesium, potassium and calcium, and the discrepancy is thought to lie in the techniques used for the analysis, with the TRC Laboratory analysis detecting only the unbound fractions, whereas the Hills analysis uses acid digestion and will be taking in the bound fractions as well. As these analytes are not controlled by conditions on consent, and are unlikely to result in adverse effects on the environment even at the elevated levels identified, the applicant has agreed to progress with the Hills method, while noting the different analysis techniques for these analytes is what is causing the discrepancy (as opposed to site practices).

Lower irrgation block		Calcium	Chloride	Conductivity	TPH	Potassium	Magnesium	Sodium	NH4	NNN	PH	SAR
	Tier One		0 - 700									0 - 6
	Tier Two		700 - 1800		< 20,000							6 - 18
	Tier Three		> 1800		> 20,000							> 18
Site	Collected	mg/kg	mg/kg	mS/m@20C	mg/kg	mg/kg	mg/kg	mg/kg	g/m3 N	g/m3 N	pH	None
SOL000177	15/05/14	245.4	1559.6	533.4	14.8	641.6	22	463.3		0.42	6.5	7.60218
SOL000177	21/01/15	168.6	1934.7	718.9		1093	14.2	617.2		1.4	6.9	12.26619
SOL000177	1/05/15	162.4	1037	485.3		731.1	12.7	364	4.24	0.07	7.1	7.40325
SOL000177	7/04/16	178.7	2502.6	560.5	<14	838.5	12.3	664.4	0.474	0.76	7.2	12.97103
SOL000177	22/06/16	72.9	156.1	103.7		213.6	4.1	120.2	0.355	0.96	7	3.70881
SOL000177	14/02/17	42.9	97.7	68.1		160.1	2.5	115.4	0.224	0.42	6.6	4.63453
SOL000177	15/06/17	93.5	368.4	153.8	15	206.4	11.2	177.3	0.392	0.37	6.8	4.61437
SOL000177	24/01/18	279	1254.2	585.6		466.9	24.3	624.3	1.36	1.51	7.2	9.62503
SOL000177	22/06/18	9600	580	0.6	<80	2200	4700	570			7.3	
SOL000177	2/11/18	13800	580	0.5	82	2500	5100	520			7	
SOL000177	12/04/19	17200	1060	<0.2	125	3300	4700	690			7.2	

Upper irrigation block		Calcium	Chloride	Conductivity	TPH	Potassium	Magnesium	Sodium	NH4	NNN	PH	SAR
	Tier One		0 - 700									0 - 6
	Tier Two		700 - 1800		< 20,000							6 - 18
	Tier Three		> 1800		> 20,000							> 18
Site	Collected	mg/kg	mg/kg	mS/m@20C	mg/kg	mg/kg	mg/kg	mg/kg	g/m3 N	g/m3 N	pH	None
SOL000176	15/05/14	159.2	1161.4	398.3	15	419.1	14	363.5		<0.05	6.2	7.41447
SOL000176	21/01/15	70.9	748.7	270.3		420.6	8.7	195.4		0.36	6.6	5.82826
SOL000176	1/05/15	238.3	1372.7	554.3		705.5	17.1	359	3.98	0.06	6.7	6.0562
SOL000176	7/04/16	160.1	1827.4	271.1	<15	378.8	10	303.7	0.43	0.78	6.8	6.29382
SOL000176	22/06/16	64.2	319.7	132.6		232.8	3.6	124.4	0.35	0.08	6.4	4.09074
SOL000176	14/02/17	54.6	150.2	77.4		188.5	4.6	153.4	0.169	0.78	7.2	5.35715
SOL000176	15/06/17	77.5	101	76	8	168.3	4.6	68.3	0.443	0.13	5.8	2.03914
SOL000176	24/01/18	33.5	119.5	49.1		23.7	4	46.8	0.325	<0.64	5.3	2.03539
SOL000176	22/06/18	5000	33	<0.2	<90	1620	4900	145			6.3	
SOL000176	1/11/18	5600	54	<0.2	<80	1950	4800	160			6.8	1.2
SOL000176	12/04/19	3900	200	0.2	<70	1360	4300	165			5.5	

SOL 193 Irrigation block		Calcium	Chloride	Conductivity	TPH	Potassium	Magnesium	Sodium	NH4	NNN	PH	SAR
	Tier One		0 - 700									0 - 6
	Tier Two		700 - 1800		< 20,000							6 - 18
	Tier Three		> 1800		> 20,000							> 18
Site	Collected	mg/kg	mg/kg	mS/m@20C	mg/kg	mg/kg	mg/kg	mg/kg	g/m3 N	g/m3 N	pH	None
SOL000193	15/05/14											
SOL000193	21/01/15											
SOL000193	1/05/15											
SOL000193	7/04/16											
SOL000193	22/06/16											
SOL000193	14/02/17											
SOL000193	15/06/17											
SOL000193	24/01/18	103.7	128.9	112.5		40.4	13.5	59.2	0.278	1.09	6.2	1.45263
SOL000193	22/06/18	13,100	73	<0.2	105	1,470	4,500	270			7.4	
SOL000193	1/11/18	10,900	470	0.4	84	1,470	550	340			7	
SOL000193	12/04/19	9,900	270	0.3	149	1,990	3,800	300			7	

S1 - Baseline		Calcium	Chloride	Conductivity	TPH	Potassium	Magnesium	Sodium	NH4	NNN	PH	SAR
	Tier One		0 - 700									0 - 6
	Tier Two		700 - 1800		< 20,000							6 - 18
	Tier Three		> 1800		> 20,000							> 18
		Calc	Calc	Calc	Calc	Calc	Calc	Calc	TRC	TRC	TRC	Calc
Site	Collected	mg/kg	mg/kg	mS/m@20C	mg/kg	mg/kg	mg/kg	mg/kg	g/m3 N	g/m3 N	pH	None
S1 - Baseline	14/11/19	2800	10	<0.2	<70	880	5100	80			5.6	

S2 - Baseline		Calcium	Chloride	Conductivity	TPH	Potassium	Magnesium	Sodium	NH4	NNN	PH	SAR
	Tier One		0 - 700									0 - 6
	Tier Two		700 - 1800		< 20,000							6 - 18
	Tier Three		> 1800		> 20,000							> 18
		Calc	Calc	Calc	Calc	Calc	Calc	Calc	TRC	TRC	TRC	Calc
Site	Collected	mg/kg	mg/kg	mS/m@20C	mg/kg	mg/kg	mg/kg	mg/kg	g/m3 N	g/m3 N	pH	None
S2 - Baseline	14/11/19	3000	6	<0.2	<70	910	5100	90			5.8	

Figure 32. Soil sampling results TRC up to 12-4-2019

The treated wastewater from the irrigation pond is irrigated onto the irrigation blocks. This operation is controlled by the Irrigation Block Management Plan (refer to section 3.5 of the Leachate and Stormwater Management Plan in **Appendix F**).

The BTW report States that Tier-Two soil levels for TPH shall be less than 20,000 mg/kg on soil (refer to page 11 Uruti Composting Facility Management Plan **Appendix H**). This would indicate the effects on the soil from TPH irrigation is less than minor, and this notwithstanding, once drilling by-products are no longer received the source of petroleum hydrocarbons received at the site will be removed.

The TRC sampled Chloride in the soils on the upper (site-SOL00176) and the lower (site-SOL00177) blocks 16 times.

In summary;

- 3 sample results were in the Tier-three range (<1,800 mg/kg) within SOL177.
- 2 sample results were in the Tier-two range (700 to 1,800 mg/kg) within SOL 177.
- Remaining sample results were in the Tier-one range (0 to 700 mg/kg)
- The Tier-three events identified occurred between 21/1/2015 and 7/4/2016.
- Chloride sample results reduced to Tier-one levels at the 22/6/2016 sampling date.
- Chloride sample results since 1/5/2016 are trending down on the upper irrigation block.

This would indicate the effects on soil from Chloride irrigated onto soils were having potential effect that was more than minor. This effect has been acknowledged by the applicant and new irrigation blocks have been commissioned, doubling the irrigation area. It was originally proposed to spell the lower irrigation block from irrigation over summer 2019/20. Results are showing that this is unlikely to be necessary, with the irrigation areas that have come on line achieving the necessary reduction in pressure on this block. Also of note;

- It was agreed in the original application that irrigation onto the lower irrigation block will only commence when the soil Chloride sample results show a downward trend. This downward trend was demonstrated over 2018 and irrigation recommenced.
- All irrigation blocks will have a cropping rotation and a "cut and carry" policy to export Nitrogen (and to a much lesser extent, Chloride) off the block.
- The source of chloride in the irrigation water is drilling by-products. No drilling by-products will be received from 31 December 2020 and the applicant is agreeable to a condition to this effect being placed on the consent.

7.3.4 Summary of effects on soil quality

The actual and potential effects on soil associated with the irrigation of effluent from the irrigation pond have been monitored and are well understood. Concerns about irrigation practices have been raised, and the applicant has taken significant steps to understand their system and processes better, and to implement mitigation measures identified through this better understanding. This is the reason that the application has taken some time to finalise.

As with the surface water quality results, the concerns raised through monitoring of the soil are attributable to site management, and in cases exacerbated by the restricted site area that has been available for irrigation, particularly in relation to chloride levels in the soil.

The new irrigation areas has provided capacity in the system so that management is not forced to make poor decisions about application of effluent – either overloading the system or applying in unsuitable conditions - but most importantly with soil concentrations, also distributing the material over a wider area so the build up of chloride (and other potential contaminants) in the soil is not concentrated in one area. With the investment in the new management system for the site, the management decisions are directly responsive to monitoring data (via the irrigation model).

Adhered to, the management system will ensure that the conditions of consent are complied with, and that the discharges to land are able to be managed in a way that has minor effects on the soil environment.

Parallel to this is the proposal to apply compost to the irrigation areas to improve the soil composition and its ability to cope with the application of effluent, and to continue to aerate the soil using standard field techniques, improving drainage by breaking up compacted soil and overall improving the soil structure and texture (aeration was been undertaken over all blocks in May 2020). Carefully managed, this will be positive for the quality of the soils, encouraging microbial activity and generally improving the capacity of the soil to treat the material that is applied and hold water.

Taking the total irrigation area to 13.18 ha (i.e. adding the new areas discussed above in earlier paragraphs) of irrigation area will provide further assurances that the soil quality issues associated with overloading soils and excess irrigation will be able to be managed. Furthermore, the removal of drilling by-products will result in a significant reduction in chloride levels, with the source of chloride essentially being removed. This is likely to result in soil chloride levels trending downwards over time, followed by a reduction in chloride in groundwater (discussed below).

7.4 Effects on Groundwater Quality

7.4.1 Background

Groundwater is monitored on the Uruti site using 7 monitoring bores. The three original bores were installed in 2011, three bores were installed in 2018 and the seventh bore was installed above the new upper irrigation block in 2019. The bores are sampled by the TRC on their regular sampling program.

7.4.2 Groundwater Monitoring

Monitoring of groundwater has occurred on site for a number of years. Results are shown in Figure 33.

The 3 Tier Management System trigger analyte levels are detailed in section 2.11.1.

