

Remediation New Zealand Ltd

Uruti composting facility

Monitoring Programme

Annual Report

2021-2022

Technical Report 2022-24



Working with people | caring for Taranaki

Taranaki Regional Council
Private Bag 713
Stratford

ISSN: 1178-1467 (Online)
Document: 3091361 (Word)
Document: 3102464 (PDF)
March 2023

Remediation New Zealand Ltd

Uruti composting facility

Monitoring Programme

Annual Report

2021-2022

Technical Report 2022-24

Remediation New Zealand Ltd

Uruti composting facility

Monitoring Programme

Annual Report

2021-2022

Technical Report 2022-24

Taranaki Regional Council
Private Bag 713
Stratford

ISSN: 1178-1467 (Online)
Document: 3091361 (Word)
Document: 3102464 (PDF)
March 2023

Executive summary

Remediation New Zealand Ltd (the Company) operates a composting facility and worm farm which produces vermicast. It is located on State Highway 3, Mokau Road, Uruti, Taranaki.

During the monitoring period, the Company demonstrated an overall poor level of environmental and administrative performance.

This report for the period July 2021 to June 2022 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the Company's activities.

The Company holds nine resource consents, which include a total of 135 conditions setting out the requirements that the Company must satisfy. The Company holds one consent to allow for discharges to air, and one consent to allow the discharge to land and water. One consent allows the discharge to water and there are six land use consents. In March 2021, the Council held a hearing of applications by the Company for renewal of two consents, for discharges to air and for discharges to land and water. On 26 May 2021 the Hearing Committee released its decision declining the renewal of the two consents. The Company appealed the Council's decision to the Environment Court. A hearing to consider the appeal began just after the end of the year under review (July 2022). The Company is allowed to continue exercising the expired consents while the appeals are being considered. The hearing is likely to continue in calendar year 2023.

The Council's monitoring programme for the year under review included 12 scheduled inspections, 152 water samples collected for physicochemical analysis, one biomonitoring survey of receiving waters, and numerous odour surveys. Because of matters raised during pre-hearing conferencing for the Court appeal, and because of numerous complaints and investigations of potential non-compliance events identified by the Council as the year unfolded, the monitoring (requiring both inspections and sampling) extended considerably beyond that originally planned. The Council's annual monitoring programmes specify that the programme as first scoped may be extended and additional costs recovered where additional Council work is necessitated.

The monitoring showed that operational and site practices are still highly variable, although changes to infrastructure that were made during the year have the potential to bring improvements in administrative and environmental performance. Odour surveys by the Council and the complaints record again indicated there is a need for improvement if non-compliance is to be eliminated. There is the potential for levels of odour offsite, even if they do not reach the threshold of being offensive and objectionable on an acute basis, to cumulatively still have an impact that is unacceptable to the neighbouring community.

Surface water was found to be impacted beyond consent limits, for at least one site and one or more contaminants, on half of the scheduled surveys of the Haehanga Stream. Impacts on the Mimitangiatua awa were measureable but usually not significant in terms of recognised environmental thresholds. Groundwater quality is generally improving in respect of markers of irrigation, from peak levels of some contaminants evident in previous years, and does not give rise to concerns over current concentrations. Soil sampling in the new irrigation area L6 prior to its use found multiple indicators that drilling wastes had been spread or applied in the field, contrary to the consent. While soils in the remaining irrigation areas also show evidence of the re-distribution of contaminants derived from drilling wastes or the treated sawdust (unauthorised) that has been blended with the drilling wastes in the past, levels of contamination are not of concern in terms of recognised soil quality criteria. Irrigation of wastewater during the year led to mass loadings of nitrogen per hectare that were well in excess of those recommended by the Council and the description of N loadings previously provided by RNZ. The rates of application in 2021-2022 raise questions about whether the ability of pasture to take up nitrogen could be surpassed, and the timing and volume of

irrigation events suggest that irrigation is being used as a means to prevent the irrigation pond from overflowing, rather than as a means of utilising pasture uptake for optimal nitrogen capture and treatment.

As in previous years, the monitoring indicated poor management of odour sources and of the maintenance of water quality within the Haehanga Stream, leading to an overall categorisation of administrative and environmental performance as 'poor'. There were five unauthorised incidents recording non-compliance in respect of this consent holder during the period under review, leading to three infringement notices and consideration of further action in respect of the remaining two incidents.

For reference, in the 2021-2022 year, consent holders were found to achieve a high level of environmental performance and compliance for 88% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 10% of the consents, a good level of environmental performance and compliance was achieved.

In terms of overall environmental and compliance performance by the consent holder over the last several years, this report shows that the consent holder's performance continued to be poor in the year under review. In terms of the number of abatement and infringement notices issued to the Company in 2020-2021 and continuing into 2021-2022, Remediation NZ has one of the lowest compliance performances of any consent holder monitored through a site-specific programme in Taranaki.

This report includes recommendations for the 2022-2023 year. As noted above, the Environment Court is considering whether to allow or decline the Company's application for consent to continue to discharge to land, water and air. The Council has prepared an appropriate interim monitoring programme based on the expired consents and the Company's environmental and administrative performance. The Company offered a number of proposals during the Court hearing (which occurred after the end of the period under review) in respect of future changes to its own operational management and site infrastructure, but as these were still prospective they have not been reflected in amendments to the compliance monitoring programme as previously prepared.

Table of contents

		Page
1	Introduction	1
1.1	Compliance monitoring programme reports and the Resource Management Act 1991	1
1.1.1	Introduction	1
1.1.2	Structure of this report	1
1.1.3	The Resource Management Act 1991 and monitoring	1
1.1.4	Evaluation of environmental and administrative performance	2
1.2	Catchment overview	2
1.3	Process description	2
1.4	Resource consents	5
1.5	Monitoring programme	6
1.5.1	Introduction	6
1.5.2	Programme liaison and management	6
1.5.3	Site inspections	7
1.5.4	Chemical sampling	7
1.5.5	Biomonitoring surveys	11
1.5.6	Odour surveys	11
2	Results	12
2.1	Inspections	12
2.2	Water	38
2.2.1	Results of discharge and receiving environment monitoring	38
2.2.1.1	Surface water monitoring locations	38
2.2.2	Presentation and discussion of surface water results	39
2.2.3	Additional monitoring- surface water incidents	57
2.3	Results of receiving environment (surface water) biomonitoring	64
2.4	Groundwater	65
2.4.1	Introduction	65
2.4.2	Results	68
2.4.3	Dissolved metals in groundwater	76
2.4.4	Discussion of groundwater results	76
2.5	Air	82
2.5.1	Results of discharge monitoring	82
2.5.2	Results of receiving environment monitoring	82
2.5.3	Odour incidents	83

2.5.3.1	Company odour monitoring survey	84
2.6	Land and soil	84
2.6.1	Inspections	84
2.6.2	Irrigation wastewater storage IND002044	84
2.6.3	Results of soil monitoring (irrigation areas)	89
2.6.4	Irrigation loading rates	106
2.6.5	Incidents of land and soil contamination	109
2.7	Incidents, investigations, and interventions- summary	110
3	Discussion	114
3.1	Discussion of site performance	114
3.2	Environmental effects of exercise of consents	117
3.3	Evaluation of performance	122
3.4	Recommendations from the 2020-2021 Annual Report	141
3.5	Alterations to monitoring programmes for 2022-2023	142
3.6	Renewal of consents	143
4	Recommendations	144
	Glossary of common terms and abbreviations	145
	Bibliography and references	148
	Appendix I Resource consents held by Remediation New Zealand Ltd	
	Appendix II Categories used to evaluate environmental and administrative performance	

List of tables

Table 1	Resource consents held by the Company	5
Table 2	Monitoring analyte by medium	8
Table 3	Surface water monitoring 8 September 2021	40
Table 4	Surface water monitoring 6 October 2021	42
Table 5	Surface water monitoring 19 October 2021	44
Table 6	Surface water monitoring 20 December 2021	46
Table 7	Surface water monitoring 11 March 2022	48
Table 8	Surface water monitoring 26 May 2022	50
Table 9	Dissolved oxygen concentrations (g/m ³) in the Haehanga Stream.	56
Table 10	Survey of physico-chemical parameters in the Haehanga catchment 11 March 2022	60
Table 11	Survey of physico-chemical parameters in the Haehanga catchment 30 March 2022	62

Table 12	Current biomonitoring sites in the Haehanga Stream catchment and comparable reference site	64
Table 13	GND2188 2021-2022 monitoring	68
Table 14	GND2189 2021-2022 monitoring	69
Table 15	GND2190 2021-2022 monitoring	70
Table 16	GND3007 2021-2022 monitoring	71
Table 17	GND3008 2021-2022 monitoring	72
Table 18	GND3009 2021-2022 monitoring	74
Table 19	GND3010 2021-2022 monitoring	75
Table 20	Dissolved metals in groundwater, 24 November 2021	76
Table 21	IND002044 irrigation pond monitoring 2021-2022	84
Table 22	Irrigation area U1 soil results 2018-2022	90
Table 23	Irrigation area U2 soil monitoring 2018-2022	91
Table 24	Irrigation area U3 soil monitoring 2019-2022	93
Table 25	Irrigation area L1 soil monitoring 2018-2022	95
Table 26	Irrigation area L2 soil monitoring 2018-2021	98
Table 27	Irrigation area L3 soil monitoring 2018-2021	100
Table 28	Irrigation area L4 soil monitoring 2019-2022	102
Table 29	Irrigation area L5 soil monitoring 2020-2022	104
Table 30	Irrigation area L6 soil monitoring 2021	105
Table 31	Summary of nitrogen loadings per irrigation area (as supplied by RNZ. See text). Prospective consent limit 400 kg/ha/yr	107
Table 32	Summary of irrigation data (as supplied by RNZ. See text)	108
Table 33	Incidents, investigations, and interventions summary table	111
Table 34	Summary of performance for consent 5838-2.2	122
Table 35	Summary of performance for consent 5839-2	126
Table 36	Summary of performance for consent 5938-2	127
Table 37	Summary of performance for consent 6212-1	128
Table 38	Summary of performance for consent 10063-1.0	129
Table 39	Summary of performance for consent 10547-1.0	131
Table 40	Summary of performance for consent 10843-1	134
Table 41	Summary of performance for consent 10825-1.0	137
Table 42	Summary of performance for all consents	140
Table 43	Evaluation of environmental performance over the last ten years	141

List of figures

Figure 1	Regional locations of the Company assets Waitara Road, Brixton and Mokau Road, Uruti	3
Figure 2	Site map of operational areas RNZ Uruti	4
Figure 3	Surface water sampling locations RNZ Uruti	10
Figure 4	Sites used for intensive conductivity-based survey on 30 March 2022, and results. Sites 1 and 2 were either side of the 'twin culverts' road access crossing of the Haehanga Stream, beyond the top (north) of the photograph.	61
Figure 5	Conductivity measured at Site HHG000106, April 2002 to April 2018	63
Figure 6	Conductivity measured at Site HHG000106, June 2018 to March 2022	63
Figure 7	Locations of groundwater monitoring wells RNZ Uruti	66
Figure 8	Irrigation areas and stream culverts RNZ Uruti	67
Figure 9	Total ionic sodium concentrations in groundwater 2018-2022	78
Figure 10	Total ammoniacal nitrogen concentrations in groundwater 2011–2022	79
Figure 11	Total nitrate-nitrite concentrations in groundwater 2011–2022	80
Figure 12	Total conductivity concentrations in groundwater 2011–2022	81
Figure 13	Chloride levels in the irrigation retention pond 2011-2022	86
Figure 14	Oxidized nitrogen (nitrate+nitrite) concentrations in the irrigation retention pond 2011-2022	87
Figure 15	Total ammoniacal nitrogen concentrations in the irrigation retention pond 2011-2022	88
Figure 16	Ionised sodium concentrations in the irrigation retention pond 2011-2022	89
Figure 17	Annual nitrogen loadings to irrigation areas (as supplied by RNZ. See text). Prospective consent limit 400 kg/ha/yr	108
Figure 18	Location of sampling points in stockpiled waste heaps near paunch pad and vermiculture beds. The tributary flows right to left, between the stockpiles and the bush	110

List of photos

Photo 1	Windrows on Pad 1. Note the height is greater (4 to 5 m) than the maximum recommended by NZS4454 (~2 m) and stagnant wastewater is present in the proximity of the piles (encircled in red). Photograph taken 01/03/2022	24
Photo 2	Location of seepage into tributary, 20 June 2022	58

1 Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period July 2021 to June 2022 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Remediation NZ Ltd (the Company). The Company operates a composting and vermiculture facility together with wastewater treatment systems situated on State Highway 3 at 1460, Uruti, in the Haehanga sub-catchment of the Mimitangiatua catchment.

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

One of the intents of the *Resource Management Act 1991* (RMA) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the Company's use of water, land and air, and is the 13th annual report by the Council for the Company. The Uruti facility was previously owned by other parties, and there are a further seven reports for earlier activities at the Uruti facility. RNZ also operate or have operated vermiculture and soil conditioner blending and distribution facilities at two sites in Brixton. Up until last year the Council prepared a single report covering all the activities of the Council in the region, but now have separated out the reporting into individual publications.

1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about:

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites through annual programmes;
- the resource consents held by the Company in the Mimitangiatua catchment;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted in the Company's site/catchment.

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

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

Section 4 presents recommendations to be implemented in the 2022-2023 monitoring year.

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

1.1.3 The Resource Management Act 1991 and monitoring

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

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

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Council is recognising the comprehensive meaning of 'effects' in as much as is appropriate for each activity. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with Section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the consent holders, this report also assigns a rating as to each Company's environmental and administrative performance during the period under review. The rating categories are high, good, improvement required and poor for both environmental and administrative performance. The interpretations for these ratings are found in Appendix II.

For reference, in the 2021-2022 year, consent holders were found to achieve a high level of environmental performance and compliance for 88% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 10% of the consents, a good level of environmental performance and compliance was achieved.¹

1.2 Catchment overview

The Haehanga Stream is a small stream, forming a tributary of the much larger Mimitangiatua awa catchment. It runs from south-east to north-west and its confluence. Almost the entire valley is owned by the Company, and consists of steep eroded hillsides, multiple side gullies, and small river flats distributed along its length. The area receives more rainfall than the northern Taranaki coastline to the south-west. Soils are generally poor and highly erodible. Patches of bush and planted trees cover most of the hillsides, with grasses over the remainder and the flats.

1.3 Process description

The Company's operations include composting, quarrying and vermiculture operations at Mokau Road, Uruti, and vermiculture operations at Waitara Road, Brixton. The Waitara Road site also has a processing

¹ The Council has used these compliance grading criteria for more than 18 years. They align closely with the 4 compliance grades in the MfE Best Practice Guidelines for Compliance, Monitoring and Enforcement, 2018

facility which blends and refines the finished products. Compliance at the Waitara Road facility is reported separately.

The Mokau Road, Uruti composting site was established in late 2001, following removal of composting operations from the old Winstone Aggregates quarry site, Manutahi Road, Bell Block (the Company no longer operates at this site). The closure of the composting operations was due to the incompatible nature of the activity with the surrounding rural residential land use, which resulted in unacceptable off-site odour incidents. The vermiculture production facilities have been operating at Waitara Road since 1998.

The wastewater collection and treatment system discharges to the Haehanga Stream.

The current site at Uruti accepts a range of waste streams which include paunch grass, poultry waste, poultry mortalities, greenwaste, and sheep skins. Drilling wastes had been accepted for about 15 years, but acceptance of drilling waste was ceased in January 2021. The acceptable material list is provided in appendix I, consent 5838-2.2. Further materials have been added to the acceptable material list specified in the consent over time and these materials have been agreed between the Company and the Council prior to acceptance. In certain cases, trials have taken place, to add confidence to the treatment of the proposed composting waste stream. The raw materials are converted, via vermiculture and composting, into a marketable biological product intended for use as a fertiliser and or soil conditioner. However, there is also a bulk stockpile of non-marketable material at the site. RNZ is committed to remediating and/or removing the material off Pad 3².

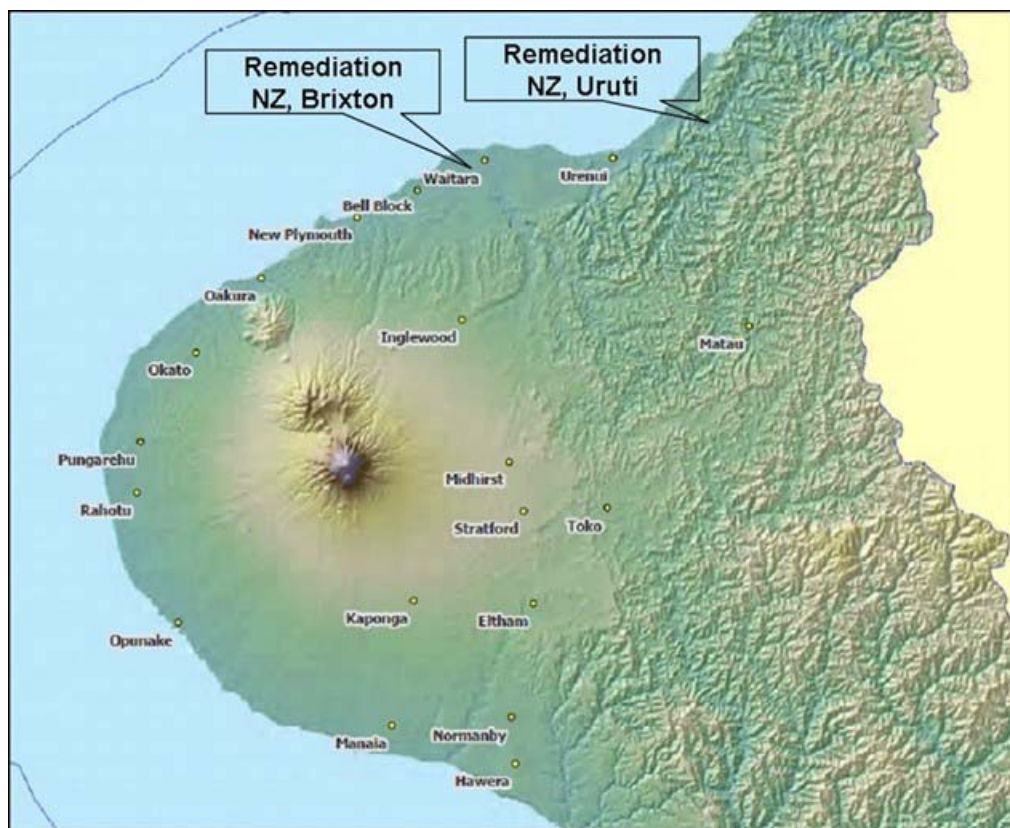


Figure 1 Regional locations of the Company assets Waitara Road, Brixton and Mokau Road, Uruti

The composting operation at the Uruti site generates a significant amount of leachate and contaminated stormwater from three main processing areas. These are the greenwaste composting pad (Pad 1), the paunch pad (pad 2) and the drilling wastes pad (pad 3).

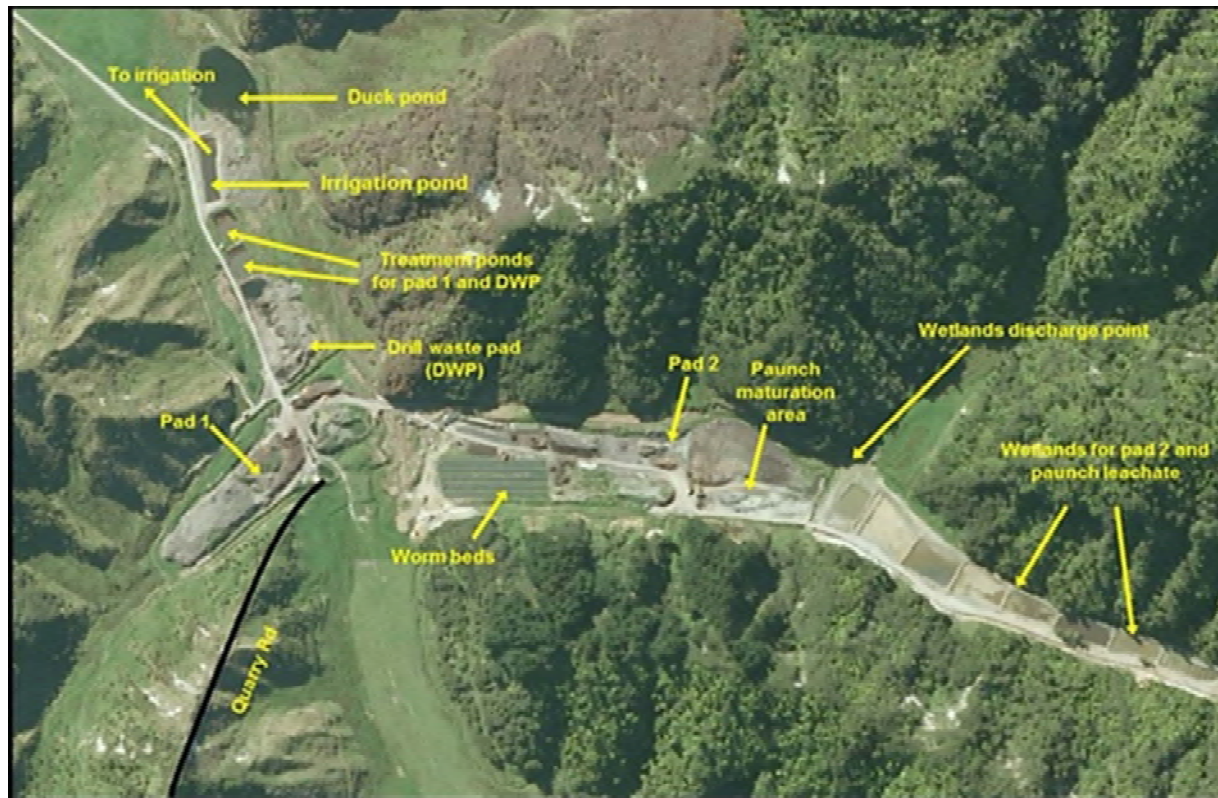


Figure 2 Site map of operational areas RNZ Uruti

Pad 3 holds drilling muds, fluids and cuttings which have been mixed with sawdust and/or other organic material such as poultry waste. This very large pile was turned initially to stimulate the composting process in the initial phase. The Company noted that it had been unable to find a market for the drilling wastes, due to perception, but in any case Council and RNZ monitoring during the year under review has found it to contain toxic contaminants at concentrations that make it unsuitable for uncontrolled distribution. Some of this material has been moved elsewhere on the site.

Any rainfall runoff and leachate that is generated on pad 3, drains into the irrigation storage pond. A series of ponds treat the leachate and stormwater from pad 1 where greenwaste and sheep skin is routinely composted, prior to it flowing into the irrigation storage pond. The treated liquid is then irrigated to cut and carry pasture on a number of irrigation areas. Harvested pasture is taken offsite for sale. During the year under review, the configuration and number of ponds was modified by the Company, in part to reduce the number and intensity of odour sources.

Pad 2, the paunch pad, is where paunch from supplying abattoirs is delivered. Drainage from the pad flows into a single large pond, from where the leachate generated from the paunch is pumped up to the top of a seven-tier constructed wetland. This wetland is planted out with the bulrush raupō which is intended to function as a nitrogen sink for the ammonia-rich paunch leachate. Under dry conditions the water from the bottom pond of the wetland is reticulated back to the top tier of the wetland. Under high flow conditions the wetland discharges the treated stormwater/leachate to a tributary of the Haehanga Stream. During the year, the Company undertook some initial works to reduce the size of the Pad 2 pond, but did not continue with them. The Company has also signaled an intention to re-configure the pad and pond, to eliminate direct discharge to the tributary of the Haehanga Stream, but has not begun any works on the site to this effect, at the time of preparation of this report.

Paunch is routinely fed to the worm beds which are located in this area of the site.

The Company also have a pea gravel quarry within the Uruti site. The quarry has been non-operational this monitoring period.

1.4 Resource consents

The Company holds nine resource consents, the details of which are summarised in the table below. Summaries of the conditions attached to each permit are set out in Section 3.3 of this report.

A summary of the various consent types issued by the Council is included in Appendix I, as are copies of all permits held by the Company during the period under review.

Two consents expired at the end of the 2020-2021 monitoring period. One was renewed (6212-1), while the other (6211-1) has lapsed. As noted above, two other consents have expired (5838-2.2 and 5839-2), but given that the Company applied within RMA timeframes for renewal, it is allowed to continue to operate under the expired consents until the application for renewal is determined. While the Council declined to renew these two consents, an appeal by the Company to the Environment Court means the consents continue to be in effect in the interim.

Table 1 Resource consents held by the Company

Consent number	Purpose	Granted	Review	Expires
<i>Air discharge permit</i>				
5839-2	To discharge emissions into the air, namely odour and dust, from composting operations	May 2010	June 2017	June 2018 Declined May 2021 RNZ continue to exercise (RMA S.124) while Court decision on renewal pending
<i>Discharges of waste to land and water</i>				
5838-2.2	To discharge: 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	August 2015	June 2017	June 2018 Declined May 2021 RNZ continue to exercise (RMA S.124) while Court decision on renewal pending
<i>Land use permits</i>				
5938-2	To use a twin culvert in the Haehanga Stream for vehicle access purposes	September 2015	June 2021	June 2033

Consent number	Purpose	Granted	Review	Expires
6211-1	To realign and divert the Haehanga Stream in the Mimitangiataua catchment for land improvement purposes	Expired 1 June 2021. Now a permitted activity		
6212-2	To erect, place, use and maintain a culvert and associated structures[s] in the bed of the Haehanga Stream in the Mimi catchment for access purposes	Application for renewal received February 2021	-	-
10547-1	To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed	March 2018	June 2021	June 2033
10825-1*	To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes	June 2020	June 2027	June 2039
10843-1*	To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream. Including associated disturbance of the stream bed	June 2020	June 2027	June 2039
<i>Discharge to water</i>				
10063-1	To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream	March 2015	June 2021	June 2027
*denotes consented activities which were developed throughout this monitoring period				

1.5 Monitoring programme

1.5.1 Introduction

Section 35 of the RMA sets obligations upon the Council to gather information, monitor and conduct research on the exercise of resource consents within the Taranaki region. The Council is also required to assess the effects arising from the exercising of these consents and report upon them.

The Council may therefore make and record measurements of physical and chemical parameters, take samples for analysis, carry out surveys and inspections, conduct investigations and seek information from consent holders.

The monitoring programme for the Company site consisted of five primary components.

1.5.2 Programme liaison and management

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

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

1.5.3 Site inspections

The Uruti site was visited 13 times during the monitoring period, excluding additional pro-active surveys for offensive odour outside normal working hours. Further visits were also undertaken during monitoring rounds of groundwater and soil, or as necessitated through complaints, generally received afterhours and concerning allegations of offensive odour (Section 2.5.3).

With regard to consents for the abstraction of or discharge to water, the main points of interest were processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters.

Air inspections focused on site processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the Company were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The Company was obliged to provide monthly records of incoming materials. The neighbourhood was surveyed for environmental effects on both air quality and water quality (Haehanga Stream and Mimitangiatua awa).

1.5.4 Chemical sampling

As the Company holds resource consents specifically related to discharges to land and water, the Council monitors the wastewaters, surface water, groundwater and soil at the Uruti site. The Council undertook sampling within the wastewater systems (to identify environmental loadings) and of the discharges from the site and the water quality upstream and downstream of the discharge point sources and mixing zone.

Surface water analysis

Surface water samples were collected from up to 15 specific monitoring locations on the Haehanga Stream and associated unnamed tributaries (Figure 3). The samples collected were tested for a range of analytes, as identified in Table 2.

The Council assessed these surface water locations six times during the monitoring period. A follow up survey was also undertaken in relation to break-through of a polluted plume of groundwater into a tributary in March 2022, and two separate investigations were undertaken, to ascertain further information on variations in dissolved oxygen levels and on pathogenic micro-organisms in the sub-catchment.

Spot field parameters were collected for field screening purposes. These were collected via a Yellow Springs Instrument (YSI) multi-parameter probe and assessed for pH, dissolved oxygen, conductivity, temperature and oxidation and reduction potential.

Two additional surface water locations were monitored on the Mimitangiatua River, to assess for any influence from the Haehanga Stream.

Groundwater analysis

The Uruti site contains an active groundwater monitoring network, as required by resource consent 5838-2.2. The monitoring well network is comprised of seven wells (Figure 7). The network was monitored quarterly this period and was assessed for the analytes identified in Table 2.

Low-flow sampling is undertaken via a peristaltic pump. Prior to sample collection, Council field staff undertook a well stabilisation procedure. This requires that readings for field parameters (which are assessed through the use of a YSI multiple parameter probe) have stabilised to within 8% over a five minute period, or within three well volumes, prior to the sample being collected.

Soil analysis

Representative soil sampling was undertaken on the site specific irrigation areas (9 areas, Figure 8) to identify any emerging issues that might arise as a direct result of irrigation to these areas. During the period under review, 13.18 ha were initially available for irrigation, with two samples collected from each irrigation area this monitoring period. With the commissioning of L6, the total area available for irrigation was increased to 15.96 ha.

Soil sampling was undertaken by two means. The first was with a soil corer which was inserted to a depth of 350 mm +/- below ground level (bgl), whereby ten soil cores are collected along a transect across an irrigated area. The ten cores are then composited to gain one representative sample. The second method was undertaken through a footstool sampler, which removes a surface plug of 70 mm bgl. In this case 20 plugs are collected and combined to gain one representative composite sample.

The rationale for the additional shallow (7 cm bgl) samples were to ascertain for any major difference between the shallow (70 mm) or deeper (350 mm) core.

The analyses undertaken by the Council in respect of soil are presented in Table 2.

Table 2 Monitoring analyte by medium

Surface Water Analytes	
Calcium	pH
Biochemical Oxygen Demand (BOD)	Chloride
Benzene	Potassium
Toluene	Magnesium
Ethylene	Un-ionised ammonia
Xylene	Ammoniacal nitrogen
Temperature	Nitrite-Nitrate nitrogen
Suspended Solids	Organonitrogen and organophosphorus pesticides screen
Conductivity	Hydrogen sulphide screen (total sulphide , un-ionised hydrogen sulphide)
Total Petroleum Hydrocarbons (TPH) C ₇ -C ₃₆	Methylene blue activated substances (MBAS)
C ₇ -C ₉	Dibutyltin
C ₁₀ -C ₁₄	Tributyltin
C ₁₅ -C ₃₆	Triphenyltin
Discharge Analytes (Irrigation pond WTS discharge)	
Un-ionised ammonia	Acid soluble lead
pH	Dissolved mercury
Conductivity	Dissolved nickel
Total suspended solids	Dissolved zinc
Temperature	Total Kjeldahl Nitrogen (TKN)
Ammoniacal nitrogen	Carbonaceous Biochemical Oxygen Demand
Nitrite-nitrate nitrogen	Total Petroleum Hydrocarbons (TPH) C ₇ -C ₃₆
Total calcium	Benzene
Total magnesium	Toluene
Total potassium	Ethylene
Sodium Absorption Ratio	Xylene (BTEX)
Total sodium	Acid soluble barium

Chloride	Total barium
Total nitrogen	Organonitrogen and organophosphorus pesticides screen
Dissolved arsenic	Hydrogen sulphide screen (total sulphide , un-ionised hydrogen sulphide)
Dissolved barium	Methylene blue activated substances
Dissolved cadmium	Dibutyltin
Dissolved chromium	Tributyltin
Dissolved copper	Triphenyltin
Dissolved lead	
Groundwater Analytes	
Benzene	Un-ionised ammonia
Toluene	Ammoniacal nitrogen
Ethylene	Nitrite-nitrate nitrogen
Xylene	Total Dissolved Salts
Chloride	Temperature
Total Petroleum Hydrocarbon (TPH)	Level
Total calcium	Dissolved barium
Total magnesium	Acid Soluble barium
Total sodium	Organonitrogen and organophosphorus pesticides screen
Soil Analytes	
Calcium	Mercury
Chloride	Zinc
Conductivity	Magnesium
Potassium	Sodium
Moisture factor	Ammoniacal nitrogen
Sodium Absorption Ratio (SAR)	Nitrite-nitrate nitrogen
Arsenic	pH
Cadmium	Total Petroleum Hydrocarbons (TPH)
Chromium	Poly-cyclic aromatic hydrocarbons (PAH)
Copper	BTEX
Lead	Organonitrogen and organophosphorus pesticides screen
Nickel	



Figure 3 Surface water sampling locations RNZ Uruti

1.5.5 Biomonitoring surveys

A biological survey was performed on one occasion in the Haehanga Stream, an associated unnamed tributary, and an offsite reference location, at seven locations this monitoring period. This was undertaken in order to determine whether or not the discharge of treated effluent to land and water, as a process of the exercise of consent, had a detrimental effect on macroinvertebrate and fish communities in the stream. A summary of this survey is provided later in this report in Section 2.3.

1.5.6 Odour surveys

Council staff undertook a number of reactive and proactive surveys to ascertain whether the activities of RNZ were causing offensive odours to be present beyond the site boundary. Surveys were conducted in accordance with the guidance provided by MfE (2016).

2 Results

2.1 Inspections

Consent 5838

To discharge:

- 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.

July 2021

An inspection was undertaken as part of routine compliance monitoring. The site visit also included the surface water sampling run. Sampling sites also included an upstream and downstream sample of the Mimitangiatua awa about its confluence with the Haehanga Stream. At the time of the inspection the weather was cold and dry with a heavy frost throughout the valley. The Haehanga Stream was slightly turbid and flowing at a level that is common for this time of the year. No irrigation was taking place at the time of the inspection. Irrigation had recently taken place on the upper most irrigation area and while an assessment of the irrigated area found that its operation was in compliance with resource consent conditions, RNZ staff were advised that no further irrigation should occur in this area in the near future as the soil appeared to be near its upper limit with regards to being able to uptake further irrigation fluid.

An inspection of the duck pond found that it was full with limited free-board remaining. RNZ were instructed to monitor the pond and to irrigate to land, if required, to ensure that adequate free-board is maintained and that there are no overland discharges from the duck pond into surface water. Approximately 0.5 m free-board was observed within the irrigation pond. The ring drain about the solid drilling mud pad was in place and well defined. A small amount of further work was still required to minimise the ponding within the ring drain, noting that it is significantly better as a result of previous works to address this issue. The waste water treatment ponds were beginning to fill with solids and these would need to be cleaned out to ensure compliance with the management plans - more detailed conversations were taking place with RNZ staff about addressing this area to make it fit for purpose going forward, noting that drilling mud and associated hydrocarbons were no longer accepted at the site. The drop off pit was reasonably full with only egg waste and egg waste mixtures (eggs and dead chickens) being dropped off into the pit. All material that was being accepted to site via the drop-off pit was being composted on the solid drilling mud waste pad.

The composting pad was well defined with a good ring drain in place. The composting windrows were well defined, however it was noted that the wind rows are beginning to increase in size. A good volume of fresh green waste was located on the pad ready to accept material for composting. All worm beds on the site were covered. The paunch pond had approximately 1 m of free-board. The wetland treatment system was full with a low volume discharge exiting the final wetland treatment pond and discharging into the tributary of the Haehanga Stream. Samples and photographs were taken of the discharge from the wetland treatment system. No visual change in colour was noted post reasonable mixing as a result of the wetland discharge.

August 2021

An inspection was undertaken as part of routine compliance monitoring, in dry weather conditions. At the time of the inspection the stream was not elevated above levels expected for the time of year. The inspection found that the site was operating as normal with the majority of material being brought to site restricted to chicken fatalities, sheep skins and greenwaste. The inspection found that no irrigation was being undertaken at the time of the inspection. An inspection of the irrigation fields found that they were

water logged in places and that any further irrigation would need to be carefully managed, utilising specific areas for irrigation. Irrigation rates would need to be light to ensure that there was no ponding/pooling or overland flow. The duck pond was full but contained, and no discharge from the pond was observed. The irrigation pond was reasonably full with approximately 0.5 m of freeboard remaining within the pond. No scums or sheens were noted within the pond. The ring drain about the drilling mud pad was in place and working well. Some ponding was observed within the lower reaches of the ring drain, and RNZ were again instructed to undertake works to further reduce the pooling within the ring drain to ensure that all stormwater from the drilling mud pad is captured and directed to the ring drain, where it is then to flow unobstructed into the irrigation pond without pooling or ponding within the drain itself.

Work was being undertaken on the drop off pit and the treatment ponds adjacent to the solids drilling mud pile. This work had included the removal of material from the drop off pit along with the overdigging of the pit to remove any further contaminants. This material had been disposed of on the solids drilling mud pile. The pit had subsequently been filled in and track rolled. Papa was used to fill the pit, the material being sourced from the site beyond any of the areas utilised for the composting operation. Further works had also been undertaken to remove material from the 2nd and 3rd treatment ponds immediately downstream of the drop off pit. The two larger treatment ponds (4 and 5 - immediately above the irrigation pond) remained operational and no works had been undertaken on these ponds. A bund had been placed across the upper end of the drop off pit / drilling mud pile to ensure that all stormwater from the upper pad including the filled in drop off pit was captured, contained and directed to the irrigation pond.

An inspection of the composting windrows found that the area remained operational with all imported material being processed on the composting pad. The elevated access track created a defined catchment area to ensure that all potentially contaminated stormwater from the composting pad was captured and directed to the irrigation pond. An inspection of the worm beds found that they were all covered. The paunch pond was found to have approximately 1 m free board within the pond. The wetland treatment system had a small volume discharge entering the tributary. No in-stream foams or scums were observed as a result of the discharge, and visual inspection found no change in clarity of the receiving environment post reasonable mixing. Significant work was still required to be undertaken to ensure with the recently issued Abatement Notice requiring the removal of chemically treated sawdust from the facility.

8 September 2021

Inspection of the Uruti composting facility was undertaken as part of routine compliance monitoring. The inspection included the surface water sampling round. At the time of inspection the weather was 9 degrees, overcast with total cloud cover and occasional rain. Rainfall in the days preceding the inspection resulted in flow within the Haehanga Stream being elevated and turbid. The ground surface was wet with puddles forming. The inspection of the site found that no irrigation was taking place on the day of the inspection, with some irrigation having occurred the previous day on the uppermost irrigation area. An inspection of the irrigation pond found that there was approximately 1 m free board within it. It was noted that the pond had a light odour but was free of any scums sheens or other floating material. RNZ had recently employed a new worker to manage the irrigation pond and associated fields to ensure that they were meeting their obligations under the RMA and associated resource consents.

A water meter had recently been installed within the irrigation pumping system so that pumped volumes of irrigation fluid could be better measured and recorded. This information in conjunction with the sampling of the irrigation pond will assist in obtaining a more accurate measure of loadings on specific irrigation areas. An inspection of the ring drain about the drilling mud pad found that it was collecting all stormwater from the drilling mud pad area and directing it to the irrigation pond. Discussions were held regarding some further works to further reduce the amount of ponding within the ring drain. Works to contour the ring drain should result in ensuring that stormwater is discharged into the irrigation pond and not left collected in the lower reaches of the ring drain. It was noted that the truck wash pond was due for another cleanout. It was also found that material had been moved onto the upper section of the drilling mud pad. This material was a composting windrow of organic material and pond cleanings that had been located on

the upper section of the composting pad adjacent to the sawdust pile. This windrow was aged material that included industrial waste (from the pond cleanings) therefore it had been relocated to sit with the rest of the contaminated material in a single location.

Compost screening equipment was brought to site during the inspection. This was placed upon the upper section of the composting pad and will be used to screen approximately 2 windrows, to prepare the product for sale. Chickens and eggs were deposited on site at the time of the inspection, and this material was promptly blended with greenwaste and incorporated into the lowermost composting windrow. The sawdust pile located at the upper end of the composting pad had been covered with polythene to ensure that contact with stormwater is reduced. A contractor was establishing equipment adjacent to the sawdust pile. The contractor was to bail the sawdust in plastic wrapping so that it could be stored onsite while an appropriate disposal method is found for the contaminated material.

Inspection of the irrigation fields found that they were all too wet for irrigation to take place on the site. It was noted, however that the irrigation area opposite the duck pond was now operational with pod irrigators established down the centre of the irrigation area. RNZ were also sourcing irrigation equipment to establish the lower most irrigation field that had been created in the previous summer adjacent to the site office.

An inspection of the paunch pad found that there was approx. 0.8 m free board within the pond. Work was being undertaken to reduce the footprint of the pad. This would greatly reduce the volume of stormwater collected within the pad. Consequently there would be less pumping to the wetland treatment system and therefore, generally an increase of retention time within the treatment system. RNZ were instructed to ensure that uncontaminated storm water runoff was unable to enter the paunch pad, so that only the rain that falls into the pond is required to be pumped through the wetland treatment system. An inspection of the wetland treatment system found a reasonable volume was discharging into the tributary. Samples were taken. It was observed that the discharge was a clear but light tannin colour discharging into a very turbid stream.

RNZ were instructed to inspect all sediment ponds onsite to ensure that they are compliant with special condition 5 of the resource consent, and to undertake maintenance work on the newly installed culvert near the site office, after the headwall was damaged in a recent flood.

29 September 2021

An inspection was undertaken as part of routine compliance monitoring, during fine weather conditions. At the time of the inspection the streams on the property were at normal flow and flowing freely. Inspection of the irrigation areas found that areas L1 and L4 were wet underfoot, but there was no ponding/pooling or runoff from these areas. The northern portion of L4 was dry. RNZ was advised that no further irrigation was to take place on these areas until the ground was in a condition to accept more fluid. Irrigation was taking place across L3 and L5 areas during the inspection, via irrigation pods. The pods were applying the liquid in an even manner across the areas. Areas U2 and U3 were also damp underfoot. It was advised that the irrigation areas should be assessed prior to any application of fluid and that any application be for a limited duration to ensure that no areas are subjected to any over application of fluid. Pipework is currently being installed adjacent to the access track to bring L6 on line as an additional application area. An inspection of the drains in place around L4, L5 and U3 found that they were all open and free flowing allowing all uncontaminated surface water from outside the irrigation areas to be intercepted and directed away from the irrigation areas.

The irrigation pond had approximately 0.5 m free board. The ring drain capturing all stormwater from the drilling wastes was flowing to the irrigation pond. No further product from off site was being put on the drilling mud pad. It was expected that some further solid material would be placed on the pad from maintenance of potentially contaminated areas such as de-sludging of ponds including the truck wash area. During the inspection a screen was in operation on the composting pad. Work was being undertaken with

the screen to process two composting windrows to prepare the material for sale off site. 2.5 windrows will remain onsite for further processing.

The large majority of the contaminated sawdust had been bailed into wrapped bails and stored onsite. Some further sawdust was yet to be processed into bails, however this material has been covered to prevent it contaminating stormwater during rainfall events, in the interim. The bailing contractors were planning on returning to site in the coming week to complete the bailing works. An inspection of the worm beds on site found that they were all covered. The paunch pond had approximately 1m of free board within the pad area. Works were planned in the summer months to reduce the footprint of the paunch pond thus reducing the stormwater catchment area and in turn reducing the volume of stormwater to be pumped through the wetland treatment system. An inspection of the wetland treatment system found that no pumping was taking place at the time of inspection. The final wetland was discharging into the tributary at a rate of approximately 1 L per five seconds. The discharge was a light tannin colour and on visual inspection there was no change in the clarity of the receiving environment post the mixing zone.

19 October 2021

The inspection was undertaken to proactively assess compliance with resource consent conditions. The weather at the time was fine but overcast with total cloud cover. The Haehanga Stream was only slightly elevated at the time of the inspection, as a result of rainfall in the previous 48 hrs. Surface water samples were taken throughout the catchment and within the Mimitangiatua Awa during the inspection.

At the time of the inspection no irrigation was taking place. Mown grass from irrigation areas L6 and L2 had been bailed and wrapped to be removed from site. Long grass was observed across L4, L2, L3, U2 and U3, which would likely be harvested and bailed in the near future. An inspection of the irrigation fields found that U2 and U3 were very wet and not suitable for irrigation. The wetness of U3 might have been a result of the water pooling within the drain on the upper side of U3 and affecting the shallow ground water flows about U3. The irrigation pond had approximately 0.5 m free board.

A discussion was held with RNZ staff with regards to infilling one of the treatment ponds. They were directed to empty the pond of all contaminants. Soil samples would then be taken to assess the level of residual contamination before Council approval could be given to fill in the pond. This process would also apply to the final treatment pond when that is filled in. An inspection of the solid drilling mud pile found that the ring drain was in place and free flowing. The northern half of the solids pile had been grassed and a good cover had resulted. Seeding of the southern half of the pile was still an outstanding requirement. The composting pad was clean and tidy, however there was some standing water within the catchment. RNZ advised that plans were being made to resolve the issue. Composting windrows were being turned during the inspection. A light northerly wind was blowing, resulting in the odour dissipating up the valley towards irrigation area U1 and U2, and away from the neighbourhood.

Contaminated sawdust on site had been bailed and contained. These bails were currently stored onsite. Some sawdust remained unballed, however RNZ had tested this material and advised that it was free of contamination. RNZ were asked to provide the Council with the analysis results, to ensure that the material does not need to be addressed. All worm beds were covered on site. The wetland treatment system was full and discharging. Samples were taken of the discharge and the receiving environment to assess compliance with resource consent conditions.

1 December 2021

No irrigation activities were taking place during the inspection. The irrigation pond was found to have approximately 1 m free-board. An inspection of Pad 3 was undertaken and it was found that all stormwater from the pad was being collected for direction to the irrigation pond via a ringdrain. The Council officer noted the ringdrain needed to be cleaned out and re-contoured to ensure that all stormwater can flow freely down the ring drain and into the irrigation pond without ponding or pooling within the drain itself. Also, a bund was required to be reinstated at the top end of Pad 3 to prevent clean stormwater from

entering the composting area and the stormwater treatment and disposal system. A riser had been installed and improved piping had been placed beneath the site access track to better receive and direct stormwater and washwater from Pad 3 and the truckwash pond into the pond immediately prior to the irrigation pond.

An inspection of the various irrigation fields found that L6 was not yet operational. L1 was covered in knee-high grass and the soil beneath was found to be moist but not sodden. The northern third of L4 was found to be not suitable for irrigation, while the eastern portion was dry and able to receive further liquid waste. L2 and L3 had some stormwater ponding from recent rain. This had ponded in the low point within the L2 irrigation area. L5, U2 and U3 were all damp underfoot as a result of recent rain and were not suitable for irrigation at that time.

An inspection of the paunch pond and associated wormbeds found that the wormbeds had been fed and were being re-covered at the time of the inspection. The paunch pond was well pumped down with approximately 1-1.5 m of freeboard. The wetland system was discharging a tea-coloured discharge into the tributary, resulting in the slight discoloration of the receiving environment within approximately 10 m of the discharge. However this discolouration cleared up with no change in clarity noted post the mixing zone.

20 December 2021

Inspection was undertaken as part of routine compliance monitoring. The weather was fine, following significant rainfall the previous week. Surface water sampling was undertaken during the inspection. The inspection found that the Haehanga Stream was slightly turbid throughout the catchment and flow was slightly elevated.

Works have been undertaken to re-contour the ring drain about the drilling mud pad, to ensure that the runoff flowed freely to the irrigation pond and did not pool or pond within the drain, where it could soak to land or give rise to odour. The drilling mud pile had been grass seeded. Further works are yet to be undertaken to remove further material from the wastewater pond wall before the Council could allow it to be filled in. A bund had been put in place about the upper end of the drilling mud pad to divert clean stormwater from entering the contaminated stormwater catchment. The irrigation pond was full, with approximately 0.5 m free board. This was expected, due to the consistent rainfall the previous week meaning that irrigation was unable to be carried out on the property. No irrigation was taking place at the time of the inspection as the paddocks would benefit from further drying time. All irrigation areas had a thick crop of grass on them and it was likely that they would be cut for hay once conditions allow.

The composting pad was in a tidy state. Works were planned to lift the pad level at the lower end to prevent the ponding issue about the drop-off area. This was planned to be undertaken in December, however the wet weather had delayed this work which would now be completed in January. In the meantime RNZ were removing the pooled stormwater with a honey wagon and discharging it into the truck wash pond. This was being undertaken to minimise potential odour emissions from the pooled water. All wormbeds on the property were covered. An inspection of the paunch pond found that there was approximately 0.5 - 0.75 m free board within the pond. No pumping was taking place into the wetland treatment system at the time of the inspection. The wetland treatment system was discharging at the time of the inspection and samples were taken to assess compliance with resource consent conditions.

26 January 2022

The inspection was undertaken as routine compliance monitoring. The weather was dry following an extended dry period. The inspection found that all streams and tributaries on the property were in low flow state with only trickle flows noted on the streams. The inspection found that irrigation area L6 had recently been harvested for hay and had not yet used for wastewater irrigation. Spray pods were established on L3, L4, L1 and L5, all of which had recently been harvested for hay. The irrigation pond had been recently pumped out and the irrigation pond and settling pond were both empty of liquid material at the time of inspection. Therefore no aeration was taking place within the irrigation pond and no irrigation was taking

place. An inspection of the irrigation fields found that they were dry, with the soil being firm underfoot. Work was being undertaken to de-sludge the irrigation pond with the sludge being removed from the irrigation pond and placed into the settling pond. From here the material was being placed within a bunded area (greenwaste was used as bund) to allow it to dewater further before being placed onto the drilling mud solids pile. All the activity was taking place within the bunded area of the drilling mud pad. The bunds about the drilling mud pad were all in good order to ensure that all contaminated stormwater was captured and directed to the irrigation pond.

An inspection of the truck wash pond found that the upper reaches of the pond had been infilled with papa since the previous inspection. This had reduced the surface area of the pond. The pond had also been cleaned out, with all material placed upon the drilling mud pad. All material on the composting pad was in defined windrows except the fresh product recently delivered to site. It was noted that work was still required to avoid water pooling within the pad. As the material was deposited into the composting pad, some was spilling into and accumulating within the ring drain. RNZ were directed to ensure that the ring drain was cleared by the end of each work day to ensure that all stormwater and leachate was able to flow freely through to the irrigation pond without obstruction.

The paunch pond was largely empty of liquid, with no pumping to the wetland treatment system taking place. The level of liquid in the final pond within the wetland treatment system was approximately 30cm below the discharge pipe to the tributary. Water from the final wetland pond was being pumped back up and through the wetland treatment system to keep it wet and thus maintain the health of the system.

February 2022

A site inspection was undertaken with Ngati Mutunga at the RNZ- Uruti facility. The purpose of the inspection was to retrieve nets that had been set at 4 locations throughout the catchment. The intent was to provide information upon which to assess the fish life throughout the catchment. The inspection found that the stream was very low and not continuous in flow with a number of disconnected pools throughout the stream. Parts of the stream were dry. No odours were detected off site at the time of inspection.

11 March 2022

The stream was in low flow at the time of inspection.

At the time of the inspection the irrigation fields had been mown and the cuttings bail-wrapped for removal from site. The irrigation fields were dry and the irrigation records showed that irrigation from the irrigation ponds onto the irrigation fields had last taken place on 8 February 2022. This had been a 4 hour irrigation run. The irrigation pond was full with approximately 0.5 m free-board remaining. The irrigation pods were being redeployed on the irrigation areas, and the intention was to recommence irrigating activities later that day.

No further product had been placed upon the drilling mud pad. The bottom half of the pad had good grass cover, but seeding of the upper half of the drilling mud pad stockpile was needed to be undertaken, following the addition of material to the pile as a result of desludging the irrigation pond and settling pond (which is prior to the irrigation pond). While the southern (higher) end of the pile on Pad 3 was well-bunded, the Council directed RNZ to reconstruct the bunds at the points of entrance to this area from the site access track, as it is unlikely that access to these areas would be required in future on a regular basis given that the pad is no longer used for operational purposes.

The composting pad was a busy operational area with raw materials being brought to site and also screened compost being loaded out for removal from the property. According to the site management plan, all product is to be stored within the pad areas from which storm water is contained and directed to the irrigation pond. The Council officer noted that some raw materials (greenwaste and bark) had been stored for a short time period on the concrete pad next to the composting pad. This area needs to be kept clean and clear, to ensure compliance with the site management plan. All fresh material brought to site, other than that mentioned above, was being deposited directly onto the composting pad where it was

being mixed with greenwaste and added to the composting process. Once screening of mature compost was complete the intention was to turn the remaining windrows and move them further up the pad. With the volume of product currently on site the full extent of the composting pad was being used.

An inspection of the worm beds found that they were all covered. At the time of the inspection, work was underway to infill the paunch pad pond to reduce the overall footprint of the pad. This would assist in reducing the risk of passive odour generation, and also reducing the stormwater footprint for the area and thus reducing the volume of stormwater that would need to be pumped to the wetland treatment system for treatment before being discharged into the stream. An inspection of the wetland treatment system found that it was full but not discharging at the time of the inspection. A sample was taken from within the final treatment pond to assess the likelihood of compliance with resource consent conditions should a discharge occur.

12 April 2022

An inspection was undertaken as part of routine compliance monitoring. The inspection found that the site was in full operation. No works had been undertaken about the drilling mud pad, and RNZ was asked to increase the bund along the uppermost vehicle access point to ensure all potentially contaminated stormwater was contained and directed to the irrigation pond. The irrigation pond was reasonably full with approximately 50 cm free-board. Irrigation was taking place on the irrigation field adjacent to the irrigation pond (across the stream). Irrigation had also occurred recently on the uppermost irrigation field. An inspection of the uppermost irrigation field found that while it was compliant with consent conditions there was a concern that this area is prone to run-off due to the limited ability of the soil on this area to retain the irrigated liquid. This was discussed with RNZ staff and they were asked to monitor this area frequently to gain a good understanding of the ability of the area to accept irrigation liquid with regards to both frequency and volume applied at any one time.

Works were being undertaken on the composting pad to move the mature compost to the upper most section of the pad to create more room to turn the remaining windrows within the pad. This had resulted in the full pad again being used for the composting operation. Only acceptable product was observed on site. This material was being covered promptly to reduce odours. The truck wash pond was operational on site. Consideration was being given to changing the truck wash facilities in order to reduce the volume of standing water on the site. A slight discharge was observed from the wetland treatment system, however no pumping into the system was taking place at the time of the inspection.

26 May 2022

An inspection of the composting facility was undertaken as part of routine compliance monitoring. This inspection was undertaken along with a full surface water sampling run. An inspection of the facility found that normal operations were taking place. The irrigation pond was full with approximately 0.5 m free board. No irrigation activities were taking place. The lower-most irrigation field (adjacent to the site security gate) was now operational and has now been used. Staff on site were applying wastewater at a light rate to understand the nature and dynamics of the new area in relation to its ability to accept irrigation fluid in compliance with consent conditions.

The settling pond was full. Works were being undertaken to lift the lowermost section of the composting pad. When completed this would ensure that all stormwater drains quickly away from the pad and is not left to pool about the composting windrows. This should reduce passive odour sources and groundwater contamination, and might also assist to reduce the contaminant levels within the wastewater as all stormwater will be quickly directed away from the composting area rather than pooling around the base of the windrows. Mature compost had been stored on the upper portion of the composting pad and also adjacent to the paunch pond. Both heaps were covered to prevent interaction with rainwater. No further material had been added to the drilling mud pad, however it was intended that a portion that had previously been removed for testing was to be returned to the stockpile.

Preparations were being made to upgrade and reduce the size of the truck wash pad. This would include the removal of the two truck wash ponds, the installation of a concrete sand trap/collection bay, and the laying of subsurface piping under the access track through to the settling pond.

All worm beds were covered on site. An inspection of the paunch pond found that there was ample free board. The wetland treatment system was discharging into the tributary at the time of inspection at a rate of approximately 1L per seven seconds. This was a light brown/tannin colour. Samples were taken of the discharge and receiving environment to assess compliance with resource consent conditions.

RNZ were instructed to continue to monitor all surface drains about the irrigation areas to ensure that they were free of blockages and flowing freely, with winter approaching.

20 June 2022

An inspection was undertaken with Gary Bedford (Council) and David Gibson (RNZ). The inspection noted that the irrigation pond was full with approximately 0.5 m of free board remaining. No irrigation was being undertaken. Irrigation activities were planned to recommence later in the day. The inspection found that improved bunding had been placed at the vehicle entrances to the drilling mud pad as requested. Work was also being undertaken to decommission the truck wash system and replace with a more appropriately designed and scaled system which is suitable for the current site operations.

The composting pad was full of product with no further product being accepted at the site until such time as appropriate space became available. All stormwater from the composting pad was being collected and directed to the settling pond. The worm beds on site were covered. The paunch pond was reasonably full with stormwater, with approximately 0.5 m free board remaining. It was noted that a small quantity of a tea coloured discharge was entering the tributary of the Haehanga Stream from the final pond within the wetland treatment system. No pumping into the wetland treatment system was taking place at the time of the inspection. All irrigation fields were operational with the lowermost field coming on line recently. It was noted that the upper most field was sodden as a result of recent rain and was not suitable for irrigation.

Consent 5839

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

July 2021

Inspection was undertaken as part of routine compliance monitoring. At the time of inspection the weather conditions were fine and still. The road surface was dry and there had been no recent rain. There was a heavy frost throughout the valley and the air temperature was 1 degree. Low fog was present within the valley, however above the fog an estimated cloud cover of 1/6th sky coverage was observed. Drainage of cold air throughout the valley was noted, with the air mass travelling in a south-westerly direction down the Mimitangiatua Valley. Smoke was observed discharging from an indoor fire at the residence opposite the composting facility. This smoke was bending strongly down the valley in line with the cold air drainage conditions that were observed. An odour survey was undertaken to the South of the SH3 bridge over the Haehanga Stream. A composting odour was detected at this location and it was found to range in strength from 1-2 (distinct to noticeable). A second odour survey was undertaken at the site entrance and while the same type of odour was detected it was found to be less strong, ranging between 0 and 2 with strength mainly sitting between 0-1. An inspection of the site found that only acceptable material was being brought to site. Fresh green waste was in place ready to mix with other waste such as chickens and sheep skins. The composting windrows were well defined, however it was noted that they are slowly increasing in size. Odours were largely limited to the first 2-3 composting windrows.

An inspection of the drilling mud pad found that some material was still being placed on the solid drilling mud pad/composting area. An RNZ staff member advised that the use of the solids drilling mud pile was

something which would cease in the near future. The treatment ponds and drop off pit were full and were in need of being de-sludged. This was to be discussed further. The irrigation pond was found to be emitting limited odour. The aerator was in place but not in operation. No hydrocarbon sheen was observed on the irrigation pond. The 2 deodorisers are still in use on the property, both being located and operated at the site office. The deodorisers had been operating overnight during the cold air drainage conditions. RNZ staff advised they undertake a weather forecasting process to ensure that potential cold air drainage conditions are identified and that appropriate actions can be taken to minimise the discharge of odours from the facility during these times.

August 2021

Inspection was undertaken as part of routine compliance monitoring. Upon arrival at the site the air temperature was approximately 5 degrees. Weather conditions were dry with a heavy dew and no cloud cover. Light cold air drainage conditions existed at the site. An odour survey at the property boundary on Mokau Road found that odour was detected. This odour was deemed to be between 0 and 2 (No odour, to noticeable) on the odour intensity scale. The odour extended from the metal pit south of the road bridge up to the site entrance. These observations were undertaken following an odour complaint for the site. When the site was subsequently visited at 1100 hrs the cold air drainage conditions had reduced and no odour was noted beyond the property boundary. All odours were deemed to be compliant with resource consent conditions. An inspection of the site found that the deodorisers were not in operation at the site. The larger of the two deodorisers had been removed from site that morning so that works could be undertaken on the machine to automate it so that it can be turned on and off remotely. A slight sulphur odour was noted about the irrigation pond. The smaller of the two aerators were installed within the irrigation pond, however this was not being operated during the inspection. The larger aerator on site was yet to be installed within the irrigation pond. A slight hydrocarbon odour was noted about the initial two treatment ponds adjacent to the drilling mud solids pile. Work was being undertaken to clean these two smaller ponds out and this work had resulted in the hydrocarbon type odour being released from the treatment ponds. The larger two treatment ponds immediately above the irrigation pond remain undisturbed. All material from the cleaned out ponds was being placed on the solids drilling mud pile (Pad 3). With the solid drilling mud pile no longer accepting material from off-site, it was noted that the odours about the upper end of the pile (where new product was previously added) had reduced greatly and was only slightly noticeable. This is due to no new material being added to the pile to commence the composting process.

All composting material brought to site was being deposited on the composting pad. Green waste was being mixed in with the fresh product as it arrived on site. An inspection in this area detected odours especially about the initial 2-3 windrows. The more mature wind rows on the upper area of the pad were found to produce limited odours. RNZ were directed to ensure that any stormwater flowed off the composting pad and was not pooling or ponding about the windrows. The placements of covers over the initial 2 wind rows on the composting pad was being investigated by the Company to assist in the reduction of odours being emitted from the facility.

8 September 2021

Inspection was undertaken as part of routine compliance monitoring, in overcast weather conditions with occasional light rain. Rain had fallen the previous day and as a result the ground surfaces were wet with puddles formed. The Haehanga Stream was elevated and turbid. The air temperature was 9 degrees at the commencement of the inspection with complete cloud cover. An odour survey was undertaken at the site boundary with SH3. No odours were detected. No odours were detected at the site office nor at the twin culverts. A slight odour was noted about the irrigation pond and at the upper end of the drilling mud pad, where some product had recently been moved from the composting pad onto the upper end of the drilling mud pad. Light odour was also noted about the composting windrows, however this odour was moving up the valley on a light wind. It was noticeable approximately 100 m upwind from the composting pad, however was not able to be detected further up the valley. Very light odours could also be detected within

the immediate vicinity of the paunch pad (pad 2). No irrigation was taking place at the time of the inspection and no aeration of the irrigation pond was taking place. The smaller aerator remained within the irrigation pond, however RNZ staff advised that with the arrival on site of a recently purchased generator, the larger aerator would be installed within the irrigation pond, with the smaller aerator being moved from its current location within the irrigation pond and placed within the final treatment pond which discharges into the irrigation pond.

A change of site manager was noted, and as part of this role, the temperatures and oxygen levels of the composting windrows were now being monitored to ensure the composting performance of these rows was satisfactory. RNZ also advised that the covers to the composting windrows were still to be ordered. Some further works had occurred on site since the previous inspection. This included the decommissioning of the small 2nd pond within the treatment system (the first pond below the drilling mud drop off pit that was decommissioned earlier). The removal of both ponds is likely to assist in the reduction of passive odours being emitted from the facility.

29 September 2021

An inspection of the RNZ- Uruti composting facility was undertaken as part of routine compliance monitoring. At the time of the inspection the air temperature was 5 degrees. There was a heavy dew, however the road surface and gravel entrance to the site was dry. There was approximately one-third cloud cover with very still air conditions. A very weak cold air drainage air flow could be detected at State Highway 3. Both deodorisers were operating at the time of the inspection. These devices were located at the site office and had been operating since approximately 0630 hrs that morning. The devices were providing a good coverage across the valley adjacent to the site office. An odour survey was undertaken to the south of the state highway bridge across the Haehanga Stream. No odour was detected in this area. A second odour survey was undertaken at the site entrance. A light composting odour was detected. This odour was consistent, but light in intensity for the first half of the odour survey. The odour did decrease toward the end of the survey to become undetectable. This was considered likely due to the increase in temperature and the cold air drainage conditions stopping as the day progressed.

An inspection on site found that all composting was being undertaken on site on the composting pad. There were four full windrows and a partly established (new) windrow on the composting pad. Screening equipment had been imported onto the site and was being operated on the composting pad to screen and process compost from the pad in preparation for sale off site. Two of the mature windrows were being processed through the screen and upon completion would leave 2.5 windrows on the pad. This process was likely to be the cause of the detectable odour at the site boundary. This operation was generating a sweet composting type odour within the immediate vicinity of the operations. A slight sulphur type smell could also be detected about the immediate vicinity of the irrigation pond. A small aerator was in operation on the pond. A new generator had been delivered to site and it was to be installed so that the larger aerator could be used within the irrigation pond. It was then planned to use the smaller aerator within the final treatment pond (ahead of the irrigation pond). All worm beds on the site were covered. Irrigation activities were taking place on the site at the time of inspection and no odours were detected in association with the application of stormwater to land.

19 October 2021

Inspection undertaken in accordance with routine compliance monitoring. At the time of the inspection the weather was fine but overcast with total cloud cover. The road surface was dry with a light dew observed on the grass. Air temperature at the time of the odour survey was 15 degrees. The air was still during the inspection, however a light northerly developed later in the day. An odour survey was undertaken at two locations along Mokau Road, at the metal pit near Haehanga Bridge and at the site entrance, and no odours were detected. Later in the day it was noted that an odour on the site could be detected, as a result of turning the composting windrows. This odour was noted across the U1 and U2 irrigation fields. On site, it was noted that all the wormbeds were covered. The irrigation pond was being aerated, and no odours were

detected about the irrigation pond. The new larger aerator had been installed within the irrigation pond. The smaller aerator had been moved from the irrigation pond into the final treatment pond. At the time of the inspection the larger aerator was operating, however the smaller aerator was not running. Readings of the DO were taken from the pond and both readings were below 1 gm/m^3 , which meant there was potential for unpleasant odours due to partially anaerobic conditions. No irrigation was taking place during the inspection. The only source of significant odour detected on site at the time of the inspection was from the turning and screening activity taking place on the composting pad. Bark material had been imported onto site. This material was to be spread over the freshest two composting windrows to act as a biofilter in an attempt to reduce odour emissions from the windrows. Two deodorisers remain on site. However they were not operating onsite at the time of the inspection.

1 December 2021

The inspection was undertaken in fine, dry, and moderately warm weather conditions with a still to very light easterly breeze.

An odour survey was undertaken west of the Haehanga Stream. No odour was detected at this location. A second off-site odour survey was undertaken at the site entrance. No odour was detected about this location. No odours were noted about the site office or at the twin culverts on site. Neither of the deodorisers were in operation at the time of the inspection. Two aerators were in operation at the facility. One aerator was operational within the irrigation pond, with the second (smaller) aerator being operated within the final pond prior to the irrigation pond. RNZ had a dissolved oxygen (DO) meter in the irrigation pond within the vicinity of the aerator and adjacent to the pump/generator shed. This meter was reading a DO level of 7.90 ppm within the irrigation pond, indicating good aeration (and hence restriction of odour generation). No odours were detected being emitted from the irrigation pond. However a sulphur-type odour was detected within the immediate vicinity of the final treatment pond.

A further inspection on site found that no detectable odours were being emitted from the solids pile on pad 3. Some odours were noted about Pad 2 (paunch pad), especially being emitted from the newest composting pile. Some standing water was observed on Pad 2 and the RNZ staff member advised their intention to ensure that all the standing water issues on pad 2 are resolved within the immediate future. The truck wash pond was beginning to be filled with solids, and RNZ was advised to look at cleaning this pond out as it could become a source of odour in the future.

The worm beds had been recently fed and staff were onsite re-covering the beds at the time of the inspection. Some light odours were associated with this activity, however these odours were only noted within the immediate vicinity of the worm beds.

20 December 2021

An inspection undertaken as part of routine compliance monitoring. The inspection was undertaken in fine weather conditions following significant rainfall the previous week. At the time of inspection the air temperature was 18 degrees with overcast conditions and total cloud cover. The ground surface was dry with no dew on the pasture. There were calm atmospheric conditions with no detectable wind at the commencement of the inspection, however during the inspection a north-westerly wind developed.

Odour surveys were undertaken at the site entrance and on the western side of the Haehanga Stream. No odours were detected. No odour was detected about the site office or at the twin culverts. An inspection of the irrigation ponds found that aerators were operating in both the irrigation pond and the settling pond prior to the irrigation pond. No odours were detected about the ponds. A DO meter within the irrigation pond was reading a DO level of 3.05 ppm. RNZ advised the inspecting officer that the aerator within the irrigation pond had been operating continuously.

No further material had been added to the drilling mud pile and the upper end of the pile had now been seeded, with grass beginning to grow. The lower portion of the drilling mud pile was already grassed. A deodoriser had been relocated at the site and established adjacent to the composting pad. It was

considered this should increase the effectiveness of the unit as it will mist the odour at the source instead of after it had already partially dispersed. The area about the composting windrows was tidy with a good supply of bark and other greenwaste on site ready to be added to the windrows as more product arrived at the site.

Work was yet to be undertaken to lift the base of the composting pad (at the lower end). RNZ advised that this had been planned to be completed in December however, wet weather conditions had delayed this work until January 2022. In the meantime RNZ were removing the pooled stormwater via a honey wagon and discharging it into the truck wash pond. This work was being undertaken to minimise the potential for odour being emitted from the pooled water. Limited works would be carried out on site over the Christmas/New Year break however, someone was to be at the site each day to ensure that product that arrived at site across this period was quickly covered with greenwaste so the composting process could commence and odour generation could be minimised.

26 January 2022

Inspection of the Remediation (NZ) Limited's Uruti composting facility was undertaken as part of routine compliance monitoring. Inspection was undertaken in fine weather conditions following an extended dry period. At the time of the inspection the air temperature was 25 degrees with total high cloud cover. All surfaces were dry. A light west/south west wind was noted at the time of the inspection. An odour survey was undertaken at the park off area on the true left bank of the Haehanga Stream. A second odour survey was undertaken at the site entrance. No odours were detected being discharged off site from the composting facility (noting that Mokau Road was upwind of the composting facility at the time of the inspection). No odours were noted about the site office or at the twin culverts. On-site, both the irrigation pond and the settling pond located prior to the irrigation pond had been emptied with all liquid contents applied to land via irrigation. Both ponds were empty and desludging activities were taking place at the site. This activity involved using two diggers to remove the accumulated sediment from the irrigation pond. As this material was of a sludge type consistency, the removed material was being taken from the irrigation pond and placed into the empty settling pond. From here the material was being placed onto the drilling mud pad, within a bund constructed from greenwaste to contain the material. Once the material de-watered further it was to be mixed with the greenwaste and placed further within the drilling mud pad. The location of the de-watering area meant that any material that discharged from this area would flow back into the settling pond and irrigation pond, and not off the drilling mud pad onto other land. This activity resulted in a light hydrocarbon type odour immediately downwind of the activity. It was also noted on site that since the previous inspection, the size of the truck wash pond had been reduced. This work resulted in the infilling of the upper section of the truck wash pond. Papa earth was used to undertake this process. The remaining pond has a much reduced surface area. The truck wash pond had also been cleaned out (material placed upon the drilling mud pad) and an aerator was operational within the pond. No odours were detected being emitted from the pond. Further work is still required to lift the level of the composting pad to prevent the pooling of contaminated water within the defined pad area. This would assist in reducing odour generation at this point. It was noted that the composting windrows on site were large. The turning of this wind rows were planned for the following day. Bark was onsite to place on top of the freshest of the windrows in an effort to reduce odour.

All worm beds onsite were covered. The paunch pond was pumped down with very little stormwater observed within the pond. The residual volume cannot easily be removed. Odours were very light about the paunch pond area.

1 March 2022

A Council officer noted that the windrows were excessively bulky (well in excess of the guidance given in NZS4454, the national guide for composting) and that they were quite odorous. Over-sized compost piles do not allow good penetration of air and thus become anaerobic, releasing unpleasant odours. Further, the drains around the piles contained stagnant water, and the initial piles had not been covered with odour-

absorbing material such as bark, soil, or mature compost, as had been previously advised by RNZ's consultant.



Photo 1 Windrows on Pad 1. Note the height is greater (4 to 5 m) than the maximum recommended by NZS4454 (~2 m) and stagnant wastewater is present in the proximity of the piles (encircled in red). Photograph taken 01/03/2022

11 March 2022

The inspection commenced at 0700 hrs to assess early morning odour emissions from the site. An independent person was also present during the inspection. At the time of the inspection the weather was fine and reasonably still. The Haehanga valley was full of fog, with less fog noted within the Mimitangiutua Valley. Cold air drainage conditions were noted in the Mimitangiutua Valley, with fog observed rolling over a spur on the valley slopes opposite the site entrance. An odour survey was undertaken at the valley entrance to the west of the Haehanga Stream bridge. Composting odour was detected beyond the boundary. An odour assessment was undertaken, and the odour was deemed to be between #1 and #2 on the Council's odour intensity scale (discernible to noticeable), and therefore deemed to be in compliance with resource consent conditions.