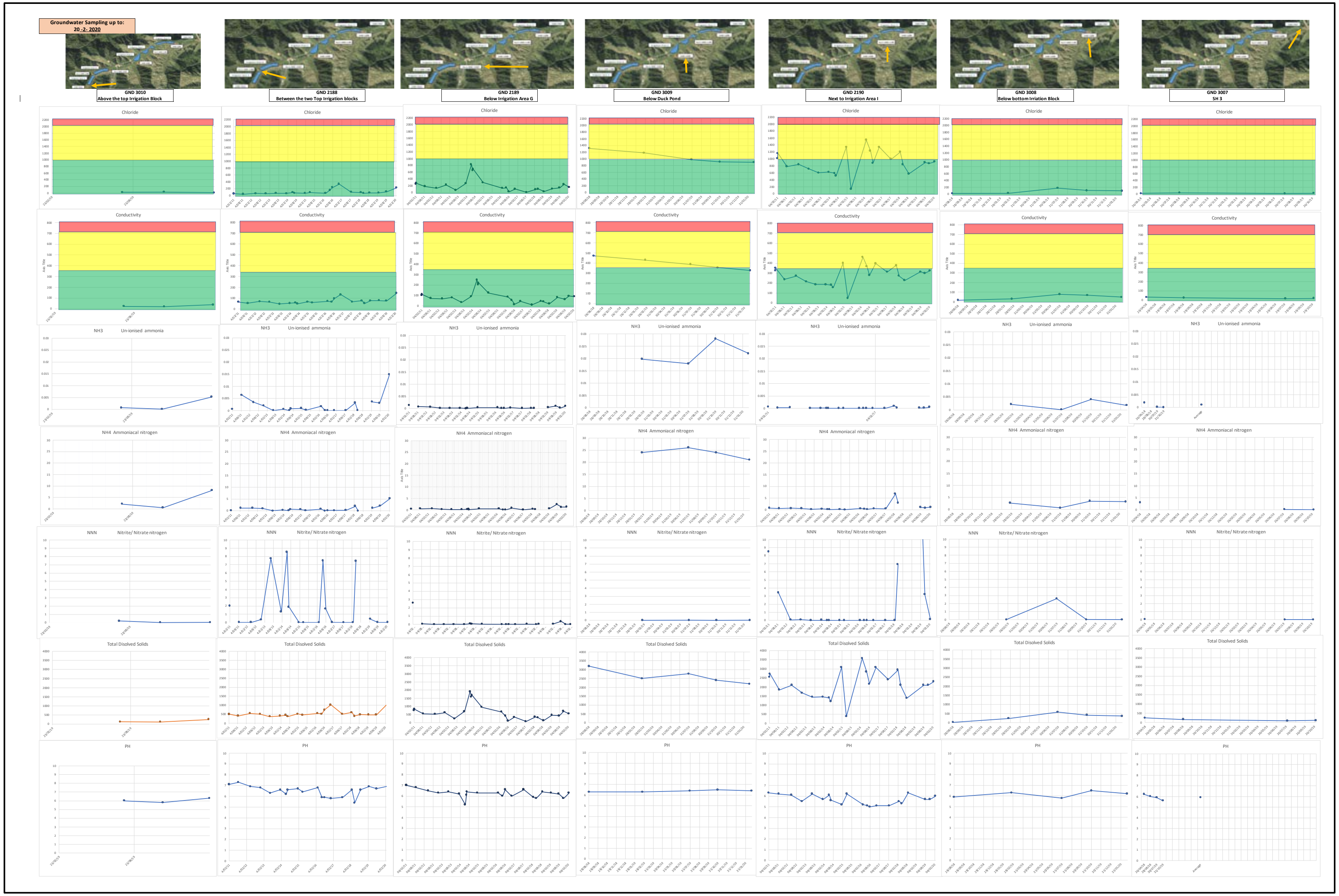


Figure 33. Groundwater Sampling Results – a larger version of this figure is available in Appendix X

7.4.3 Commentary on ground water sampling results and connectivity effects on surface water

Ground water sampling results from the routine sampling program carried out by the TRC to 12th April 2019 show that chloride and conductivity levels in bore GND 2190 have shown Tier Two levels between 21-1-2015 and 28-2-2018. This would indicate that the irrigation of the irrigation block upgradient to this bore is affecting the groundwater. Sampling results 26-4-2018 and 28-8-2018 show these levels have fallen back into Tier one. The most recent monitoring (October 2019) also shows this remains within Tier One. Nitrate levels were also of concern in this bore, however these too have reduced in the most recent sampling visit.

GND003009 (below the 'duck pond') has shown high levels of nitrogen (ammoniacal nitrogen in particular). While this has reduced slightly over recent sampling events, it remains high. This is the subject of the discussion in section 2.3.3.3, and the driving factor behind intentions to assess the need for the duckpond, which may be the source of this elevated nitrogen.

The contamination of groundwater is of a concern on this site due to its potential to contaminate surface water due to connected hydrology. Surface water results indicate that effects on the waterway are minor and within the sampling limits for the majority of the time, the exceptions being discussed below, and attributed to management practices and overland flow, rather than to infiltration via groundwater;

a) A spike in Chloride occurred on 13 March 2014 at site HHG00190 - SH3 bridge (ground water leaving the site) resulting from the importation of drilling muds contaminated with seawater and a breach in the bund which allowed some contaminated liquids to flow into the Haehanga Stream. The bund was repaired and drilling muds from offshore drilling contaminated with sea water are no longer taken onto the site. This was therefore not related to groundwater connectivity.

b) Two spikes in NH_4 occurred on 16 June 2011 and 13 October 2015 at site HHG00190 – SH3 bridge. No corresponding spikes were recorded at the two sampling sites upstream from site HHG 190. The cause of these 'spikes' is unknown, but levels returned to normal soon after each occurrence.

c) On 28 February 2018 a breach in the bund at site HHG00106 resulted in a discharge of contaminated liquid into a tributary of the Haehanga Stream. The incident resulted in an infringement notice and an infringement fee from TRC. The bund was repaired, and the culvert was extended past the pad mixing area to prevent re-occurrence. The culvert was also increased in diameter from 500 mm to 1,000 mm to prevent any land overflow through to the irrigation pond. This too was therefore unattributable to groundwater connectivity.

d) Monitoring results at site HHG00103, discharge from the wetland show spikes in ammoniacal nitrogen (NH_4) in April to June in the last 4 years. During Autumn, wetland plants experience plant die-back which can reduce the treatment capability of the wetland system, which in turn may lead to higher ammonia levels in the discharge to the Wetland tributary stream. This is a natural phenomenon experienced in wetland treatment systems and it is acknowledged in the existing Wetland Treatment System Plan. This is not attributable to groundwater connectivity.

Water quality results in the Haehanga have been examined, and indicate that effects on the waterway are less than minor for the majority of the time, the exception being the spike in chloride levels in Site HHG 00190 leaving the property on 13-3-2014. This exception has been analysed by the consent holder and Management practices developed to prevent the circumstances that caused this from occurring again. Water samples have been taken at the Mimitangiatua River both upstream and downstream of the confluence of the Haehanga Stream and Mimitangiatua River.

These results show that at the time of sampling there was no contamination of the Mimitangiatua River resulting from the RNZ composting activity.

7.4.4 Direct losses to groundwater from Compost Pads

While the irrigation of effluent to land is the key concern at this site, it is prudent to first address the potential for direct losses to groundwater via the compost pads onsite.

All compost pads have been constructed of a one metre deep layer of compacted papa. This construction was engineered to create an imperious barrier above the subsurface soil. This is described in section 2.4.

It is highly unlikely that stormwater will percolate through the composting pad to groundwater at rates and with nutrient concentrations that will cause adverse effects on water quality in groundwater beneath the site (the key risk here being that this flows into surface water).

7.4.5 Groundwater effects - Irrigation

Through irrigation to land, the plant material and soil will filter and attenuate the majority of contaminants in the irrigation water. Particulate material not retained in the settling pond will be filtered by vegetation and will readily break down following resumption of dry (aerobic) conditions. The soil in the upper profile will also assist in this process. This is likely to remove the majority of organic material (i.e. BOD), especially suspended organic material. Other nutrients that may be potential contaminants will also be removed by similar attenuation processes.

Specific concerns have been raised in relation to Nitrogen and Chloride levels in groundwater at the site. These two contaminants are discussed in more detail in the following sections.

7.4.6 Nitrogen in Groundwater

Figure 33 shows that nitrogen levels are a concern in bore GND2190 adjacent to irrigation area 1, with recent spikes in Ammonia and Nitrate recorded. This has been identified by the TRC and accordingly further information about N losses has been requested.

AECOM were commissioned July 2019 to produce a site Nitrogen Balance Report, with the farm modelled using OVERSEER® to complete this analysis. This report showed that under 2019 operating practices the total nitrogen loading over the irrigation areas was determined to be 7550 kg/year, with a loss – to leaching and runoff of 3574 kg N/year. On a whole farm basis the losses were 11 kg/N/ha/year under the AECOM model.

As a result of this investigation, management practices and activities have been further refined on site with a mind to reducing N losses, and the steps to mitigate loses implemented.

The AECOM report has therefore been superceded and revised activities have been modelled in the Kay Consulting report in **Appendix AA**. This replaces the AECOM report, however as discussed previously, the AECOM report is still included as **Appendix Z** for reference, and for comparison.

'OVERSEER®' is a modelling package which was developed as an agricultural management tool. It analyses the nutrient loading versus losses to advise farming yield optimisation. It was determined that this is an appropriate tool to provide an estimate of nitrogen loading and losses across the Uruti site.

Modelling of three scenarios has been undertaken – each scenario was identical with the exception of the rate of application of Compost as a soil conditioner (one with no compost, one with 1000 m^3 and one with 2000 m^3 compost application). The report in **Appendix AA** recommends that, for the minimisation of N losses to groundwater, compost be applied at a rate of 500 tonnes (1000 m^3) per year, but that this may be able to be increased if the nitrogen levels in irrigation water are reduced.

The revised OVERSEER® model indicates that total farm losses of Nitrogen (with compost applications at 500 tonnes per year included) will be reduced to 2093 kg N/year. Total farm losses will be 5kg N/ha/year.

7.4.6.1 Mitigation of Nitrogen Losses (i.e. reducing N Loss)

The original AECOM report identified that a change in management practices would have a significant impact on reducing the N losses from the irrigation areas and the applicant is committed to implementing these management practices. These have been incorporated into the revised OVERSSER® budget.

The AECOM model sensitivity analysis shows that an increase in irrigation area, increase in production (in the form of removal of hay bales in the AECOM model) and decrease in compost application all have a noticeable effect on decreasing the volume of nitrogen leached from the site.

Recommendations made by AECOM to improve the accuracy of the model and decrease the volume of nitrogen leached are outlined below-

- Increase area of irrigator application and proportional increase in harvest (planned for summer 2019/20)
- Continue with regular aeration of irrigation pond
- Take weekly samples of irrigation pond liquid and test for TKN
- Investigate plant species grown in irrigation areas i.e take up of Nitrogen/Chloride and rate of growth.

(It is noted that AECOM also identified that the use of compost as soil conditioner only on new irrigation areas may assist in reducing nitrogen leaching. This recommendation has not been modelled, with compost applied over the entire irrigation area (13.18 ha), but at a lower application rate than considered by AECOM.)

These recommendations have been incorporated into the site management plans. As N-Losses are a system-wide process, a separate Farm Environmental Management Plan has been prepared and is included in **Appendix O**. This documents the measures that will be taken over the next 3 years to reduce N losses from the farm. The applicant has implemented regular sampling for TKN and aeration of the irrigation pond.

While the monitoring data suggests that the current activities are not having an effect beyond the immediate local environment (with bore GND3007 and surface water monitoring site HHG000190 both showing no evidence of adverse downstream effects), the N modelling undertaken enables the applicant to firstly identify potential mitigation measures, and secondly, model the reduction in losses that are likely to occur in response to changes in management.

The general principle of reducing N losses is to either reduce the amount applied, and/or increase the amount removed. There are demonstrated ways to deal with the issue of N losses in any system, and these are reflected in the AECOM report in **Appendix Z**. The main options at this site are;

1) **Increase the irrigation area** to which the N is applied – which decreases the loading and increase overall uptake by plants;

2) **Increase N export** - export more Nitrogen from the site in the form of compost removed or removal of

supplements (e.g. Hay, Baleage or other crop).

3) **Reduce N Application** - decrease the concentration of N in the discharge onto the land by

- reducing N inputs into the irrigation pond;

- aeration of the irrigation pond; and,

- diluting the pond during dry periods with water from the duck pond.

The applicant proposes to take actions in relation to all three areas above. These are detailed below.

7.4.6.1.1 Increase irrigation area

The TRC has noted in their request for further information that the updated AECOM nitrogen balance report states that approximately 50% of the nitrogen applied to the irrigation areas is currently leached to groundwater and/or surface water.