The Council officer and other party then walked the State Highway from the site entrance back to the location of the odour survey. Odours were detected intermittently during the period of the survey (approximately 1 hr) and these odours were deemed to largely reflect the odours recorded in the earlier odour survey and to be in compliance with resource consent conditions relating to the odour limits beyond the boundary of the property. The odour detected was best described as a composting odour.

A site inspection was undertaken post the odour survey. The inspection found that there has been an increase in the volume of product being composted at the facility. This is evidenced by the size of the windrow piles on the pad and the volumes of raw material being brought to site to be composted. Mature compost was being screened at the upper end of the site and the screened material was being loaded onto trucks at the time of the inspection and removed from site. The windrows were due to be turned. However this process was being delayed until a suitable weather window was available to allowing the turning process to take place in weather conditions that would limit the migration of odour down the valley towards sensitive receptors. The Council noted that it is vitally important that the windrows are managed and turned on a regular basis to ensure that odour generation and potential migration are controlled in a manner that ensure ongoing consent compliance. On this occasion it was noted that there was very limited volume of bark on the windrows with no continuous bark cover noted on the composting wind-rows. It was

also noted that ponding was still occurring within the composting pad, despite this being raised as an issue previously with RNZ.

The aerator was operational within the irrigation pond with only a slight odour being noted within the immediate vicinity of the pond. All worm beds were covered. Works were also being undertaken to reduce the footprint of the paunch pad- this may assist to reduce passive odour sources at the site.

24 March 2022

A permanent continuous dissolved oxygen monitoring meter was still to be installed in the irrigation pond, to enable maintenance of aerobic conditions. The pond was being aerated only on an intermittent basis. Most of the contaminated material on the stockpile on Pad 3 excavated from the wastewater system remained fully exposed. Proposals to reduce the size of the paunch pad and pond had been initiated but were still far from completion. Two deodorising units were on site near Pad 1, with a third on order.

25 March 2022

A pro-active odour survey was undertaken to assess compliance with resource consent conditions. No site inspection was undertaken. An odour assessment was undertaken along Mokau Road. The only odours detected were noted between the site entrance and approximately 50 m west (towards New Plymouth) of the Haehanga Stream. At the time of the surveys the wind was blustery and swinging mainly between east and south. A composting odour was detected. Both odour surveys undertaken (one being at the site entrance and one at the park off bay near the stream) measured odours to be at an intensity scale of 0-1 for a majority of the surveys with a few occasions of intensity 2 detected (as detailed within the odour surveys). The odour was not steady, and would come and go with the wind strength and associated direction. The odour assessments found that the odours being discharged were within consent limits. Odour scouting was undertaken further afield from the odour plume detected as detailed above, extending to the community hall in the east through to 3km west of the site. No further odours were detected.

31 March 2022

An evening inspection was undertaken as part of proactive monitoring of potential odour emissions from the RNZ Uruti composting facility. The odour assessment was undertaken between 2055 hrs and 2220 hrs. At the time of the odour scouting and associated surveys the air was particularly still with no noticeable wind direction detected. Air temperature was 19 degrees and no dew was noted on the grass. All surfaces were dry with no rain in the area preceding or during the inspection. No stars were observed within the sky, indicating total cloud cover. The headlights on the trucks using Mokau Road during the time of the inspection suggest that there was light fog within the Mimitangiatua Valley. These conditions remained consistent throughout the inspection. No site inspection was undertaken as part of this inspection. Odour scouting was carried out along Mokau Road between the entrance to Jones Quarry in the west through to 1585 Mokau Road in the east. Odour surveys were undertaken at the entrance to the Haehanga valley specifically at about the site entrance and also at the western edge of the valley (west of the Mokau Road bridge over the Haehanga Stream). The investigation found that no odours were detected during the odour surveys and no odours were noted within the wider odour scouting area.

12 April 2022

This inspection was undertaken as part of routine compliance monitoring. Weather conditions were 18 degrees air temp with overcast conditions and significant but not total cloud cover. Two odour surveys were undertaken. No odours were detected off site, with the wind during the survey noted as swirling and very light. Inspection found that all composting was being carried out on the composting pad, with some of the mature compost windrows being moved to the upper extent of the composting pad and heaped up to create more room for composting operations. The increase in product coming to site in 2022 had resulted in pressure on the composting pad in relation to available space to continue to compost material. No unauthorised product was observed on site. Work was yet to be completed to lift the bottom end of the

composting pad drainage system to ensure that water does not pond within the composting pad. Limited bark cover of the composting windrows was observed.

The upper end of the drilling mud pad had not been grassed as has been requested previously. An inspection of the worm beds found that they were all covered. The paunch pond was being used to store paunch, however little odour was detected from either source. RNZ were considering undertaking works to reduce the footprint of the truck wash ponds, however no detail on this was provided to the Council. RNZ staff were advised of the results of soil samples taken from stored product adjacent to the worm beds, including the fact that the samples indicated that the product likely contains drilling mud. They were advised not to disturb, add product to or remove product from this pile at this stage and that the appropriate way to deal with this material is a matter that should be discussed with the experts who have been engaged for the consenting process that the site is currently subject to.

Both aerators were in operation, one within the irrigation pond and the second operating within the settling pond.

The lowermost irrigation area was not yet operational. It was advised that this needs to be operational for the site to operate through the winter months. At this stage this area is not an area that can be included in calculations of annual nitrogen loading for 2021-2022 on the site.

19 April 2022

An evening inspection was undertaken as part of proactive monitoring of potential odour emissions from the Remediation (NZ) Limited, Mokau Road - Uruti composting facility. Three odour surveys were conducted between 1930 hrs and 2013 hrs. At the time of conducting the surveys, the air was particularly still with no noticeable wind direction. Air temperature was 21 degrees Celsius. All surfaces were dry with no rain in the area preceding or during the inspection. There was a small amount of cloud cover. Odour surveys were undertaken at the entrance to RNZ, the Community Centre (North of RNZ), and the roadside gravel pit (South of RNZ). The investigation found that there was some odour at the site entrance (compost odour, 1 to 2 on intensity scale) and a small amount of compost odour was detected at the gravel pit (1 on intensity scale), and there was no odour detected at the Community Centre. No site inspection was undertaken as there was no breach of consent.

May 2022

A proactive odour inspection was undertaken at the Remediation (NZ) Limited's Mokau Road composting facility. At the time of the inspection the weather conditions were recorded as 9 degrees air temperature, in dry conditions. Both the Mimitangiatua and Haehanga valleys were foggy. There was dew on the grass, with the gravelled areas and road surfaces being dry. A light N/NNW wind was detected and cold air drainage conditions were noted within the valleys. Odour scouting was undertaken between the entrance to Jones Quarry and 1585 Mokau Road. No odour was detected north of the entrance to the RNZ facility. Odours were however detected from the site entrance through to and slightly past the entrance to Jones Quarry, south of the RNZ activities. As a result of the odour scouting, odour surveys were undertaken at the site entrance, the parkover area south/west of the Haehanga Bridge, and at Jones Quarry. Odours were detected in these areas, which ranged from 0 (no odour) through to 3 (distinct). The odours detected were largely composting odour in character, however as the intensity increased an odour reminiscent of decomposition or rotting wastes was also detected. The assessment of the odours against the FIDOLT factors found that they would likely be considered offensive if the odours were to be continuous or frequent. Although the odour assessment was deemed compliant with resource consent conditions as a one-off event, the Council officer was concerned the degree of odour being discharged off site was close to breaching consent conditions.

May 2022

An evening inspection was undertaken as part of proactive monitoring of potential odour emissions from the Remediation (NZ) Limited, Mokau Road - Uruti composting facility. Three odour surveys were

conducted between 1836 hrs and 1939 hrs. At the time of conducting the surveys, the air was particularly still with no noticeable wind direction. Air temperature was 15 degrees Celsius. All surfaces were dry, with no rain in the area preceding or during the inspection. There was a small amount of cloud cover. Odour surveys were undertaken outside the residential property situated at 1415 Mokau Road, the entrance to RNZ, and Jones Quarry entrance. The investigation found that there was some odour at the residential address (compost/dead animal odour character, wafting from 0 through to 1 to 2 on intensity scale), and a similar result was found at the entrance to RNZ. The survey at Jones Quarry was negative for odour detection. No site inspection was undertaken as there was no breach of consent.

11 May 2022

An evening inspection was undertaken as part of the Council's proactive monitoring of potential odour emissions from the Remediation (NZ) Limited, Mokau Road - Uruti composting facility. Two odour surveys were conducted between 1850 hrs and 2001 hrs. At the time of conducting the surveys, the air was particularly still with no noticeable wind direction. Air temperature was 9 degrees Celsius. All surfaces were dry with no rain in the area preceding or during the inspection. There was no cloud cover. Odour surveys were undertaken at the residential property situated at 1415 Mokau Road and at the entrance to RNZ. The occupant of 1415 Mokau Road advised the Council officers that in these still conditions the odour would usually be evident however on the evening in question they conceded there was no odour at their address. The investigation found that there was no odour detected at either odour survey location. No site inspection was undertaken at RNZ as there was no breach of consent.

23 May 2022

An evening inspection was undertaken as part of proactive monitoring of potential odour emissions from the Remediation (NZ) Limited, Mokau Road - Uruti composting facility. Two Council officers conducted a couple of odour surveys were conducted between 1825 hrs and 1847 hrs. At the time of conducting the surveys, the air was particularly still with no noticeable wind direction. Air temperature was 11 degrees Celsius. All surfaces were dry with no rain in the area preceding or during the inspection. There was no cloud cover. Odour surveys were undertaken at the entrance to RNZ and at the residential property situated at 1415 Mokau Road. The occupant of 1415 Mokau Road advised there had been no odour during the evening for the past week, but stated there had been some during the day (possibly from trucks unloading product). The investigation this evening found that there was a weak compost odour detected at the entrance to Remediation NZ and no odour at the residential address. No site inspection was undertaken at RNZ as there was no breach of consent.

26 May 2022

An inspection was undertaken of the composting facility as part of routine compliance monitoring. Inspection was undertaken in fine, cold weather conditions with high cloud cover and some small patches of mist within the Mimitangiatua Valley. A heavy dew was noted on the ground, but the road surfaces were dry. Odour scouting was undertaken beyond the site boundary, and as a result of the scouting two detailed odour surveys were undertaken along SH3. These surveys were undertaken to the south-west of the Haehanga Stream bridge (SH3) and at the RNZ site entrance. The odour surveys recorded low level odour at both locations and were deemed to be compliant with resource consent conditions. Inspection onsite noted no odours during the sampling run in the lower reaches of the valley.

An inspection of the irrigation pond onsite found that it was reasonably full with approximately 0.5 m free board. The aerator in the pond was in operation and a DO meter was being used to record oxygen levels within the water column. Minimal odour was noted being emitted from the irrigation pond.

No further material had been added to the drilling mud pad, however there was one small windrow of material that might be put back into this area in the coming weeks. This material had originally been removed from the pad and stored adjacent to the pad where it could be turned on a frequent basis and sampled to measure contaminant levels within the material. This trial was now complete and the material

was to be placed back onto the drilling mud pad for storage until a final solution can be decided. The drilling mud pad had been seeded for grass growth. Works were being undertaken on the site to lift the base level of the composting pad drainage. To undertake this work, the composting material was being moved further along the composting pad. Clean papa was then being placed within the composting stormwater collection area and compacted (track rolled) in order to lift the base of the pad and prevent stormwater from pooling in the area. Further to this, work was being planned for the coming weeks to remove the truck wash ponds (X2), install a concrete sandtrap to collect the truck washings, and then install a pipe to pipe the truckwash water through to the settling pond and adjacent irrigation pond. Therefore a small truckwash facility would still be operational at the site into the future, however the size of this and the associated volume of standing water will be greatly reduced. This work was being undertaken to reduce passive odour sources at the site.

An inspection of the paunch pad/pond area found that no further works had been done to reduce the footprint of this facility. The area that had been infilled now had compost stored upon it. This compost was covered to reduce odour emissions and prevent rainwater from interacting with the compost. Any leachate from the compost would discharge into the paunch pond. No leaching was noted at the time of the inspection. Light odours were noted within the active area of the paunch pond.

27 May 2022

A morning inspection was undertaken as part of proactive monitoring of potential odour emissions from the Remediation (NZ) Limited, Mokau Road - Uruti composting facility. The Council officer was in the area for an unrelated matter and took the opportunity to complete a survey. Three odour surveys were conducted between 0812 hrs and 0850 hrs. At the time of conducting the associated surveys the air was particularly still with no noticeable wind direction. Air temperature was between 4 - 6 degrees Celsius. All surfaces were dry with no rain in the area preceding or during the inspection. There was no cloud cover. Odour surveys were undertaken at the entrance to RNZ, outside the Community Centre, and at the roadside gravel pit south of RNZ. The investigation found that there was a weak compost odour detected at the gravel pit, and no odour detected at the other two sites. No site inspection was undertaken at RNZ as there was no breach of consent.

10 June 2022

A morning inspection was undertaken as part of proactive monitoring of potential odour emissions from the Remediation (NZ) Limited, Mokau Road - Uruti composting facility. Council officers were in the area for an unrelated matter and completed this survey. Two odour surveys were conducted between 0757 hrs and 0850 hrs. At the time of conducting the associated surveys the air was moderate and from a northerly wind direction. Air temperature was between 16 - 17 degrees Celsius. All surfaces were wet with overnight rain in the area, but there was only one very brief shower during the end of the first survey. There was full cloud cover. Odour surveys were undertaken at the entrance to RNZ, and at 1589 Mokau Road north of RNZ. The investigation found that there was no odour detected at either of the two sites. An assessment was undertaken at 1430 Mokau Road Jones quarry site, but no odour was detected so no detailed survey was done at the location. No site inspection was undertaken at RNZ as there was no breach of consent.

20 June 2022

An unscheduled inspection was undertaken with Gary Bedford (Council) and David Gibson (RNZ). At the time of the inspection a blustery S/E wind was noted, with 11 degree air temperature and dry weather conditions. No odours were noted off site. A meteorological station had been erected near the site entrance. An inspection of the site found odours were being emitted from the irrigation pond. The odour from the irrigation pond was extremely putrid, with a very low concentration of dissolved oxygen (well below that recommended by RNZ's air quality expert). The DO meter was recording a DO reading of approximately 0.44 mg/l, which was extremely low. The reading fluctuated during the inspection around this reading. The DO meter is located in the upper section of the water column within the proximity of the aerator, meaning the DO levels could be much less elsewhere in the pond. (RNZ later reported the probe

was faulty, but the character of the odour established that the pond was highly anaerobic and adequate DO concentrations had not been maintained). The aerator was operating at the time of the inspection. The irrigation pond was full with approximately 0.5 m free board remaining within the pond. No irrigation was taking place at the time of the inspection.

An inspection of the truck wash pond found that work had commenced to decommission the ponds, with works planned later in the week to install a pipe which take the contents from the concrete sand trap (not yet on site at time of inspection) through to the riser adjacent to the access track and settling pond, before flowing to the irrigation pond. The truckpond removal would serve to eliminate that as an odour source. The small open pond adjacent to the composting pad had been replaced with a concrete riser. Mr Gibson of RNZ confirmed that all contaminated material that was excavated was being removed and placed onto the drilling mud pad. Works had recently been completed to lift the base level of the composting pad at the lower end to reduce the pooling of leachate and contaminated storm water at this location. This works appeared to have achieved the desired result, although noting that there was a small amount of pooling at the time of the inspection as the result of a small blockage against the screen at the mouth of the culvert.

Stagnant water in the drain around Pad 3 was also anaerobic.

The composting pad was full with windrows with very limited space remaining. The fresh windrows on Pad 1 were uncovered with any odour-absorbing material, against the advice of RNZ's own air quality expert. Mr Gibson advised that product had been ceased being brought to site until space became available to adequately compost fresh material. It was anticipated that product would not be arriving at site for approximately 2 weeks. The covered stockpile of compost located at the upper end of the composting pad was being trucked at intervals from the site to provide the space necessary to process further material.

An inspection of the worm beds found that they were all covered. The paunch pond was reasonably full of stormwater with approximately 0.5 m of free board remaining within the pond. A low volume tea coloured discharge was noted coming from the final pond within the wetland treatment system.

29 June 2022

An inspection was undertaken of the RNZ – Uruti composting facility to assess potential odour discharges off site. The inspection was undertaken between 1948 hrs and 2110 hrs. At the time of the inspection, weather conditions were dry with dry ground underfoot. Full cloud cover was likely as no stars could be seen in the sky. The air temperature was 9-10 degree with a light wind. The wind was assessed to be flowing down the valleys as had been previously experienced in cold air drainage conditions. Odour scouting was undertaken at various locations extending between the entrance to the Jones Quarry adjacent to Mokau Road up to 1587 Mokau Road. Full odour surveys were undertaken at Jones Quarry and at the RNZ site entrance. No odours were detected at the odour survey locations or during the wider odour scouting areas. No site inspection was undertaken during this time.

Consent 5938

To use a twin culvert in the Haehanga Stream for vehicle access purposes.

July 2021

Inspection of the twin culverts on site was undertaken as part of routine compliance monitoring, in fine weather conditions. At the time of the inspection the stream was flowing at a moderate rate. An inspection of the twin culverts found that both culverts were open and free of any blockages and/or obstructions. An inspection of the head walls about the culvert found that they were in place and appeared stable. The two rock riffles installed downstream to lift the static water levels throughout the culvert were in place and stable. No erosion was observed within the vicinity of the culverts and no other issues were identified at the time of inspection.

August 2021

Inspection was undertaken as part of routine compliance monitoring. It was found that both of the twin culverts were open and flowing freely and evenly, with no blockages and or obstructions. Observation of the headwalls found that they were in place with no signs of erosion about the walls. The riffles remained in place with the static water level through the culverts allowing for fish passage. No issues were identified at the time of inspection.

8 September 2021

Inspection was undertaken as part of routine compliance monitoring, in overcast conditions with occasional light rain. Rainfall preceding the inspection had resulted in flows within the Haehanga Stream being elevated. The inspection of the twin culverts found that they were open and free flowing with no signs of blockages and/or obstructions. The stream was observed to be flowing reasonably evenly through both culverts with no obstructions to fish passages observed. Although the stream was elevated at the time of the inspection, the effect of the downstream riffles in lifting the water level could still be noted. No issues were identified at the time of inspection.

29 September 2021

Inspection was undertaken to assess compliance with resource consent conditions. The inspection found that the twin culverts were free of blockages and or obstructions with the stream flowing reasonably evenly through both culverts. The downstream riffles were stable and secure ensuring that the static water level through the culvert was at a level to ensure fish passage. The head walls were in place and no erosion was noted about the culvert. No issues were identified during the inspection.

19 October 2021

Inspection was undertaken in accordance with compliance monitoring. The culverts were found to be open and free flowing with the stream flowing evenly through both culverts. The headwalls were in place and visually secure. No fish passage obstructions were noted during the inspection. No issues were identified at the time of inspection.

1 December 2021

The Haehanga Stream was observed to be at its usual dry weather levels. Inspection of the twin culverts found that they were both open and free-flowing, with no signs of blockages and/or obstructions. The headwalls were in place and secure. The rock riffles placed downstream of the culvert to lift the static water level throughout the culvert were in place and working well. No issues were identified at the time of inspection.

20 December 2021

Inspection was undertaken as part of routine compliance monitoring. The weather was fine, following significant rainfall the previous week. The water levels within the culvert were slightly elevated. The culverts were open and free of any blockages and/or obstructions, and water was flowing freely and evenly through both of the culverts. The riffles in place downstream of the culverts to lift the static water level were working well with a good water level noted throughout the culvert that would enable fish passage. The headwalls were observed to be in place and secure. The banks of the stream within the immediate vicinity of the culverts were well vegetated with no signs of erosion. No issues were noted on the inspection.

26 January 2022

Inspection was undertaken as part of routine compliance monitoring. The Haehanga Stream was in a low flow condition. The inspection of the twin culverts found that both were open and free flowing with a small flow passing evenly through the two culverts. The riffles remained in place and working well to maintain the static water level at a height so as to maintain fish passage through the culvert. Headwall were seen to be secure with no issues identified at the time of inspection.

11 March 2022

The stream was in low flow conditions. An inspection of the culvert found that both were open and free-flowing, with no signs of blockages and/or obstructions. The headwalls were in place and appeared secure with no signs of erosion about the culvert. The riffles placed upon the stream bed below the culvert were in place and stable, ensuring that the static water level was at an elevation that would allow fish passage through the culvert.

12 April 2022

Inspection of the twin culvert onsite was undertaken to assess compliance with resource consent conditions. Inspection found that both culverts were open and free flowing with no signs of blockages and/or obstructions. The stream was flowing evenly through both culverts. The riffles in place below the culvert were well bedded in with no signs of movement, thus ensuring the static water level was maintained within the culvert.

26 May 2022

Inspection was undertaken as part of routine compliance monitoring, in fine weather conditions. The Haehanga Stream was flowing at a reasonable base flow level. An inspection of the twin culverts on site found that both were open and free flowing with no signs of blockages and/or obstructions. Water was observed to be flowing reasonably evenly through both culverts. An inspection of the headwalls found that they were in place and apparently secure. No erosion was noted about the culverts. Both lower riffles that have been installed upon the stream bed to lift the static water level through the culverts were found to be secure and working well to increase the static water level, thus providing for fish passage. It did not appear that recent flood events had affected these riffles. No issues were identified at the time of the inspection.

Consent 6212

To erect, place, use and maintain a culvert and associated structure[s] in the bed of the Haehanga Stream in the Mimitangiatua catchment for access purposes.

July 2021

Inspection of the culverts on the property were undertaken as part of routine compliance monitoring. The inspection was undertaken in dry weather conditions. The stream was in moderate to normal flows for the time of year. An inspection of the culvert beneath the access track to the worm beds found that it was open and free flowing with no instream obstructions. The headwalls were in place and visually appeared to be stable with no signs of erosion about the culvert. Fish passage was currently being provided for, but some further works will be required to lift the static water level through the culvert for the dry/low flow summer months. An inspection of the culvert located adjacent to the access track culvert found that it also was free flowing and clear of blockages. Fish passage is provided for via some riffles installed downstream which have provided for a good depth of slow flowing water through the culvert.

August 2021

An inspection was undertaken as part of routine compliance monitoring. The culverts on site were found to be open and free flowing. No blockages and/or obstructions were observed. Headwalls were in place and appeared to be secure. Fish passage through the large culvert leading to the worm beds was provided for over the winter months. This is a result of the work done to lift the static water level at the lower end of the culvert. However it was noted further works might be needed in this area to ensure that fish passage remained provided for through the low flow summer months.

8 September 2021

Inspection was undertaken at the Uruti composting facility as part of routine compliance monitoring. At the time of inspection the stream was elevated and swift, flowing freely through the culvert and filling approximately one-quarter of the volume of the culvert. The inspection found that the culvert was free of

any blockages and/or obstructions with water flowing freely through it. The head walls were in place with no signs of erosion about the culvert. No issues were identified at the time of the inspection.

29 September 2021

Inspection of the culvert on site found that it was open and free flowing with no obstructions. The headwalls appeared secure and no other issues were identified at the time of the inspection.

19 October 2021

An inspection was undertaken as part of routine compliance monitoring. Inspection found that the culvert was open and free flowing with no blockages and/or obstructions. Headwalls were observed to be in place and appeared secure. No issues were identified at the time of inspection.

1 December 2021

An inspection of the culvert under the access track to the lower worm beds and the smaller culvert adjacent to this point found that both culverts were open and free of any blockages and/or obstructions. No erosion was noted about either of the culverts. All headwalls were inspected and found to be secure with no signs of failure.

21 December 2021

Inspections of the culverts on site were undertaken in accordance with routine compliance monitoring. Inspection found that all culverts were open and free flowing, and no obstructions and or blockages were observed. Fish passage was provided for through all culverts on site. A further inspection was to be undertaken within the low flow summer months to ensure that fish passage is maintained through the large culvert beneath the access track that leads to the worm beds. RNZ were directed to monitor this culvert and if fish passage was not being provided for during low flows, RNZ were to undertake remedial works to ensure that fish passage is maintained.

26 January 2022

Inspections of the culverts onsite were undertaken as part of routine compliance monitoring. Inspection found that the culverts on site were open and free flowing with no signs of blockages and/or obstructions. Fish passage was being maintained through the culverts. No issues were identified at the time of inspection.

11 March 2022

The culverts on the property were open and free-flowing, with no blockages and/or obstructions noted. Fish passage was provided for throughout the culverts. No issues were identified at the time of inspection.

April 2022

An inspection of the culverts on site found that they were open and free flowing with no signs of blockages and/or obstructions. Fish passage was provided for through the culverts. No signs of erosion about the culverts or head walls was noted.

26 May 2022

An inspection was undertaken as part of routine compliance monitoring. The inspection was undertaken in fine weather conditions. The inspection was carried out in association with a full surface water sampling run. An inspection of the culverts onsite found that they were open and free flowing with no blockages and/or obstructions. The headwall of the culvert beneath the track leading to the worm beds appeared secure with no signs of erosion within the vicinity of the culvert. Fish passage was being provided for through the culverts. However it was noted this would require ongoing maintenance to ensure that fish passage continued to be provided for. No issues were found as a result of this inspection.

Consent 10063

To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream.

July 2021

The inspection was undertaken as part of routine compliance monitoring. Inspection found that the quarry was not currently in operation neither was the access track. Further work to control sediment would be required when the site became operational again as the subsequent soil disturbance would require improved sediment controls.

August 2021

Inspection was undertaken as part of routine compliance monitoring, during fine weather conditions. At the time of the inspection the quarry was not in operation and had not been operating yet in 2021. As a result the area was beginning to naturally stabilise with vegetation. The access track had not been used and all cut off drains and bunds remained in place. Some works would be required prior to the commencement of gravel extraction to ensure that the sediment controls were appropriate to treat stormwater from an active area of soil disturbance. RNZ were instructed to ensure that the Council was notified prior to operating the quarry to ensure that all consent conditions are satisfied for an operational quarry site.

8 September 2021

Site inspection was undertaken as part of routine compliance monitoring. The quarry operation was not being carried out and the site and access track had not been used for an extended period of time.

29 September 2021

The inspection was undertaken as part of routine compliance monitoring. Inspection found that the quarry remained unused. RNZ staff were reminded that the Council would require notice prior to the recommencement of operations at the quarry to ensure appropriate silt and sediment controls were put in place prior to any activities that will result in the destabilising of the area.

1 December 2021

Inspection found that the quarry remained non-operational, meaning that site stabilisation via natural re-vegetation and minimal sediment mobilisation due to inactivity remained the status quo. Some work had been undertaken to re-contour the access track to the quarry.

The RNZ staff member on site was advised that more cut-off drains should be installed on the access track and that all sediment controls would need to be installed as per the site management plan, prior to the quarry becoming operational again. The Council was to be contacted to discuss silt controls and general compliance requirements prior to operating the quarry again.

20 December 2021

Inspection was undertaken as part of routine compliance monitoring. Inspection found that works were continuing on the access track. The works were being undertaken to allow access to the quarry over the forthcoming summer months when extraction was planned to commence. With regards to the access track, RNZ were instructed to ensure that there were plenty of cut off drains along the access track to ensure that all stormwater that falls on the access track is quickly directed off the track and is not allowed to flow for any distance down the access track, as this will greatly increase sediment yields. A full inspection of the quarry and the extraction methodology was to be undertaken with RNZ on site prior to the quarry becoming operational.

26 January 2022

An inspection was undertaken as part of routine compliance monitoring. Inspection found that the quarry remained inactive, however works had recently been undertaken to re-contour the site access track in preparation for the potential opening of the quarry again. Material from the site access track had been

carted off the track and deposited for processing at the upper end of the worm beds. A conversation was held with RNZ staff, who were advised that should this area become a frequently used area for the stockpiling of material from the quarry then further sediment controls would be required in this area. These controls would likely be based around a Sediment Pond sized for a minimum of 3% catchment and designed in accordance with the Waikato Earthworks Guidelines.

11 March 2022

The quarry was not currently operational. However it was noted work had been undertaken on the site access track in preparation for excavation to recommence within the quarry. These works included the installation of two sediment traps to receive and treat stormwater from the access track. Further work was requested to control the stormwater on the lower section of the access track, to prevent the likelihood of sediment-laden stormwater running off the lower portion of the access track into the stream at the base. This work was completed immediately upon request and consisted in the installation of further cut-off drains and a large bund at the base of the track to direct stormwater off the track and into the adjacent paddock, where it would be filtered by the grass before becoming a diffuse discharge during heavy rain into the adjacent stream. RNZ were instructed to monitor this track during rainfall events to ensure that all stormwater entering surface water contains a suspended solid limit of less than 100 gm/m³, to ensure compliance with resource consent conditions.

Consent 10547

To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed.

July 2021

Inspection was undertaken as part of routine compliance monitoring. It was observed that the culvert was open and free flowing, clear of any obstructions and/or blockages. An inspection of the headwalls found that they were all in place and apparently stable with no signs of erosion about the approaches or exit of the culvert. Water was flowing freely through the culvert with no barriers to fish passage observed. No issues were identified at the time of the inspection.

August 2021

Inspection was undertaken as part of routine compliance monitoring, during fine weather conditions. The stream was moderate flowing. The inspection of the stream and associated culvert found that the culvert was free of any blockages and or obstructions, allowing the stream to flow through the culvert freely. The headwalls of the culvert were in place and appeared secure, with no signs of erosion of the banks within the vicinity of the culvert. There were no issues noted at the time of inspection.

8 September 2021

The inspection was undertaken as part of routine compliance monitoring. A surface water sampling run was also completed at the time of the inspection. At the time of the inspection the weather was overcast with occasional light rain. Rain had fallen in the days prior to the inspection and as a result the streams on the property were elevated and turbid. An inspection of the culvert beneath the site operations area found that it was open and free flowing with no signs of any blockages and/or obstructions. No signs of erosion were noted within the immediate vicinity of the culvert. An inspection of the head walls found that they were both in place and appeared secure to visual inspection. No issues were noted with the culvert during the inspection.

29 September 2021

The inspection was undertaken to assess compliance with resource consent conditions. The culvert was open and free flowing with no signs of blockages and/or obstructions. The stream was in moderate flow levels through the culvert. An inspection of the headwalls found that they are both in place and appeared secure with no signs of erosion about the culvert. No issues were identified at the time of inspection.

19 October 2021

Inspection was undertaken as part of routine compliance monitoring. It was found that the culvert was open and free flowing with no blockages and/or obstructions. Both headwalls were in place with no signs of recent erosion. No issues were noted at the time of inspection.

1 December 2021

Inspection found that the culvert was open and free-flowing, with no signs of blockages and/or obstructions. An inspection of the stream immediately upstream and downstream of the culvert found that the bed and banks appeared stable with no signs of accelerated erosion arising from the placement of the culvert within the stream. The headwalls were heavily vegetated and on visual inspection shown to be stable and secure. No obstructions to fish passage were noted at the time of inspection.

It was noted by the Council officer that the upper reaches of the stream would benefit (stream health) by the exclusion of stock access, which RNZ had promised would occur in the coming months due to the gradual de-stocking of the property.

20 December 2021

Inspection was undertaken as part of routine compliance monitoring, in fine weather conditions following significant rainfall the previous week. An inspection of the culvert and associated headwalls found that the culvert was open and free flowing with no blockages and/or obstructions observed. Fish passage was provided for throughout the length of the culvert. The headwalls were inspected and on visual inspection were found to be in place and secure. The banks and bed of the stream within the immediate vicinity of the culvert appeared stable with well vegetated banks showing no signs of erosion, and no bed erosion was noted within the stream. A moderate flow was observed within the stream. Samples of water quality of the stream were taken in association with the site's discharge consent.

26 January 2022

Inspection was undertaken as part of routine compliance monitoring. The inspection was undertaken in fine weather conditions that followed an extended dry period. the stream at the time was flowing freely through the culvert with no signs of blockages and or obstructions within the culvert. The headwalls were well vegetated and visually secure. No issues were identified at the time of the inspection.

11 March 2022

The inspection found that the culvert was open and free-flowing, with no blockages and/or obstructions. There was only a very low flow through the culvert. Both headwalls were in place and secure with no erosion noted about the culvert. No issues were identified at the time of the inspection.

12 April 2022

Inspection was undertaken to assess compliance with resource consent conditions. At the time of the inspection, the tributary was in low flow conditions. The culvert was open and free flowing with no blockages and/or obstructions throughout the length of the culvert. The culvert was bedded well into the streambed with no fish barrier noted. The headwalls were in place and well vegetated showing no signs of erosion. No issues were identified at the time of the inspection.

26 May 2022

An inspection was undertaken to assess compliance with resource consent conditions. The inspection was undertaken in fine weather conditions when the Haehanga Stream had a good base flow. An inspection of the culvert found that it was open and free flowing with no signs of blockages or obstructions. Both upper and lower headwalls were visually secure with well-established vegetation about the concrete headwalls. No obstructions to fish passage were observed at the time of the inspection.

Consent 10825

To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes.

29 September 2021

The inspection was undertaken as part of routine compliance monitoring, to assess compliance with the resource consent conditions for the stream realignment. The inspection of the works found that the area disturbed by earthworks during the realignment had been stabilised with the batters now beginning to have some grass growth on the exposed faces. RNZ were instructed that while the channel was settling over time, they were to monitor it and ensure that any slips or slumps of the batter faces were remediated and that debris was removed from the stream bed. The inspection also found that riparian planting had taken place along the true right bank of the realignment. However further planting was required along the true left bank. RNZ indicated that the paddock on the true left side of the realignment was planned to be destocked and planted in the winter of 2022. This would mean a permanent alteration in fencing on the true left bank would not be required in the long term. It was discussed that a temporary fence be erected to provide a setback for stock from the realignment prior to the destocking activities.

1 December 2021

The inspection was undertaken in fine weather conditions, with the stream levels through the realignment being in low flow conditions (noting that this stream does dry up during the summer months). The inspection found that the bank batters were holding well. A couple of small slumps with the batters were noted; however these are not increasing in size and no further erosion about these areas was observed.

It was noted that riparian planting has been installed along the banks of the stream, and the required stock exclusion limits were in place. However, RNZ were instructed to make contact with the Council land management officer for the property to ensure that the planting is enhanced during the 2022 winter (infill planting).

20 December 2021

Inspection was undertaken as part of routine compliance monitoring. The weather was fine although there had been significant rainfall in the week preceding the inspection. The inspection found that the realigned section of the stream was open and free flowing throughout the length of the realignment. There were no blockages or obstructions. Fish passage was also being provided for throughout the realignment and the culvert beneath the site access track. A moderate flow was observed within the stream as a result of recent rainfall, however it was likely that the channel would largely dry out during the coming summer months. The batters were intact. There were a couple of points along the channel where the batters had previously slumped, however these were not increasing in size and appeared to be stable. Although riparian planting had been undertaken along the length of the realignment, further plantings were required in the coming winter to provide a better canopy and shading effect for the stream. While the consent allows the realignment of two tributaries on the property, at this stage only the lower tributary has been realigned.

26 January 2022

Inspection of the stream realignment works was undertaken as part of routine compliance monitoring. The weather at the time was dry and fine, and followed an extended period of dry weather. As a result, the stream to which the realignment relates was only running at a trickle flow. The realignment appeared stable upon inspection, with the batters beginning to vegetate with naturally seeded grass and associated weeds. Stock exclusion was being maintained. Riparian planting had been carried out. However, as advised in feedback provided by the Council's Land Management team, further infilling of planting would be required during the 2022 planting season. No fish passage obstructions were observed and no recent slumping of the batters was noted. Stage one of the wetland regeneration plan had been completed with further works required within the 2022 planting season. RNZ were directed to prepare for this so that the required works could be planned and completed within the appropriate timeframe.