TRC raise concerns that this has been calculated using 7 ha of irrigation area, but in reality, there is only about 4.5 ha of irrigation area available once areas J and H are 'spelled', as proposed.

It is firstly noted that spelling the identified areas is no longer deemed necessary, as the soil levels and groundwater results have improved, and the increased irrigation area to 13.18 ha will result in less application, and provide more rest periods between applications.

A study was commissioned (BTW Company, 2015) to review the operation of the site with recommendations to further develop soil and groundwater management plans. The recommendations from the study have been incorporated in the Leachate and Stormwater Management Plan (**Appendix F**). The BTW study identified that existing irrigation areas had the potential to become overloaded, and as a result of this an application was made to the TRC to increase the irrigation areas. These areas are now both constructed, along with further area taking the total area to 13.18 ha. The BTW study can be found **Appendix U**.

The AECOM model did not take into account:

- The implementation of 13.18 ha irrigation area
- The use of baleage as a crop instead of hay
- It did not address potential deficiencies in other nutrients (most significantly P and K)

Accordingly the new model has been prepared and is included in the report provided in **Appendix AA**. The original AECOM report is included for completeness as **Appendix Z**. This AECOM modelling also provides a comparison between the N losses from the 2019 management of the site against the N losses from the site with the mitigation measures that have been implemented in place.

The key means of reducing N losses (and maximising N export) that are incorporated into the new model are discussed below.

7.4.6.1.2 Increase export of N

Export of N from this site can be achieved in two main ways – removal of the compost offsite, or exporting feed (maize silage, hay). By removing N offsite, less N is available to be lost to groundwater through the soil profile.

a) Removal as compost

The AECOM report notes that removing compost from the site instead of applying it to land contributes significantly to a reduction in nitrogen leaching.

The scenario recommended by Kay Consulting, includes the application of 500 tonnes (1000 m^3) compost per year to the 13.18 ha irrigation area, as this is the worst case scenario and removal/sale of this compost offsite is not yet guaranteed. The impacts of adding the compost applications are discussed in the report in **Appendix AA**. This report concludes that OVERSEER® calculates that, under the recommended scenario (500 tonnes compost/year) the compost applications added 114 kg N/ha/yr to the irrigation areas and the total nitrogen leached from the Irrigation Area increases to 2,093 kg N. When modelled on a whole farm basis, nitrogen leached over the whole farm increased from 4 to 5 kg N/ha/yr as a result of the application of 1000m^3/500 tonnes of the pad 3 compost.

Once the drilling material is through the composting process and no more drill waste is received, it is highly likely that all compost will be exported from the site and sold through existing sales routes and markets operated by the applicant throughout NZ.

b) Removal in hay/other cut and carry feed crops

The TRC originally questioned whether the proposed number of haybales can realistically be removed from the site, noting that if this level of hay export cannot be achieved, nitrogen leaching is likely to be significantly higher than reported to date. This concern is addressed by first confirming the removal of N in hay/baleage and secondly verifying the ability to produce the hay/baleage on the site. This discussion is below.

Feasibility of hay removal

I. Verification of N removal in hay

The Proposed Scenario in OVERSEER® reports that 197 tonnes of hay is removed from the 13.18 ha irrigation block in the cut and carry operation and also that 286 kg N/ha is removed in that hay.

This can be cross checked using the formula: Crude Protein (CP) = Nitrogen % x 6.25

DairyNZ fact sheet "Feed Values"[1] CP (as a percentage of dry matter) in pasture hay ranges from poor hay 5 – 10% to good hay 15 – 20%.

Using the formula shown above the nitrogen content in hay is calculated:

Dry Matter (kg) x Nitrogen (%) = Total Nitrogen (kg)

These calculations are summarised in the table below.

Table 22. Calculation of Nitrogen removed in Hay Cut and Carry

	CP	Nitrogen	Hay removed 13.18 ha	Nitrogen removed in hay
	% DM	%	Tonnes (DM)	Kg N/ha
Pasture hay (poor quality)	5 - 10	0.8 – 1.6	197	120- 239
Pasture hay (good quality)	15 – 20	2.4 – 3.2	197	359 - 479
Overseer file	12.50	2.0	197	286

197 tonnes of dry matter in hay equates to 616 large round bales of baleage. This is discussed further below.

Accordingly, it is confirmed that the OVERSEER ® modelled numbers are in the correct range, being between average quality (higher DM content than 'poor' but lower DM than 'good') after this cross check.

II. <u>Verification of hay production on site</u>

The removal of 197 tonnes of dry matter from the irrigation areas has been modelled in OVERSEER® (see report in Appendix AA). This level of cut and carry equates to 14,946 kg/dm/ha/year removed. The way to verify this is found within the OVERSEER ® model, in that OVERSEER® calculates the DM produced from the blocks involved.

The modelled dry matter production from the irrigation blocks (13.18 ha) over the period of one year under this scenario is 14,946 kg/ha/year. OVERSEER® also notes how much is eaten by stock, based on the stock numbers modelled, and as the blocks are not grazed, removal by stock grazing is 0. Accordingly, the removal of 14,946 kg/dm/ha/year as hay (or any other cut and carry feed) is not unfeasible – noting that 4 crops per year can be achieved, the area is not grazed meaning the majority of the dry matter produced from the areas is available to be exported.

Accordingly, it is confirmed that the 197 t DM is removed from the 13.18 ha irrigation area (under the proposed 2022 scenario with mitigations in place) is certainly feasible, and in fact based on the modelled DM production, a higher yield should be possible. This revised budget is included in **Appendix AA**.

<u>Harvest of Baleage instead of Hay</u>

A similar exercise has been performed based on baleage harvest instead of hay, as shown in Table 23. Ninety five bales of baleage were cut from 4.17 ha within the irrigation areas in the week of 5 November 2019, enabling the estimate of the number of bales to be verified.

Based on 4 cuts of baleage per year, starting 1/10/2019 the predicted total DM yield from the 4.17 ha cut area is 14,964 kg/ha. This is what a good dairy farm would achieve and given there is no grazing by stock and the regular application of water and nitrogen, this is considered feasible. The estimate is considered conservative and has been adjusted to account for the differences in each season the baleage is cut.

Table 23. Calculations of likely Baleage harvest

Predicted		Number bales	Area	Wet wgt	%DM	DM	Total DM	DM/ha	Bales/ha
1/10/2019		50	4.17	800	0.4	320	16,000	3837	12.0
10/11/2019	40	65	4.17	800	0.4	320	20,800	4988	15.6
9/01/2020	60	45	4.17	800	0.4	320	14,400	3453	10.8
8/04/2020	90	35	4.17	800	0.4	320	11,200	2686	8.4
Total		195						14964	

The same formula is used for calculating the N removal of baleage and demonstrates that baleage is equally as good as hay for removal of Nitrogen, and potentially better. See Table 24.

Table 24. Calculation of Nitrogen removed in Baleage Cut and Carry

	Crude Protein	**Nitrogen**	**Baleage removed 4.17 ha**	**Nitrogen removed in baleage**
	% DM	%	Tonnes (DM)	Kg N/ha
Baleage	12-17	1.92 – 2.72	197	287-407

7.4.6.1.3 Decrease N concentration in the discharge

The mitigation measures that will be put in place to decrease the amount of Nitrogen in the irrigated water are discussed below.

a) Decrease N inputs into the irrigation pond

The process of depositing received organic waste directly into the 'receiving pond' commenced in late 2017, and was ceased in April 2020. It is believed that this was contributing to a high load of Nitrogen (and BOD) within the pond system, as the material was starting to break down within the pond before it was removed and put into the compost piles. This is illustrated by the graph in Figure 7, which clearly shows that from late 2017 N levels in the pond have increased. This co-incides precisely with the practice of depositing the material directly into the pond.

There are two issues with this: first is the N loading into the pond system, the second is the loss of nutrients that could be captured in the compost process. The waste material will be applied directly into the composting process instead of to the pond. Only liquid waste (generally only produced water from drilling) will be discharged directly to the pond system.

Acceptance of drilling by-products will cease from 31 December 2020. While most drill muds themselves have little N in them, there are occasional mud systems with a high N content (nitrate based muds), and the drilling fluids were adding considerable liquid to the system. They do however add significant chloride to the process as discussed in other sections of this assessment.

This change in practice will mean the only N flowing into the pond system will be from leaching of compost piles or stormwater runoff from the compost piles. With the Good Management Practices followed on the site, the compost piles will act like a sponge and absorb the majority of rainfall that falls on them, and there will be very little leachate generated.

The additional benefit of this is that volume of liquid put through the pond system is expected to reduce significantly once the drilling by-products are no longer received. The net result is anticipated to be less material requiring irrigation, with a lower contaminant concentration.

While absolute figures on these reductions are unable to be provided, the applicant has already commenced testing of the irrigation pond water for TKN.

b) Aeration of the irrigation pond

Aeration of the irrigation pond will further reduce N concentration in the irrigation water increasing the volatisation of nitrogen gas into the atmosphere. This has been implemented by the applicant and initial results are promising.

c) Dilution of the irrigation pond during dry weather

When N monitoring of the irrigation pond indicates that concentrations of N are increasing above 200g/m3 due to evaporation, water from the 'duck pond' will be pumped into the irrigation pond to dilute the irrigation water. This process has been occurring on site already, albeit visually as pond levels become low.

While it would be possible to apply the more concentrated irrigation water in summer, there is concern that the nitrogen applied may build up in the soil and be flushed through with the next rainfall. At present, while drilling by-products is received, dilution is also necessary to lower chloride levels in the irrigation water.

d) Utilisation of the wetland

The onsite wetland has been maintained recently, and the applicant proposes to test the performance of the wetland by pumping water from the irrigation pond through the wetland and monitoring the nutrient attenuation it provides. This is proposed to occur during the dry, summer months and if successful, may provide an alternative to diluting the irrigation pond. Accordingly it is sought that flexibility is retained in the consent to allow greater utilisation of the wetland if it proves feasible. This is no longer proposed.

e) Irrigation of compost piles

Ultimately, once the drilling by-product is through the process and no longer present on the compost site, it will be possible to use the water in the irrigation pond to irrigate the compost piles when these become dry. (Noting that until the drilling by-products are removed, this will not occur as this would expose the 'non-drilling' compost to drilling by-products). This will return nutrients to the compost, ensure optimal compost conditions are achieved and reduce the need to irrigate to the irrigation land areas. When the compost is sold offsite, the nutrients will be exported in this manner, rather than applying then to land in effluent then cutting and carrying.

f) Monitoring

The ongoing monitoring of the irrigation pond water will provide information to the applicant on how successful these mitigation measures are. This monitoring is underway however it is too early to determine any changes.

The OVERSEER® model provided in **Appendix AA** is based on seasonal averages of N concentration in the irrigation water. Sensitivity analyisis in the report in **Appendix AA** shows that if this can be reduced, the subsequent losses also reduce, and this is an area the applicant will focus on. On current possibility is that the applicant is currently reviewing the suitability of woodchip bioreactor to reduce N in the irrigation water.

7.4.6.2 Updated OVERSEER® Model

The updated OVERSEER® model is shown in **Appendix AA**. In summary, the mitigation measures that are in place will result in total N loss of 2093 kg N/year. The AECOM model of the September 2019 'current operation' (i.e. without the mitigation identified) was 3754 kg N/year. This demonstrates that the mitigation measures identified (and largely implemented already by the applicant) will result in significant decrease in N losses compared to what has been occurring to date.

7.4.6.3 Comparison of N application to other activities

The rate of N applied to the irrigation blocks in irrigation water varies seasonally (as shown in Table 7 earlier), and equates to 350 kg N/ha/year. Additionally, it is proposed to apply 1000 m^3 (500kg) compost to the irrigation areas as a soil conditioner, taking the application of Nitrogen to 460 kg N/ha/year.

Other consents for similar activities in Taranaki indicate that for a site where the grass is cut and carried, a rate of up to 600 kg/N/ha/year is acceptable. [13]

Similarly, the Waikato Regional Council identifies this same level is appropriate in their Regional Plan (Table 38). [14]

Accordingly, it is considered that the rates of application at the site are appropriate, and the applicant is agreeable to a condition of consent as follows;

The Total Nitrogen applied to any hectare of land shall not exceed:

(a) 600 kilograms in any 12-month period for 'cut and carry areas'; or

(b) 200 kilograms in any 12-month period for any other land (including grazed pasture).

For the purposes of this condition of consent 'cut and carry areas' is land that is not grazed and any vegetation is routinely cut and removed.

The OVERSEER® budgets prepared for the site support this approach of allowing greater N application to cut and carry areas, showing that 265 kg N/ha/year is exported off the irrigation blocks in this manner.

7.4.7 Summary of mitigation and effects – Nitrogen losses

The proposed mitigation measures to minimise N losses from the site are below:

- Increased irrigation area to 13.18 ha total (complete).

- Reduce the N concentration in the irrigation water by aeriation, and removal of direct nutrient inputs by altering the use of the receiving pond (complete, monitoring over time will indicate the impacts of this on N levels in the irrigation water).

- Optimising the composting process, including the possibility of irrigation of the compost piles to

[13] TRC Consent 5221-2, condition 10 and TRC Consent 5736-2, condition 7.
[14] https://www.waikatoregion.govt.nz/council/policy-and-plans/rules-and-regulation/regional-plan/waikato-regional-plan/3-water-module/35-discharges/355-implementation-methods-farm-effluent-discharges/

ensure the correct moisture content (commenced).

- Treat drilling by-products separately from other waste streams, and cease receipt of drilling by-products from 31 December 2020, meaning compost can be exported from site (commenced).
- Cut and carry as much as possible from the irrigation areas in the form of hay or other supplementary feed crop. (e.g. bailage, maize, maize silage). (Baleage has commenced and feasibility of yields demonstrated).

These mitigation measures are documented in the site management plans, and have been brought together in a new Farm Environmental Management Plan which is attached as **Appendix O**. The mitigation offered by the additional irrigation area and the cut and carry cropping regime have been modelled and it is confirmed that these would result in a significant reduction in N lost in drainage.

With the adoption of the mitigation measures, noting that all are in progress at the time of writing this document, and the adherence to the management plans that ensure they are incorporated into the day to day management of the site, it is considered that the effects of the activities can be avoided, remedied or mitigated to the extent they are no more than minor.

The revised OVERSEER® budget shows a total N loss of 2093 kg N/year. The AECOM model of the September 2019 'current operation' (i.e. without the mitigation identified) was 3563 kg N/year of total nitrogen lost from the irrigation areas. More importantly, and reflecting the additional irrigation area, under the AECOM scenario the irrigation areas were losing 992 kg N/ha/year from the root zone. Under the proposed scenario with the additional irrigation areas, this reduces to 159 kg N/ha/year. This demonstrates that the mitigation measures identified (and largely now implemented) will result in significant decrease in N losses through the soil on this site. There is also potential for these to be further reduced, by further reducing the amount of N in the irrigation pond, and by export of compost from the site in the future.

When assessed on a 'whole farm' level, the total N losses from this parcel of land are very low. While the TRC have expressed that they disagree with this approach, this is prudent to note, given that other regulations assess N losses as a whole farm level (as opposed to from individual blocks), allowing offset from other, less intensive areas. Accordingly, in terms of the wider effect on the environment and the amount of Nitrogen added to the environment as a result of the entire operation of the land parcel that is subject to this consent, significant offset is provided due to the fat that the remainder of the land is under native bush and is not grazed.

The relevance of OVERSEER® modelling in terms of modelling effects on the environment is widely debated, and caution must be applied when extrapolating the long term modelled averages produced by OVERSEER® to environmental effects. TRC guidance on this matter is provided in the report prepared to assist the TRC Review of the Regional Freshwater Plan titled 'Supplementary Report - Nutrient management Tools/Models, April 2015'. This report states;

> *Nutrient Budgets (prepared using OVERSEER® 6) estimate the amount (kg) of N/ha/yr lost to the atmosphere as gaseous forms of N and how much (kg) N/ha/yr is lost from beneath the farming system. This is primarily the estimate of how much N moves below the root zone in drainage water, particularly on flat land. However, it is not, nor should be interpreted as, the amount of N which necessarily enters receiving water (confined, unconfined aquifers or surface water). Given that the N loss estimate is what is leaving the root zone, it is inappropriate to use OVERSEER® loss estimates to solely determine N loss limits which are designed to protect or improve receiving water quality.*

TRC also express in this report that;

> *The use of an on-farm annual nutrient budget model to estimate in-stream receiving water quality is not supported as there is no quantifiable link between on farm N loss below the root zone and in-stream receiving water.*

Accordingly, while OVERSEER® modelling provides some indication that the mitigation measures proposed will significantly reduce N losses from the site (AECOM modelled the current operations and found that 3574 kg N/year, and 992 kg/ha/year was being lost to water from the irrigation blocks. The proposed scenario (including 1000m^3 compost) shows that these will be reduced to 2093 kg N/year in total, and 159 kg/ha/year from the irrigation blocks) the environmental effects of the activity are best assessed by the monitoring results, and we are fortunate to have a large volume of data available for the subject site.

Groundwater monitoring of water below the site activities is within the tier 1 response criteria, indicating that, all modelling aside, actual effects from current operations are less than minor. Similarly, surface water results also show that water quality in the receiving stream has been largely unaffected by the irrigation discharge, even under the sub-optimal conditions (as modelled by AECOM) that have occurred on this site until recently.

The mitigation (and significant N reductions) modelled are significant, and will likely become apparent in future monitoring results. The most important outcome of the modelling however has been the information it has provided to the applicant, enabling changes to the management of the site, particularly the increased irrigation areas, and the modified irrigation rates between the Upper (high risk soil) irrigation blocks and the lower (low risk soils) irrigation blocks and the changes to the management of the irrigation pond and effluent inputs.

Compared to other similar consented activities in Taranaki where effluent is applied to land, and other guidance on appropriate N levels in effluents applied to cut and carry blocks, a rate of 600 kg N/Ha/year is considered appropriate by both the TRC and Environment Waikato. The rate of N application to land at the subject site is 350 kg N/ha/year, well below this threshold.

7.4.8 Chloride in Groundwater

7.4.8.1 Mitigation of Chloride Losses (i.e. reducing Cl Leaching)

The key measure for reducing Cl losses from the irrigation area is to cease taking drilling by-products. Both the drill cuttings and produced water have high levels of Cl which can generally only be resolved through dilution.

No drill waste will be received after 31 December 2020, allowing notice to be given under current contracts.

In the interim, drill cuttings will be directly applied to the composting area, instead of via the receiving pond. This is discussed above. This will prevent chloride from the drill cuttings directly entering the pond system. Until this time, produced water will be discharged directly to the pond system as there is not alternative to this. It is expected however that beyond cessation of receipt of drilling materials, that chloride levels in the ponds, and then gradually within the entire system, will decrease significantly. Monitoring will confirm this. Until this occurs, the development of more irrigation areas will reduce chloride loading on the lower irrigation area, downstream of which elevated chloride levels are being noted in bore GND2190. (Though these do remain within the Tier 1 (Green) management threshold).

The potential decrease in irrigation volume resulting from changes to the receiving pond (discussed above in associated with the N discharges), will also assist in reducing the Cl applied to the land via irrigation until the drilling by-product is removed from the system.

The applicant is agreeable to a condition of consent stating that no drilling by-products shall be received after 31 December 2020.

Desktop analysis indicates that, based on the concentration of Cl in the irrigation pond (average for 2017-2019 is 1420 mg/L), the irrigation rate (17,000 m^3/year) and the area of land to which it is applied (7 ha at present, but noting this will be expanded to 13.18 ha in coming months), levels of approximately 3449 kg Cl ha/year are applied to land. By increasing the irrigation area to 13.18 ha, the rate decreases to 1832 kg Cl/ha/year, while also noting that as of 31 December 2020, receipt of waste containing chloride will cease, significantly reducing the concentration of chloride in the discharge.

Soil, groundwater and surface water monitoring can indicate what effect this level of application has had on the environment.

Soil analysis showed that Cl levels in the lower irrigation area (SOL177) were high in 2016. This was due to a significant amount of produced water being managed at the facility over this period, and the levels quickly dropped to within the Tier 1 (Green) levels where they remained until late 2017. In early 2018 Cl levels rose to be within the Tier 2 (Yellow) levels, thought to be due to the dry conditions at this time, as subsequent soil monitoring shortly thereafter showed levels again within the Tier 1 (Green) thresholds. Sodium Absorbtion Ratio (SAR) reflects this trend.

Cl is lost from the soil via leaching, and therefore it is not unexpected that following the 2016 elevated soil levels, Cl levels in GND2190 (downgradient of the lower irrigation area at this time) became elevated. They remained in the Tier 2 (Yellow) management threshold band until the elevated level in early 2018 was detected, but recent monitoring has shown that levels in groundwater at this point are again within the Tier 1(Green) management threshold.

Environmental monitoring in groundwater bores and surface water indicate that the levels in the receiving environment are within the 'Green' thresholds in the 3-tier management system at present, and have largely remained there. So while the desktop analysis is showing high application levels, this is not detected at concerning levels in the environment.

The 3-Tier management system responds to Cl levels with the intention of identifying concerns and addressing them with mitigation. Cl in soil is monitored monthly, and if levels are within tier 2 for more than 6 months, or tier 3, remedial action is identified, including freshwater irrigation (See section 5 of the plan in **Appendix H**). Cl levels in the irrigation pond are also monitored. While to date these are within the green, Tier 1 levels there are steps identified should levels increase, including ceasing irrigation at levels greater than 2000 mg/L if drier periods are forecast, especially over the summer months.

With the additional irrigation area, application will reduce by more than half. Once drilling by-products are no longer received chloride levels in the irrigation pond will decrease significantly. This will follow through the system and it is anticipated that there will be a steady decrease in the chloride Levels in the soil. As chloride is leached through the soil, as the inputs to the surface soil decrease/cease, the levels subsequently found in groundwater will also decrease over time. The ceasing of receipt of this waste is considered a significant mitigation measure, that will ensure effects on the environment are no more than minor.

The removal of drill waste is expected to address any concerns about chloride levels in the medium to long term. Immediately, some of the mitigation measures proposed to address N levels (such as increased irrigation area) will also assist in reducing Cl loading on the irrigation blocks until such time as drilling by-products are no longer received.

The Taranaki Regional Council monitors groundwater quality throughout the region, and reports on these results in the State of the Environment Groundwater Quality Report. The 2016-2017 report (Technical Report 2017-45, https://www.trc.govt.nz/assets/Documents/Environment/Monitoring-SOE/Groundwater/SEM-groundwater2017-web.pdf) provides the most recent information. In relation to chloride, the report finds (page 29) that the highest median sodium and chloride concentrations are found in shallow, unconfined groundwater close to the coast, and that groundwater in shallow, unconfined aquifers has sodium to chloride ratios that indicate rainfall as the primary source of these ions. The purpose for providing this information is to confirm there are natural inputs of chloride from rainfall, and while the applied chloride will be masking this, in the future once the chloride inputs are removed, chloride concentrations on their own need to be treated with caution and should be considered alongside Sodium, and compared to the Seawater Dilution Line (SWDL) as has been done in the TRC Technical report.

The Drinking Water Standards for NZ (2008) (DWSNZ) provide Guideline Values for chloride, beyond which chloride will affect the taste of water, and corrosion levels in pipes. This guideline value is set at 250 mg/L and it is noted (see **Appendix X**) that few of the samples taken on this site exceed this level, and those that do can be attributed to direct discharges to the waterways caused by poor management (e.g. the spike in March 2019), as opposed ongoing leaching from irrigation areas.

7.4.9 Summary of Mitigation and effects - Chloride losses

Consistent with the discussion of effects so far in this assessment, the effects on groundwater have been monitored and are well understood.