26 May 2022

The inspection was undertaken to assess compliance with resource consent conditions. The inspection found that only the stream near the site entrance (lower most irrigation field) had been realigned. No works had been undertaken to realign the second stream authorised by this consent. The stream was found to be open and free flowing with no obstructions to fish passage noted. While there was some initial slumping of the stream bank in a couple of locations following the re-construction of the stream, these areas now appeared to have stabilised with no further slumping noted. All stock have been removed from the property on a long term basis with no plans to bring any animals back onto the land at this stage. The irrigation field adjacent to the true right bank was now operational. No animals were grazing the hillside on the true left bank and this entire area is planned to be planted in the 2022 winter. As discussed with RNZ on the visit, further infilling of the riparian planting along the realigned section of stream was required to satisfy consent conditions. Also the second year operations of the wetland offset restoration planting and pest control programme was required to be undertaken. RNZ were instructed to make contact with the Council's assigned Land Management Officer to ensure that their planting plan would satisfy the conditions of the consent. This planting needs to be completed during the winter 2022 planting season.

Consent 10843

To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream, including associated disturbance of the stream bed.

29 September 2021

Inspection was undertaken as part of routine compliance monitoring. Inspection of the culvert (which is located just inside site entrance security gate) found that both headwalls were in place. The upper head wall had been repaired following damage done during a heavy rainfall event. The rock rip rap remained in place and there were no signs of erosion about the culvert. RNZ were directed to continue to monitor the culvert and headwalls to ensure that they remained compliant with consent conditions and were stable as the area 'settles' following the works. RNZ were also directed to ensure that fish passage was being maintained throughout the length of the culvert and associated stream realignment.

19 October 2021

Inspection was undertaken as part of routine compliance monitoring, during fine weather conditions. The inspection found that the culvert was open and free flowing with no blockages and or obstructions. Fish passage was provided for through the culvert and the associated realignment. No issues were identified as a result of the inspection.

1 December 2021

Inspection found that the realigned stream leading to the culvert was open and free-flowing, with no obstructions. An inspection of the culvert found that some works were required to ensure the continuing integrity of the upper headwall, as one of the larger concrete blocks had become dislodged. RNZ were requested to undertake works to repair this aspect of the culvert. The batters about the culvert both upstream and downstream appeared stable with no visible signs of erosion or slumping. The lower headwall was in place and visually secure. The culvert was seen to be sitting within the bed of the stream and it did not appear to be a barrier to fish passage.

20 December 2021

Inspection of the culvert was undertaken as part of routine compliance monitoring. The inspection was undertaken in fine weather conditions, although there had been significant rainfall in the week preceding the inspection. The inspection found that the stream was flowing freely through the culvert with no signs of blockages and/or obstructions within or in the vicinity of the culvert. Fish passage was being provided for, with the rock above, below and within the culvert providing a good pathway for fish to access the upper catchment of the tributary. No issues were identified with the culvert at the time of the inspection.

26 January 2022

Inspection was undertaken to assess compliance with resource consent conditions. The inspection was undertaken in fine weather conditions and the preceding extended dry period meant there was only a trickle flow through the culvert. The culvert remained embedded within the bed of the stream and was not perched. Rocks within the culvert would assist with fish passage. At this time there was no obstructions to fish passage, however once the flow increased a little the static water level below the culvert would be assessed. The water level had been increased as a result of a riffle being placed downstream. A concrete block from the headwall within the upper end of the culvert had dislodged and fallen onto the bank of the stream. While at this stage it was not obstructing flow, the displacement was brought to the attention of RNZ staff, who committed to arranging repairs in the coming week. A dislodged headwall could result in an increase in erosion about the culvert during a rainfall event.

26 May 2022

Inspection of the culvert located at the site entrance (security gate) was undertaken as part of routine compliance monitoring. The inspection found that the culvert was open and free flowing. Rocky material was now present within the lower reaches of the culvert, which would assist with fish passage. The lower head wall was in place and appeared to be secure. However some further works would be required to ensure that the upper headwall was secure as it appears that this area has slumped. This was not affecting flow through the culvert, however it did require some attention to ensure that the headwall can withstand both the erosion potential of flood events and also the pressures on the wall as a result of heavy traffic passing over the culvert on a regular basis. This issue was discussed with RNZ staff on site who undertook to make the repairs in appropriate weather conditions. The riffle downstream had held well to lift the static water level in the lower section of the culvert. The culvert will continue to be monitored for fish passage.

2.2 Water

2.2.1 Results of discharge and receiving environment monitoring

2.2.1.1 Surface water monitoring locations

The Company holds consent 5838-2.2. This allows the discharge of waste material to land for composting and 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. The Haehanga Stream itself and associated tributaries were sampled at a total of up to 15 sites (Figure 3), on six scheduled occasions in the 2021-2022 period. Full surveys were undertaken on 8 September, 6 October, 19 October, and 20 December 2021 and 11 March and 26 May 2022. A survey undertaken on 2 July 2021 was reported in the 2020-2021 Annual Report.

The Wetland Treatment System (WTS) on Pad 2 (Figure 2) functions by pumping primarily ammonia-enriched fluid from the paunch mixing pond, to the top of a multi-tiered wetland treatment system. The wetland has been planted with the bulrush raupō. This is intended to treat nutrient-enriched water through assimilation, while the dense planting of the raupō may act as a filter for particulate matter and associated contaminants. Discharge sample location IND003008 is at the point of entry from the last wetland pond into the tributary of the Haehanga Stream. The discharge is periodic, as flow is returned preferentially to the head of the WTS in order to maintain water levels within the wetland. The condition of the tributary receiving the discharge is assessed by sampling conducted at Site HHG000103, approximately 40 metres downstream of the point of WTS discharge, and comparing results with those for HHG000098, located just above the discharge. Water quality at HHG000098 can be affected by diffuse runoff from adjacent vermiculture beds.

Sites HHG000090 (main stem) and HHG000097 (tributary) can be considered upstream or baseline sites. They are located above the upper irrigation fields and composting and vermiculture facilities.

Sites HHG000099 and HHG000100 are below the upper irrigation fields, while HHG000109 is adjacent to the main composting facilities and HHG000115 lies below them. Site HHG000150 is adjacent to the lower irrigation fields, and HHG000165 is on an unnamed tributary flowing from a new irrigation area and entering the main stem of the Haehanga Stream between sites HHG000160 (just upstream of the confluence) and HHG000168 (downstream). HHG000190 is the lowest site in the Haehanga, above its confluence with the Mimitangiatua awa.

Sites MMI000200 and MMI000204 were established during the year. They are located in the Mimitangiatua awa, respectively above the confluence with the Haehanga Stream and below the mixing zone of the two water courses. The effects of any discharges carried down the Haehanga Stream into the Mimitangiatua awa will be seen in changes in MMI000204.

Site IND002044 is the irrigation water reservoir. This wastewater is not discharged to surface water, but irrigated over fields in both the upper and lower catchment. Excessive application rates or irrigation during periods of rainfall or high soil moisture increases the risk of runoff or rapid shallow subsurface migration into the Haehanga Stream.

Discovery of unauthorised discharges during the period under review triggered additional investigations, particularly of the unnamed tributary flowing between pads 1 and 3 (established site HHG000106).

2.2.2 Presentation and discussion of surface water results

The results of the scheduled surface water sampling surveys are presented in Table 3 to Table 8 below.

The discharge from the WTS (IND003008) has been included in the results to provide context to the results of the receiving waters below this point source discharge (HHG000103). Analytes of total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene and xylenes (BTEX), were analysed at numerous sites across all monitoring rounds. None were identified above the LOD. As such these have been omitted from the results.

MfE(2018) sets out the means of calculating compliance with the national compulsory maximum value for ammoniacal nitrogen in water (NPS 2020), expressed in terms of the toxicity of a solution containing ammoniacal nitrogen at pH 8. In the tables below, the toxicity of the measured (field) ammoniacal concentration has been used as the basis to calculate the equivalent concentration of ammoniacal nitrogen that would have the same toxicity when at pH 8. The current (expired) consent does not require RNZ to meet the NPS 2020 total ammoniacal nitrogen attribute standard, but it has been raised as a matter of consideration before the Environment Court.

The most significant parameters for assessing potential environmental effects on water quality and stream health are ammonia (toxicity), biochemical oxygen demand (excessive organic enrichment and undesirable slime growths), dissolved oxygen (loss of life-sustaining ability), suspended solids (abrasive damage to flora and fauna, and smothering of habitat), nitrate-nitrogen (eutrophication and toxicity), and *E coli* (indicator for pathogenic microorganisms). Any exceedance of a consent condition is shown by **red text**.

Table 3 Surface water monitoring 8 September 2021

SW1 08/09/2021	NH ₃	pH	<i>E coli</i>	EC	EC	TSS	Temp
Site	g/m ³	pH Units	cfu/100 ml	mS/m	µS/cm	g/m ³	°C
Consent 5838-2.2 condition 11 max	>0.025						
HHG000090	0.00008	7.0	5,000	13.2	132	240	11.0
HHG000093	0.00031	7.1	3,500	14.3	143	290	10.7
HHG000099	0.0028	7.3	10,000	18.6	186	112	11.3
HHG000100	0.00124	7.1	3,000	16.7	167	250	10.8
HHG000097	0.00015	7.2	1,300	16.6	166	250	10.3
HHG000098	0.00008	7.1	1,200	14.3	143	175	10.2
IND003008	1.58	8.0	2,600	120	1200	183	11.1
HHG000103	0.026	7.5	2,100	20.2	202	188	10.4
HHG000106	0.00073	7.3	7,000	18.8	188	-	11.6
HHG000109	0.0040	7.3	8,000	18.1	181	-	10.2
HHG000115	0.0034	7.2	8,000	17.8	178	-	10.2
HHG000150	0.0031	7.2	5,000	19.7	197	410	10.0
HHG000160	0.0061	7.3	11,000	24.2	242	610	10.0
HHG000165	0.00010	7.1	5,000	16.6	166	181	10.3
HHG000168	0.0054	7.3	12,000	23.7	237	530	10.0
HHG000190	0.0054	7.2	8,000	24.0	240	-	10.1
MMI000200	0.000067	6.9	2,400	11.5	115	105	11.0
MMI000204	0.00060	6.9	3,000	13.5	135	112	10.9
	Total Sodium	Chloride	Total ammoniacal nitrogen NH ₄	Total ammoniacal nitrogen with equivalent toxicity at pH 8 ¹	NNN	DCBOD	CBOD
Site	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	g O ₂ /m ³	g O ₂ /m ³
Consent 5838-2.2 condition 11 max		>150		>0.4 ¹		>2.0	
HHG000090	8.1	10.9	0.037	-	0.095	< 1.0	-
HHG000093	8.9	12.8	0.137	-	0.126	1.1	-
HHG000099	-	13.4	0.70	-	-	< 1.0	-
HHG000100	9.2	14.7	0.49	-	0.26	< 1.0	-
HHG000097	-	10.9	0.047	-	0.046	< 1.0	-
HHG000098	-	10.9	0.033	-	-	< 1.0	-
IND003008	-	28.0	87.0	-	3.8	-	-
HHG000103	-	12.1	4.8	2.7 ¹	-	< 1.0	-
HHG000106	-	13.0	0.186	-	-	< 1.0	-
HHG000109	-	14.6	1.10	-	-	1.2	-
HHG000115	10.5	14.8	1.06	-	0.27	< 1.0	-
HHG000150	11.0	16.7	1.04	-	0.33	< 1.0	-
HHG000160	12.9	21.0	1.72	-	0.67	1.0	-
HHG000165	9.8	12.4	0.045	-	0.106	< 1.0	-
HHG000168	12.8	21.0	1.64	-	0.68	1.2	-
HHG000190	-	22.0	1.89	-	-	-	2.2
MMI000200	9.3	11.1	0.045	-	0.22	< 1.0	-
MMI000204	10.3	12.7	0.35	-	0.33	1.0	-

¹Calculated as per MfE 2018. Not a consent condition

Surface water monitoring round one (08 September 2021, Table 3) indicated the following:

- Temperature ranged 10.0–11.3 °C.
- Un-ionised ammonia was found to be above the consent limit (0.025 g/m³) on one occasion at HHG000103 which is immediately below the boundary of the mixing zone for the discharge from the WTS. The rest of the sites were below the limit, ranging 0.000067–0.0061 g/m³.
- Total ammoniacal nitrogen (NH₄) results adjusted to pH 8 were not undertaken this monitoring round. However, Total NH₄ at sample pH ranged 0.033–4.8 g/m³. The highest concentration was

below the boundary of the mixing zone for the WTS (HHG000103). This latter result was almost 7 times the concentration permitted by the NPS-FM (2020).

- pH remained stable ranged 6.9–7.5.
- Electrical conductivity indicated a slight increase in concentration down the catchment.
- Chloride concentration increased down catchment, though no site was in breach of consent.
- Dissolved carbonaceous biochemical oxygen demand (DCBOD) was recorded above laboratory limit of detection on five different occasions, but still at low levels ranging < 1.0–1.2 g/m³.
- CBOD was recorded at 2.2 g O₂/m³ at HGG000190. This does not constitute a breach of the consent, which prohibits an increase of more than 2.00 g O₂/m³ in dissolved (ie filtered) CBOD rather than in total CBOD.
- *E. coli* monitoring indicated elevated results at all sites, but with increasing counts down through the catchment, ranging 1,200–12,000 cfu/100 ml. The most elevated counts were recorded at HGG000168 with 12,000 cfu, then at HGG000160 with 11,000 cfu. All results were far above recognised guidelines³ for contact use of a water body.
- The quality of the Mimitangiatua awa deteriorated due to the discharges from RNZ into the Haehanga Stream. The concentration of every contaminant measured in the Mimitangiatua awa, was higher below the confluence of the two water bodies than above it. The deterioration was not a significant change in environmental quality.

³ MfE/MoH 2003 and NPS-FM 2020

Table 4 Surface water monitoring 6 October 2021

SW1 06/10/2021	NH ₃	pH	E coli	EC	EC	TSS	Temp
Site	g/m ³	pH Units	cfu/100 ml	mS/m	µS/cm	g/m ³	°C
Consent 5838-2.2 condition 11 max	>0.025						
HHG000090	0.00008	7.2	220	14.5	145	9.0	13.7
HHG000093	-	-	-	-	-	-	-
HHG000099	-	-	-	-	-	-	-
HHG000100	-	-	-	-	-	-	-
HHG000097	-	-	-	-	-	-	-
HHG000098	-	-	-	-	-	-	-
IND003008	-	7.9	7,000	65.1	651	28	17.2
HHG000103	0.0049	7.3	500	15.1	151	39	13.1
HHG000106	0.00136	7.4	900	20.1	201	-	15.2
HHG000109	-	-	-	-	-	-	-
HHG000115	-	-	-	-	-	-	-
HHG000150	-	-	-	-	-	-	-
HHG000160	-	-	-	-	-	-	-
HHG000165	-	-	-	-	-	-	-
HHG000168	0.0026	7.2	700	18.7	187	25	14.1
HHG000190	0.0034	7.2	600	18.7	187	-	14.1
MMI000200	0.00010	6.9	1,000	9.2	92	47	14.2
MMI000204	0.00020	7.0	110	9.8	98	43	14.3
	Total Sodium	Chloride	Total ammoniacal nitrogen (NH ₄)	Total ammoniacal nitrogen with equivalent toxicity at pH 8	NNN	DCBOD	CBOD
Site	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	g O ₂ /m ³	g O ₂ /m ³
Consent 5838-2.2 condition 11 max		>150		>0.4 ¹		>2.0	
HHG000090	10.5	9.7	0.012	-	0.129	< 1.0	-
HHG000093	-	-	-	-	-	-	-
HHG000099	-	-	-	-	-	-	-
HHG000100	-	-	-	-	-	-	-
HHG000097	-	-	-	-	-	-	-
HHG000098	-	-	-	-	-	-	-
IND003008	-	-	38	-	4.3	3.0	-
HHG000103	-	11.3	1.14	(0.53)	0.187	< 1.0	-
HHG000106	-	11.5	0.20	-	-	< 1.0	-
HHG000109	-	-	-	-	-	-	-
HHG000115	-	-	-	-	-	-	-
HHG000150	-	-	-	-	-	-	-
HHG000160	-	-	-	-	-	-	-
HHG000165	-	-	-	-	-	-	-
HHG000168	12.2	15.0	0.71	-	0.29	< 1.0	-
HHG000190	-	15.5	0.82	-	-	-	< 1.0
MMI000200	8.7	10.6	0.047	-	0.107	< 1.0	-
MMI000204	9.2	10.8	0.080	-	0.127	< 1.0	-

¹Calculated as per MfE 2018. Not a consent condition.

Surface water monitoring round two (06 October 2021, Table 4) indicated the following:

- Temperature in in-stream samples ranged 13.1–15.2 °C.
- Un-ionised ammonia was below the consent limit (0.025 g/m³) at all sites recorded.
- Calculations of equivalent total ammoniacal nitrogen (NH₄) adjusted to pH 8 to assess toxicity were not undertaken this monitoring round for all results. However, Total NH₄ at sample pH ranged 0.012–1.14 g/m³. The highest concentration was below the boundary of the mixing zone for the WTS (HHG000103). This latter result exceeded the NPS-FM (2020) limit.
- pH in the Haehanga Stream remained stable, and ranged 7.2–7.9.
- Electrical conductivity remained relatively stable down the catchment ranging 145–201 uS/cm.
- Chloride concentration increased down catchment, though no site was in breach of consent.
- Dissolved carbonaceous biochemical oxygen demand (DCBOD) and CBOD remained below the limit of detection.
- *E. coli* monitoring indicated reduced results compared to the previous round ranging 110–1,000 cfu/100 ml. with the most elevated recorded upstream at MMI000200. Other than at the most upstream site, concentrations all again exceeded recognised guidelines for immersive use of the Stream.

Table 5 Surface water monitoring 19 October 2021

SW1 19/10/2021	NH ₃	pH	E coli	EC	EC	TSS	Temp
Site	g/m ³	pH Units	cfu/100 ml	mS/m	µS/cm	g/m ³	°C
Consent 5838-2.2 condition 11 max	>0.025						
HHG000090	0.00006	7.3	380	15.1	151	6.0	15.4
HHG000093	0.00091	7.2	270	16.2	162	9	15.0
HHG000099	0.00029	7.5	1,000	19.1	191	4	15.9
HHG000100	0.00080	7.2	270	17.8	178	25	15.2
HHG000097	0.00026	7.2	130	17.0	170	85	13.1
HHG000098	0.00024	7.1	140	16.1	161	28	14.4
IND003008	2.5	8.0	8,000	98.6	986	18	20.3
HHG000103	0.025	7.4	430	20.5	205	17	14.3
HHG000106	0.00149	7.4	1,000	21.9	219	-	11.3
HHG000109	0.0043	7.3	380	19.5	195	-	14.5
HHG000115	0.0041	7.3	420	19.3	193	-	14.6
HHG000150	0.0038	7.2	500	20.3	203	11	14.4
HHG000160	0.0036	7.2	400	20.6	206	9	14.6
HHG000165	0.00021	7.0	430	19.1	191	8	15.5
HHG000168	0.0032	7.2	600	20.6	206	12	14.3
HHG000190	0.0032	7.2	440	20.3	203	-	14.5
MMI000200	-	-	-	-	-	-	15.0
MMI000204	-	-	-	-	-	-	15.0
	Total Sodium	Chloride	Total ammoniacal nitrogen	Total ammoniacal nitrogen with equivalent toxicity at pH 8	NNN	DCBOD	CBOD
Site	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	g O ₂ /m ³	g O ₂ /m ³
Consent 5838-2.2 condition 11 max		>150		>0.4 ¹		>2.0	
HHG000090	9.8	9.3	0.011	-	0.054	< 1.0	-
HHG000093	10.8	11.3	0.23	-	0.147	< 1.0	-
HHG000099	-	11.1	0.034	-	-	< 1.0	-
HHG000100	10.5	12.2	0.182	-	0.154	< 1.0	-
HHG000097	-	10.3	0.067	-	0.058	< 1.0	-
HHG000098	-	10.4	0.069	-	-	< 1.0	-
IND003008	-	22.0	63	-	4.1	-	-
HHG000103	-	11.7	4.1	(2.1)	-	< 1.0	-
HHG000106	-	12.8	0.32	-	-	< 1.0	-
HHG000109	-	12.9	0.82	-	-	< 1.0	-
HHG000115	11.6	13.1	0.81	-	0.38	< 1.0	-
HHG000150	12.7	15.6	0.87	-	0.45	1.5	-
HHG000160	12.6	16.5	0.89	-	0.53	< 1.0	-
HHG000165	12.4	14.0	0.076	-	0.079	< 1.0	-
HHG000168	12.6	16.2	0.83	-	0.52	< 1.0	-
HHG000190	-	16.8	0.77	-	-	-	< 1.0
MMI000200	-	-	-	-	-	-	-
MMI000204	-	-	-	-	-	-	-

¹Calculated as per MfE 2018. Not a consent condition

Surface water monitoring round three (19 October 2021, Table 5) indicated the following:

- Temperature ranged 11.3–15.9 °C.
- Un-ionised ammonia was recorded at the consent limit (0.025 g/m³) on one occasion at HGG000103, however, this was not a breach as it did not exceed this limit. This result was found below the boundary of the mixing zone for the WTS (HHG000103).
- The rest ranged 0.00006–0.0041 g/m³.
- Total ammoniacal nitrogen (NH₄) results adjusted to equivalent toxicity at pH 8 were not undertaken this monitoring round for all samples. However, Total NH₄ at sample pH ranged 0.011–4.1 g/m³. The latter result, below the discharge from the WTS, was more than 5 times higher than allowed by the NPS-FM (2020).
- pH remained stable ranged 7.0–7.5.
- Electrical conductivity indicated an increasing concentration down the catchment.
- Chloride concentration increased down catchment, though no site was in breach of consent.
- Dissolved carbonaceous biochemical oxygen demand (DCBOD) was recorded above laboratory limit of detection one occasion at 1.5 g O₂/m³ at HGG000150.
- CBOD was below the LOD.
- *E. coli* fluctuated in the catchment ranging 130–1,000 cfu/100 ml. These results were lower than found in the previous two sampling runs, although still above recognised guidelines⁴.
- As in the previous sampling runs, the concentrations of all contaminants increased in a downstream direction along the length of the Haehanga catchment.

⁴ MfE/MoH 2003 and NPS-FM (2020)

Table 6 Surface water monitoring 20 December 2021

SW1 20/12/2021	NH ₃	pH	E coli	EC	EC	TSS	Temp
Site	g/m ³	pH Units	cfu/100 ml	mS/m	µS/cm	g/m ³	°C
Consent 5838-2.2 condition 11	>0.025						
HHG000090	<0.00010	-	210	-	135	3	-
HHG000093	0.00032	7.3	230	13.7	137	6	19.0
HHG000099	0.00166	7.6	1,200	23.9	239	6	16.6
HHG000100	0.00130	7.4	1,200	17.5	175	8	18.0
HHG000097	0.00086	7.4	300	15.5	155	17	15.3
HHG000098	0.00085	7.4	400	15.2	152	21	16.3
IND003008	4.5	8.2	800	114.9	1149	14	21.1
HHG000103	0.049	7.6	500	20.1	201	27	16.6
HHG000106	0.0039	7.5	1,300	23.5	235	-	17.4
HHG000109	0.0045	7.5	800	19.3	193	-	17.3
HHG000115	0.0039	7.5	1,000	19.5	195	-	17.5
HHG000150	0.0031	7.4	300	20.9	209	25	17.9
HHG000160	0.0030	7.4	700	21.3	213	33	17.7
HHG000165	0.00048	7.3	500	19.9	199	12	17.1
HHG000168	0.0024	-	400	-	213	23	-
HHG000190	0.0021	7.3	200	20.9	209	-	17.9
MMI000200	0.00031	7.4	600	9.7	97	17	17.8
MMI000204	0.00024	7.2	500	10.3	103	18	17.7
	Total Sodium	Chloride	Total ammoniacal nitrogen as N	Total ammoniacal nitrogen with equivalent toxicity at pH 8	NNN	DCBOD	CBOD
Site	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	g O ₂ /m ³	g O ₂ /m ³
Consent 5838-2.2 condition 11 max		>150		>0.4 ¹		>2.0	
HHG000090	9.3	8.6	<0.010	-	0.128	<1.0	-
HHG000093	9.6	9.4	0.039	-	0.112	< 1.0	-
HHG000099	-	10.6	0.146	-	-	< 1.0	-
HHG000100	10.4	11.1	0.144	-	0.220.132	< 1.0	-
HHG000097	-	8.8	0.111	-	0.103	< 1.0	-
HHG000098	-	8.9	0.112	-	-	< 1.0	-
IND003008	-	21	78	-	0.83	-	-
HHG000103	-	10.2	4.1	2.51	-	< 1.0	-
HHG000106	-	13.4	0.38	0.24	-	< 1.0	-
HHG000109	-	12.3	0.43	-	-	< 1.0	-
HHG000115	11.1	12.8	0.41	-	0.45	1.2	-
HHG000150	13.0	18.7	0.42	-	0.57	1.3	-
HHG000160	13.7	19.5	0.40	-	0.62	< 1.0	-
HHG000165	13.2	13.3	0.083	-	0.156	< 1.0	-
HHG000168	13.4	19.0	0.37	-	0.61	< 1.0	-
HHG000190	-	18.8	0.29	-	-	-	< 1.0
MMI000200	8.6	9.7	0.035	-	0.23	<1.0	-
MMI000204	8.7	10.2	0.048	-	0.24	<1.0	-

¹Calculated as per MfE 2018. Not a consent condition

- A notable finding from the freshwater survey undertaken on 20 December 2021 was the breach of the consent limit on unionised ammonia (highlighted in Red above) in the tributary below the discharge from the WTS. The result of 0.049 g/m³ is double the allowed limit, and depending upon the duration and frequency of the discharge would pose a risk of environmental impacts upon invertebrates and fish. The next sampling site downstream (which is in the main stem), HHG000109, showed a much more acceptable level of ammonia.
- More generally there is an increase in the concentration of a number of contaminants as the Haehanga Stream flows through the property. This can be shown most markedly by comparing the results for HHG000160 (main stem) and HHG 000165 (tributary from a new irrigation area). The main stem at the confluence has significantly greater concentrations of chloride, unionised and total ammoniacal nitrogen, and nitrate nitrogen, which are all products of decomposition and leaching from process materials and drilling wastes. The concentration of biochemical oxygen demand also is highest lower in the catchment, although dropping below the threshold of detection by the time the stream reaches the Mimitangiatua awa.
- The Mimitangiatua awa showed a negligible influence from the Haehanga Stream on this occasion in terms of environmental effects, although most contaminants were again at higher concentrations below its confluence with the Haehanga Stream than above it.
- In addition to the analyses reported above, sites HHG000090, HHG000106, HHG000160, HHG000168, HHG000190 (ie above and below the operational areas) and the two sites on the Mimitangiatua were analysed for organophosphate and organonitrogen fungicides [light organic solvent preservatives (LOSPs)]. The pesticides permethrin, propiconazole, and tebuconazole have been detected in the sawdust stockpiled on the RNZ site (in breach of their consent) and have entered the surrounding environment. No trace was found in the Haehanga Stream or the Mimitangiatua awa at a detection limit of <0.00002, <0.00004, and <0.00004 g/m³, respectively.
- However, the irrigation wastewater was found to contain 0.010 g/m³ propiconazole and 0.0127 g/m³ tebuconazole. While this establishes that the preservatives are being leached from the drilling wastes and/or the site of previous sawdust storage, the wastewater is discharged to the irrigation fields rather than to surface water. It is considered the LOSPs will degrade within soil.
- The sample from HHG000097 was also analysed for total metals, to give baseline data against which the environmental effects of any leaching of metals from tanalised sawdust or the drilling wastes could be assessed in future. The results were (all as g/m³ total metals): arsenic 0.0020; cadmium <0.000053; chromium 0.00080; copper 0.0028; lead 0.00099; nickel 0.0042; and zinc 0.0024. Concentrations of these levels are not of environmental significance.

Table 7 Surface water monitoring 11 March 2022

SW1 11/03/2022	NH ₃	pH	E coli	EC	EC	TSS	Temp
Site	g/m ³	pH Units	cfu/100 ml	mS/m	µS/cm	g/m ³	°C
Consent 5838-2.2 condition 11 max	>0.025						
HHG000090	< 0.00007	7.2	500	19.8	198	< 3	19.8
HHG000093	< 0.00013	7.6	500	22.3	223	47	18.1
HHG000099	< 0.00004	7.1	160	36.2	362	60	17.5
HHG000100	0.00067	7.1	800	33.0	330	89	16.9
HHG000097	0.00055	6.9	80	23.2	232	7.0	15.0
HHG000098	0.00033	7.4	1,500	20.8	208	7.0	16.3
IND003008	0.099	7.6	1,200	43.4	434	11	20.0
HHG000103	0.0052	7.3	1,800	25.9	259	13	16.4
HHG000106	0.022	7.0	1,100	87.2	872	-	16.9
HHG000109	0.00173	6.9	22,000	55.0	550	-	17.6
HHG000115	0.0038	7.2	2,200	50.7	507	-	17.7
HHG000150	0.00015	7.5	100	61.5	615	7.5	20.0
HHG000160	< 0.00005	7.1	900	54.7	547	11	18.5
HHG000165	0.00036	6.6	1,400	33.6	336	6.0	17.3
HHG000168	< 0.00005	7.1	500	46.7	467	12	18.3
HHG000190	< 0.00007	7.3	800	40.4	404	-	17.8
MMI000200	< 0.00018	7.6	70	15.1	151	< 3	20.7
MMI000204	0.00017	7.6	150	15.5	155	3.0	20.7
	Total Sodium	Chloride	Total ammoniacal nitrogen	Total ammoniacal nitrogen with equivalent toxicity at pH 8	NNN	DCBOD	CBOD
Site	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	g O ₂ /m ³	g O ₂ /m ³
Consent 5838-2.2 condition 11 max		>150		>0.4 ¹		>2.0	
HHG000090	12.2	7.5	< 0.010	-	< 0.002	< 1.0	-
HHG000093	15.3	11.4	< 0.010	-	< 0.002	1.7	-
HHG000099	-	35	< 0.010	-	-	< 1.0	-
HHG000100	21	33	0.153	-	0.26	< 1.0	-
HHG000097	-	9.8	0.25	-	0.33	< 1.0	-
HHG000098	-	9.8	0.39	-	-	< 1.0	-
IND003008	-	18.6	6.0	-	0.071	-	-
HHG000103	-	12.6	0.86	-	-	< 1.0	-
HHG000106	-	161	7.0	(2.9)	-	< 1.0	-
HHG000109	-	85	0.66	-	-	< 1.0	-
HHG000115	39	73	0.64	-	0.49	< 1.0	-
HHG000150	50	122	0.012	-	0.091	< 1.0	-
HHG000160	39	102	< 0.010	-	0.044	< 1.0	-
HHG000165	18.7	22	0.27	-	0.006	< 1.0	-
HHG000168	31	70	< 0.010	-	0.013	< 1.0	-
HHG000190	-	58	< 0.010	-	-	-	1.4
MMI000200	13.2	12.8	< 0.10	-	0.002	< 1.0	-
MMI000204	13.3	13.3	0.010	-	0.003	< 1.0	-

¹Calculated as per MfE 2018. Not a consent condition

Surface water monitoring round five (11 March 2022, Table 7) indicated the following:

- Temperature ranged 15.0–20.7 °C.
- Un-ionised ammonia was found to be below the consent limit (0.025 g/m³) at all locations. However, it was close to the limit on one occasion at HGG000106 which was recorded at 0.022 g/m³.
- Total ammoniacal nitrogen (NH₄) results adjusted to pH 8 were not undertaken this monitoring round. However, Total NH₄ at sample pH ranged < 0.010–7.0 g/m³. The latter result, in a tributary running between pads 1 and 3, was more than 7 times higher than the maximum permitted by the NPS-FM (2020).
- pH ranged 6.6–7.6.
- Electrical conductivity indicated slight increments in concentration down the catchment.
- Chloride concentration increased down catchment ranging 7.5–161 g/m³ with the highest recording located at HGG000106.
- Dissolved carbonaceous biochemical oxygen demand (DCBOD) was recorded above laboratory limit of detection on one occasion at HGG000093 with a value of 1.7 g O₂/m³. This site is below some of the upper irrigation fields.
- CBOD was recorded at 1.4 g O₂/m³ at HGG000190.
- *E. coli* monitoring fluctuated greatly ranging 70–22,000 cfu/100 ml. with the most elevated recorded at HGG000109 (on the main stem of the Haehanga Stream, below the composting pad and wastewater system) with 22,000 cfu, then at HGG000115 with 2,200 cfu.
- Of note, the results for site HHG000106 were highly anomalous by comparison with other results during the year for this site, and show evidence of a break-out of contaminated groundwater. Site HHG000106 is on a tributary running adjacent to Pads 1 and 3 and the wastewater collection system. By comparison with the nearest upstream site in the main stem of the Haehanga Stream (HHG000100) site HHG000106 showed a 5-fold increase in chloride from 33 to 161 g/m³, a 45-fold increase in total ammonium nitrogen from 0.153 to 7.0 g/m³, and a 2.6-fold increase in EC from 330 to 872 µS/cm. Downstream sites in the main stem of the Haehanga Stream were markedly affected. This break-through and subsequent investigations and enforcement actions are discussed further below in Section 2.2.3.
- The influence of the Haehanga Stream on the Mimitangiatua awa was again clear, although the changes in the Mimitangiatua awa were of no ecological significance.

Table 8 Surface water monitoring 26 May 2022

26/05/2022	NH ₃	pH	E coli	EC	EC	TSS	Temp
Site	g/m ³	pH Units	cfu/100 ml	mS/m	µS/cm	g/m ³	°C
Consent 5838-2.2 condition 11 max	>0.025						
HHG000090	0.000080	6.9	120	17.2	172	10	9.8
HHG000093	0.000085	6.9	120	18.1	181	20	9.7
HHG000099	0.00034	7.2	1,000	30.7	307	6	9.5
HHG000100	0.00020	7.0	360	23.0	230	9	9.6
HHG000097	0.00026	7.0	140	22.2	222	26	9.4
HHG000098	0.00021	7.0	370	19.7	197	20	9.5
IND003008	0.60	7.8	3,200	90.8	908	109	11.8
HHG000103	0.0082	7.2	560	25.6	256	26	9.6
HHG000106	0.00162	7.1	390	28.7	287	-	10.7
HHG000109	0.00092	7.1	590	25.3	253	-	9.7
HHG000115	0.0097	7.2	3,000	29.9	299	-	9.4
HHG000150	0.037	7.3	22,000	43.1	431	35	10.0
HHG000160	0.067	7.1	90,000	65.8	658	64	10.5
HHG000165	0.0020	6.7	1,600	35.0	350	17	10.6
HHG000168	0.074	7.1	71,000	70.2	702	135	10.7
HHG000190	0.080	7.2	60,000	68.9	689	-	10.7
MMI000200	0.000077	6.9	340	11.5	115	9	11.1
MMI000204	0.00075	6.9	1,800	12.6	126	16	11.1
	Total Sodium	Chloride	Total ammoniacal nitrogen	Total ammoniacal nitrogen with equivalent toxicity at pH 8	NNN	DCBOD	CBOD
Site	g/m ³	g/m ³	g/m ³	g/m ³	g/m ³	g O ₂ /m ³	g O ₂ /m ³
Consent 5838-2.2 condition 11 max		>150		>0.4 ¹		>2.0	
HHG000090	10.7	9.0	0.053	-	0.169	< 1.0	-
HHG000093	11.0	10.5	0.060	-	0.170	< 1.0	-
HHG000099	-	13.4	0.111	-	-	< 1.0	-
HHG000100	11.7	12.8	0.102	-	0.164	1.3	-
HHG000097	-	9.8	0.142	-	0.153	< 1.0	-
HHG000098	-	10.2	0.114	-	-	< 1.0	-
IND003008	-	27	47	-	1.30	-	-
HHG000103	-	11.6	3.2	-	-	< 1.0	-
HHG000106	-	18.4	0.59	-	-	< 1.0	-
HHG000109	-	15.2	0.43	-	-	< 1.0	-
HHG000115	14.6	20	3.5	(1.6)	0.36	5.3	-
HHG000150	19.4	36	10.4	(5.0)	0.21	14	-
HHG000160	27	54	25	(10.8)	0.004	39	-
HHG000165	17.6	22	2.3	(0.87)	0.078	4.7	-
HHG000168	27	54	28	(12.1)	0.010	36	-
HHG000190	-	54	27	(12.2)	-	-	46
MMI000200	9.4	11.2	0.045	-	0.30	< 1.0	-
MMI000204	10.0	12.0	0.45	-	0.29	< 1.0	-

¹Calculated as per MfE 2018. Not a consent condition

Surface water monitoring round six (26 May 2022, Table 8) indicated the following:

- Temperature ranged 9.4–11.1 °C.
- Un-ionised ammonia was found above the consent limit (0.025 g/m³) at four separate locations ranging 0.037–0.080 g/m³. The most elevated was recorded at HGG000190 which is one of the furthest sites from the discharge point. All other breached sites were also near the end of the catchment.
- Total ammoniacal nitrogen (NH₄) results adjusted to pH 8 were not undertaken this monitoring round for all samples. However they have been calculated for the site in the lower reaches of the Haehanga catchment, Total NH₄ at sample pH ranged 0.045–28 g/m³. When equivalent toxicity is calculated, the sites were found to be up to more than 25 times higher than the maximum total ammonium concentration permitted by the NPS-FM (2020).
- pH ranged 6.7–7.3.
- Electrical conductivity increased in concentration down the catchment.
- Chloride concentration also increased down the catchment ranging 9.0–54 g/m³ with the highest recording located at HGG000160.
- Dissolved carbonaceous biochemical oxygen demand (DCBOD) was recorded above laboratory limit of detection on four occasions ranging 4.7–39 g O₂/m³. The highest recording was at HGG000160, then HGG000168 (36 g O₂/m³), HGG000150 (14 g O₂/m³), and HGG000165 (4.7 g O₂/m³).
- CBOD was recorded at 46 g O₂/m³ at HGG000190.
- *E. coli* monitoring fluctuated greatly ranging 120–90,000 cfu/100 ml. with the most elevated recorded at HGG000160 with 90,000 cfu, then HGG000168 (71,000 cfu), HGG000190 (60,000 cfu), and HGG000150 (22,000 cfu). It is to note that this monitoring round indicated the greatest values of *E. coli* for the period.
- The sampling run of May 2022 found there was very significant pollution occurring in the Haehanga Stream, from its midpoint down to its confluence with the Mimitangiatua awa. In particular, the concentrations of un-ionised ammonia were more than 3 times the consented limit and far above thresholds of toxicity; of faecal indicator bacteria two orders of magnitude above guidelines for immersive use of a water body⁵, and the BOD (measure of organic load) was up to 20 times the consented limit and the national guideline provided through the Ministry for the Environment for protection of in-stream ecological health and the avoidance of the growth of undesirable species. Enforcement action was under consideration by the Council at the end of the period under review⁶.
- The main effect upon the quality of the Mimitangiatua awa downstream of the confluence was a very significant increase in faecal indicator bacteria (*E. coli*). While the downstream concentration of *E. coli* had been higher on 8 September 2021, on that occasion the upstream concentration was also very high, whereas on 26 May 2022 the downstream concentration of *E. coli* was increased by more than 5 times above that upstream. The concentration of total ammonium nitrogen found on 26 May was also the highest recorded in the Mimitangiatua awa below the confluence all year, and represented a ten-fold increase above the upstream concentration on this occasion..

Pathogenic micro-organisms survey October 2021

As noted above, concentrations of faecal pollution indicator bacteria are elevated in the vicinity of RNZ activities, to far above the recognised guidelines and standards for immersive uses of water referenced above. In October 2021 Council scientists undertook a survey at selected sites, in order to gain a more direct understanding of the risks that might arise from pathogenic microorganisms on and in the vicinity of

⁵ MfE/MoH 2003 and NPS-FM 2020

⁶ After investigation, the Council issued an infringement notice in October 2022

the site. Samples were collected from both the irrigation wastewater storage pond and the wetland treatment system discharge to the Haehanga Stream, to differentiate between contributions from possible on-site sources. Samples were also collected from the Haehanga Stream itself at locations above and below the composting facility (monitoring sites HHG000090 and HHG000190) in order to differentiate possible pathways into the Stream. The samples were analysed for the levels of *Escherichia coli*, enterococci, *Campylobacter*, *Salmonella*, Shiga toxin-producing *E coli* (**STEC**), *Cryptosporidium*, *Giardia*, norovirus, enterovirus, and adenovirus.

In brief

Campylobacter causes gastro-enteric infections, which may have chronic as well as acute outcomes, and is the most common cause of such infections in New Zealand.

Human norovirus genogroups I and II (**GI** and **GII**) are major causes of viral gastroenteritis.

STEC and giardia cause abdominal cramps and diarrhoea, which in some cases (up to 10%) can advance to more severe and life-threatening conditions.

Adenovirus is associated with respiratory illnesses as well as gastric upsets.

Some types of *Salmonella* bacteria, typically associated with poultry and spread through contaminated water, cause the gastric illness salmonellosis, with symptoms of diarrhoea, fever, and cramping.

Transmission of *Cryptosporidium parvum* and *C hominis* occurs mainly through contact with contaminated water (e.g. drinking or recreational water). Upon ingestion, these pathogenic parasites multiply in the gut, causing cryptosporidiosis, a disease that evidences in watery diarrhoea, or more severe symptoms in people with weakened immune systems. Infected cattle and sheep are recognised as significant reservoirs.

The four sites sampled were as follows:

HHG000090: background (upstream) water quality sampling site in the Haehanga Stream, approximately 200 m above irrigation areas.

IND003008: discharge to the Haehanga Stream from the wetland treatment system for Pad 2 (paunch vermiculture pad runoff and stockpiled paunch leachate).

IND002044: discharge to land from the irrigation pond.

HHG000190: Downstream (receiving environment) water quality sampling site in the Haehanga Stream, downstream of RNZ facilities and operations, and 50 m above SH3 bridge.

The results show that the RNZ site is a very significant source of faecal-derived pollution of the Haehanga Stream, as evidenced by the increase in the concentrations of the faecal markers *E coli* (which doubles) and enterococci (which increases by a factor of 38 times) from upstream to downstream of the RNZ facilities.

This is reinforced by the extremely high loadings of these markers in the site's wetland treatment system (IND003008) and the irrigation system (IND002004). *E coli* in IND003008 is 20 times higher and enterococci is 32 times higher than in the upstream Haehanga Stream; and *E coli* in IND002004 is 124 times higher and enterococci is more than 6,200 times higher than in the upstream Haehanga Stream.

Based on ESR's guidance for equivalent concentrations for results derived by different analytical methods (see ESR discussion in the 'comments' section of the attached certificate) the *E coli* concentration in the upstream sample (HHG000060) was within the 2003 MoH/MfE bathing guideline for a single sample, whereas the *E coli* concentration in the downstream sample (HHG000190) was well in excess of the maximum guideline.

Concentrations of *campylobacter jejuni*, typically sourced from chicken offal and bird wastes, are much higher in both of the on-site wastewater samples than in the Haehanga Stream, and the concentration downstream is almost four times higher than upstream.

No salmonella bacteria, cryptosporidium ova, or giardia, were detected in any samples collected in this survey, at the limits of detection of the analytical techniques and sample volumes used.

The very highly toxic STEC Stx1 was detected in the land irrigation reservoir pond. This system receives the runoff from the pads used for composting sheepskins and chicken offal. Cattle and sheep are recognised as significant reservoirs of the toxin-producing *E coli* bacteria strains.

Overall, the land irrigation pond carries the highest loadings of the various pathogenic microorganisms. This survey confirmed that the RNZ facilities are a source for a range of pathogenic microorganisms to enter the wider environment, in significant concentrations. Likewise, the bi-monthly sampling undertaken by the Council (Tables 3-8) regularly showed increase in *E coli* concentrations downstream through the catchment.

Results of qPCR Pathogen DNA Marker Analysis:

ESR Number	Client Reference	E.coli copies / 100 mL	Enterococci copies / 100 mL	C. jejuni copies / 100 mL	C. coli copies / 100 mL	Salmonella copies / 100 mL	STEC/VTEC E.coli stx1 copies / 100 mL	STEC/VTEC E.coli stx2 copies / 100 mL	Crypto hominus copies / 100 mL	Crypto parvum copies / 100 mL	Giardia copies / 100 mL
CMB210925	HHG000090	5,000	3,700	53	< 10	< 15	< 20	< 1	< 15	< 10	< 10
CMB210926	IND003008	100,000	120,000	1,100	< 15	< 30	< 35	< 1	< 25	< 15	< 20
CMB210927	IND002044	620,000	23,000,000	890	540	< 30	100	< 1	< 25	< 15	< 20
CMB210928	HHG000190	10,000	140,000	190	< 10	< 15	< 20	< 1	< 15	< 10	< 10

Abbreviations: NA = sample was not analysed for this marker.
NC = not calculated
LOQ = limit of quantitation

Comments:

As expected, *E.coli* and *Enterococci* was detected in all samples and particularly high levels were detected in sample IND002044. *Campylobacter jejuni* was also detected in all samples, however *Campylobacter coli* and *E.coli* stx 1 was only detected in sample IND002044. This is consistent with this sample having the highest levels of faecal indicator bacteria (*E.coli* and *Enterococci*). Of the pathogens tested for, no others were detected in any of the samples.

It is not possible to directly compare the units used in this report (copies / 100 mLs) with units used in traditional micro testing ie cfu or MPN / 100 mLs. We have done some work comparing traditional *E.coli* MPN results with the *E. coli* DNA assay and offer the following estimated comparison as a guide.

ESR Number	Client Reference	E.coli copies / 100 mL	E.coli (estimated MPN / 100 mL)
CMB210925	HHG000090	5,000	≈300
CMB210926	IND003008	100,000	≈10,000
CMB210927	IND002044	620,000	>20,000
CMB210928	HHG000190	10,000	≈600

Notes:

Levels of the same pathogen marker in different samples can be compared. For example;

- If sample A has an *E.coli* result of 1,000 and sample B has an *E.coli* of 10,000 it is valid to conclude there is more *E.coli* in sample B than in sample A; or
- To be classified as a significantly greater or lesser result the level of pathogen should vary by a factor of 10.

Levels of the different pathogen marker in the same sample can not be compared. For example;

- If sample A has an *E.coli* result of 1,000 and an *C. jejuni* result of 1,000 it is not valid to conclude sample A has the same amount of C. jejuni and E. coli

Brief details of the methods of analysis are available on request.

These results relate to samples as received.

This report may not be reproduced except in full.

Table 9 Dissolved oxygen concentrations (g/m³) in the Haehanga Stream.

Results below 5.0 g/m³ are highlighted. Multiple readings were made on 11 March 2022 during the course of a day

Site	HHG000093 Upstream	HHG000097 Upstream, side tributary	HHG000100 Below upper irrigation fields	HHG000103 Tributary below WTS	HHG000106 Tributary subject to inflow from Pads 1 and 3	HHG000109 Beside composting plant	HHG000115 Below plant	HHG000150 Beside lower irrigation plant	HHG100190 Above roadside
Date									
28/02/18	6.3	8.2	6.9	7.8	1.8	5.5	5.9	3.4	6.6
26/04/18	6.7	9.4	8.7	8.5	8.6	8.6	8.1	5.8	7.4
19/12/18	3.4	5.7	5.2	4.6	4.2	5.9	4.5	4.9	4.8
22/02/19	0.7	0.3	2.4	0.7	0.8	5.0	2.2	3.3	3.3
12/04/19	7.6	9.6	8.4	9.1	7.2	5.9	6.1	6.2	5.8
06/01/20	7.0	8.0	5.9	8.5	6.4	6.9	6.5	3.5	4.7
06/03/20	3.2	7.0	7.0	6.4	6.1	6.0	6.7	4.2	4.8
25/02/21	5.2	5.0	3.2	4.3	4.0	4.7	3.6	2.1	4.0
20/12/21	7.6	8.3	8.5	8.1	9.2	8.9	8.6	7.0	6.5
11/03/22	8.0–9.8	2.6–4.7	5.4–6.9	2.7–3.4	0.2–3.4	2.4–4.7	2.8- -6.3	9.9–11.3	3.9- -10.0

Dissolved oxygen surveys

An adequate concentration of DO is essential for aquatic ecosystem health. As concentrations drop below 100% saturation of water with oxygen, species diversity and abundance begin to diminish, with most species being unable to thrive or even survive when concentrations fall below around 5-6 g/m³ at 15°C.⁷ Schedule 3 of the RMA requires that the minimum concentration of oxygen in waters being managed for a number of purposes, including for the gathering or cultivating of shellfish for human consumption, shall be at least 80% of the concentration at saturation, which is around 8 g/m³.

Council staff measured the oxygen content of the Haehanga Stream on a bi-monthly basis throughout the period under review. It has been found that surveys in summer show the lowest concentrations of DO. The presentation of results in Table 9 show those collected during the months of December to April for the last five years. Higher flows during the remainder of the year mean more turbulence (aeration and re-aeration) and greater dilution of oxygen-depleting discharges (i.e. there is a proportionately greater capacity in the stream to supply oxygen demand).

The results in Table 9 demonstrate the impact on DO concentrations in the Haehanga Stream from point source and diffuse discharges within the RNZ property (especially the WTS, the upper irrigation areas, the composting pads, and the lower irrigation fields) on the Haehanga Stream. There are multiple occasions and sampling sites where the discharges from the RNZ activities have reduced the concentrations of dissolved oxygen of the Stream to below the levels that are recognised in criteria established for protecting the life-supporting capacity of waterways..

Migration of CCA into the Haehanga Stream from sawdust and Pad 3 stockpile.

Council officers undertook sampling of the discharges from the RNZ facility and the Haehanga Stream itself on 2 July 2021 following consideration of potential migration and wider effects. The survey discovered CCA was present at non-natural concentrations in the site's discharges and downstream in the Haehanga Stream itself. In particular, upstream of the site there was no detectable arsenic in the Haehanga Stream, but the irrigation pond was found to have a concentration of arsenic more than 20 times the laboratory limit of detection, and the wetland discharge to the Stream had arsenic at 4 times above the limit of detection. Copper was 4 times more concentrated in the irrigation pond and 2 times more concentrated in the wetland discharge to the Stream, than in the Stream itself; and chromium was 100 times more concentrated in the irrigation pond and two times more concentrated in the wetland discharge to the Stream, than in the Stream itself.

The concentrations of CCA chemicals in the Haehanga Stream, while elevated, did not reach concentrations of ecological significance in samples collected during the year. Because of the potential that they may do so in the future, physicochemical and biological monitoring will continue.

2.2.3 Additional monitoring- surface water incidents

A routine monthly scheduled survey of the physico-chemical quality across the Haehanga catchment was undertaken on 11 March 2022. Significant analytes and results are shown in Table 10. Of particular significance were the anomalous results found at site HHG000106. HHG000106 is a sampling site in a small tributary that runs between, and is downslope of, Pad 1, the truckwash pond, the former Pad 3 raw wastes reception pond, and Pad 3 and the blended drilling wastes stockpile. By comparison with data for upstream sites in other tributaries or the main stem of the Haehanga Stream, the total alkalinity at site HHG000106 was elevated by 1.5 to 2 times; hardness by 2 to 3 times; conductivity (a measure of total dissolved ionic strength) by 3 to 4 times, chloride by approximately 15 times, and total ammoniacal nitrogen by approximately 30 times.

⁷

For example, see <https://niwa.co.nz/freshwater-and-estuaries/research-projects/dissolved-oxygen-criteria-for-fish>.

The contract laboratory was subsequently asked to conduct analysis on the HHG000106 sample for the presence of the organonitrogen and organophosphate pesticides that have previously been detected in the treated sawdust stockpile and the blended drilling wastes stockpile on Pad 3 on the RNZ site. The laboratory detected two of the three pesticides in the water sample.

The laboratory was asked also to analyse the HHG000106 sample for the presence of barium, as this is a definitive marker for drilling wastes from hydrocarbon extraction sites. The laboratory detected barium at a concentration of 0.30 mg/L (acid soluble barium) and 0.29 mg/L (total barium). For all intents and purposes these two results are identical.

The laboratory analysis of the sample collected at site HHG000106 on 11 March 2022 also detected an extremely high chloride concentration, which is a typical marker for drilling wastes. While LOSPs are also present in the sawdust stockpile on Pad 1, there is no basis to assign the origin of the extremely high chloride leakage to the sawdust or to the materials composting on Pad 1. Therefore, it is reasonable to assume that the source of the contamination found to be leaking into the tributary is associated more particularly with the drilling wastes. This is likely to be from the stockpile, the holding pond previously used to receive wastes destined for Pad 3, and/or the truck-wash and irrigation ponds, as these have received run-off and leachate from Pad 3 and its dumping pond.

The point of seepage is to the east of the drilling wastes stockpile and several metres below it downslope. The various ponds are further away, beyond Pad 3. The point of seepage is shown below in photo 2, by the white plastic standard.



Photo 2 Location of seepage into tributary, 20 June 2022

Given the fine weather on the day of this sampling survey, and the day preceding it, this result is regarded as clear evidence of a plume of contaminated groundwater emerging as a discharge into the unnamed tributary at some point or points, rather than being due to uncontrolled surface stormwater runoff or pond overflow.

As a consequence of the elevated concentrations of the range of parameters detected at routine sampling site HHG000106 on 11 March 2022, an intensive survey using field meters to measure conductivity *in situ* was consequently conducted, on 30 March 2022. Figure 4 shows the locations of these intensive investigations into the sources of elevated conductivity. The location of site HHG000106 is shown in Figure 3. It lies on the unnamed tributary running between pads 1 and 3 shown in Figure 4, and is at the same point as the location denoted as site 4 in Figure 4.

The purpose was to identify whether there was a particular point at which pollution was entering the tributary, or whether there was widespread (diffuse) contamination of groundwater in the vicinity. Council staff walked the tributary, along with other watercourses on the property, tracking changes in conductivity readings within each waterway. The results of this survey are presented alongside the aerial photograph in Figure 4.

The survey identified a spot within the tributary where, over the course of a distance of less than a metre between survey sites 13 and 12, the conductivity in the tributary increased by between 5.5 and 9 times, from readings of 29.1 to 31.6 mS/m at site 13, to readings of 161 to 260 mS/m at site 12. Two meters were used, to ensure independent confirmatory readings at these two sites. The measurements were made in a stretch of the stream where the inflow was not fully mixed into the stream flow, and so variations in readings were to be expected. Further down the tributary, prior to its confluence with the main stream of the Haehanga Stream, the conductivity reduced to about 58 mS/m, which was still much higher than measurements of conductivity anywhere else in the catchment on the day of the survey.

The Council officers then cleared both sides of the tributary at Site 12, seeking to ascertain the point of ingress. The bank on the true left side (i.e. left-hand side facing downstream) was damp and gravelly in nature, while the true right bank was dry. The seepage rate from the left bank was too low to be measured directly for conductivity.

The results of physico-chemical analyses on samples collected on 30 March 2022 are presented in Table 11. Between site 13 (immediately upstream of the identified point of seepage in the tributary), and sites 12 and 4 (respectively at the point of seepage, and a few metres downstream but still within the tributary), there were highly significant increases in metrics such as conductivity (by two times), chloride (by four times), total ammoniacal nitrogen (by 10 to 20 times), and acid-soluble barium (by three to 10 times).

Measurements of total ammoniacal nitrogen and of un-ionised ammonia are close to or exceeding recognised water quality criteria, although not breaching the conditions set out in the current (expired) consent 5838-2. The concentration of barium was within the range that is routinely detected in the wastewater originating from the vicinity of Pads 1 and 3, which is collected in the irrigation storage pond. The changes in water quality, and thus the presence of the seepage, are unmistakeable.

Each of these analytes are recognised markers for drilling muds that has been blended with tannalised and preservative-treated sawdust and with vegetation, as previously confirmed to be found on Pad 3 at RNZ's facility.

This conductivity-based survey confirmed a narrow discharge of highly polluted groundwater, and all results (physico-chemical measurements and field observations) taken in conjunction establish that the contamination is consistent with the contamination originating from the drilling wastes stockpile, and/or the now rehabilitated drop-off pond used to receive the wastes that were subsequently placed on to the drilling wastes stockpile, and/or the wastewater collection and storage system. In these two surveys, uncontrolled contamination was found to be leaching from one or more of these sources, and resulting in degraded water quality in the tributary.

Table 10 Survey of physico-chemical parameters in the Haehanga catchment 11 March 2022

Site		HHG000093	HHG000097	HHG000100	HHG000103	HHG000106	IND002044	HHG000109	HHG000115	HHG000150	HHG100190
		Upstream	Upstream of WTS on side tributary	Below upper irrigation fields	Tributary below WTS	Tributary subject to runoff or infiltration from Pads 1 and 3	Irrigation pond	Main stem, below composting plant	Below plant	Beside lower irrigation fields	Above roadside
Time	NZST	10:25	10:45	10:05	10:45	10:15	09:58	09:40	09:52	09:10	08:52
Alkalinity as CaCO ₃	g/m ³	67	84	89	89	129	1840	113	109	81	89
Hardness as CaCO ₃	g/m ³	83	92	112	72	230	420	152	137	161	124
EC	mS/m	22.3	23.2	33.0	25.9	87.2	644	55.0	50.7	61.5	40.4
Chloride	g/m ³	11.4	9.8	33	12.6	161	730	86	73	122	58
TAN	g/m ³	<0.010	0.25	0.153	0.86	7.0	390	0.66	0.64	0.012	<0.010
NH3	g/m ³	0.00017	0.00055	0.00067	0.0052	0.022	47	0.00173	0.0038	0.00015	<0.00007
Propiconazole	g/m ³					0.00011	0.0083				
Tebuconazole	g/m ³					0.00009	0.0102				
Permethrin	g/m ³					<0.00002	<0.0005				

EC: Conductivity

TAN: Total ammoniacal nitrogen

NH3: Un-ionised ammonia, calculated on the basis of site pH and temperature at time of measurement



Figure 4 Sites used for intensive conductivity-based survey on 30 March 2022, and results. Sites 1 and 2 were either side of the ‘twin culverts’ road access crossing of the Haehanga Stream, beyond the top (north) of the photograph.

Haehanga Stream		
Site	Distance from Site 4 (metres)	Condy mS/m
1	845 downstream	44.2
2	835 downstream	44.1
3	21 downstream	31.7
5	12 upstream	27.2

Unnamed tributary of Haehanga Stream										
Site	6	7	8	9	10	14	13	12	11	4 (HHG106)
Distance upstream from Site 4 (m)	110	101	48	39	31	29	28	27	21	-
Condy mS/m	28.3	28.9	30.6	30.9	31.6	36.0	29.2; 31.6	161.0; 260.5	59.2	56.7

Table 11 Survey of physico-chemical parameters in the Haehanga catchment 30 March 2022⁸

Site		Upper tributary. Site 7 in Figure 2	Tributary, immediately upstream of site of contamination infiltration. Site 13 in Figure 2	Tributary at point of contamination infiltration. Site 12 in Figure 2	HHG000106 Tributary below point of contamination infiltration. Site 4 in Figure 2	Upstream Haehanga- 15 m above confluence with tributary	Downstream Haehanga Stm At or about Site 3 in Figure 2	Downstream HHG000150 Beside lower irrigation fields
Time	NZST	10:52	12:15	11:45	10:27	10:38	10:08	09:22
EC	mS/m	32.1	34.9	65.3	67.1	33.3	38	50.9
Chloride	g/m ³	19.4	23	106	106	22	34	67
TAN	g/m ³	0.68	0.24	2.2	4.7	0.2	0.79	2.4
NH3	g/m ³	0.003	0.00165	0.0065	0.02	0.0010	0.0047	0.0156
Acid-soluble Barium	g/m ³	0.045	0.061	0.65	0.199	0.034	0.057	0.058
<i>E coli</i>	/100ml	>2420	>2420	1300	1414	1046	1414	326

EC: Conductivity

TAN: Total ammoniacal nitrogen

NH3: Un-ionised ammonia, calculated from TAN on the basis of site pH and temperature at time of measurement.

⁸ No organo-nitrogen or organo-phosphate pesticides were detected. Metal analyses other than for barium were undertaken only on the sample from site 12 (the zone of infiltration previously detected). Acid soluble metals: arsenic 0.002 g/m³; chromium <0.0010 g/m³; copper 0.0012 g/m³. For comparison, the concentrations of dissolved barium in the Pad 1 and 3 wastewater pond (irrigation storage pond) during 2018-2021 ranged from 0.23 to 0.77 g/m³. For arsenic in the wastewater pond, the range during 2018-2021 was 0.026 to 0.77 g/m³; for chromium was 0.008 to 0.069 g/m³; and for copper was 0.004 to 0.0109 g/m³. At site HHG000090, an upstream (background) sampling site, on 19 October 2021 total arsenic was not measurable at <0.0011 g/m³; total chromium was not measurable at <0.00053 g/m³; and total copper was detected at 0.0021 g/m³.

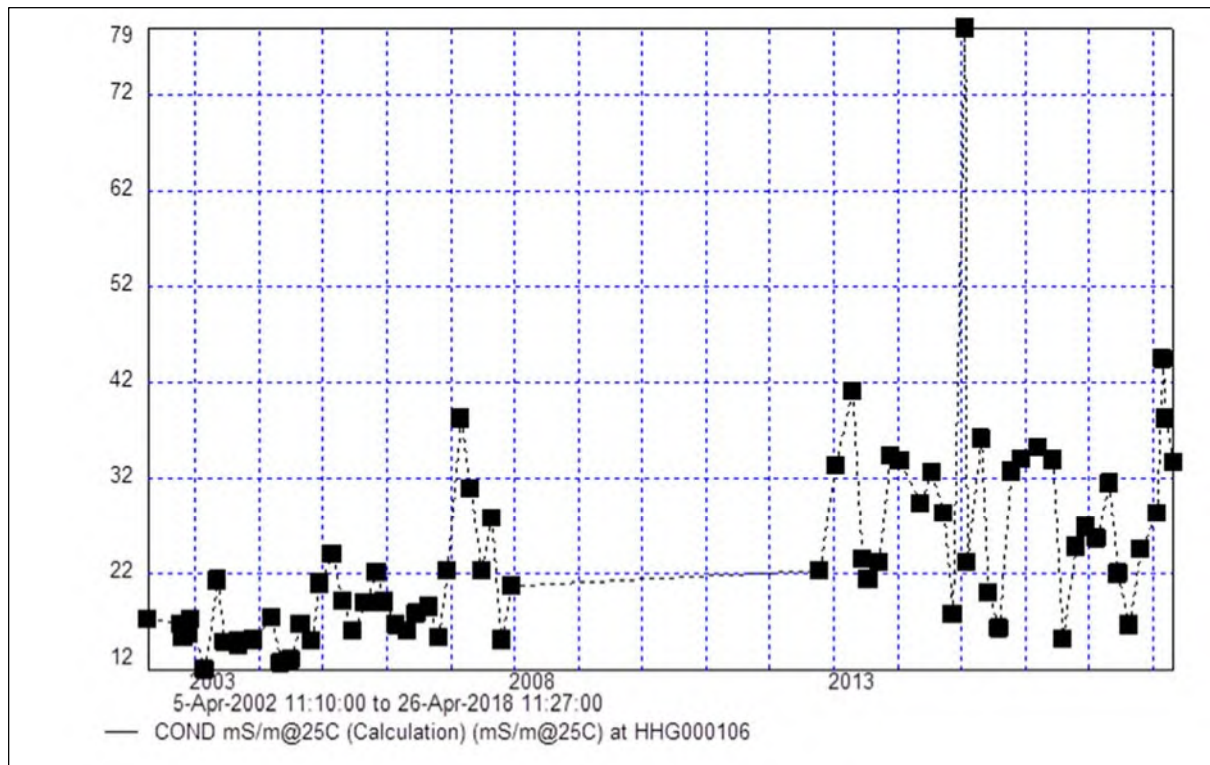


Figure 5 Conductivity measured at Site HHG000106, April 2002 to April 2018

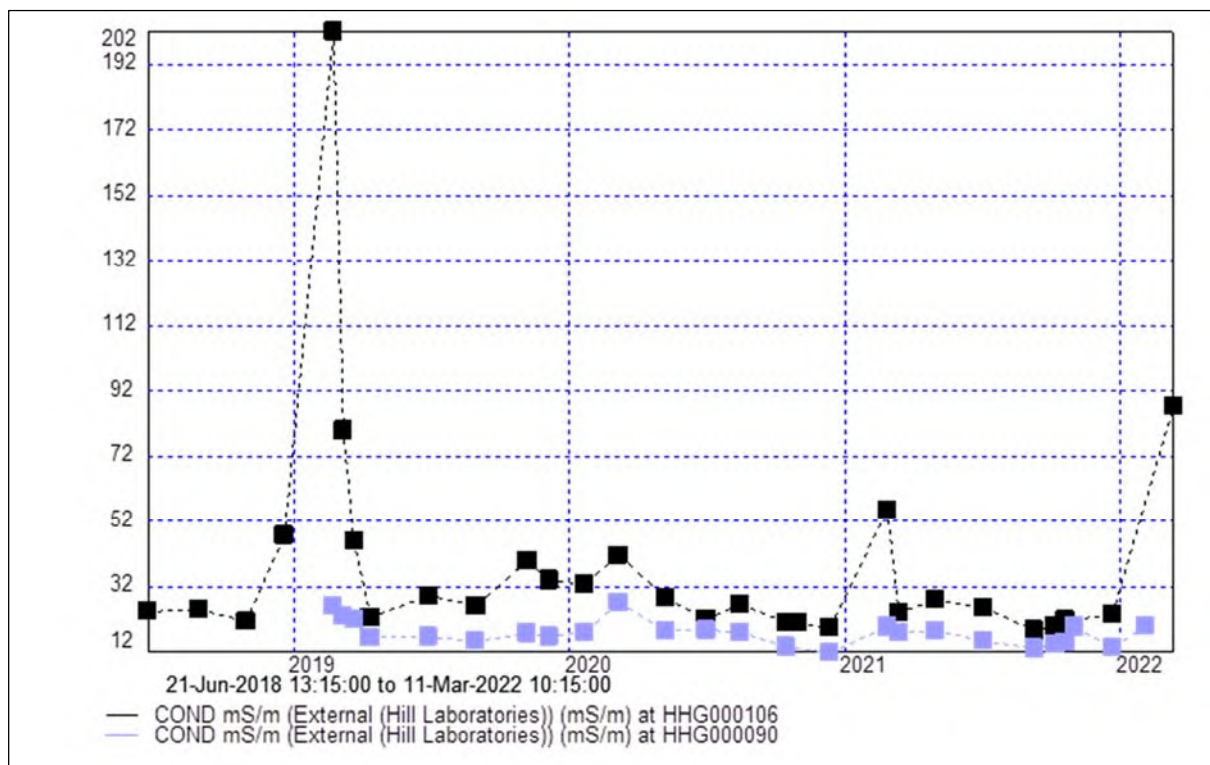


Figure 6 Conductivity measured at Site HHG000106, June 2018 to March 2022

Figure 5 and Figure 6 display the conductivity measured at Site HHG000106 since 2002. The monitoring site is at the bottom of the tributary. There is clear evidence that the leakage of contaminated wastewater into the tributary has been a recurring issue over this entire period. There seems to be a pattern that it is most evident in summer surveys. In addition, by observation there appears to be a pattern of an overall increase in conductivity recorded at the monitoring site over the years (Figure 5), while conductivity in the tributary is consistently elevated above background levels upstream in the Haehanga Stream itself. Conductivity has not been measured previously upstream in the tributary itself.

2.3 Results of receiving environment (surface water) biomonitoring

One biomonitoring survey was scheduled for the 2021-2022 year. The Council's standard 'kick-sampling' technique was used at eight established sites to collect streambed macroinvertebrates from an unnamed tributary and the main stem of the Haehanga Stream, and a reference site in the Waikekeho Stream, on 24 January 2022. Samples were processed to provide the number of taxa (richness), MCI and SQMCI_s scores for each site. The sites used in the survey are described in Table 12 and shown in Figure 3.

Table 12 Current biomonitoring sites in the Haehanga Stream catchment and comparable reference site

Site	Site Code	GPS coordinates (Easting- Northing)	Location
1	HHG000090	1732685-5684577	Upstream of upper irrigation area
2	HHG000100	1732272-5684972	Downstream of upper irrigation area
T2	HHG000098	1732747-5685043	Tributary: upstream of wetland discharge point
T3	HHG000103	1732692-5685042	Tributary: downstream of wetland discharge point
5	HHG000115	1732124-5685478	Main stem, 25 m downstream of last pond and swale collection area (composting and wastewater facilities)
6	HHG000150	1731673-5685796	30 m downstream of lower irrigation area
7	HHG000190	1731611-5686514	50 m upstream of State Highway 3 bridge
RS*	WKE000800	1735152-5684987	Waikekeho Stream, 10 m upstream of old Ri Rd. bridge

* RS site had incorrect coordinates displayed from the previous report (KC031)

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities. It may be the more appropriate index if non-organic impacts are occurring.

Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

The macroinvertebrate survey conducted on 24 January 2022 observed very low flows in the Haehanga catchment with either very slow or still water at all sites, after a prolonged period of dry weather. Periphyton filaments were observed at mid and lower catchment sites, although not at the upstream sites. Silt covered the bed of the stream at all sites.

Macroinvertebrate taxa richness was moderately low throughout the Haehanga catchment except for the primary impact site T3 (below the WTS direct discharge) which had moderate taxa richness. There was only a four taxa difference among sites in the main stem (11-15 taxa richness) with the most notable result a small decrease of four taxa between sites 5 and 6 on the main stem, and a nine taxa increase in a downstream direction between the two unnamed tributary sites. Taxa richness and taxa abundances are a robust

measure when ascertaining whether a macroinvertebrate community has been exposed to toxic discharges such as ammonia or petrochemicals that could be discharged into the Haehanga Stream and its tributary. The lack of any significant impact on taxa richness or of taxa abundances indicates that no significant toxic discharges have recently occurred from the WTS that have been affecting the macroinvertebrate communities in the tributary of the Haehanga catchment.

MCI scores indicated that sites in the main stem of the Haehanga were of 'poor' health and sites in the unnamed tributary were in 'fair' health. There were no significant differences in MCI scores among the main stem sites or between the two sites on the unnamed tributary. There were also no significant differences between current results and historical medians, which indicates at the time of the survey macroinvertebrate communities were in typical health.

The SQMCI can be more sensitive to nutrient enrichment compared with the MCI. SQMCI scores indicated that site T2 was in 'good' health while site T3 below the WTS discharge was in 'fair' health, as was site 2. Sites 1, 7 and the reference site RS were in 'poor' health, and sites 5 and 6 were in 'very poor' health. There were several significant differences in a downstream direction. Sites 5 and 6 (below the main RNZ facilities) had significantly lower SQMCI values than both sites 1 and 2 (the upstream or baseline sites), and site T3 was significantly lower than site T2. These results may indicate nutrient enrichment. The discharge between sites T2 and T3 may have caused an increase in more pollution tolerant taxa; but given the MCI values recorded little difference between the two sites suggests that any impact was at a more minor level.

Overall, macroinvertebrate community health in the main stem of the Haehanga Stream can be regarded as poor, being dominated by pollution tolerant taxa, which would be a direct result of poor habitat quality and conditions at the time of sampling. The unnamed tributary that receives the WTS discharge has better habitat quality and subsequently better macroinvertebrate health. In order to have strong confidence in the results comparisons with sites with the same habitat features are necessary. Both the control and reference sites have habitat features that differ to the main stem and unnamed tributary and therefore caution is needed when making direct comparisons. There was a lack of evidence that indicates that Remediation NZ discharges were causing direct toxic effects as evidenced by taxa numbers and abundances. There was also no evidence based on MCI scores of any significant effects, but there was some evidence of effects based on SQMCI scores (particularly at sites 5 and 6). However, given the lack of congruence with MCI scores and the poor habitat and conditions throughout the catchment at the time of sampling the results do not provide sufficient evidence to conclude that Remediation NZ discharges were having any obvious and significant effect on macroinvertebrate communities in the Haehanga catchment.