RNZ identified that the irrigation areas on the site were insufficient and has now commissioned new areas, taking the total irrigation area to 13.18 ha. The additional area gives site management more options for irrigation and enable a greater rest time between applications.

Again – the occasions when monitoring has shown a breach in consent conditions were not attributable to natural phenomena, these are directly linked to management of the site. The new site management system, when fully implemented will ensure that the effects of the proposed activities on the groundwater environment are avoided, remedied and mitigated to the extent that they are no more than minor.

The cessation of receipt of drilling by-products from the site from 31 December 2020, can be formalised by way of a consent condition and will ensure that the levels of chloride applied to land will significantly reduce, and the likelihood of chloride entering groundwater will reduce in proportion to this. Again, it is expected that the chloride levels will remain within Tier 1 (green) levels, this will ensure effects will be no more than minor in the immediate term and will improve significantly into the future when receipt of chloride laden drilling by-products ceases.

In the interim, drill cuttings are no longer deposited directly to the pond adjacent to Pad 3 (from where they were scooped out), but will be applied directly to the pad and mixed in situ. This will reduce the amount of chloride that enters the irrigation pond system.

7.5 Effects of discharges on instream flora and fauna

Fish and Biomonitoring surveys of the Haehanga Stream have been undertaken on an annual basis by the TRC. A Fish Survey of the Haehanga Stream in December 2016 stated that '*In summary, the results of the current survey do not indicate that the composting activities and wastewater irrigation undertaken by Remediation NZ Ltd, alongside the Haehanga Stream, have had a deleterious impact on the fish communities of this stream*'.

A biomonitoring survey conducted in December 2016 stated that '… *with the exception of site 1, all sites recorded MCI scores higher than their respective medians. Overall, this survey found that macroinvertebrate communities of the mainstream sites and two unnamed tributaries were of above average health. Undesirable heterotrophic growths were not recorded at any of the seven sites in this survey*'

The biomonitoring survey also sampled Taxa and stated '*In general, the communities in the Haehanga Stream had moderate proportions of sensitive taxa. Low numbers of sensitive taxa are expected in small, silty bottomed streams such as the Haehanga Stream and the number of taxa were generally similar to other lowland hill country streams surveyed at similar altitude'.*

The conclusions of the December 2016 survey would indicate that the instream flora and fauna in the Haehanga catchment are in average to above average condition when compared to similar sites in the area. The results also indicate that the effects of composting and vermiculture operations on the streams are minor.

Similar results were found in the latest 2018 survey, while noting that this survey was undertaken in very low flow conditions. The latest report notes:

"In summary, the results of the current survey do not indicate that the composting activities and wastewater irrigation undertaken by Remediation NZ Ltd, alongside the Haehanga Stream, have had a deleterious impact on the fish communities of this stream. This is consistent with the findings of the macroinvertebrate survey, completed on the same day. However, the impact on fish passage caused by the three access culverts is likely to have contributed to the reduced species richness at site 1".

Both the 2018 Fish and Biomonitoring Survey are attached in **Appendix X4**.

7.6 Effects of the Wetland Discharge

Discharge from the wetland is carried out immediately following heavy rain-events. During periods of low intensity rain there is little or no discharge from the final pond of the wetland.

Stormwater discharges from the final pond are likely to coincide with already high stream flows. Typically, during periods of high stream flows, the water quality is likely to have already deteriorated as a result of other runoffs, both up and downstream from the site (i.e. have elevated concentrations of nutrients and sediment). As the stream water level recedes, the discharge from the final pond will cease or reduce considerably.

During Autumn, wetland plants experience plant die-back which can reduce the treatment capability of the wetland system, which in turn may lead to higher ammonia levels in the discharge to the Wetland tributary stream. Monitoring results show spikes in ammoniacal nitrogen (NH_4) in April to June in the last 4 years. This is a natural phenomenon experienced in wetland treatment systems and it is acknowledged in the Wetland Treatment System Plan.

It is considered that the effects of contaminants discharged from the final pond of the wetland will continue to have no adverse affect on the stream or shallow groundwater quality, with performance of this system evidenced in monitoring results.

7.6.1 Summary of Proposed mitigation measures – discharges to land

The Uruti compost site has been selected such that it is as far as is practicable remotely located from neighbouring property owners.

The input of raw material is currently controlled in consent conditions. The acceptance procedures are listed in the Waste Acceptance Plan.

RNZ has prepared a contingency plan should any spillage of hydrocarbons to waterways occur. There is a 'Spill Control' trailer permanently on site.

The effects of the discharge of stormwater and leachate from the process to land are mitigated as follows:

- Minimising the potential for leachate and stormwater effects is achieved by utilising a combination of the interception drains, capacity of the settling ponds, irrigation systems, attenuation action, wetlands and biological treatment.

- Fencing of the Haehanga stream and riparian planting is in progress to enhance water quality and increase and diversity of the stream flora/fauna at the site.


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Figure 34 Riparian Planting the banks of the Haehanga Stream

- Stormwater volumes are kept as low as possible by diverting all clean stormwater around the active site with bunding, diversions and cut of drains.

- The stormwater treatment system is designed and managed to accommodate a significant rainfall event - at a minimum it will accommodate a 1 in 10 year event of duration 60 minutes.

- All potentially contaminated stormwater, and all leachate, is collected within the pond systems, treated and managed.

- There is no direct discharge to water, and all management plans are designed to achieve this even under high intensity rainfall events.

- Operations are undertaken in accordance with detailed Management plans which are discussed below.

- A dam is nearing completion in the east tributary of the Haehanga Stream and will be used to augment flows during dry/low flow conditions in the stream. (This is constructed within the permitted activity criteria and reviewed by the TRC).

- Repair and maintenance of the wetland has occurred, with a mind to increasing the Wetlands utilisation and treatment performance. This work includes desludging the sediment retention pond and planting Raupo in the terrace ponds.

- More than 6 ha of new irrigation area has been added taking the total area to 13.18 ha and reducing contaminant loading on soil, and potential for contaminant losses to groundwater.

- Address the build-up of ammonia/other contaminants in water (during low stream flows) by diverting water from the dam into the stream to create flow.

- Reduction of N and Cl losses via the N and Cl mitigation measures detailed in sections 5.3.4 and 5.3.5.

With the mitigation measures above in place, many of which are formalised in site management plans, it is considered that the discharges to land for which consent is sought are able to be avoided, remedied or mitigated so that the effects on the environment are no more than minor.

7.7 Effects of Stockpiled Material

The effects of the material stockpiled on pad 3 is specifically discussed in this section.

Effects from these stockpiles include leachate and stormwater runoff from the stockpiles and odour emissions.

7.7.1 Stormwater & Leachate from ponds/stockpiles

Stormwater is in the first instance directed around the stockpiles so it does not become contaminated.

Any stormwater that is in contact with the stockpile or the area surrounding the stockpiles may entrain contaminants, including nutrients, metals and hydrocarbons is directed to the irrigation pond system via a network of drains for treatment before being irrigated.

As discussed earlier in this document, effective composting should not result in leachate. This notwithstanding, any leachate, or water that runs through or over the piles, could entrain similar contaminants to stormwater, and is also directed to the irrigation pond system via a network of drains for treatment before being irrigated.

Reducing the potential contaminants within the stockpiles also reduces the potential amount of contaminants entrained in stormwater or leachate. Contaminants are typically reduced with effective composting, and the applicant has commenced more active management of these stockpiles to increase the breakdown process. TPH reduces over time, and is the key contaminant targeted with the more active management of the stockpiles.

The one contaminant that does not break down notably is chloride, which is typically lost through leaching, and therefore released to the irrigation pond. The effects of chloride within the irrigation pond are discussed in section 5. Once drilling by-products are no longer received, chloride will become less of a concern on the site.

7.7.2 Odour Emissions from Stockpiles

Odour emissions from the wider site are discussed below. The stockpiles on pad 3 are unlikely to generate odour given the nature of the material however if there was any emission of odour it would be mitigated with other odour emissions from the site, and in accordance with the site-wide odour mitigation procedures.

7.7.3 Effects of Compost application to land

The application now includes application of compost to land as a soil conditioner. This will occur under the permitted activity rules in the RFWP, confirming that the effects of this activity are within those anticipated in the RFWP.

7.7.4 Leaching of Nitrogen from Stockpiles and from Applied Compost

The composition of the stockpiled material is shown in **Appendix G2 and G3**. This analysis has been used to inform the most recent OVERSEER® budget that is included as **Appendix AA**, which ensures that the nitrogen present compost is accounted for. The effects of the overall N losses from both irrigation and compost application to the irrigation areas are dealt with in section 7.4.7.

In terms of the Nitrogen leached from stockpiled material while it is still being stockpiled, any leached material will be collected and diverted to the management ponds on the site, as occurs with other stockpiles. It is however noted that the level of total nitrogen in the compost sampled is 0.61% . For comparison, literature has been reviewed in order to compare this level of Total Nitrogen to typical topsoils in Taranaki.

A report prepared by Manaaki Whenua for the Taranaki Regional Council titled "Soil Quality in the Taranaki Region 2017: current status and comparison with previous samplings" provides a useful comparison of Total Nitrogen levels in soils over 20 sampling sites. Appendix 1 of this report summarises Soil Chemistry and Biochemistry Data, and Total Nitrogen (%) over the sampled sites ranged from 0.48 % to 1.38%. The nearest sampling site to the application site (SOL00191 in the TRC report) showed Total N levels of 0.49%.

This report is available here:

https://www.trc.govt.nz/assets/Documents/Research-reviews/Land/SoilReport2018.pdf

A report prepared in 2016 Titled: "*Analysis Of The Relationship Between Total Nitrogen And Available Nitrogen In Non-Pastoral Topsoils Of New Zealand From A Large Soil Test Database" (Guinto & Catto, 2016)* presented data on Total Nitrogen as part of a wider study, and also provided the comparative data sought. Table 1 identified the mean % of Total Nitrogen in 250 samples of topsoil (surface 15cm) in Taranaki as 0.79%. (the same table in this report identified that the minimum was 0.41% and the maximum was 1.07 %)

The report is available here;

http://flrc.massey.ac.nz/workshops/16/Manuscripts/Paper_Guinto_2016.pdf.

Accordingly it is considered that the level of Total Nitrogen in the compost that is stockpiled, and which is also applied to land at the RNZ Uruti facility is comparable to natural topsoil in Taranaki and is certainly not excessively elevated to be a concern.

Effects from nitrogen leached from stockpiles will be less than minor.

7.8 Discharges to air

7.8.1 Effects of Air Discharges

The process of composting organic wastes can create odour discharges and can be unpleasant when experienced at nearby dwellings, reducing the amenity and enjoyment of private properties. Complaints from, and consultation with neighbours confirm that any odour emitted from the site has been noticeable from time to time. Cold air drainage phenomena has been identified as the main cause of these events. Bunding and tree planting has also been completed as a mitigating strategy to reduce cold air drainage out of the valley.

7.8.2 Odour and Dust mitigation

Remediation (NZ) Ltd has continued to develop, improve and enhance their management practices. Minimising the potential for odorous emissions to arise associated with compost production is achieved by ensuring aerobic conditions remain present at all times. However, as a contingency planning measure, should objectionable or offensive odours arise, one or more of the following procedure(s) can be immediately employed as a mitigation measure:

(a) Carbon primary compounds such as sawdust or aged compost will be used in a smothering effect to cover the waste lines. This has been successfully utilised at the RNZ New Plymouth site with neighbours in extremely close proximity.

(b) The use of compounds such as lime may be employed to increase the speed of breakdown of the organic components and increase microbial activity. While some air emissions are expected to arise with this type of facility, objectionable odours are not expected to arise at or beyond the property boundary. By carefully selecting and controlling the waste materials to be composted, Remediation (NZ) Ltd can control the likelihood for potential offensive or objectionable odours to arise at or beyond the property boundary. The nearest farming boundary is located approximately 2000 m from the operation and approximately 3500 m to the closest residential dwelling.