It should be noted that poor habitat conditions at the time of the survey could have masked any effects of direct or diffuse discharges from the activities of RNZ on the property, as sensitive taxa would be sparse or absent in any case (as was found to be the situation in this survey).

Copies of biomonitoring reports for this property are available from the Council upon request.

2.4 Groundwater

2.4.1 Introduction

Key measures within the groundwater analytical programme are any changes in ionic strength (measured by conductivity, total dissolved solids, sodium, and chloride), sodicity, which affects the integrity of the soil structure (measured by ratios between sodium, calcium, and magnesium), the nitrogen loading (measured by ammoniacal and nitrate nitrogen species), and any evidence of the leaching of potentially toxic substances (hydrocarbons, LOSP preservatives, and the metals arsenic, barium, copper, and chromium). Analytes are listed in full in Table 2 and the results are presented in section 2.4.2 below.

Seven bores were monitored in four surveys during the year under review, on 22 October and 24 November 2021, and 17 March and 29/30 June 2022. The locations of the bores are shown in Figure 7, and the locations of the irrigation fields are shown in Figure 8.



Figure 7 Locations of groundwater monitoring wells RNZ Uruti

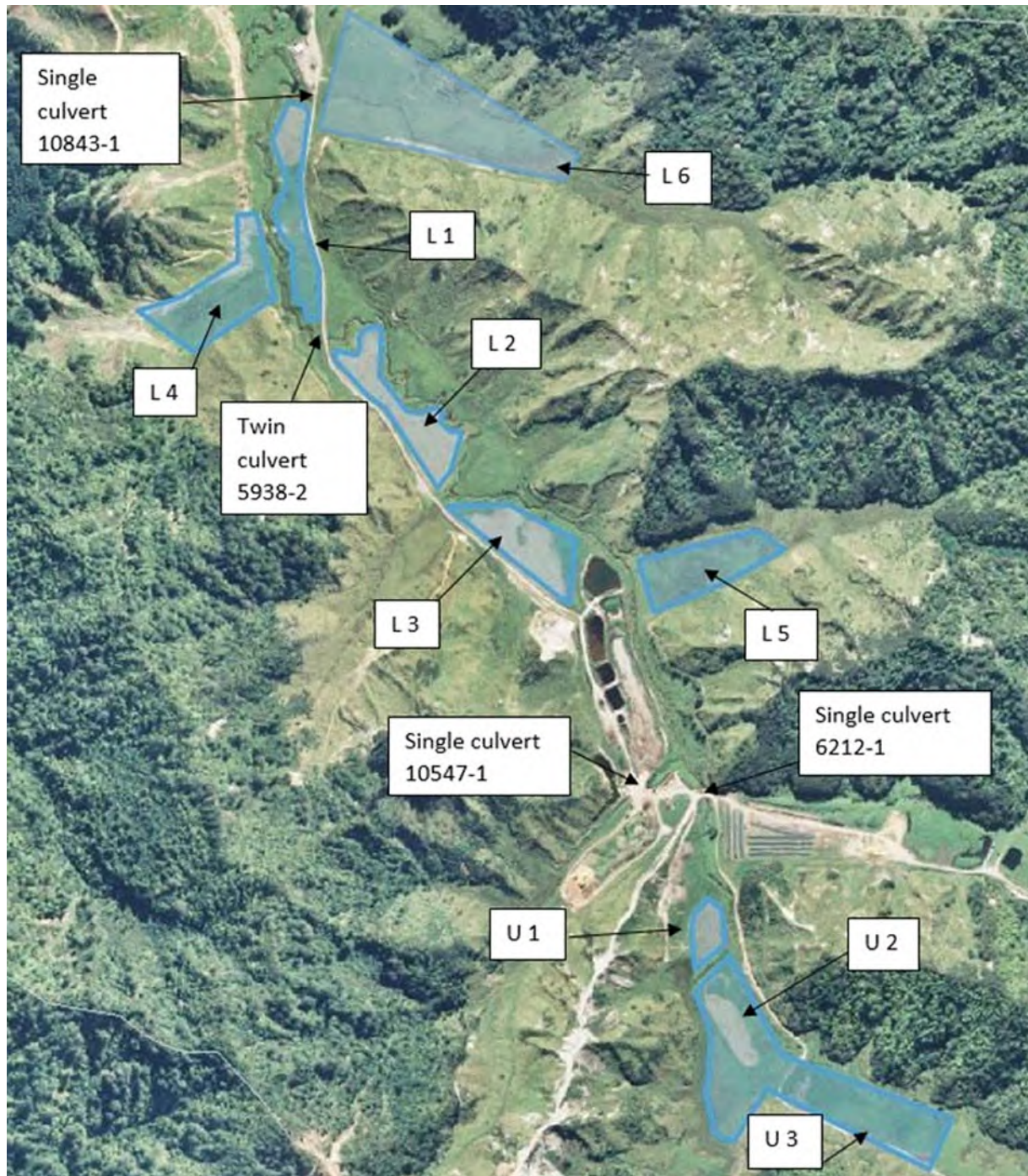


Figure 8 Irrigation areas and stream culverts RNZ Uruti

2.4.2 Results

The results from the four groundwater monitoring rounds are displayed below in Table 13 to Table 16.

Table 13 GND2188 2021-2022 monitoring

GND2188	Date	22 Oct 2021	24 Nov 2021	17 Mar 2022	29 Jun 2022
Parameter	NZST	07:55	09:30	08:20	14:20
Level	M	1.17	1.33	1.70	0.52
Sample Temperature	°C	13.8	16.1	17.3	14.1
pH	pH Units	6.5	6.8	6.8	6.1
Free Ammonia	g/m ³	0.00034	0.0030	0.0046	0.000120
Total Ammoniacal-N	g/m ³	0.39	1.66	1.99	0.32
Nitrate-N + Nitrite-N (NNN)	g/m ³	0.43	0.003	0.077	0.22
Electrical Conductivity (EC)	mS/m	22.8	38.4	50.2	35.1
Electrical Conductivity (EC)	µS/cm	228	384	502	351
Total Dissolved Solids (TDS)	g/m ³	189	-	280	210
Dissolved Barium	g/m ³	0.037	0.049	0.061	0.044
Acid Soluble Barium	g/m ³	< 0.11	< 0.11	< 0.11	< 0.11
Total Calcium	g/m ³	15.4	27.0	45.0	23.0
Total Magnesium	g/m ³	3.4	5.2	9.1	6.7
Total Sodium	g/m ³	11.7	15.7	22.0	19.0
Chloride	g/m ³	12.7	19.0	32.0	29.0
Organonitro & phosphorus Pesticides Screen in MR Water Liq/liq					
Tebuconazole	g/m ³	0.00010	0.00015	0.00019	< 0.00004
BTEX in Water by Headspace GC-MS					
Benzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m ³	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water					
C7 - C9	g/m ³	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m ³	< 0.20	< 0.20	< 0.20	< 0.20
C15 - C36	g/m ³	< 0.40	< 0.40	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m ³	< 0.70	< 0.70	< 0.70	< 0.70

GND2188 is located to south west of the site, within irrigation area U2. This was previously the old control bore, prior to the expansion of the irrigation areas southwards (upslope).

- Groundwater level ranged 0.52–1.70 m below ground level (bgl).
- pH results maintained a weakly acidic concentration, ranging 6.1–6.8 pH throughout the year.
- Electrical conductivity (EC) demonstrated an increase in the summer months, in conjunction with lower rainfall (less dilution of dissolved salts). The increase was lower than in the previous monitoring period, ranging 22.8–50.2 mS/m @ 25°C, compared to 58.9–106.8 mS/m @ 25°C (2020–2021). Long

term monitoring of this analyte had indicated a slow and steady increase over time (since 2011), but with a recent reduction (Figure 12).

- Total dissolved solids followed a similar trend to the EC, with a peak observed in March 2022 and ranging 189–280 g/m³.
- Dissolved barium remained measurable and fairly consistent across the monitoring period, ranging 0.037–0.061 g/m³. A noticeable decrease from the 2020–2021 period of 0.107–0.156 g/m³.
- Acid soluble barium was below the LOD for the entire period.
- Chloride results ranged 12.7–32.0 g/m³, increasing during the summer months.
- Total ammoniacal nitrogen (NH₄) ranged 0.32–1.99 g/m³, while NNN ranged 0.003–0.43 g/m³.
- Note that NH₄ has decreased drastically since the most elevated recorded level of 22 g/m³ in Feb 2021.
- The pesticides (LOSPs) previously detected in the treated sawdust blended with drilling wastes on Pad 3 were detected in the irrigation field groundwater on all four sampling occasions. It appears that these are being spread across the site through the application of the irrigated wastewater (they are routinely detected in the wastewater storage pond surveys). However, no hydrocarbons were detected on any occasion.

Table 14 GND2189 2021-2022 monitoring

GND2188	Date	22 Oct 2021	24 Nov 2021	17 Mar 2022	29 Jun 2022
Parameter	NZST	09:20	10:35	09:05	15:30
Level	M	0.72	0.895	1.2	0.48
Sample Temperature	°C	13.9	16.1	15.9	13.2
pH	pH Units	5.6	5.7	6.4	5.9
Free Ammonia	g/m ³	0.000065	0.000053	0.00043	0.000042
Total Ammoniacal-N	g/m ³	0.51	0.36	0.48	0.194
Nitrate-N + Nitrite-N	g/m ³	0.027	< 0.002	< 0.002	0.019
Electrical Conductivity (EC)	mS/m	60.0	65.2	68.7	48.2
Electrical Conductivity (EC)	µS/cm	600	652	687	482
Total Dissolved Solids (TDS)	g/m ³	360	-	430	290
Dissolved Barium	g/m ³	0.24	0.26	0.28	0.24
Acid Soluble Barium	g/m ³	0.30	0.26	0.28	0.23
Total Calcium	g/m ³	32	34	42	28
Total Magnesium	g/m ³	10.3	10.1	12.8	8.3
Total Sodium	g/m ³	43	45	53	38
Chloride	g/m ³	142	153	153	124
BTEX in Water by Headspace GC-MS					
Benzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m ³	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water					
C7 - C9	g/m ³	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m ³	< 0.20	< 0.20	< 0.20	< 0.20

GND2188	Date	22 Oct 2021	24 Nov 2021	17 Mar 2022	29 Jun 2022
Parameter	NZST	09:20	10:35	09:05	15:30
C15 - C36	g/m ³	< 0.40	< 0.40	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m ³	< 0.70	< 0.70	< 0.70	< 0.70

GND2189 is located on the northern end of irrigation area U1.

- Groundwater level ranged 0.48- 1.2 m bgl, remaining slightly deeper than in the previous year.
- pH fluctuated by 0.8 units this monitoring period, and remained weakly acidic, tending slightly more acidic throughout the monitoring period.
- EC demonstrated the typical seasonal fluctuation during the monitoring period, peaking in summer.
- TDS also demonstrated the typical seasonal fluctuation this monitoring period, about 50% higher in summer than in the lowest reading.
- Both dissolved and acid soluble barium remained steady in concentration throughout the monitoring period.
- Chloride also remained fairly consistent during the monitoring period.
- Total ammoniacal nitrogen remained below 1 g/m³ across all four monitoring rounds.
- Nitrate nitrite nitrogen (NNN) remained very low across the year.
- BTEX and TPH were below the LOD across all four monitoring rounds.
- The reduction in results for indicators of nitrogen or dissolved salts loadings in the last survey, is indicative of higher use of the surrounding area for irrigation only earlier in the year.

Table 15 GND2190 2021-2022 monitoring

GND2190	Date	22 Oct 2021	24 Nov 2021	17 Mar 2022	30 Jun 2022
Parameter	NZST	10:50	09:10	10:20	12:15
Level	M	0.725	0.92	1.58	0.515
Sample Temperature	°C	15.2	17.0	18.3	14.7
pH	pH Units	5.7	5.3	5.6	5.1
Free Ammonia	g/m ³	0.000027	0.000026	0.000132	< 0.000010
Total Ammoniacal-N	g/m ³	0.179	0.37	0.82	0.24
Nitrate-N + Nitrite-N	g/m ³	0.35	< 0.002	0.077	1.66
Electrical Conductivity (EC)	mS/m	112.0	231	230	175.8
Electrical Conductivity (EC)	µS/cm	1120	2310	2300	1758
Total Dissolved Solids (TDS)	g/m ³	640	-	1330	990
Dissolved Barium	g/m ³	0.56	1.40	1.38	0.91
Acid Soluble Barium	g/m ³	0.56	1.37	1.32	0.85
Total Calcium	g/m ³	53	104	98	72
Total Magnesium	g/m ³	9.3	15.7	16.2	12.1
Total Sodium	g/m ³	87	187	210	148
Chloride	g/m ³	280	690	680	500
BTEX in Water by Headspace GC-MS					
Benzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m ³	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010

GND2190	Date	22 Oct 2021	24 Nov 2021	17 Mar 2022	30 Jun 2022
Parameter	NZST	10:50	09:10	10:20	12:15
Total Petroleum Hydrocarbons in Water					
C7 - C9	g/m ³	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m ³	< 0.20	< 0.20	< 0.20	< 0.20
C15 - C36	g/m ³	< 0.40	< 0.40	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m ³	< 0.70	< 0.70	< 0.70	< 0.70

GND2190 is located in irrigation area L2.

- The groundwater level ranged 0.515-1.58 m below ground level (BGL), indicating groundwater levels were slightly deeper than in 2020-2021.
- Groundwater pH remained relatively stable this monitoring period. All results were in the moderately acidic range (<6.0 pH).
- EC results remained elevated and showed the typical seasonality (highest in summer), and lower than in previous years, during the monitoring period.
- TDS showed the typical seasonality during the monitoring period.
- Dissolved and acid soluble barium likewise were highest in summer.
- Sodium remained elevated throughout the monitoring period, and had almost tripled in March by comparison with October, though it is noted that this analyte was lower than the levels that have been typical (250 g/m³ +/-) since August 2019.
- Chloride showed a similar pattern to sodium within this monitoring period, although again has decreased overall since earlier periods, (900 g/m³ +/-).
- Dissolved inorganic nitrogen (DIN, NNN+NH₄) remained low across all monitoring rounds. By the end of the year, the concentration of nitrate-N was higher than that of ammoniacal-N, indicating stabilisation (oxidation) of nitrogen species under aerobic groundwater conditions. While nitrate-N is more mobile in soil, the total nitrogen concentration remains below levels that would be of concern for the wider environment.
- BTEX and TPH were not recorded above the LOD.

Table 16 GND3007 2021-2022 monitoring

GND3007	Date	22 Oct 2021	24 Nov 2021	17 Mar 2022	30 Jun 2022
Parameter	NZST	11:40	12:25	11:45	14:35
Level	M	1.95	2.10	2.75	1.787
Sample Temperature	°C	15.6	16.5	17.9	14.6
pH	pH Units	5.7	5.7	6.0	6.3
Free Ammonia	g/m ³	< 0.000010	< 0.000010	0.00023	0.000011
Total Ammoniacal-N	g/m ³	0.049	< 0.10	0.51	0.020
Nitrate-N + Nitrite-N	g/m ³	0.011	0.002	0.002	0.025
Electrical Conductivity (EC)	mS/m	15.1	14.8	20.2	12.5
Electrical Conductivity (EC)	µS/cm	152	148	202	125
Total Dissolved Solids (TDS)	g/m ³	112	-	118	75
Dissolved Barium	g/m ³	0.032	0.028	0.057	0.044
Acid Soluble Barium	g/m ³	< 0.11	0.029	< 0.11	< 0.11
Total Calcium	g/m ³	10.8	10.2	15.4	9.2
Total Magnesium	g/m ³	3.3	3.1	4.1	2.6
Total Sodium	g/m ³	9.5	9.6	11.9	8.9

GND3007	Date	22 Oct 2021	24 Nov 2021	17 Mar 2022	30 Jun 2022
Parameter	NZST	11:40	12:25	11:45	14:35
Chloride	g/m ³	15.0	14.2	14.6	12.2
BTEX in Water by Headspace GC-MS					
Benzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m ³	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water					
C7 - C9	g/m ³	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m ³	< 0.20	< 0.20	< 0.20	< 0.20
C15 - C36	g/m ³	< 0.40	< 0.40	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m ³	< 0.70	< 0.70	< 0.70	< 0.70

GND3007 is located at the entrance of the site, in close proximity to the State Highway.

- Groundwater level ranged 1.787-2.75 m bgl this monitoring period, the same overall depth but within a narrower range than in the previous year.
- Un-ionised ammonia and total ammoniacal nitrogen concentrations returned to very low levels, having been considerably higher in the previous year (peaks of 0.00023 and 0.51 g/m³, compared with 0.00031 and 1.56 g/m³ respectively in the previous year).
- pH remained lightly acidic across the four monitoring events, ranging 0.6 units.
- EC and dissolved solids results demonstrated the typical seasonal trend through the monitoring period.
- Dissolved barium recorded a doubling in concentration between the first two monitoring rounds, before reducing.
- Both sodium and chloride remained stable and of low concentrations across all monitoring events.
- Nitrate nitrite nitrogen remained at low concentrations across the four monitoring events.
- BTEX and TPH remained below the LOD across all four monitoring events.
- The data indicates that minimal migration of contaminants due to irrigation practices is reaching the boundary of the property. RNZ commenced using a new irrigation area during the year under review, that is in closer proximity to bore GND 3007 than other fields. The question will be whether the current lack of impact is maintained, or whether elevated concentrations of various parameters as found in previous years will recur.

Table 17 GND3008 2021-2022 monitoring

GND3008	Date	22 Oct 2021	24 Nov 2021	17 Mar 2022	30 Jun 2022
Parameter	NZST	12:20	10:45	10:55	13:30
Level	M	2.71	2.595	2.99	2.083
Sample Temperature	°C	14.7	16.6	17.6	15.8
pH	pH Units	6.5	6.4	6.6	6.8
Free Ammonia	g/m ³	0.0023	0.00132	0.0041	0.0028
Total Ammoniacal-N	g/m ³	2.3	1.54	2.5	1.28
Nitrate-N + Nitrite-N	g/m ³	0.006	0.69	0.003	0.007
Electrical Conductivity (EC)	mS/m	103.9	79.6	82.9	55.6

GND3008	Date	22 Oct 2021	24 Nov 2021	17 Mar 2022	30 Jun 2022
Parameter	NZST	12:20	10:45	10:55	13:30
Electrical Conductivity (EC)	$\mu\text{S/cm}$	1039	796	829	556
Total Dissolved Solids (TDS)	g/m^3	650	-	550	350
Dissolved Barium	g/m^3	0.28	0.30	0.185	0.106
Acid Soluble Barium	g/m^3	0.28	0.28	0.20	0.14
Total Calcium	g/m^3	76	65	74	54
Total Magnesium	g/m^3	25	21	16.4	10.6
Total Sodium	g/m^3	59	55	38	24
Chloride	g/m^3	220	145	104	54
BTEX in Water by Headspace GC-MS					
Benzene	g/m^3	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m^3	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m^3	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m^3	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m^3	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water					
C7 - C9	g/m^3	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m^3	< 0.20	< 0.20	< 0.20	< 0.20
C15 - C36	g/m^3	< 0.40	< 0.40	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m^3	< 0.70	< 0.70	< 0.70	< 0.70

GND3008 is located on the northern end of irrigation area L1.

- Groundwater level ranged in a narrower range (2.083-2.99 bgl) than in the previous year (1.8-3.47 m bgl).
- pH remained weakly acidic, ranging pH 6.4-6.8.
- EC and TDS results fluctuated across the four monitoring events, and are highly elevated by comparison with fields that do not experience the same usage. Of interest, the conductivity and TDS were highest in early spring, suggesting significant irrigation usage of the surrounding area in the period prior to October. This is contrary to good practice, which would be to maximise irrigation in summer and seek to retain wastewater in the retention pond during winter, when pasture is sodden and runoff more likely to occur.
- Dissolved barium and acid soluble barium are higher in these results than most other bores, indicating the spread of the metal from the drilling stockpile on Pad 2. The most elevated concentrations were recorded in August 2020 (0.91 g/m^3 dissolved and 0.96 g/m^3 acid soluble), and have reduced since then. A pattern of ongoing slow reduction since August 2020 (which would be by continuing migration through the ground) seemed apparent at the end of the period.
- Chloride analysis indicated an overall reduction in concentration throughout the monitoring period, again since August 2020.
- Ammoniacal nitrogen remained in the same elevated range during this period (1.28-2.5 g/m^3) as in 2020-2021 (1.01-3.3 g/m^3).
- Nitrate/ nitrite nitrogen was extremely high (53 g/m^3) in August 2021), but has reduced since then. The concentrations measured during the year under review were not of environmental concern.
- BTEX and TPH were not recorded above the LOD.

Table 18 GND3009 2021-2022 monitoring

GND3009	Date	22 Oct 2021	24 Nov 2021	17 Mar 2022	30 Jun 2022
Parameter	NZST	10:05	11:35	09:40	10:15
Level	M	1.82	1.80	2.07	1.72
Sample Temperature	°C	15.4	17.1	16.8	13.2
pH	pH Units	6.8	6.5	6.5	6.7
Free Ammonia	g/m ³	0.00093	0.0157	0.021	0.00121
Total Ammoniacal-N	g/m ³	0.44	15.9	16.7	0.77
Nitrate-N + Nitrite-N	g/m ³	0.006	0.007	0.011	0.092
Electrical Conductivity (EC)	mS/m	187.7	232	221	187.3
Electrical Conductivity (EC)	µS/cm	1877	2320	2210	1873
Total Dissolved Solids (TDS)	g/m ³	1570	-	1260	1600
Dissolved Barium	g/m ³	0.068	0.23	0.21	0.079
Acid Soluble Barium	g/m ³	< 0.10	0.35	0.40	< 0.11
Total Calcium	g/m ³	310	94	85	320
Total Magnesium	g/m ³	56	20	19.1	58
Total Sodium	g/m ³	56	220	240	37
Chloride	g/m ³	57	500	460	65
BTEX in Water by Headspace GC-MS					
Benzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m ³	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water					
C7 - C9	g/m ³	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m ³	< 0.20	< 0.20	< 0.20	< 0.20
C15 - C36	g/m ³	< 0.40	< 0.40	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m ³	< 0.70	< 0.70	< 0.70	< 0.70

GND3009 is located to the north of the duck pond and to the east of irrigation area L3.

- Groundwater level remained relatively stable across the four monitoring events, ranging 1.72 to 2.07 m bgl. This range was very similar to that of 2020-2021 (1.96-2.12 m bgl).
- pH fluctuated close to neutral across the four monitoring rounds.
- EC monitoring recorded the highest readings across both spring and summer, and were higher overall (1873-2320 µS/cm) than in the 2020-2021 year (1252-2600 µS/cm), which was itself very elevated.. Taken together, and noting the high ammoniacal nitrogen concentrations, these findings indicate the potential continuing over-application of wastewater to the surrounding area.
- TDS monitoring followed a similar trend to the EC,.
- Ammoniacal nitrogen demonstrated a considerable deal of variation across the four monitoring events as it had in the previous year, ranging 0.44-16.7 g/m³ (cf 0.5-21 g/m³). The concentrations of dissolved inorganic nitrogen (ammoniacal nitrogen + nitrate-nitrite nitrogen) in November 2021 and March 2022 were the highest found in any bore during the 2021-2022 monitoring year.

- Nitrate nitrite nitrogen remained at low concentration across the four monitoring events, indicating soil conditions remain sour (anaerobic).
- BTEX and TPH were both below the LOD, across all four monitoring events.

Table 19 GND3010 2021-2022 monitoring

GND3010	Date	22 Oct 2021	24 Nov 2021	17 Mar 2022	29 Jun 2022
Parameter	NZST	08:35	08:40	07:45	12:40
Level	M	1.70	1.715	2.07	1.526
Sample Temperature	°C	14.5	15.6	16.6	14.8
pH	pH Units	6.0	6.0	6.2	6.3
Free Ammonia	g/m ³	0.00022	0.00043	0.0042	0.00122
Total Ammoniacal-N	g/m ³	0.75	1.57	7.5	1.79
Nitrate-N + Nitrite-N	g/m ³	0.007	0.002	0.002	2.7
Electrical Conductivity (EC)	mS/m	32.8	29.1	40.3	26.3
Electrical Conductivity (EC)	µS/cm	328	291	403	263
Total Dissolved Solids (TDS)	g/m ³	210	-	260	157
Dissolved Barium	g/m ³	0.043	0.025	0.006	0.036
Acid Soluble Barium	g/m ³	< 0.11	< 0.11	< 0.11	< 0.11
Total Calcium	g/m ³	23	16.3	18.3	18.6
Total Magnesium	g/m ³	8.9	7.2	8.0	8.1
Total Sodium	g/m ³	16.6	14.3	19.1	14.2
Chloride	g/m ³	21.0	21.0	12.7	24
BTEX in Water by Headspace GC-MS					
Benzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m ³	< 0.002	< 0.002	< 0.002	< 0.0002
o-Xylene	g/m ³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water					
C7 - C9	g/m ³	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m ³	< 0.20	< 0.20	< 0.20	< 0.20
C15 - C36	g/m ³	< 0.40	< 0.40	< 0.40	< 0.40
Total hydrocarbons (C7 - C36)	g/m ³	< 0.70	< 0.70	< 0.70	< 0.70

GND3010 is located south east of irrigation area U3.

- Groundwater level ranged 1.526-2.07 m bgl across the four monitoring events. These levels are very similar to those in 2020-2021 (1.71-2.22 m bgl).
- pH remained relatively stable and weakly acidic, fluctuating around pH 6.
- EC results also remained relatively stable across the four monitoring events, showing typical seasonality and remaining below the peak value observed in the December 2020 event (487 µS/cm).
- Sodium results were relatively stable across the four monitoring events, and similar to those in 2020-2021.
- Chloride results were higher in the winter months than in the summer. However, concentrations remained low when compared to other wells on site.

- Ammoniacal nitrogen results ranged from 0.75-7.5 g/m³, slightly higher overall than in 2020-2021.
- Nitrate nitrite nitrogen results ranged 0.02-2.7 g/m³. Overall, the groundwater in the vicinity was more often anaerobic than aerobic.
- Unlike the August 2020 monitoring event, no toluene or other BTEX or hydrocarbon compounds were detected on any occasion.

2.4.3 Dissolved metals in groundwater

A survey was undertaken for particular metal contaminants of interest, in November 2021. Results are presented in Table 20 below.

Table 20 Dissolved metals in groundwater, 24 November 2021

Site		GND3010	GND2190	GND2188	GND2189	GND3007	GND3008	GND3009
Parameter	Unit	08:40	09:10	09:30	10:35	12:25	10:45	11:35
Dissolved Arsenic	g/m ³	0.0026	0.0023	0.0019	< 0.0010	< 0.0010	0.0012	0.0024
Dissolved Barium	g/m ³	0.025	1.40	0.049	0.26	0.028	0.30	0.23
Dissolved Cadmium	g/m ³	< 0.00005	0.00038	< 0.00005	< 0.00005	< 0.00005	0.00006	< 0.00005
Dissolved Chromium	g/m ³	< 0.0005	< 0.0005	0.0006	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Copper	g/m ³	< 0.0005	0.0018	0.0045	< 0.0005	< 0.0005	0.0008	< 0.0005
Dissolved Lead	g/m ³	< 0.00010	0.00026	0.00022	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Mercury	g/m ³	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008
Dissolved Nickel	g/m ³	0.0065	0.028	0.0043	0.0062	0.0027	0.0150	0.0062
Dissolved Zinc	g/m ³	0.0025	0.036	0.0128	0.0072	0.0029	0.0147	0.0068

The groundwater samples collected on 24 November 2021 were further analysed for the dissolved metals arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel and zinc. Bore GND3007, the closest to the road and furthest from the RNZ operations, consistently had the lowest concentrations of each of the metals measured. Bore GND2190, located within irrigation field L2, had very significantly elevated barium (almost one hundred times higher than Bore GND 2188, which is upslope of the upper irrigation areas and serves as a control site). Barium was also elevated in bores GND 3009, 2189, and 3008, each of which sample groundwater below irrigation areas of composting and wastewater operational areas.

Other metals were detected variously across some of the bores, but without any clear pattern emerging. In particular, there is no evidence from the groundwater survey that copper, chromium, or arsenic are being elevated in groundwater beneath irrigation areas. These metals are associated with pollutants present within the stockpile of drilling wastes on Pad 3.

2.4.4 Discussion of groundwater results

Changes in groundwater quality over the duration of monitoring are shown for all groundwater bores in Figure 9 to Figure 12 below for the parameters sodium, total ammonia, nitrate nitrogen, and conductivity.

Bores GND2189 and GND3009 (immediately below the upper irrigation areas, and immediately below the main composting and wastewater collection area, respectively) have shown the highest concentrations and greatest variation of ionic sodium over the duration of monitoring. They had lower levels in the 2021-2022 year than previously. Both bores show higher values in summer and lower in winter (which is consistent with rainfall in winter diluting chloride applied in the wastewater).

The highest concentrations of ammoniacal nitrogen have been found in bores GND2188 (irrigation area U2, a mid-upper irrigation area), GND 3009, and GND 3010 (irrigation area U3), with somewhat lower

concentrations in GND3008 (downslope of area L4). There is a very strong seasonality to the ammoniacal results, peaking in summer periods and falling in winter.

Nitrate concentrations have been highest in bores GND 2188 and GND3008. New Zealand has a drinking water standard of a maximum concentration of nitrate-nitrogen of 11.3 g/m³. The drinking water standard is not directly applicable to the RNZ site, as there is no abstraction for consumption, but the figure is often used as a working criterion to give perspective. The groundwater at the RNZ property did not exceed this value in the 2021-2022 year. The NPS-FM (2020) sets a median 95th percentile attribute value for nitrate in surface water, of 2.4 g/m³, and a 95th percentile attribute value of 3.5 g/m³. Contaminants migrating from groundwater into surface water are typically diluted by a number of times, but in any case groundwater on the RNZ property was found to be below the NPS-FM values during 2021-2022.

For conductivity, the highest readings have been in bores GND2190 (irrigation area L2), GND3008, and GND3009. Readings in all these bores have been reducing over the past 4 years.

For all four attributes, concentrations in groundwaters when measured during the 2021-2022 period were generally somewhat lower than those measured in the previous three years.

While there is evidence of groundwater contamination by metals from the activities of RNZ, all concentrations of dissolved metals are below recognised thresholds of environmental concern.

Sodium

The data in the graph show that sodium values across majority of the bores has remained stable since 2018. However, bores GND2189 and GND3007 have fluctuated during this period and generally have higher concentrations of sodium than the other sites.

Ammonia

Total ammoniacal nitrogen was recorded at reasonably stable low levels for sites GND2188, GND2189, GND2190, and GND3007 from 2011–2018. Site GND2188 has since displayed an overall increase in ammonia concentrations from 2018 onwards. Sites GND3008, GND3009, and GND3010 first began ammonia monitoring in 2018. GND3008 and 3010 have slightly higher concentrations of ammonia when compared to other sites, but are still below recognised thresholds of environmental concern. GND2188 and GND3009 however displayed the highest ammonia concentrations in 2019–2021, but are showing an overall decrease since late 2021.

Nitrate nitrogen

Total nitrate nitrogen values have typically been fluctuating between the limit of detection and 10.0 g/m³ for majority of the sites since 2011. Sites GND2188, GND2190, and GND3008 have shown a gradual increase in concentration from 2019–2021, but are now slightly decreasing in concentration.

Conductivity

The conductivity graph is displaying an overall general decrease in concentration across all bores from 2011–2022. Bores GND3008 and GND3009 appeared to increase slightly during 2020 to late 2021, but are decreasing once again.