Odour emissions are controlled by maintaining aerobic "moist" conditions as this allows for minimal build up of nitrogen and sulphur based gases, such as ammonium and sulphide derivatives, which typically occur under anaerobic conditions. Regular turning of the windrows also further assists in maintaining aerobic conditions within the windrows

Discharges to air associated with storage, transfer, treatment and disposal of wastes are considered a controlled activity under the Taranaki Regional Air Quality Plan if objectionable or offensive odour or objectionable deposition of dust occurs at or beyond the property boundary. The site is operated with the intention that no objectionable or offensive odours or objectionable depositions of dust will occur at or beyond the property boundary.

As mentioned above, the applicant has identified that some types of waste, including cheese waste from dairy factories, causes an increase in odour on the site. The applicant ceased receiving this waste when it became apparent that odour effects were occurring, and this waste is no longer be accepted in large volumes.

Dust is mitigated by wet suppression using a tractor drawn water tanker as appropriate during dry weather and ensuring that traffic speeds are kept low on the access roads. Dust has not typically been a concern on this site, with no dust complaints received.

Timing of operations – in particular turning the compost piles and removing sludge from the ponds – is also a key method of avoiding odour travelling offsite. Having regard to the prevailing wind conditions and undertaking this work when residential dwellings are not down wind is a standard mitigation technique. The applicant has invested in their own long-reach digger, so that they have more control over the timing of this work (i.e. do not have to rely on an independent contractor).

Air quality (odour and dust management) matters are also addressed in the Site Practices Plan .

With the mitigation measures above in place, it is considered that the effects of discharges to air are entirely contained within the site and can be avoided, remedied or mitigated to the extent that they are less than minor.

RNZ commissioned AECOM to undertake an assessment of odour effects at their facility (see **Appendix Y** for full report).

The conclusion from AECOM report - 'Assessment of Odour Effects' (**Appendix Y**) is as follows;

"Having assessed the addition of food waste composting against the FIDOL factors, AECOM considers that there is a low likelihood of off-site odour from Revital Group's Uruti operations being categorised as objectionable and offensive at nearby receptor locations. This is based on the following factors:

- *The addition of food waste composting is only an additional 20 percent of material that will be processed on site, and the food waste should not be as odorous as the animal waste that is currently onsite. Based on the way the human nose perceives odour, this amount of increase wold not result in any noticeable change in intensity of odour from the site.*
- *The compost is turned frequently in the early stages, which prevents anaerobic conditions, which give rise to offensive odours.*
- *Any odorous waste is either covered with greenwaste, saw dust or mature compost shortly after it is received on-site.*
- *Based on the meteorological data for the area and the site topography, the nearby receptors would most likely only be affected by odours during periods of Katabatic flows, and based on the metalogical data, these events occur approximately 4.5 percent of the time. Based on the varied emission rate from the site operations, there is a low probability of higher odour emission rates occurring at the same time as poor dispersive conditions in the direction of these receptors.*
- *There is a large separation distance (greater than 1,600 metres) between the composting operations, and the sensitive receptors. There is also a good separation between the areas of irrigation (greater than 550 metres) and the receptors. These separation distances will help dilute any odour that might be generated by the composting operations.*
- *The surrounding land zoned rural, therefore it is not unusual to experience rural type odours such as silage or even compost.*

However, for the majority of the time the composting and vermiculture material will not be disturbed and therefore odour emission will generally be low. It is generally only during times of mechanical disturbance that could arise to higher odour emissions and these are limited to between the hours of 7:30am and 5:00pm Monday to Friday and have to coincide with poor dispersive conditions.

In terms of odour as a result from irrigating leachate to land, unlike compost where there are fugitive odours, the activity of irrigation can be managed. Considering the control measures in place, the irrigation of leachate to land can be done in a way that will result no residential dwellings being downwind of any potential odour, also the way in which the leachate is applied (1 metre above ground and little mist) the potential for odour to travel in optimal wind speeds is low."

7.8.3 Summary of Effects of discharges to air

With the mitigation measures in place, including adherence to the site management plans, effects of the discharges to air are able to be avoided, remedied and mitigated to the extent they are no more than minor.

7.9 Vermin / Disease

Remediation (NZ) Ltd has well established operational sites within the Taranaki, Waikato and Bay of Plenty regions, with no evidenced effects or presence of vermin or disease located/transmitted. The material utilised does not attract vermin and the composting procedures do not allow conditions to cause pathogen or disease development.

Composting has become, over the past 20 years, one of the favoured methods for disposal of a variety of organic waste materials worldwide. As the temperature of the substrate in which micro-organisms/pathogens are located rises, the expected survival time drops rapidly. The maximum critical temperature above which pathogen destruction is very rapid is approximately 55°C. Since the compost will be produced by thermophilic method i.e. temperatures of 60-70°C, any residual micro-organism would be destroyed rapidly in the process. Fly larvae, pupae and adult phases would also be destroyed.

The thermophilic aerobic system provides a high level of assurance of destruction of bacterial and viral pathogen, and of eggs and larvae of insects and other pests. The concentration of pathogens in the rumen contents (paunch) will in any case be very low, in comparison with for example manure on the pasture or dairy shed effluent.

The Uruti facility will not present a hazard to animal or human health either directly or through disease vectors[15].

7.10 Feral animals

Due to the nature of the surrounding area feral animals can be a nuisance. These are monitored and if numbers get to a stage where they cause problems i.e. feral goats walking over worm bed covers causing damage) culling is carried out as necessary.

7.11 Effects on Tangata Whenua

Discharges to land and water can impact on the cultural and spiritual values of waterways and whenua.

An Assessment of Cultural Effects has been prepared, and this is attached as **Appendix S**.

A number of matters were addressed by the applicant during the consultation process with Ngati Mutunga, and these are documented in the attached assessment. This assessment makes the following recommendations;

- A thorough site exit plan be developed for the site, to ensure there is no 'legacy' left behind

[15] [1] The above information is supported by Professor Roger S Morris BVSc (hons) V/MVSc, PHD, FRSNZ, F Amer CE, FACNSc, Gilruth Prof of Animal Health, Director of Massey University EpiCentre, Advisor to EC on BSE and numerous international governments on epidermiology; and Dr Ian Andrew entomologist from Massey University.

for which Ngati Mutunga is left picking up the pieces.

- Involve Ngati Mutunga in the monitoring of the site.
- Develop a procedure for ensuring the Hapu received monitoring information and reports in a timely manner.
- Remove the biosolids from the 'acceptable wastes' list.

The applicant is agreeable to these recommendations, and for these to be implemented by way of conditions of consent as appropriate. Where appropriate these recommendations are also incorporated into the Site Practices Plan (see below).

The applicant has also identified (via the Ngati Mutunga Environmental Management Plan and consultation) that the correct name for the 'Mimi' River is Mimitangiatua. All documentation prepared by the applicant therefore reflects this name.

It is considered that with the identified measures and controls in place, effects on cultural and spiritual values can be avoided, remedied and mitigated to be less than minor.

7.11.1 Conclusions & Recommendations from CIA

The Haehanga Stream and the Mimitangiatua River hold high cultural and spiritual significance for Ngāti Mutunga, and this is clearly identified and detailed in the Ngāti Mutunga Iwi Environmental Management Plan.

While recognising the role facilities such as the Uruti Composting Facility have in waste management and recycling, in exercising their role as kaitiaki, Ngāti Mutunga need to be assured that effects on the Haehanga Stream are remedied in the first instance (e.g. riparian planting to remedy the current state of stream banks and cease stock access), and avoided, monitored and mitigated into the future. Risk and environmental mitigation measures have been identified by Remediation (NZ) which will result in environmental improvement in the Haehanga Stream, and this in turn will assist in mitigating a number of the cultural effects. Key to mitigating the cultural and spiritual effects is ensuring there is no direct discharge of the material managed on the site to waterways. Also key is ensuring there is appropriate monitoring in place to identify if activities are causing adverse changes in water quality trends early, and then taking action before this can result in adverse environmental effects. Riparian fencing and planting will allow the stream banks to repair and will assist in restoring the water quality and the health of the Haehanga Stream.

It is recommended that Remediation (NZ) continue their engagement with Ngāti Mutunga in relation to the environmental management of the Uruti facility and maintain this into the future. Expectations of both parties could be formalised by way of a Memorandum of Understanding (MOU) and comply with the limits in Table 15 presented earlier in this document, and provide sampling to the TRC confirming compliance prior to application of material.

It is expected that cessation of receipt of drilling by-products at the site and the measures proposed to address the composted drill-waste material will also address concerns about the nature of the material being received at the facility.

7.12 Integrated Management System

A detailed Integrated Management System (IMS) has been prepared and is referred to throughout this report as one of the key mitigation measures for the site and the activities for which consent is sought. This IMS has incorporated all existing management plans prepared for the site and integrated these into one document which also includes compliance with consent conditions and waste receipting procedures.

A key part of the management plan is making sure it is complied with. In this regard the applicant proposes to;

- Monitoring of site to be responsibility of one person reporting to the General Manager - Composting
- Internal auditing process to be carried out on a regular basis
- External Audit to be carried out on an annual basis

Identified during consultation was the need for a thorough site exit plan to be in place for the facility, given that there will be a long 'run out' time until consents can be surrendered. The applicant has provided for this in the Management Plan, and the key principles of site exit will be:

- All compostable material completely composted
- Irrigation pond system cleaned out and ponds back filled
- Wetlands system decommissioned
- All pad areas returned to pasture

Drafts of most management plans are provided in this application as the applicant is unable to finalise these until consent conditions are deferred. The applicant will provide final management plans to the TRC within 3 months of the consent being granted, and will provide updated versions annually thereafter.

Critical to any management system are the staff responsible for the procedures and day to day site management. Changes have been made on site to increase the accountability of onsite staff including:

- Inductions
- Consultation with staff on management and proposals
- Review and sign off of procedures
- Incorporation of procedural requirements in job descriptions.
- Weekly minuted meeting with senior management and site staff

7.13 Summary of Effects

The likely or potential environmental impacts associated with the Uruti site are considered to be both well anticipated and understood.

- The ponds are designed and managed to ensure that there is sufficient capacity to contain a 1 in 10 year event that lasts for 60 minutes duration at the site.
- The composting site is unlikely to produce high volumes of leachate if well managed.

- Liquid contamination from the composting pad is only likely after rain events i.e. stormwater will be contained within the settling ponds.

- During minor rain events there may not be any Stormwater discharged from the site.

- If stormwater volumes exceed the settling pond capacity, the concentration of contaminants will be reduced significantly by dilution and will be captured in the final pond for irrigation.

- Attenuation by vegetation and soil will significantly reduce any contaminants entering shallow groundwater.

- Contaminants discharge from the wetland's final pond will be at low concentrations at times of high groundwater flows.

- An integrated management system has been developed to address the materials received, anticipated flows and expected weather events. This documents how effects on the environment will be avoided, remedied and mitigated.

- N Losses have been modelled and found to be high. Mitigation measures have been developed to address Nitrogen losses, and management practices put in place.

- Concerns about chloride in groundwater have been raised. These will be addressed in the long term with the removal of drilling by-products form the system. Short term mitigation measures are also proposed.

Overall, the effects of the activity are able to be managed so that the effects on the environment (both from the discharge to air and the discharge to land) are able to be avoided, remedied and mitigated to the extent that they are no more than minor. The key to ensuring this occurs is adherence with the new site management plans and procedures.

7.14 Other Assessment Matters

In accordance with Clause 7 of Schedule 4 of the RMA the following provides an assessment of the activity's effects on the environment:

7.15 SOCIAL AND ECONOMIC ANALYSIS and VALUE OF EXISTING INVESTMENT.

The Uruti site employs 3 full time staff, and a number of contractors as required.

To replace the site infrastructure today would cost in the vicinity of $3.5 to $5m dollars.

Over the years Remediation has invested significantly in the site and continues to work on enhancing the local ecosystem with riparian planting along the Haehanga Stream boundaries and the planting of Manuka.