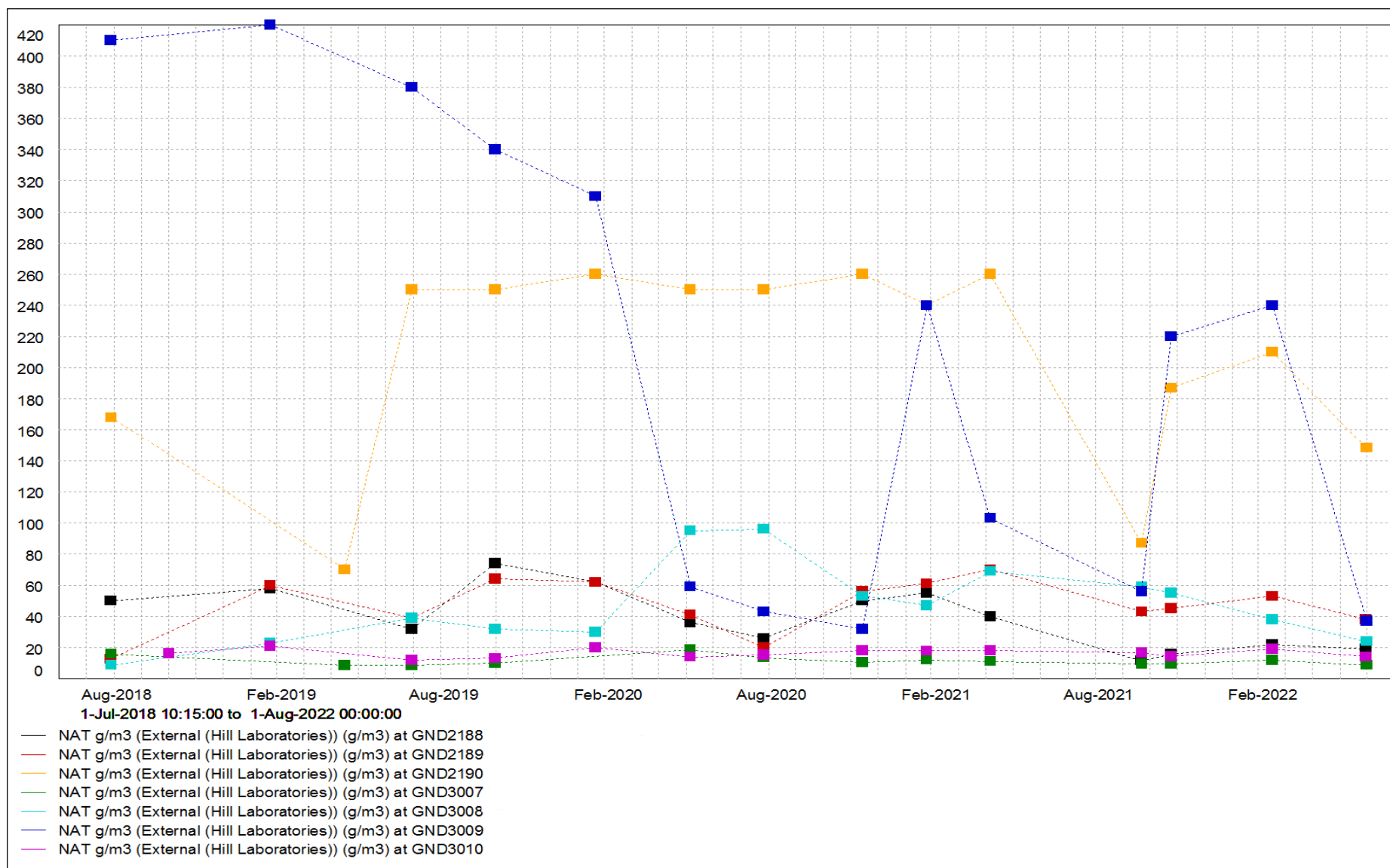


Figure 9 Total ionic sodium concentrations in groundwater 2018-2022

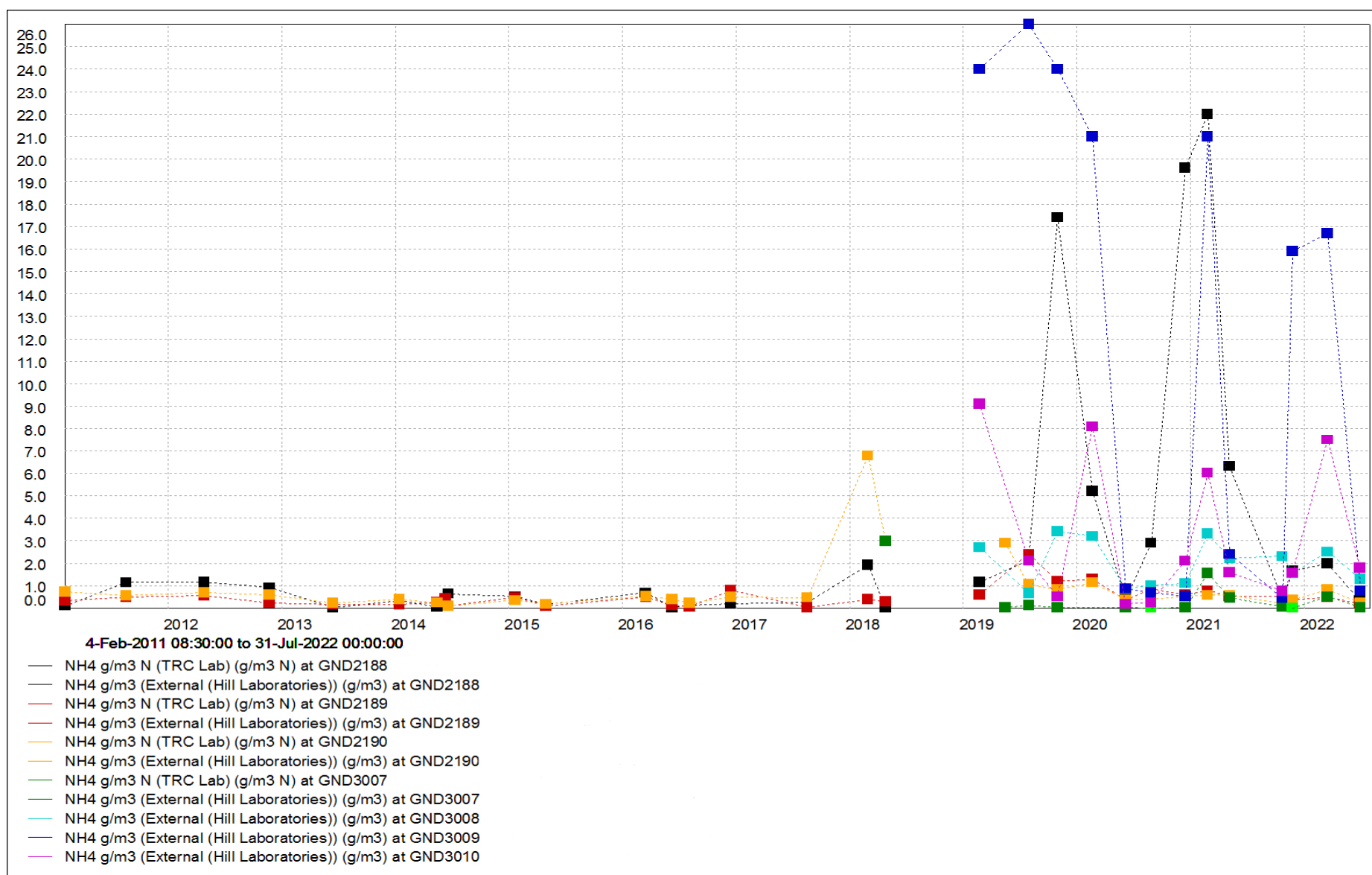


Figure 10 Total ammoniacal nitrogen concentrations in groundwater 2011–2022

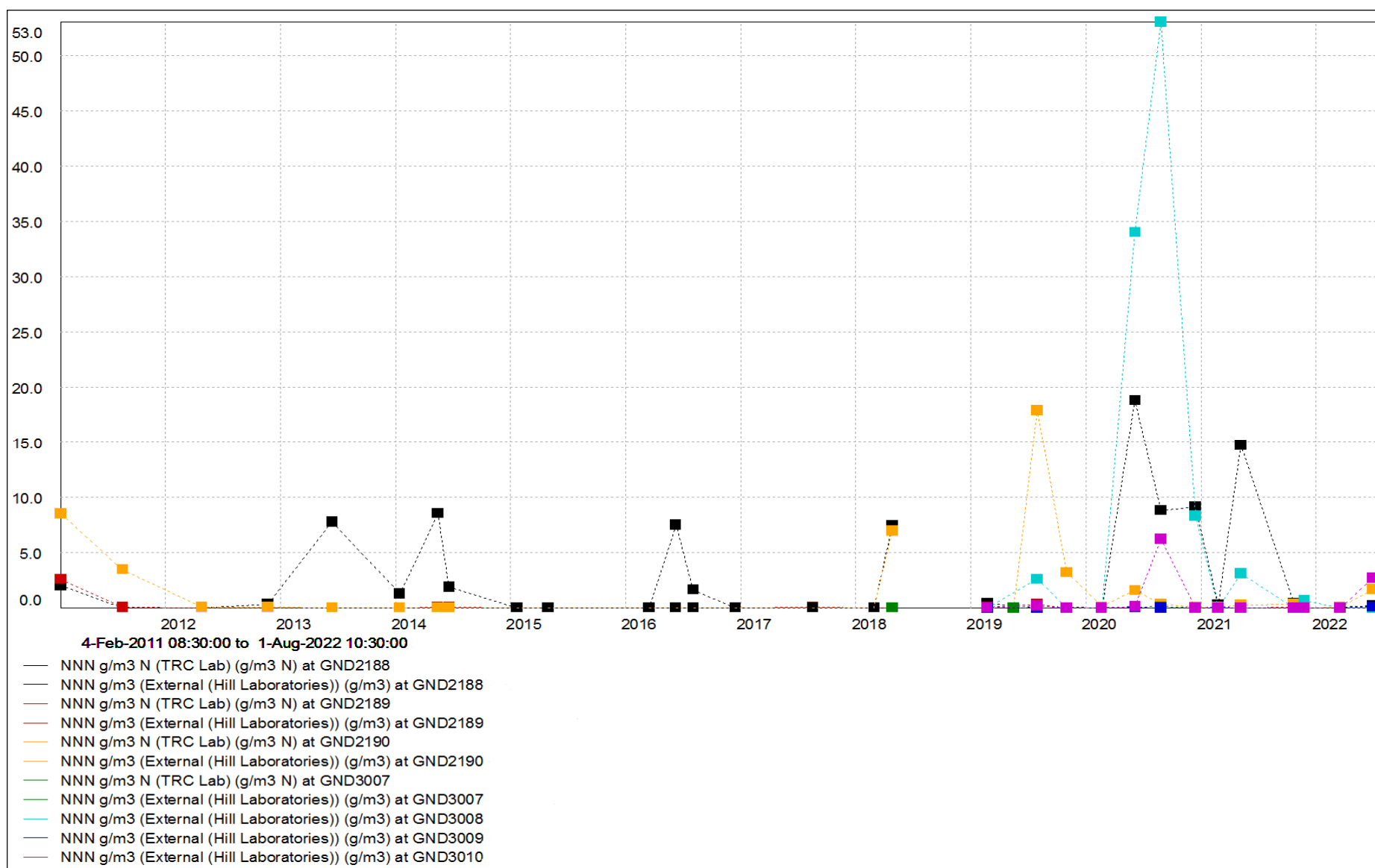


Figure 11 Total nitrate-nitrite concentrations in groundwater 2011–2022

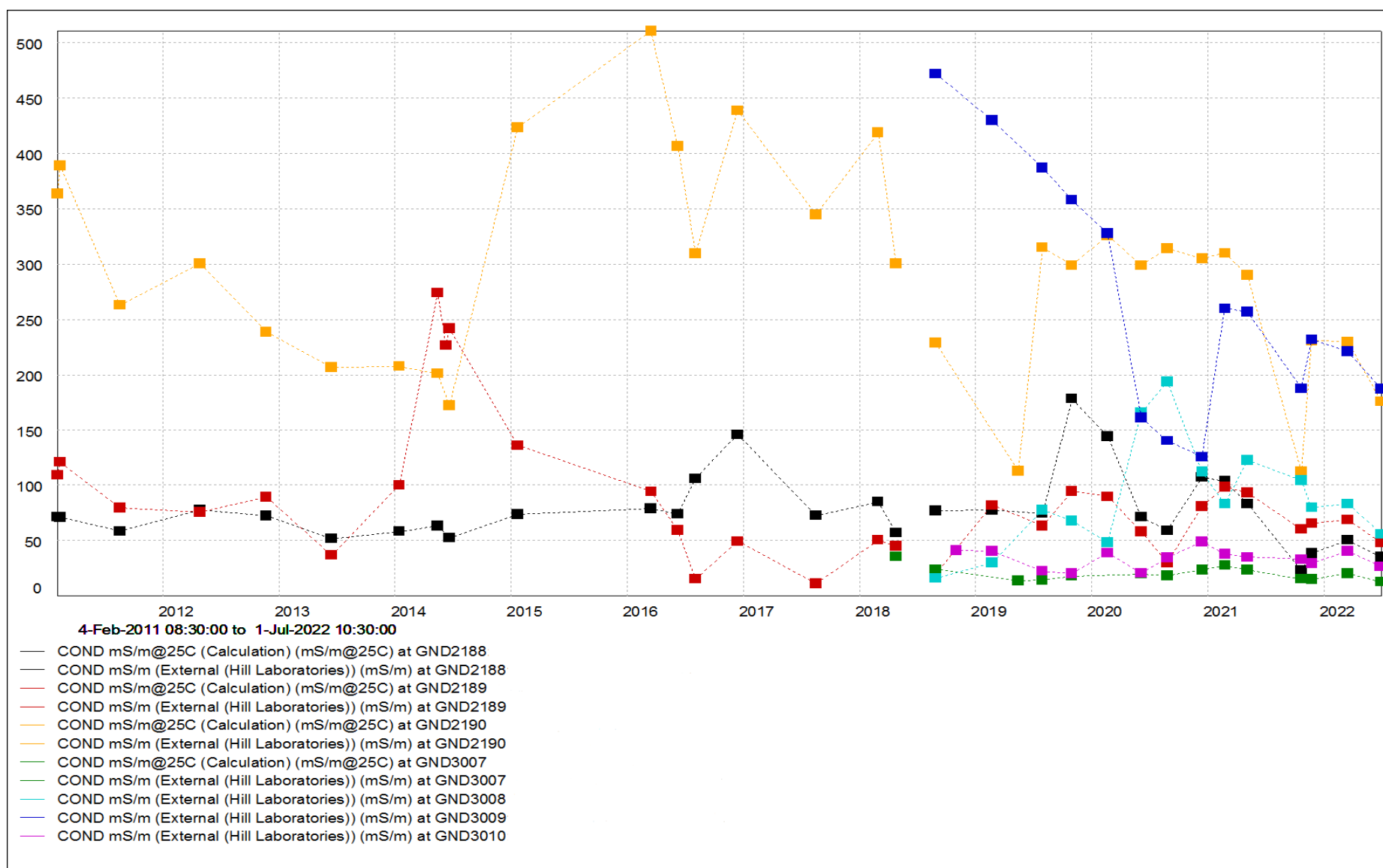


Figure 12 Total conductivity concentrations in groundwater 2011–2022

2.5 Air

2.5.1 Results of discharge monitoring

The Council undertook measurements of various air toxics on the site during the 2020-2021 period (BTEX aromatic hydrocarbons, ammonia, and hydrogen sulphide). Given the results were well below thresholds of concern, no further monitoring was implemented during the period under review. With the Company's proposal to increase the volume of wastewaters irrigated in the lower area (closer to the local community), it is intended that there should be further surveys for relevant chemical and microbiological contaminants of interest.

2.5.2 Results of receiving environment monitoring

The records of odour surveys undertaken by Council officers over the period 1 January 2021 to 2 May 2022 were reviewed to ascertain whether they provide information on odour events that, when taken in isolation have been below the threshold of being offensive and objectionable, but collectively over a longer term may amount to offensive and objectionable due to their frequency or continuation. This period was chosen for examination, as covering the time when RNZ have begun to make changes to site layout and operational management, and when air quality experts have begun conferencing on causes of and options for management of degraded air quality at the site, as well as being a sufficiently long period to identify patterns in the state of air quality in the area.

The Council holds assessments of 32 odour surveys undertaken by Council officers during the period reviewed. Each survey included individual assessments at up to five separate locations beyond the boundary of the RNZ property. These surveys included both proactive and reactive (complaints-driven) surveys, and were undertaken both during and outside normal work hours. The Council has dealt with around 100 complaints over the past year. However, for much of this period the Council was not responding to after-hours complaints if lodged by certain individuals, because of safety concerns, and so no on-site odour surveys were undertaken in such cases.

Of the 32 surveys, on 11 occasions no odour was detected at any off-site location that was visited. On another 14 survey occasions, Council officers detected odour at least in one location during the survey, but at no location was odour considered to be immediately (acutely) or potentially (chronically) offensive or objectionable, over any duration or frequency.

On four surveys, or just over 10% of the surveys reviewed, the investigating officer did detect odour at least one of the locations visited, and considered that it would be offensive and objectionable if it occurred frequently or continuously. That is, the officer found the odour might be chronically offensive in the receiving environment. On two surveys, the investigating officer did detect odour at least one of the locations, and determined that it was immediately offensive or objectionable. On the one remaining survey, the officer did not categorise the offensiveness of the odour beyond stating that it was 'strong'.

The last seven Council surveys reviewed, which have been conducted in the two months from 1 March to 2 May 2022, had all been undertaken on a proactive basis. On one of these surveys, a complaint was received when the Council officer was already on-site. The record for these most recent surveys was that on one occasion odour was determined to be acutely offensive and objectionable at one or more locations beyond the boundary; on one occasion it was considered that odour would become offensive and objectionable if it were to be continuous or repeated; on three occasions odour was detected but at a level considered to not be offensive or objectionable, even if continuing or repeated; and on two occasions no odour was detected at any location.

The record shows that on the majority of odour surveys, Council officers are detecting odour emitted from RNZ beyond the site boundary, with the evidence becoming clearer that even if on a single survey odours

are not offensive or objectionable, when their cumulative impacts are taken into account then the odours could be considered chronically offensive⁹. The implications of this will be addressed further during the Environment Court hearing.

2.5.3 Odour incidents

A third party reported to the Council that they had experienced offensive and objectionable odours at the entrance to RNZ's property on two occasions (17 and 18 February 2022). Further discussion found that while the observations were made outside the gate entrance, it could not be established conclusively that the observer was beyond the boundary of the property. No consent non-compliance could therefore be established beyond reasonable doubt.

At 8.50 pm on 27 April 2022, two Council compliance officers attended the RNZ site in response to an odour complaint that the Council had received. Air movement conditions were calm to light breezes, from the east and south-east and occasionally from the south. The Council officers undertook odour surveys at multiple off-site locations. While odour strength varied from none too strong during the periods of observation at the various locations, the frequency and duration of odour detection in conjunction with consideration of its hedonic tone resulted in the officers determining that the odour was offensive and objectionable at four separate locations beyond the boundary.

On 2 May 2022 the Council advised and requested a response from RNZ, noting the alleged consent non-compliance and the contravention of an earlier abatement notice, EAC-23628. Abatement Notice EAC-23628 had been issued to RNZ by the Council on 11 November 2020. It referenced four contraventions by RNZ of the air discharge permit 5839-2 that had occurred between 2 October and 3 November 2020. Two contraventions were in respect of the discharge by RNZ of odours that were found by the Council to be offensive and objectionable beyond the boundary of the property, and two were separate incidents of unauthorised materials being accepted at the site.

Abatement Notice EAC-23628 had instructed RNZ to undertake works to ensure compliance with resource consent 5839-2. The Abatement Notice required RNZ to comply with the abatement notice by 15 November 2020 and thereafter. Therefore the odour event of 27 April 2022 contravened the abatement notice.

On 13 May RNZ acknowledged on-site activities that gave rise to the odour event. RNZ were subsequently issued an infringement notice because of the incident.

On the evening of 1 March 2022, several complaints were received concerning odour emanating from the RNZ composting site. Investigation by Council officers at around 9.15 pm detected odours off-site. The officer's assessment against the FIDOLT¹⁰ factors found that the odours were in compliance with the conditions of resource consent 5839-2. However, inspection on the site found that an unauthorised load of beef lungs and livers had been deposited at the site. Receiving animal offal is in contravention of the conditions of the relevant resource consent (consent 5838-2). This incident is discussed further below (section 2.6.5).

⁹ The Ministry for the Environment's Good Practice Guide for Assessing and Managing Odour defines chronically offensive odour as: *'low-intensity and/or moderately unpleasant odours occurring frequently or continuously over a long period..... Cumulatively, these low-level odours can have an adverse effect even though no single odour event in isolation could reasonably be considered offensive or objectionable. A longer-term assessment of the frequency and nature of odour impacts is required for chronic odour effects'*

¹⁰ Frequency, intensity, duration, offensiveness, location and timing.

2.5.3.1 Company odour monitoring survey

During conferencing for the Environment Court appeal hearing, the air quality experts for the parties noted that RNZ were to contract an independent odour scout to undertake intensive odour surveys during the period of April to June 2022. It was further agreed that an integral element of these surveys was that the Council was to be contacted on a number of these observation occasions, to facilitate joint odour assessments. RNZ did not undertake the specified survey.

When queried, the Company noted that the original scout failed to undertake any surveys, and when a replacement was found, RNZ were not able to book their calibration of sensitivity to odour. It is noted that it had been agreed the surveys were to be undertaken in any case (even if calibration was not immediately available), and further, that several Council staff had had their sensitivity calibrations undertaken during the time that RNZ were claiming they were not able to access calibration services. After the end of the period covered in this review, RNZ have stated they intend to continue their efforts to implement the survey as originally promised. The Council will seek to ensure the Company's contracted odour survey does take place as promised.

2.6 Land and soil

2.6.1 Inspections

2.6.2 Irrigation wastewater storage IND002044

Leachate generated from both pad 1 (greenwaste pad) and pad 3 (drilling mud pad) flow through a series of sediment collection ponds prior to reaching the irrigation pond. From here, the leachate is irrigated across the irrigation areas (Figure 8) which initially totalled 13.18 ha during the year under review, but was extended during the year to 15.96 ha.. The fluid leachate was sampled on five occasions this monitoring period. Results are provided in the tables below. The ranges since 2018 for each analyte are also provided.

Table 21 IND002044 irrigation pond monitoring 2021-2022

IND002044	Date	Range	8 Sep 21	19 Oct 21	20 Dec 21	11 Mar 22	26 May 22
Parameter	Time	2018-2021	10:45	11:10	10:00	09:58	10:30
Sample Temperature	°C	8.4-23.6	12.1	16.9	19.6	20.2	13.3
Acid Soluble Barium	g/m ³	0.28-2.1	0.26	0.29	0.23	0.12	0.21
Acid Soluble Lead	g/m ³	0.002-0.061	0.25	0.013	0.011	0.025	0.013
Benzene	g/m ³	0.002-0.139	0.0013	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m ³	0.007-0.78	0.0071	0.0020	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m ³	0.0009-0.0179	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
o-Xylene	g/m ³	0.0018-0.057	0.0011	0.0011	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m ³	0.004-0.144	0.002	0.002	< 0.002	< 0.002	< 0.002
C7 - C9	g/m ³	0.07-1.17	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m ³	0.3-1.5	< 0.20	0.4	< 0.20	< 0.20	< 0.20
C15 - C36	g/m ³	0.5-22	1.8	2.7	0.6	3.1	1.0
Total hydrocarbons (C7 - C36)	g/m ³	1-23	2.0	3.1	< 0.70	3.3	1.2
Carbonaceous Biochemical Oxygen Demand (cBOD ⁵)	g O ₂ /m ³	103-1,340	290	181	16	139	2900
Electrical Conductivity (EC)	µS/cm	4,620-18,360	5930	5250	3700	6440	9020
	mS/m	462-1,836	593	525	370	644	902

IND002044	Date	Range	8 Sep 21	19 Oct 21	20 Dec 21	11 Mar 22	26 May 22
Parameter	Time	2018-2021	10:45	11:10	10:00	09:58	10:30
Chloride	g/m ³	430-570	680	530	430	730	600
Dissolved Arsenic	g/m ³	0.026-0.25	0.23	0.193	0.108	0.095	0.061
Dissolved Barium	g/m ³	0.23-0.77	0.25	0.26	0.169	0.127	0.20
Dissolved Cadmium	g/m ³	<LOD	< 0.00005	< 0.0003	< 0.00010	< 0.0005	< 0.0005
Dissolved Chromium	g/m ³	0.008-0.069	0.035	0.026	0.0106	0.014	0.010
Dissolved Copper	g/m ³	0.004-0.0109	0.0063	0.006	0.0160	0.011	< 0.005
Dissolved Lead	g/m ³	0.0009-0.0032	0.00105	0.0015	0.0062	0.0154	0.0012
Dissolved Mercury	g/m ³	<LOD	< 0.00008	< 0.0008	< 0.00008	< 0.00008	< 0.00008
Dissolved Nickel	g/m ³	0.03-0.136	0.043	0.036	0.035	0.042	0.026
Dissolved Zinc	g/m ³	0.005-0.024	0.023	0.017	0.019	2.7	0.015
<i>Escherichia coli</i>	cfu / 100 ml	1,100-16,000	2000	12000	13000	< 10	2400000
Free Ammonia as N	g/m ³	1.84-26	12.6	19.7	24	47	16.5
Nitrate-N + Nitrite-N	g/m ³	0.006-0.24	0.10	0.20	13.8	0.04	0.03
Total Ammoniacal-N	g/m ³	165-590	430	380	220	390	830
Total Kjeldahl Nitrogen (TKN)	g/m ³	230-600	440	440	260	460	950
pH	pH Units	7.4-8.4	8.1	8.2	8.5	8.5	7.9
Sodium Absorption Ratio (Total)		3.1-11	3.1	2.7	2.5	5.0	3.7
Total Barium	g/m ³	0.42-5.6	0.52	1.52	1.06	3.8	2.1
Total Calcium	g/m ³	138-550	180	163	140	73	193
Total Magnesium	g/m ³	18.1-59	37	35	27	57	62
Total Nitrogen	g/m ³	230-600	440	440	270	460	950
Total Potassium	g/m ³	320-2,700	420	380	290	590	580
Total Sodium	g/m ³	170-950	173	147	124	240	230
Total Sulphide Trace	g/m ³	0.29-22	2.8	0.50	< 0.02	0.18	2.2
Turbidity	NTU	189-490	240	260	87	310	1470
Un-ionised hydrogen sulphide	g/m ³	0.009-2.7	0.22	0.029	< 0.002	0.005	0.27
Methylene Blue Active Substances	g/m ³	1	1.4	1.1	1.0	1.2	1.7
Permethrin	g/m ³	LOD-0.0002	< 0.00006	0.00048	< 0.00015	< 0.0005	< 0.0005
Propiconazole	g/m ³	0.014-0.019-	0.0110	0.0118	0.0100	0.0083	< 0.004
Tebuconazole	g/m ³	0.024-0.029	0.0166	0.0193	0.0127	0.0102	< 0.005
Dibutyltin (as Sn)	g/m ³	<LOD	-	-	-	-	-
Tributyltin (as Sn)	g/m ³	<LOD	-	-	-	-	-
Triphenyltin (as Sn)	g/m ³	<LOD	-	-	-	-	-

In terms of consent compliance, the sodium absorption ratio (SAR) is required to be below 18 SAR, while the concentration of TPH within the fluid must be below 5% (50,000 g/m³).

For most contaminants and parameters, results during the 2021-2022 year remained within the ranges found during previous periods. However, it is notable that on 26 May 2022, the irrigation pond held the highest concentrations measured in recent years, and for a few parameters the highest concentrations ever recorded, of carbonaceous biochemical oxygen demand, chloride, *E coli*, total ammoniacal nitrogen, total

Kjeldahl (organic) nitrogen, total nitrogen, and turbidity. Hydrogen sulphide was also elevated above usual concentrations. A significant water pollution event in the lower Haehanga Stream was detected by Council officers on the same day (see sections 2.2.2 and 2.2.3). This coincidence strongly suggests the pollution of the Haehanga was caused by over-irrigation of collected wastewater, on or immediately preceding that day.

The average concentration of ammoniacal nitrogen during the 2021-2022 year was 450 g/m³. It is noted that RNZ have calculated the area of land needed for irrigation of wastewaters using a concentration of only 250 g/m³. This strongly suggests that RNZ have under-estimated the area of land they should be using, if excessively nitrogen loading (and hence risk of break-through into groundwater and eventually into the Haehanga Stream) is to be avoided.

LOSP pesticides were routinely detected in the irrigation pond wastewaters on most occasions, indicating their ongoing leaching from the drilling wastes stockpile into the wider environment. Likewise, barium continues to be mobilised. Barium is a marker for drilling wastes due to its use as a weighting mud.

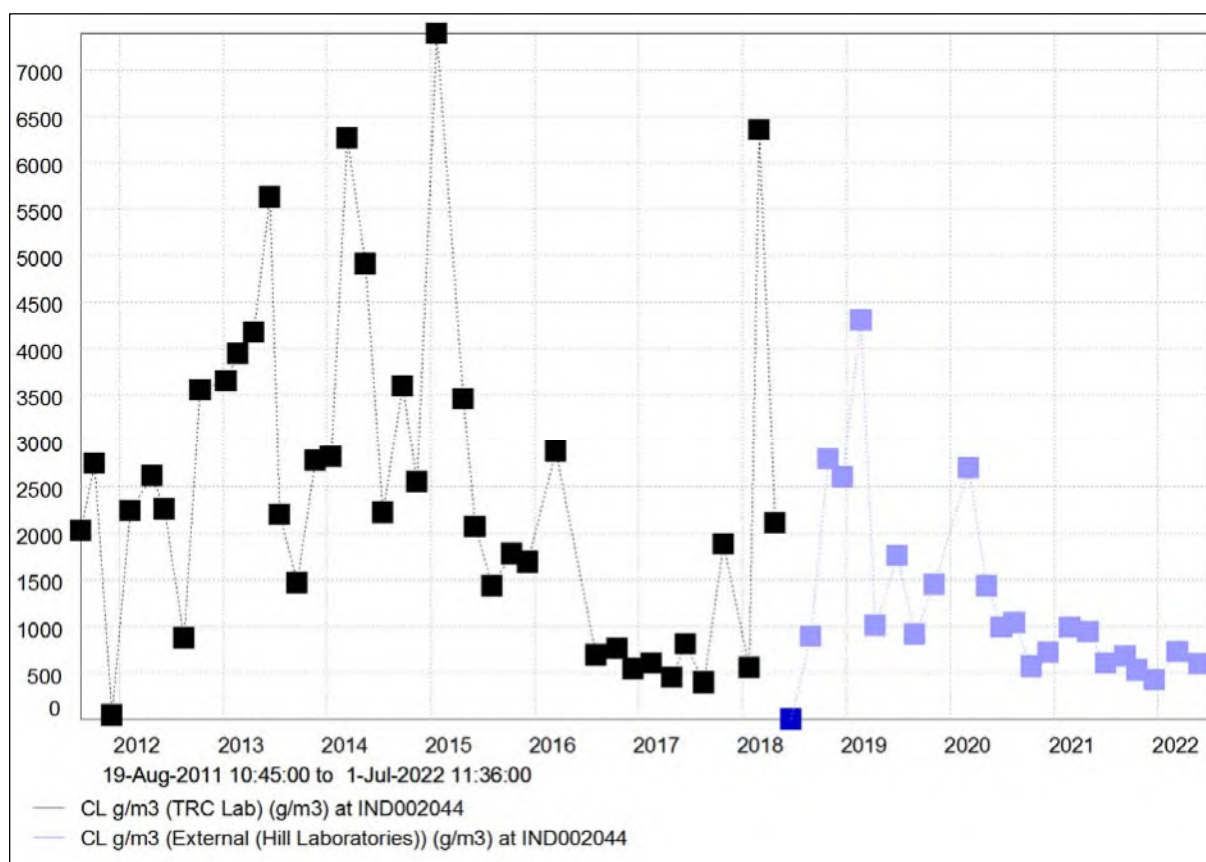


Figure 13 Chloride levels in the irrigation retention pond 2011-2022

Figure 13 above shows the trends in the concentration of chloride in the irrigation pond since 2011. RNZ committed to ending the acceptance of drilling wastes in or about December 2020. The data shows a substantial reduction in the concentration of chloride entering the irrigation holding pond since that date, while noting a pattern of overall reducing chloride leachate prior to that decision, particularly in 2017.

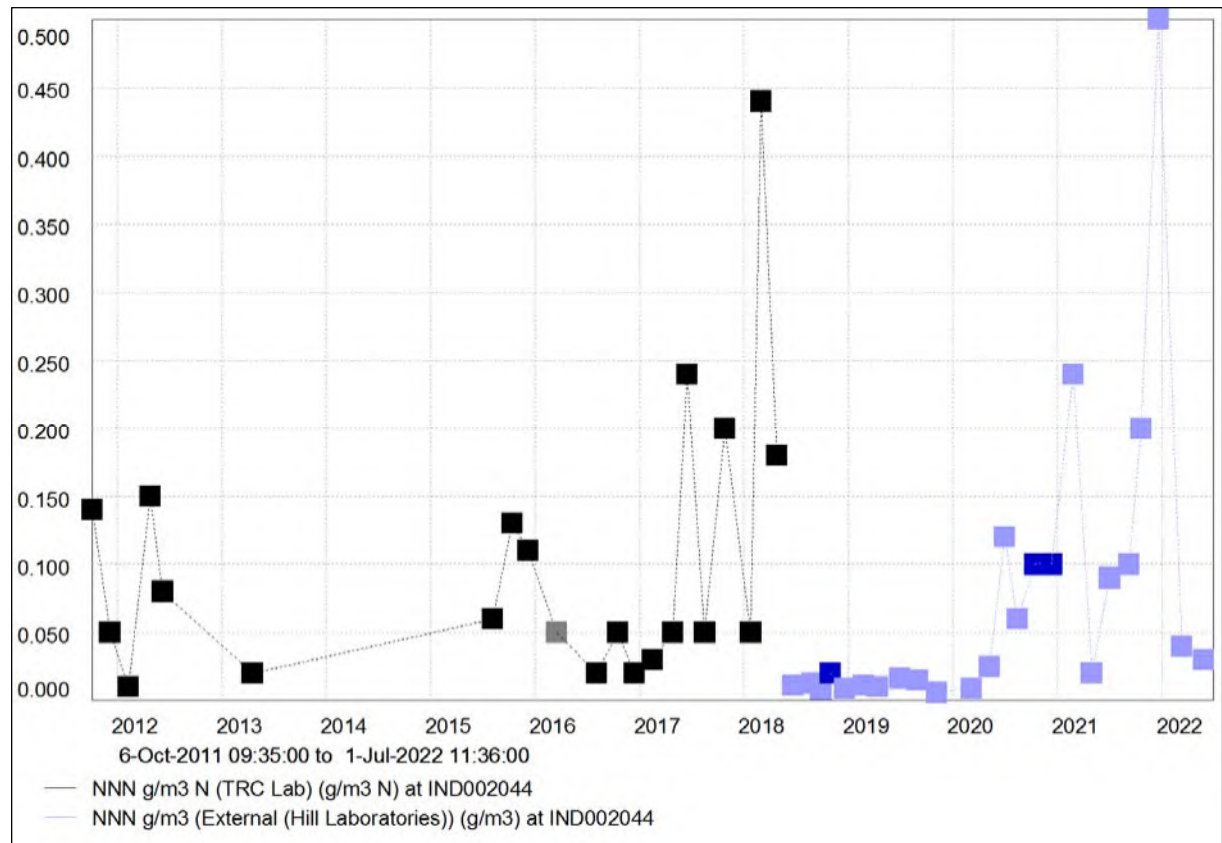


Figure 14 Oxidized nitrogen (nitrate+nitrite) concentrations in the irrigation retention pond 2011-2022

Figure 14 above shows the trends in the concentration of nitrate-nitrogen in the irrigation pond since 2011. The data show considerable variation in the concentration of nitrate within the irrigation holding pond over that period, with peaks in 2018 and again in December 2022. The December 2022 value was the highest recording value to date at 13.8 g/m³. The data suggests that at times, the composting process is creating highly stable compost (shown by peaks in oxidised nitrogen), while at other times ammonia rather than nitrate is being leached from Pad 1 (see Figure 15 below).

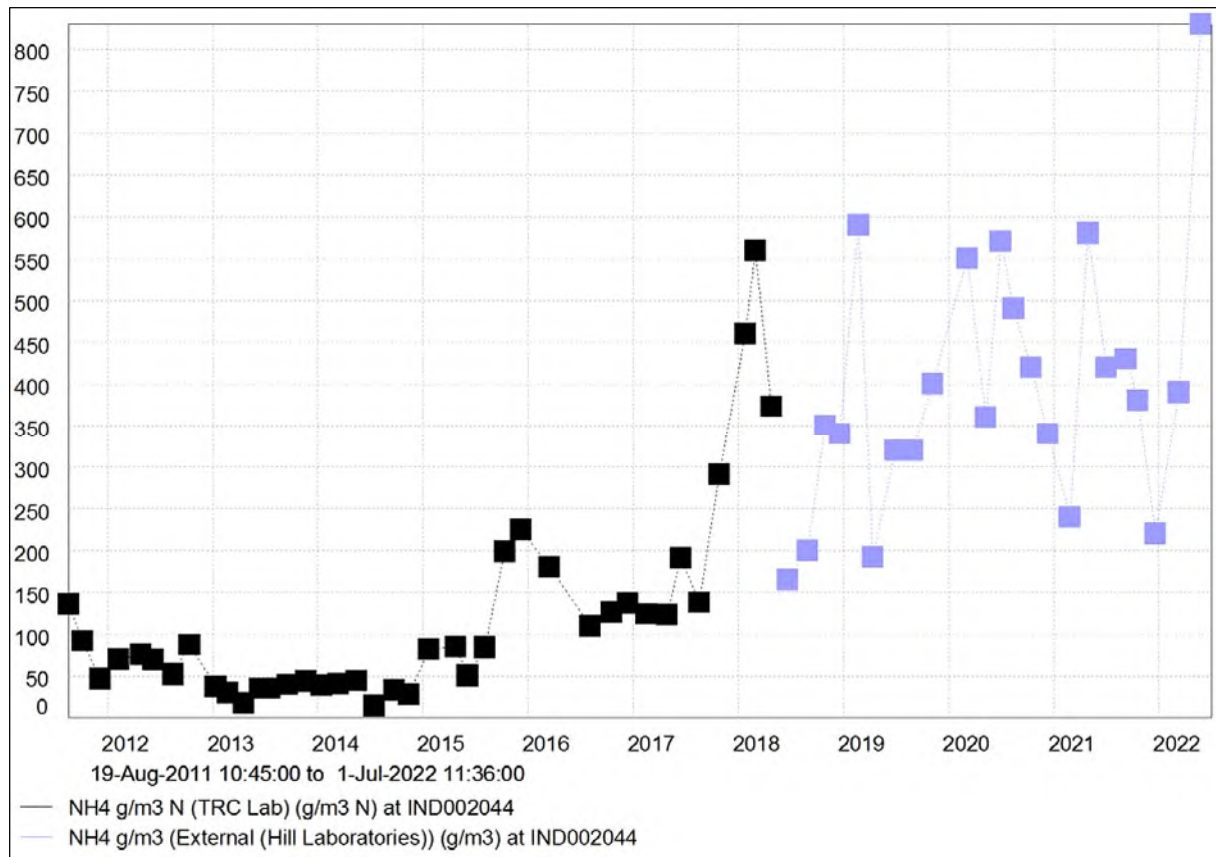


Figure 15 Total ammoniacal nitrogen concentrations in the irrigation retention pond 2011-2022

Figure 15 above shows the trends in the concentration of ammoniacal nitrogen in the irrigation pond since 2011. The data show a substantial overall increase in the concentration of ammonia entering the irrigation holding pond since around 2018, and a sharp and high peak in May 2022 that was more than a third higher than any previous result (and is the most recent sampling run reported). The significance of the recent increased ammoniacal nitrogen for the nitrogen loading on the pasture in the irrigation fields is discussed in Section 3.1.

The pattern of much higher leaching of ammonia in recent years is suggestive of much greater volumes of organic wastes being processed, and/or poorer covering of the materials during the composting process, leading to greater leaching and loss rates of soluble nutrients.