8. STATUTORY CONSIDERATIONS

The Resource Management Act 1991 (RMA) provides a framework within which consents for various aspects of the operation must be obtained. It explicitly outlines the requirements of the applicant in lodging their application and the process by which the consent authority shall make a decision. The process is generally subject to Part II of the Act as outlined below. This section of the AEE for the project briefly outlines the statutory background to the consent process and details the planning documents, which, in combination with the RMA, assist in determining the consent requirements for the project.

Schedule 4 of the RMA requires that an assessment of the activity against the matters set out in Part 2 and any relevant provisions of a document referred to in Section 104 of the RMA is provided when applying for a resource consent for any activity. These matters are assessed as follows.

8.1 Part 2 of the RMA (Purpose and Principles)

The purpose of the RMA is to promote the sustainable management of natural and physical resources. All policies, plans and resource consents are subject to this principle.

The RMA defines sustainable management as:

" managing the use, development and protection of natural and physical resources in a way or at a rate, which enables people and communities to provide their social, economic and cultural wellbeing and for their health and safety while –

(a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) Safeguarding the life-supporting capacity of air, water, soil and ecosystems; and

(c) Avoiding, remedying, or mitigating any adverse effects of activities on the environment."

Whilst the effects of waste are dealt within the ambit of the RMA, the Act itself does not specifically deal with waste generation per se. This said, increasing public concern for the environment, coupled with a general recognition by regulators and the public for the need to incorporate where practicable, a waste management hierarchy based on reduce, reuse, recovery and recycling, means that there is a recognised need to promote and endorse a range of environmentally sound and acceptable methods for the management of solid and liquid wastes.

Composting and Vermicast production and its necessary supporting activities (pre-composting) represents a simple, sustainable and innovative method for dealing with a range of unwanted organic waste streams that might otherwise require less desirable residual disposal methods, such as landfilling. This is considered a sustainable use of natural resources and a sustainable management method.

By ensuring the potential effects of the activities are avoided remedied and mitigated as presented in the AEE, it is considered that the activities are entirely consistent with the purposes and principles of the RMA.

The RMA also lists several matters of "National Importance" which must be recognised in decisions affecting the management, use, development and protection of natural and physical resources. Such matters include:

"(a) The preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, lakes and rivers… and the protection of them from inappropriate subdivision, use and developments;

(b) The protection of outstanding natural features and landscapes from inappropriate subdivision, use and developments;

(c) The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna;

(d) The maintenance and enhancement of public access to and along the coastal marine area, lakes and rivers;

(e) The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga."

In addition to the above, particular regard must be had for several other matters which include Kaitiakitanga, the intrinsic values of ecosystems, the heritage values of sites, buildings or places, the quality of the environment, the finite characteristics of resources and the Treaty of Waitangi. All of these matters must be considered during the decision making process, and all to varying degrees, the granting of the consent sought.

"Effects" that are likely to arise from granting of the consent are generally limited to the discharge of minor amounts of leachate and stormwater. The effects associated with these discharges are considered to be no more than minor in nature and are each addressed within the AEE presented. The design, management and operational practices utilised at the Uruti Site are detailed in the Site Management Plan and can be found in **Appendix D**. Methods employed by Remediation (NZ) Ltd (including contingency measures) to further mitigate any potential effects that may arise are also discussed in this report.

The proposal is consistent with the purpose and principles of the RMA, as outlined in Section 7 of this document The proposal will have less than minor effect on resource ability to meet the reasonably foreseeable needs of future generations, or on the life-supporting capacity of the resource and any ecosystems associated with them. The proposal ensures that adverse effects on the environment are avoided, remedied or mitigated and offers a valuable environmental service, composting waste into usable nutrients.

There are no matters of national importance under Section 6 of the RMA that will be affected by the proposal. The proposal is also consistent with the requirements of Section 7 of the RMA, with particular regard given to Kaitiakitanga and the ethic of stewardship by taking onboard the findings of the CIA, and the efficient use of natural resources, by composting and reusing nutrients as opposed to landfilling the waste streams involved. Regarding Section 8, the proposed activity is not inconsistent with the principles of the Treaty of Waitangi.

Overall, the activity is considered to be consistent with Part 2 of the RMA, given the proposed mitigation measures and reflecting the significant improvements made to operations over the course of this application.

8.2 Section 104(1)(b) of the RMA

In accordance with Schedule 4 of the RMA, an assessment of the activity against the relevant provisions of a document referred to in 104(1)(b) of the RMA must be included in an application for resource consent. Documentation in this section are noted as being:

(i) a National Environmental Standard;

(ii) other regulations;

(iii) a National Policy Statement;

(iv) a New Zealand Coastal Policy Statement;

(v) a Regional Policy Statement or Proposed Regional Policy Statement;

(vi) a plan or proposed plan.

Under the RMA, regional plans need to give effect to NPSs, NESs and RPSs. For an application of this scale, an assessment of the application against the regional plans is adequate as these plans ultimately give effect to the higher order statutory instruments.

Section 104 sets out the matters to which the consent authority must have regard when considering an application for a resource consent. In summary, the following have to be taken into account:

- Any actual and potential effects on the environment.
- Any national or regional policy statements.
- Any objectives, policies or rules in any plan.

Regard must be had to the relevant statutory documents of the Taranaki Regional Council. In 2010 the Taranaki Regional Council adopted its Regional Policy Statement (RPS) for the Taranaki Region. An interim review of this RPS was carried out in June 2017. Remediation (NZ) Ltd was an external stakeholder participant in this review. In 2001 the Taranaki Regional Council also adopted a Regional Fresh Water Plan for the Taranaki Catchment. Both of these documents are relevant to the application under consideration. Each is now discussed further.

8.2.1 Objectives and policies of the Regional Policy Statement

Part B section 12 of the Regional Policy Statement for the Taranaki Region (RPS) sets out the objectives and policies for the region. It identifies the significant issues in relation to waste are -

- WST - ISS 1 Minimising the volumes of waste generated and requiring disposal.
- WST - ISS 2 Providing for the efficient and effective disposal of waste while avoiding, remedying or mitigating any adverse environmental effects associated with waste disposal.

The work that Remediation (NZ) Ltd carries out at the Uruti Site is entirely consistent with meeting the objective of waste minimisation and control.

In relation to discharges for which consent is sought, section 5.2 of the RPS discusses maintaining healthy soils, and HSO OBJECTIVE 1 is relevant to the activities:
To maintain soil health in the Taranaki region by maintaining soil nutrients at appropriate levels and avoiding or minimising soil compaction and soil contamination caused by inappropriate land management practices.

Carefully managed in accordance with the Site Management Plan, the applicant can ensure the health of the soil is maintained at the site. The compost itself can be used to enhance the soil condition on other sites.

Section 6.2 of the RPS addresses *maintaining and enhancing the quality of water in our rivers, streams, lakes, and wetlands.* The water quality issues identified relate to managing the effects arising from point source, diffuse and cumulative discharges to the environment on freshwater resources. The activity is consistent with WQU

OBJECTIVE 1, which is *to maintain and enhance surface water quality in Taranaki's rivers, streams, lakes and wetlands by avoiding, remedying or mitigating any adverse effects.*

Methods for avoiding, remedying and mitigating effects have been presented in this report.

Section 7.1 relates to maintaining air quality in the region, and AQU OBJECTIVE 1 *To maintain the existing high standard of ambient air quality in the Taranaki region, to improve air quality in those instances or areas where air quality is adversely affected, and to avoid, remedy or mitigate adverse effects on people and the environment resulting from discharges to air.*

Remediation (NZ) has demonstrated how they proposed to ensure effects on air quality are avoided, remedied or mitigated.

8.2.2 Waste Management and Minimisation Strategy Taranaki

Section 6 of the Waste Management and Minimisation Strategy specifically identifies the objective of minimising organic wastes to be disposed of. A 2010 survey identified that 29.8% of waste going to landfill was organic.

6.1 ISSUE: Quantities of organic waste requiring disposal

Issue 6.1 deals with reduction in volume of organic waste being disposed of within the Taranaki region and increase the quantity of solid waste being recycled and re-used or recovered. Composting and vermiculture utilises the recycling of organic matter and associated nutrients to produce a marketable biological fertiliser and soil conditioner.

Incorporated into discussion of this latter identified issue, is the recognition that many waste materials can be used as raw materials for producing other goods. Well operated compost and vermiculture production represents one such example of an environmentally sound method for reusing a waste stream as a valuable input for another production or manufacturing process. Thus, whilst the composting and vermiculture site provides an environmentally acceptable alternative waste disposal opportunity to many waste generators within the region, the reuse of these waste streams is aligned to waste stream reuse or recycling, rather than waste disposal.

To address the above described issues the policies and objectives are summated above with methods of implementation noted below.

6.2 Objective

'To minimise organic waste disposal of, in order to protect the environment and public from harm and to provide economic, social, cultural and environmental benefits'

Implementing wider adoption of the waste management hierarchy (based on reduce, reuse, recovery and recycling) necessitates promoting and encouraging of a range of environmentally sound and acceptable methods for the management of solid and liquid wastes.

With oil exploration being a major contributor to the Taranaki economy, the sustainable conversion of drilling cuttings and subsidiary fluids, promotes the above, and further develops the technology required to reuse a potential waste line. The inclusion of synthetic drilling muds requires this technology update to guarantee the appropriate disposal/conversion options, which are also a high priority within the companies directly involved with oil exploration.

For each of the above-described reasons, the applicant therefore considers the proposed activity is consistent with and enforces the policies and objectives of the Regional Policy Statement and the Waste Management and Minimisation Strategy for the Taranaki region.

8.2.3 Objectives and Policies of the Taranaki Regional Freshwater Plan

The following policies, which give effect to the plan's objectives, are relevant to this application for resource consent.

Under this plan the proposed activity of the application of drill cuttings liquid and compost leachate would be classified as a discretionary activity (Rule 44). Rule 44 states:

Discharge of contaminants onto or into land restricted by s15(1)(b) (where contaminants may reach water) and s15(1)(d) (where the discharge is from industrial or trade premised) of the Resource Management Act 1991 which is not expressly provided for in Rules 21-37 or which is provided for but does not meet the standards, term or conditions and any other discharge of contaminants to land which is provided for in Rules 21-37 but which does not meet the standards, terms or conditions of those rules (irrespective of whether the discharges are from industrial or trade premises or are likely to reach water).

Specifically, it is relevant to mention the buffering organic material as a potential, however limited source, of nutrient leachate and how they relate to permitted and controlled activities. Whilst some of the performance standards for the permitted or controlled activities for discharges to land are not directly relevant to the application, those that can be considered relevant are in general easily complied with.

The discharge of leachate onto and into land would be classified a permitted activity (Rule 29). Rule 29 States:

Discharge of contaminants from industrial and trade premises onto or into land, excluding those provided for by Rules 22, 23 and 27.

The potential leachate generated directly from the windrows is analysed in detail in section 4.1.2 table 3. As stated there is no direct discharge of any leachate contaminant into the surface water body and no bore well within 50m of any of the production sites. Additionally, there is no ponding or runoff of contaminant into a surface water, with any potential minimal volumes being utilised on site via nutrient uptake/utilisation, and so meeting the required standards for Rule 25, a permitted activity.

The discharge of Stormwater onto and into land would be classified a controlled activity (Rule 24). Rule 24 States:

Discharge of Stormwater into or onto land or into water (excluding those wetlands listed in Appendix II) that is not provided for by Rules 25 – 27 and that does not come within or comply with the conditions of Rule 23.

Details for management of stormwater are detailed in the AEE, again indicating no adverse effect on the environment. Remediation (NZ) Ltd will at all times adopt the best option to prevent any potential for environmental impact relating to discharge and control of storm water to any water body.

OBJ 6.2.1 of the RFWP is *to maintain and enhance the quality of the surface water resources of Taranaki by avoiding, remedying or mitigating the adverse effects of contaminants discharged to land and water from point-sources.*

POL6.2.2 Requires that *discharges of contaminants or water to land or water from point sources should:*

(a) be carried out in a way that avoids, remedies or mitigates significant adverse effects on aquatic ecosystems;

(b) maintain or enhance, after reasonable mixing, water quality of a standard that allows existing community use of that water for contact recreation, and water supply purposes, and maintains or enhances aquatic ecosystems;

(c) be of a quality that ensures that the size or location of the zone required for reasonable mixing does not have a significant adverse effect on community use of fresh water or the life supporting capacity of water and aquatic ecosystems.

OBJ 6.3.1 is *to maintain and enhance the quality of the surface water resources of Taranaki by avoiding, remedying or mitigating the adverse effects of contaminants discharged to water from diffuse sources.*

POL 6.3.1 states that *Land use practices which avoid, remedy or mitigate adverse effects on water quality will be encouraged and promoted including, (f) land management practices, including the discharge of contaminants to land, that avoid or reduce contamination of surface water.*

OBJ 6.3.2 is *To maintain and enhance the riparian margins of surface waterbodies in order to avoid, remedy, or mitigate the adverse effects of activities on water quality, and aquatic and instream habitat.*

The AEE provided has shown that the proposed activities are able to occur in a manner that is consistent with the relevant policies in the RFWP.

Assessment of the activity against the TRC policies for Tangata Whenua, their cultural relationships with land and water are described in the Cultural Impact Assessment (CIA) in **Appendix S**.

8.2.4 Objectives and Policies of the Regional Air Quality Plan for Taranaki

The Regional Air Quality plan for Taranaki (RAQP) has the following relevant policies.

Policy 1.2: Odour:

Ensure that, (to the fullest extent practicable), any discharges to air of odorous contaminants do not cause odours beyond the boundary of the property of the discharger that are offensive or objectionable.

Policy 1.3: Smoke, dust and other particulate matter:

Ensure that any discharge to air of dust, smoke and other particulate matter beyond the boundary of the property, and on the electricity transmission network, does not occur at a volume, concentration, or rate or in a manner that causes or is likely to cause a hazardous, noxious, dangerous, offensive or objectionable effect, including the significant restriction of visibility or the soiling of property, to the extent that the restriction of visibility or the soiling of property causes or is likely to cause the above effects.

The AEE presented shows that the proposed activities are consistent with these policies.

8.3 Section 124 of the RMA

When considering an application affected by section 124 of the RMA the consent authority must have regard to the value of the investment of the existing consent holder. This is detailed in section 7.15.

9. CONCLUSION

Remediation (NZ) has operated the Uruti facility for a number of years and continues to refine and develop their practices onsite. This has continued through processing the application for renewal of consent, as documented by this revised AEE.

The N balance/OVERSEER® modelling undertaken by AECOM has provided valuable information to the applicant and enabled them to make relatively straightforward changes to operations in order to reduce N losses. Modelling of these mitigation measures has shown that they will result in a significant reduction in N losses, as shown by the updated OVERSEER® model in **Appendix AA**.

There have been incidents and concerns raised about specific breaches of consent at the site, and the overall site management practices and these are acknowledged by the applicant. Despite these concerns, the extensive monitoring of the streams, ground water and soils on and downstream of the site have shown that the composting and vermiculture operation is having minimal impact on the environment and those areas where there have been breaches are generally attributable to site management. With the development of and adherence to new and updated site management plans, the likelihood of such breaches reoccurring should be significantly reduced.

Coupled with the instigation of more rigorous site management plans, a review of practices onsite, particularly in relation to Chloride and Nitrogen Management, and a review of the monitoring results, has resulted in significant changes, most of which have been implemented in response to the requests for further information that have been made by TRC in relation to this consent application. These are summarised below;

- Comprehensive site management plans have been developed that cover the full range of activities on the site - from control and documentation of incoming materials to release of final product. Staff training, accountabilities and management now reflects these procedures. These are briefly summarised below:

    - The Integrated Management System Manual (**Appendix C**) is the overarching document that defines the system and processes within it.

    - The Site Practices Plan (**Appendix D)** ensures the operations, environmental and Health and Safety risks associated with the operation of the Site are managed within regulatory rules and consent conditions. It details the composting/vermiculture procedures, management of vectors, firefighting procedures and facilities, management of dust and odour, inspections and community liaison.

    - The Wetland Treatment System Management Plan (**Appendix E1**) specifically addresses management of the Wetland Treatment System onsite.

    - The Leachate and Stormwater Management Plan (**Appendix F1**) sets out how the pond system that treats leachate generated from the compost pile and contaminated stormwater from pads 1 and 3 and the Truck Washdown area is managed, including irrigation to land. This plan in particular addresses how irrigation is managed to avoid overloading, and to ensure there is capacity in the irrigation pond to accommodate peak rainfall events. It sets out how the irrigation model is used onsite.

    - Release of Final Product Management plan (**Appendix G1**) provides the methodology and procedures required to certify compost products produced are suitable for release from the composting area. Products may be used either on site or off site depending on the standard the product meets, and this procedure details this.

- o The Uruti Composting Facility Management Plan (**Appendix H**) documents the 3-tier procedures for responding to results of monitoring data, to improve soil and groundwater quality. (Note: this was prepared prior to the consent applications being lodged as a reuiqrement of the current consent).

- o The Groundwater, Soil and Stream Monitoring Plan (**Appendix I**) documents the steps required to comply with monitoring requirements at the facility.

- o The Landscaping Plan (**Appendix K**) documents the riparian planting, stock exclusion and action plan for these activities.

- o The Environmental Management Plan (**Appendix L**) details the environmental policy at the site, inventory requirements, waste minimization and recycling, monitoring and improvement, spill contingency and incident management practices at the site.

- o The Waste Acceptance Plan (**Appendix M**) documents the consent conditions relating to approved materials, the approved materials list, process for materials not on the accepted list and waste reception protocol.

- o The Site Exit Plan (**Appendix N**) details the protocols for when the site is no longer required. The purpose of this plan is to ensure the site is left in an appropriate condition in the future.

- o The Farm Environmental Management Plan (**Appendix O**) documents the system-wide processes to ensure the operation is consistent with Good Management Practices, focusing on avoiding and mitigating N losses to surface and ground water via leaching, generally from the irrigation blocks.

- Drilling by-products, the key source of Chloride in the system (and also a source of other contaminants including Hydrocarbons and Barium), will cease being accepted after 31 December 2020.

- The total area available to receive irrigation has more than doubled, from 5.3 ha to 13.18 ha, significantly reducing the loading of contaminants via irrigation of effluent. The timing of the development of these areas has been expedited in response to concerns raised.

- Low rate irrigators have been purchased and installed, allowing more flexibility in application of irrigation water to land. This has removed some of the issues that were associated with the previous travelling irrigator.

- Site practices have been improved so that the amount of nutrients entering the irrigation pond is as low as possible – capturing the nutrients instead in the compost.

- More rigorous composting practices are being applied to the pad 3 materials that contain legacy drilling by-products to improve the speed of contaminant breakdown, and ensure this material is able to comply with the necessary criteria for application to land within the site while options for sale of the material offsite continue to be investigated.

- A plan for the sustainable management of the stockpiled pad 3 materials has been developed, so that this material is managed, and in the future, the issue of exposure to drilling related material does not compromise the ability to market compost for sale off site.

- The irrigation pond is now aerated, to reduce nitrogen levels in the pond.

- The routine harvesting of baleage from the irrigation areas is now identified as a key part of site management, to ensure the export of Nitrogen from the site and reduce potential N losses to water.

- Cold air bunds will be improved and enhanced, to further mitigate odour emissions that occur when cold air drainage occurs in inversion conditions. Improved site and compost management will also help ensure odour emissions are avoided.

- Riparian fencing and planting has been a key focus, with a large portion of the banks of the Haehanga Stream now fenced and planted. Perched culverts continue to be addressed.

- A plan has been put in place to investigate a) the need for and b) the integrity of the 'duck pond' on the site, and a condition of consent is proposed which gives the TRC certainty around this process.

- The dam at the top of the site has been completed (with the exception of the spillway) as a result of TRCs concerns that this was taking too long. This dam may provide the opportunity to augment low flows in the Haehanga where necessary, or to dilute the irrigation pond in the future if the duck pond is deemed inappropriate or unnecessary.

Mentioned briefly earlier in this AEE are recent investigations into the potential benefits of installation of a woodchip bioreactor to reduce the levels of nitrogen in the irrigation water before it is applied to land. The sensitivity analysis undertaken in relation to nitrogen losses confirms that any reduction in N in the discharge correlates positively to reduced potential for N losses from the irrigation areas, so this may present an opportunity, though it is still too early to determine whether this will be feasible.

Ultimately, the mitigation proposed is to ensure that breaches of consent that are attributable to poor management do no occur, and that activities are undertaken with as minimal environmental impact as possible. The results of environmental monitoring of soil, surface and groundwater are expected to show improvement from current levels – while noting that even under recent site practices, monitoring shows that the effects on the receiving environment from day to day operation are no more than minor.

As previously discussed in section 5.4, the Uruti facility represents an example of an environmentally sound method for reusing a waste stream as a valuable input for another production process.

The activities that are undertaken by the applicant provide a sustainable means of managing waste streams that, without such facilities, would otherwise be disposed of to landfill. With robust site management, these activities are able to occur with minimal environmental impact. Over the course of this application and in direct response to the concerns and questions raised throughout this process by the public and the TRC, the applicant has acknowledged the need for improvement, and embarked on a process of transforming this site into a quality composting facility.

It is acknowledged that responding to the questions and concerns has taken some time, and the applicant is grateful for the flexibility of all parties in allowing the activities to be fully reviewed, assessed and thoroughly understood in order to identify mitigation strategies that are implementable (and now largely, have actually been implemented), and which will have meaningful benefits.

In summary, this assessment of effects has demonstrated that with the mitigation measures and mitigating factors identified, the effects of the discharges for which consent is sought can be avoided remedied and mitigated to the extent where they are no more than minor and contained to within the site boundaries. Effects on adjoining properties are able to be avoided, remedied and mitigated to the extent that they are no more than minor.

Appendix A Copy of title and a property map.

Appendix B Existing Consents Held

Appendix C Uruti Integrated Management System (IMS)

Appendix D Uruti Site Practices Plan

Appendix E Uruti Wetlands Treatment System Management Plan

-E2 Stormwater Channels

Appendix F **Uruti Leachate & Stormwater Management Plan**

-Irrigation Model

- SWPI Irrigation (Revision A 28 May 2020)

Appendix G Uruti Release of Final Product Protocols

- April 2018 Compost Results

- January 2020 Compost Results

Appendix H Uruti Composting Facility Management Plan – BTW company undated

Appendix I Groundwater Soil & Stream Monitoring Plan

Appendix J Remediation NZ Ltd Organic Composting Protocols (Applies to Vermiculture Processes only)

Appendix K Landscaping Plan

-Riparian Planting Plan

Appendix L Uruti Environmental & Safety Management Plan

Appendix M Uruti Waste Acceptance Plan

Appendix N Uruti Site Reinstatement (Exit) Plan

Appendix O Farm Environmental Management Plan

Appendix P Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand -Ministry for the Environment – August 1999

Appendix Q Plan of RNZ Irrigation Blocks

Appendix R Drilling Mud Sample Results

Appendix S Assessment of Cultural Effects

Appendix T Uruti Process Diagram

Appendix U Haehanga Catchment Preliminary Groundwater Investigation - BTW company June 2015

Appendix V Letter to Neighbours

Appendix W Haehanga-Mimitangiatua confluence test results

Appendix X **X1 Sampling Data - Summaries**

X2 Fish Survey and Biomonitoring Report TRC 2018

Appendix Y AECOM Report-Assessment of Odour Effect

Appendix Z AECOM Report 'Uruti Composting Facility: Nitrogen Balance'

Appendix AA Irrigation Block Nitrogen Analysis – Kay Consulting 2020

Appendix AB **Irrigating High and Low Risk Soils on the RNZ Uruti Site – Kay Consulting 2020**