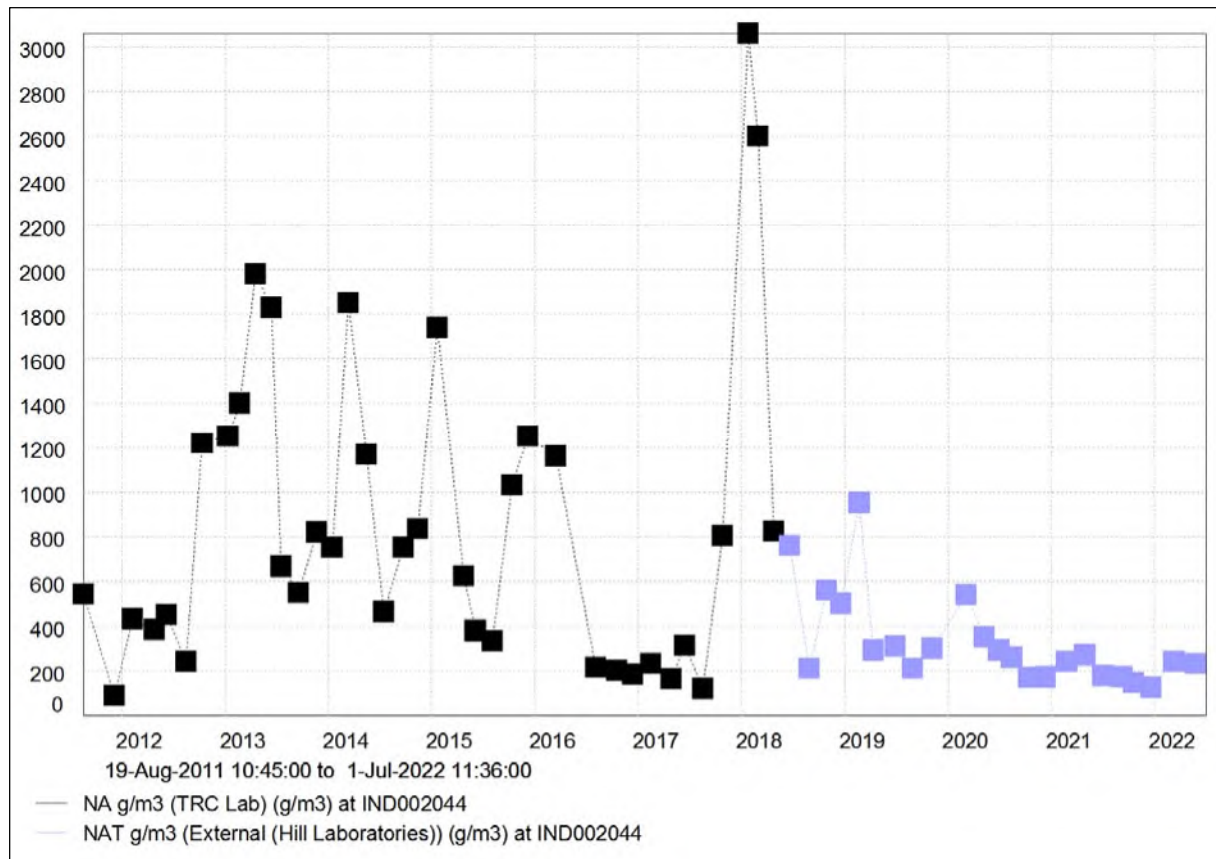


Figure 16 Ionised sodium concentrations in the irrigation retention pond 2011-2022

Figure 16 above presents the data for the concentration of sodium in the irrigation wastewaters since 2011. The application of excessive quantities of ionic sodium to soil causes degradation of soil structure, leading to loss of productivity and increased erosion. The pattern of reducing sodium concentrations is encouraging. It is noted that RNZ committed to eliminating the reception of drilling wastes from December 2020, and this appears to have had clear benefits, while noting that sodium concentrations were overall reducing prior to this time in any case (but with considerable variability and wide ranges in results).

2.6.3 Results of soil monitoring (irrigation areas)

Nine irrigation areas are now in operation at the Uruti site (Figure 8). Two composite samples were collected from each irrigation area this monitoring period, on 3-5 August 2021. Of the two samples, one was collected via a soil corer extracted to a depth of 37 cm bgl. The second, a shallow sample, was collected via a push corer down to 7 cm bgl.

The aim of these were to assess for any variation between the shallow and deep core samples and specifically to assess from any azole based pesticides which were contained within the irrigation fluid. In addition, four spot samples were collected from the drilling mud pad, (Pad 3). Included in the data set are the sample results from the previous three monitoring periods, where available, for comparison purposes.

Irrigation area U1

Table 22 Irrigation area U1 soil results 2018-2022

Soil results	Area	U1	U1	U1	U1 shallow
Parameter	Unit/Date	24 Jan 18	26 Jun 20	3 Aug 21	3 Aug 21
Dry Matter (Env)	g/100 g as rcvd	69	69	68	54
Soluble Salts	g/100 g dry wt	-	< 0.05	< 0.05	< 0.05
Conductivity from soluble salts	mS/cm	-	< 0.2	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	-	570	900	2,200
Total Recoverable Calcium	mg/kg dry wt	33.5	3,700	3,900	4,600
Total Recoverable Magnesium	mg/kg dry wt	4	6,000	6,400	5,700
Total Recoverable Potassium	mg/kg dry wt	23.7	1,300	1,340	1,580
Total Recoverable Sodium	mg/kg dry wt	46.8	199	165	177
Chloride	g/m ³	119.5	240	49	74
pH	pH Units	5.3	5.6	6	6
Total Recoverable Arsenic	mg/kg dry wt	5	4	5	4
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.12	0.1	0.13
Total Recoverable Chromium	mg/kg dry wt	22	21	21	18
Total Recoverable Copper	mg/kg dry wt	13	11	12	14
Total Recoverable Lead	mg/kg dry wt	15.4	13	14.6	12.4
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	16	14	15	13
Total Recoverable Zinc	mg/kg dry wt	66	61	68	77
Permethrin	mg/kg dry wt	-	-	< 0.003	< 0.004
Propiconazole	mg/kg dry wt	-	-	< 0.006	< 0.008
Tebuconazole	mg/kg dry wt	-	-	< 0.009	< 0.011
Benzo[e]pyrene	mg/kg dry wt	<u>0.015</u>	< 0.014	< 0.014	< 0.014
Perylene	mg/kg dry wt	<u>0.019</u>	< 0.014	< 0.015	< 0.018
Sodium Absorption Ratio (SAR)		2	2	1.6	1.2

Area U1 (0.51 ha) is located up gradient from the drilling mud pad, towards the south east side of the Uruti composting site. The monitoring over the past four years indicated the following:

- Soluble salts and the conductivity from the soluble salts were all below the laboratory limit of detection (LOD).
- Total barium demonstrated a rapidly increasing concentration between 2020 and 2021, noting the concentration of barium was more elevated in the shallow soil sample from 2021, (U1 shallow, 03/08/2021), as opposed to the deeper core (U1, 03/08/2021).
- Total recoverable calcium results demonstrated a relatively stable concentration between 2020 and 2021, having substantially increased after the first sampling (January 2018). It is noted that in the most recent survey, the shallow sample (U1 shallow) held a somewhat more elevated concentration than the deeper core (U1, 03/08/2021).
- It should be noted in the case of the calcium, potassium and sodium concentrations, results are significantly higher after the initial survey, but have remained stable since. However, this is at least in

part due to change in laboratory analytical technique. The more recent samples have been analysed through a complete digestion, rather than measuring what was bioavailable.

- Chloride results demonstrated a decrease in concentration over time.
- Total heavy metal concentrations have remained stable across the four samples.
- The pesticides permethrin, propiconazole and tebuconazole were all below the LOD.
- No benzene, toluene, ethylbenzene, or xylenes were recorded above the LOD. These were not tabulated.
- In terms of polycyclic aromatic hydrocarbons, only compounds which were detected were tabulated. No recent detections of benzo[a]pyrene or perylene were recorded above the LOD this monitoring period.
- The sodium absorption ratio (SAR) remains low.
- Other than the increasing concentration of total barium in the soil, there are no results or trends of concern at this time for the area being monitored. The barium is presumably being re-distributed from the drilling wastes on Pad 3, via the irrigation wastewaters.

Irrigation area U2

Table 23 Irrigation area U2 soil monitoring 2018-2022

Soil results	Area	U2	U2	U2	U2	U2	U2 shallow
Parameter	Unit/Date	21 Jun 18	1 Nov 18	12 Apr 19	26 Jun 20	3 Aug 21	3 Aug 21
Dry Matter (Env)	g/100 g as rcvd	49	53	64	71	69	53
Soluble Salts	g/100 g dry wt	-	< 0.05	0.07	0.09	0.05	0.07
Conductivity from soluble salts	mS/cm	-	< 0.2	0.2	0.2	< 0.2	0.2
Total Recoverable Barium	mg/kg dry wt	-	-	780	186	450	550
Total Recoverable Calcium	mg/kg dry wt	5,000	5,600	3,900	3,700	5,100	9,200
Total Recoverable Magnesium	mg/kg dry wt	4,900	4,800	4,300	5,700	6,500	6,200
Total Recoverable Potassium	mg/kg dry wt	1,620	1,950	1,360	1,280	1,720	1,780
Total Recoverable Sodium	mg/kg dry wt	145	160	165	143	210	260
Chloride	g/m ³	33	54	200	125	153	130
pH	pH Units	6.3	6.8	5.5	5.5	6.4	7
Total Recoverable Arsenic	mg/kg dry wt	-	5	4	5	5	6
Total Recoverable Cadmium	mg/kg dry wt	-	0.19	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	-	18	19	19	20	20
Total Recoverable Copper	mg/kg dry wt	-	14	12	11	14	20
Total Recoverable Lead	mg/kg dry wt	-	13.2	13.4	13.2	14.6	20
Total Recoverable Mercury	mg/kg dry wt	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	-	12	14	16	16	17
Total Recoverable Zinc	mg/kg dry wt	--	63	56	57	70	93

Soil results	Area	U2	U2	U2	U2	U2	U2 shallow
Parameter	Unit/Date	21 Jun 18	1 Nov 18	12 Apr 19	26 Jun 20	3 Aug 21	3 Aug 21
Permethrin	mg/kg dry wt	-	-	-	-	< 0.003	< 0.004
Propiconazole	mg/kg dry wt	-	-	-	-	< 0.006	< 0.008
Tebuconazole	mg/kg dry wt	-	-	-	-	< 0.009	< 0.011
TPH C15 - C36	g/m ³	55	< 50	< 40	< 40	< 40	67
Sodium Absorption Ratio (SAR)		0.8	1.2	1.5	1.6	1.9	1.1

Irrigation area U2 (2.53 ha) is also located in the upper reaches of the Uruti composting facility. Six soil samples have been collected at this location since June 2018 (Table 23).

- Soluble salts have ranged from below the LOD through 0.09 g/100 g (900 mg/kg). In terms of the shallow and deep 2021 soil samples, the shallower sample held a higher concentration than the deeper core, with both results slightly lower than in the previous survey..
- Conductivity from the soluble salts remains near or below the LOD.
- Total recoverable barium results ranged 186-780 mg/kg. There is no clear trend over time.
- Calcium ranged 3,700-9,200 g/m³. The shallower soil sample (U2 shallow, 9,200 g/m³), held a more elevated result than the deeper core (U2, 03/08/2021, 5,200 g/m³). While the latest shallow soil result is the highest to date, there is no consistent pattern of an increase in the concentration of calcium.
- Magnesium results demonstrated a slight increasing concentration since 2018.
- Potassium remained relatively stable across the seven samples, with little difference between the shallow or deeper core.
- Soil sodium results demonstrated a slight but steady increase in concentration since 2018. However, the sodium absorption ratio remains very low, so the increase is not yet of concern.
- pH results remained weakly acidic, ranging 5.5-7.0 pH.
- Total recoverable (TR) arsenic results have remained relatively stable and low across all monitoring rounds.
- TR cadmium results, apart from a trace detection (0.19 g/m³, 01/011/2018), early in the data set, were below the LOD.
- TR chromium, copper, lead and nickel remained relatively stable across the soil samples.
- TR mercury was below the LOD in all samples.
- TR zinc demonstrated as slight increasing trend over time.
- Permethrin, propiconazole and tebuconazole were not detected above the LOD this monitoring period.
- In terms of PAH's, no compound has been detected above the LOD in any of the soil samples of this area, over time (since 2018). These results have not been tabulated.
- In terms of TPH, only carbon chain C15-C36 recorded trace concentrations in June 2018, but again more recently in the August 2021, U2 shallow sample.
- Sodium absorption ratios remained low across all soil samples.
- There are no results or trends that give rise to concern at this time for the area being monitored.

Irrigation area U3

Table 24 Irrigation area U3 soil monitoring 2019-2022

Soil results	Area	U3	U3	U3 shallow	U3
Parameter	Unit/Date	12 Apr 19	26 Jun 20	3 Aug 21	3 Aug 21
Dry Matter (Env)	g/100 g as rcvd	77	74	78	62
Soluble Salts	g/100 g dry wt	< 0.05	0.17	0.08	0.08
Conductivity from soluble salts	mS/cm	< 0.2	0.5	0.2	0.2
Total Recoverable Barium	mg/kg dry wt	270	360	1,080	690
Total Recoverable Calcium	mg/kg dry wt	5,500	6,200	5,900	5,400
Total Recoverable Magnesium	mg/kg dry wt	6,300	6,800	7,000	6,300
Total Recoverable Potassium	mg/kg dry wt	1,410	1,660	1,520	1,580
Total Recoverable Sodium	mg/kg dry wt	156	230	240	188
Chloride	g/m ³	8	290	250	67
pH	pH Units	6.5	6.4	6.6	6.7
Total Recoverable Arsenic	mg/kg dry wt	5	5	5	6
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	20	21	21	19
Total Recoverable Copper	mg/kg dry wt	14	15	15	16
Total Recoverable Lead	mg/kg dry wt	16.2	16.4	16.8	22
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	20	19	19	18
Total Recoverable Zinc	mg/kg dry wt	67	68	72	74
Permethrin	mg/kg dry wt	-	-	< 0.003	< 0.003
Propiconazole	mg/kg dry wt	-	-	< 0.006	< 0.007
Tebuconazole	mg/kg dry wt	-	-	< 0.008	< 0.010
Perylene	mg/kg dry wt	< 0.013	0.084	< 0.013	0.029
C15 - C36	mg/kg dry wt	< 40	42	< 40	47
Sodium Absorption Ratio (SAR)		0.7	1.7	1.3	1.2

Irrigation area U3 is the irrigation area furthest up catchment, spanning an area of 1.98 ha. Four soil samples have been collected from this area since 2019.

- Soluble salts ranged from below the LOD through to 0.17 g/100 g (1,700 mg/kg).
- Conductivity from the soluble salts ranged from below the LOD, through to 0.5 mS/cm.
- TR barium recorded an increase in concentration since 2019, ranging 270–1,080 mg/kg. The shallow core (U3, 03/08/2021) recording close to twice the deeper core concentration, and 3-4 times higher than earlier samples.
- Calcium, magnesium, potassium and sodium remained relatively stable across the four soil samples.
- Chloride results indicated an increase between the first and the subsequent monitoring rounds, noting the shallow sample held a higher concentration than the deeper core, in this monitoring period.
- Soil pH remained stable across all four samples, weakly acidic.
- TR arsenic, copper, lead, nickel and zinc remained stable across all four samples.
- TR cadmium and mercury were below the LOD in all four samples.

- Permethrin, tebuconazole and tebuconazole were all below the LOD.
- In terms of PAHs, only perylene has been recorded at low concentration, on two separate occasions. 26/06/2020 and 03/08/2021, U3 shallow). Remaining PAHs were all below their respective LOD's.
- In terms of TPH, only carbon chain C15-C36 was recorded, on the same two occasions: 26/06/2020 and 03/08/2021.
- Sodium absorption ration (SAR) remained low in all four samples.
- Other than the indications of an increasing trend in barium, all results give rise to no environmental concerns at this time for the area being monitored.

Irrigation area L1

Table 25 Irrigation area L1 soil monitoring 2018-2022

Soil results	Area	L1	L1	L1	L1	L1	L1	L1 shallow
Parameter	Unit/Date	24 Jan 18	21 Jun 18	1 Nov 18	12 Apr 19	26 Jun 20	5 Aug 21	5 Aug 21
Dry Matter (Env)	g/100 g as rcvd	70	61	63	61	71	71	53
Soluble Salts	g/100 g dry wt	-	-	0.15	0.1	0.08	< 0.05	0.09
Conductivity from soluble salts	mS/cm	-	-	0.4	0.3	0.2	< 0.2	0.3
Total Recoverable Barium	mg/kg dry wt	-	-	-	1660	1280	930	1,940
Total Recoverable Calcium	mg/kg dry wt	103.7	13,100	10,900	9,900	7,100	7,700	11,400
Total Recoverable Magnesium	mg/kg dry wt	13.5	4,500	5,500	3,800	5,500	5,900	5,100
Total Recoverable Potassium	mg/kg dry wt	40.4	1,470	1,470	1,990	1,500	1,590	1,880
Total Recoverable Sodium	mg/kg dry wt	59.2	270	340	300	320	290	310
Chloride	g/m ³	129	73	470	270	450	220	155
pH	pH Units	6.2	7.4	7	7	7.3	7	7.4
Total Recoverable Arsenic	mg/kg dry wt	4	-	6	5	5	5	7
Total Recoverable Cadmium	mg/kg dry wt	0.21	-	0.2	0.28	0.18	0.18	0.23
Total Recoverable Chromium	mg/kg dry wt	20	-	20	16	19	22	21
Total Recoverable Copper	mg/kg dry wt	14	-	24	19	21	16	26
Total Recoverable Lead	mg/kg dry wt	16.3	-	22	19.8	18.8	16.5	24
Total Recoverable Mercury	mg/kg dry wt	< 0.10	-	< 0.10	< 0.10	< 0.10	0.18	< 0.10
Total Recoverable Nickel	mg/kg dry wt	15	-	15	10	13	16	14
Total Recoverable Zinc	mg/kg dry wt	73	-	98	95	76	80	105

Soil results	Area	L1	L1	L1	L1	L1	L1	L1 shallow
Parameter	Unit/Date	24 Jan 18	21 Jun 18	1 Nov 18	12 Apr 19	26 Jun 20	5 Aug 21	5 Aug 21
Permethrin	mg/kg dry wt	-	-	-	-	-	< 0.003	< 0.004
Propiconazole	mg/kg dry wt	-	-	-	-	-	< 0.006	< 0.008
Tebuconazole	mg/kg dry wt	-	-	-	-	-	< 0.009	< 0.011
C15 - C36	mg/kg dry wt	69	96	84	149	47	< 40	100
Total hydrocarbons (C7 - C36)	mg/kg dry wt	69	105	84	149	< 70	< 70	101
Sodium Absorption Ratio (SAR)		1.4	1.3	1.6	1.8	1.9	1.7	1.5

Irrigation area L1 (1.31 ha) is located at the northern end of the site, in close proximity to the main gate. It is one of the lower irrigation areas at the site as it is second furthest down catchment.

- Seven soil samples have been collected from this area since 2018 (Table 25).
- Soluble salts has been analysed in five of the seven samples, these ranged from below the LOD through to 0.15 g/100 g (1,500 mg/kg).
- TR barium results ranged 930–1,940 mg/kg, with the elevated result recorded in the most recent survey in the shallow core (L1 shallow).
- TR calcium results, barring the initial round (24/01/2018), ranged 7,100–13,100 mg/kg. It should be noted that a change in laboratory analytical technique resulted in a more rigorous digestion of the soil samples, and as such the concentrations for cations are more elevated in the subsequent rounds than the initial.
- TR magnesium also, barring the initial round, ranged 3,800–5,900 mg/kg.
- TR potassium, bar the first round (24/01/2018) ranged relatively stable ranging 1,470–1,990 mg/kg.
- TR sodium also remained relatively stable, bar the initial round, ranging 270–340 mg/kg.
- Chloride concentrations ranged 73–470 mg/kg, and more recently have recorded a decrease in concentration over time.
- TR arsenic remained relatively stable, ranging 4–7 mg/kg across the six samples analysed.
- TR cadmium was measurable in all samples analysed, ranging 0.18–0.28 mg/kg.
- TR copper, lead, nickel and zinc remained relatively stable across all samples.
- TR mercury recorded a trace concentration (0.18 mg/kg, 05/08/2021), remaining samples were below the LOD.
- No permethrin, propiconazole, or tebuconazole was recorded above the LOD.
- Similarly no PAH's were recorded above the LOD across all samples collected.
- In terms of TPH, hydrocarbons in the carbon chain group C15-C36 have been consistently detected, above the LOD in six of seven samples.
- Sodium absorption ration (SAR), remained of low concentration, ranging 1.3–1.9.
- Other than the indications of an increasing trend in barium, all results give rise to no environmental concerns at this time for the area being monitored. The hydrocarbon concentrations are well below any recognised thresholds for environmental effects.

Irrigation area L2

Table 26 Irrigation area L2 soil monitoring 2018-2021

Soil results	Area	L2	L2	L2	L2	L2 shallow	L2	L2 shallow
Parameter	Unit/Date	24 Jan 18	1 Nov 18	12 Apr 19	26 Jun 20	26 Jun 20	5 Aug 21	5 Aug 21
Dry Matter (Env)	g/100 g as rcvd	73	59	54	68	74	66	60
Soluble Salts	g/100 g dry wt	-	0.18	0.31	0.08	0.13	< 0.05	< 0.05
Conductivity from soluble salts	mS/cm	-	0.5	0.9	0.2	0.4	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	-	-	1,380	490	2,300	410	650
Total Recoverable Calcium	mg/kg dry wt	279	13,800	17,200	8,500	9,800	7,300	6,900
Total Recoverable Magnesium	mg/kg dry wt	24.3	5,100	4,700	5,200	6,000	6,300	6,100
Total Recoverable Potassium	mg/kg dry wt	466.9	2,500	3,300	2,300	1,800	2,000	1,850
Total Recoverable Sodium	mg/kg dry wt	624.3	520	690	370	400	240	250
Chloride	g/m ³	1,254	580	1,060	440	680	68	53
pH	pH Units	7.2	7	7.2	7.2	7.1	7.2	7
Total Recoverable Arsenic	mg/kg dry wt	5	5	6	4	5	4	5
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.32	0.27	0.18	0.12	0.16	0.15
Total Recoverable Chromium	mg/kg dry wt	20	18	19	19	20	23	22
Total Recoverable Copper	mg/kg dry wt	21	32	24	13	18	14	16
Total Recoverable Lead	mg/kg dry wt	18.4	22	29	14.5	20	14.3	14.5
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	18	13	13	13	16	16	15
Total Recoverable Zinc	mg/kg dry wt	75	94	109	68	84	73	72
Permethrin	mg/kg dry wt	-	-	-	-	-	< 0.003	< 0.003
Propiconazole	mg/kg dry wt	-	-	-	-	-	< 0.007	< 0.007
Tebuconazole	mg/kg dry wt	-	-	-	-	-	< 0.009	< 0.010
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.014	< 0.017	0.019	< 0.015	< 0.013	<0.016	<0.017
Fluoranthene	mg/kg dry wt	< 0.014	< 0.017	0.02	< 0.015	< 0.013	<0.016	<0.017

Soil results	Area	L2	L2	L2	L2	L2 shallow	L2	L2 shallow
Parameter	Unit/Date	24 Jan 18	1 Nov 18	12 Apr 19	26 Jun 20	26 Jun 20	5 Aug 21	5 Aug 21
Perylene	mg/kg dry wt	0.087	< 0.017	< 0.019	0.048	< 0.013	< 0.015	< 0.017
C10 - C14	mg/kg dry wt	< 20	< 20	< 30	22	40	< 20	< 20
C15 - C36	mg/kg dry wt	157	82	125	167	260	< 40	55
Total hydrocarbons (C7 - C36)	mg/kg dry wt	157	82	125	189	300	< 70	< 70
Sodium Absorption Ratio (SAR)		9.6	4.3	4.3	3.5	2.1	2.3	1.7

Irrigation L2 (1.61 ha) is one of the oldest irrigation areas on site. Six soil samples have been collected since 2018 (Table 26).

- Soluble salts have ranged from below the LOD through to 0.31 g/100 g (3,100 mg/kg). It was noted that the samples collected in this period were below the LOD on both occasions (shallow and deep cores). This suggests a reduction in salt concentrations when compared to the 2018 and 2019 sample rounds.
- TR barium ranged 410–2,300 mg/kg.
- TR calcium ranged (barring the initial round, see comment calcium area L1) 6,900–17,200 mg/kg. The concentration appears to have reduced from earlier peak values.
- TR magnesium ranged relatively stable across the soil samples (bar the initial sample, see comment L1 cation digestion).
- TR potassium and sodium both demonstrated a slight reducing trend since 2018 and 2019 respectively.
- Chloride concentrations have reduced significantly in this area since 2018.
- Soil pH has remained stable, remaining neutral, 7–7.2 pH.
- TR arsenic remained stable across all samples analysed.
- TR cadmium was measurable in all but one sample (24/01/2018), ranging 0.15–0.32 g/m³.
- TR chromium, copper, nickel and zinc remained relatively stable across the monitoring round and are within back ground soil concentrations for these elements.
- TR mercury was below the LOD in all samples analysed.
- Permethrin, propiconazole and tebuconazole were below the LOD in both samples collected this monitoring period.
- In terms of PAHs, benzo (a) pyrene was recorded on one occasion (12/04/2019, 0.19 mg/kg).
- Fluoranthene was also recorded on one occasion (12/04/2019, 0.02 mg/kg).
- Perylene was recorded on two occasions (24/01/2018, 0.087 mg/kg and 26/06/2020, 0.048 mg/kg).
- In terms of TPH, carbons chain C10-14 was detected on both sampled from 26/06/2020, ranging 22–40 mg/kg) and C15-C36 on six occasions, ranging 82–260 mg/kg, and was still present in the shallow sample of the latest survey.
- Sodium absorption ratio (SAR) ranged 1.7–9.6. It is noted the most recent results are the lowest results for this parameter, in this data set.
- The apparent reductions in sodium and chloride would be positive for soil quality and health if maintained. The recent absence of aromatic hydrocarbons at detectable concentrations is likewise encouraging. All results give rise to no environmental concerns at this time for the area being monitored. The hydrocarbon concentrations are well below any recognised thresholds for environmental effects.

Irrigation area L3

Table 27 Irrigation area L3 soil monitoring 2018-2021

Soil results	Area	L3	L3	L3	L3 shallow
Parameter	Unit/Date	21 Jun 18	26 Jun 20	3 Aug 21	3 Aug 21
Dry Matter (Env)	g/100 g as rcvd	56	74	78	68
Soluble Salts	g/100 g dry wt	-	0.13	0.05	< 0.05
Conductivity from soluble salts	mS/cm	-	0.4	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	-	2,300	320	450

Soil results	Area	L3	L3	L3	L3 shallow
Parameter	Unit/Date	21 Jun 18	26 Jun 20	3 Aug 21	3 Aug 21
Total Recoverable Calcium	mg/kg dry wt	9,600	9,800	6,000	10,600
Total Recoverable Magnesium	mg/kg dry wt	4,700	6,000	7,100	6,900
Total Recoverable Potassium	mg/kg dry wt	2,200	1,800	1,480	1,480
Total Recoverable Sodium	mg/kg dry wt	570	400	230	230
Chloride	g/m ³	580	680	230	52
pH	pH Units	7.3	7.1	6.7	7.2
Total Recoverable Arsenic	mg/kg dry wt	-	5	5	5
Total Recoverable Cadmium	mg/kg dry wt	-	0.12	< 0.10	0.11
Total Recoverable Chromium	mg/kg dry wt	-	20	21	21
Total Recoverable Copper	mg/kg dry wt	-	18	14	17
Total Recoverable Lead	mg/kg dry wt	-	20	15.2	21
Total Recoverable Mercury	mg/kg dry wt	-	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	-	16	18	16
Total Recoverable Zinc	mg/kg dry wt	-	84	73	91
Permethrin	mg/kg dry wt	-	-	< 0.003	< 0.003
Propiconazole	mg/kg dry wt	-	-	< 0.006	< 0.007
Tebuconazole	mg/kg dry wt	-	-	< 0.008	< 0.009
Benzo[b]fluoranthene + Benzo[j]fluoranthene		<0.013	0.013	<0.013	<0.013
Pyrene	mg/kg dry wt				
C7 - C9	mg/kg dry wt	< 11	< 8	< 8	< 9
C10 - C14	mg/kg dry wt	< 30	40	< 20	< 20
C15 - C36	mg/kg dry wt	49	260	< 40	60
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 80	300	< 70	< 70
Sodium Absorption Ratio (SAR)		4.6	2.1	2.1	1.2

Irrigation area L3 (1.47 ha) is also a long term irrigation area.

- Four samples have been collected from this area since 2019 (Table 27).
- Soluble salts ranged from below the LOD through to 0.13 g/100 g, with the latest results being below the LOD.
- Conductivity from field salts ranged from below the LOD on two occasions (including the latest results) up to 0.4 mS/cm.
- TR barium ranged from 320-2,300 mg/kg, with the latest results being the lowest.
- TR calcium ranged from 9,600-10,600 mg/kg, with no apparent pattern or trend.
- TR magnesium ranged 54,700-7,100 mg/kg, with no apparent pattern or trend.
- TR potassium ranged 1,480-2,200 mg/kg, with no apparent pattern or trend.
- TR sodium ranged 570-230 mg/kg, with an apparent reducing trend.
- Chloride demonstrated an apparent reduction across the samples, over time, ranging 52-680 mg/kg.
- pH results remained relatively stable, fluctuating either side of pH 7.
- TR arsenic, cadmium, copper, lead, nickel and zinc remained stable across the three sampling rounds analysed.

- TR mercury was below the LOD on the three occasions analysed.
- Permethrin, propiconazole and tebuconazole results were all below the LOD.
- In terms of PAHs, benzo[b]fluoranthene + benzo[j]fluoranthene was recorded on one occasion (26/06/2020) at a low concentration. The rest of the PAHs were below the LOD.
- TPH results recorded C10-C14 (40 mg/kg) on one occasion (26/06/2020), while C15-C36 (260 mg/kg) have been detected frequently including in the latest survey.
- Sodium absorption ratio ranged 1.2-4.6.
- The apparent reductions in sodium and chloride would be positive for soil quality and health if maintained. The recent absence of aromatic hydrocarbons at detectable concentrations is likewise encouraging. The hydrocarbon concentrations are well below any recognised thresholds for environmental effects. All results give rise to no environmental concerns at this time for the area being monitored.

Irrigation area L4

Table 28 Irrigation area L4 soil monitoring 2019-2022

Soil results	Area	L4 Baseline	L4 Baseline	L4	L4 shallow
Parameter	Unit/Date	11 Nov 19	11 Nov 19	5 Aug 21	5 Aug 21
Dry Matter (Env)	g/100 g as rcvd	68	77	72	62
Soluble Salts	g/100 g dry wt	< 0.05	< 0.05	0.08	0.06
Conductivity from soluble salts	mS/cm	< 0.2	< 0.2	0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	36	39	230	1,030
Total Recoverable Calcium	mg/kg dry wt	2,800	3,000	5,800	6,800
Total Recoverable Magnesium	mg/kg dry wt	5,100	5,100	7,200	5,400
Total Recoverable Potassium	mg/kg dry wt	880	910	1,460	1,640
Total Recoverable Sodium	mg/kg dry wt	80	90	192	210
Chloride	g/m ³	10	6	66	121
pH	pH Units	5.6	5.8	7.2	6.9
Total Recoverable Arsenic	mg/kg dry wt	4	3	4	5
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.14
Total Recoverable Chromium	mg/kg dry wt	18	16	23	19
Total Recoverable Copper	mg/kg dry wt	9	9	14	17
Total Recoverable Lead	mg/kg dry wt	10.8	10.4	15.1	19.3
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	14	14	19	15
Total Recoverable Zinc	mg/kg dry wt	54	54	71	81
Permethrin	mg/kg dry wt	-	-	< 0.003	< 0.003
Propiconazole	mg/kg dry wt	-	-	< 0.006	< 0.007
Tebuconazole	mg/kg dry wt	-	-	< 0.009	< 0.010
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	73
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	< 70	77
Sodium Absorption Ratio (SAR)		0.8	0.9	1	1.2

Irrigation area L4 (2.25 ha) is one of the newer irrigation area areas, constructed in the 2018-2019 monitoring period. Four soil samples have been collected from this area since November 2019 (Table 28).

The two soil samples collected in November 2019 stand as baseline soil samples. These were collected before the area was augmented to an irrigation area.

The analysis indicated the following:

- Soluble salts ranged from below the LOD in the baseline samples, through 0.08 g/100g (800 mg/kg) in the deeper core of the latest survey (05/08/2021, L4).
- Conductivity from soluble salts recorded one result above the LOD, in the latest survey (0.2 mS/cm, L4, 05/08/2021).
- TR barium results increased from the November 2019 monitoring round, with range of 36-39 mg/kg, through to 230-1,030 mg/kg in the latest survey. Of note, the shallower soil sample (1,030 mg/kg) contained a more elevated concentration than the deeper core (230 mg/kg) in the 2020-2021 monitoring period.
- TR calcium concentrations doubled in concentration between the November 2019 and the September 2021 monitoring rounds, increasing from 2,800-3,000 mg/kg to 5,800-6,800 mg/kg.
- TR magnesium concentrations remained relatively stable, though the deeper core (L4, 03/08/2021) held a more elevated concentration than the shallower core, which appeared within range of the November 2019 samples.
- TR potassium results increased between the monitoring rounds.
- TR sodium results doubled between the two monitoring rounds.
- Chloride concentrations increased from 6-10 mg/kg through 66-121 mg/kg.
- Soil pH results increased from a weakly acidic concentration (5.6-5.8 pH), to a more neutral concentration pH 6.9-7.2.
- TR arsenic remained relatively stable across the four soil samples.
- TR cadmium results recorded one concentration above the LOD, (L4 shallow, and 0.14 mg/kg).
- TR chromium, copper, lead, nickel and zinc recorded marginal increases between 2019 and 2021.
- TR mercury remained below the LOD across all samples.
- It should be noted that all heavy metals remained within background concentrations.
- Permethrin, propiconazole and tebuconazole was not recorded above the LOD.
- No PAHs were recorded above the LOD in all samples analysed, thus these results have not been tabulated.
- In terms of TPH, carbon chain C15-C36 recorded a low concentration of 73 mg/kg in the latest shallow sample (L4 shallow, 03/08/2021), which brought the total hydrocarbons value to 77 mg/kg in the same sample.
- Sodium absorption ratio remained low across all samples analysed.
- The soil quality in this area is being significantly altered, with increases in a number of parameters that are markers of the application of irrigated wastewaters from RNZ's processes. Barium, associated with drilling wastes, has increased some 30 times over. Sodium has more than doubled; the concentrations of chloride have increased some 6-12 times over. On the other hand, the potentially toxic metals are not showing any evidence of increases that are of concern.

Irrigation area L5

Table 29 Irrigation area L5 soil monitoring 2020-2022

Soil results	Area	L5	L5	L5 shallow
Parameter	Unit/Date	26 Jun 20	3 Aug 21	3 Aug 21
Dry Matter (Env)	g/100 g as rcvd	68	67	57
Soluble Salts	g/100 g dry wt	< 0.05	< 0.05	< 0.05
Conductivity from soluble salts	mS/cm	< 0.2	< 0.2	< 0.2
Total Recoverable Barium	mg/kg dry wt	67	71	72
Total Recoverable Calcium	mg/kg dry wt	4,400	4,000	3,400
Total Recoverable Magnesium	mg/kg dry wt	6,400	6,800	5,800
Total Recoverable Potassium	mg/kg dry wt	1320	1,320	1,340
Total Recoverable Sodium	mg/kg dry wt	137	140	116
Chloride	g/m ³	81	22	48
pH	pH Units	6.1	5.8	5.7
Total Recoverable Arsenic	mg/kg dry wt	5	5	4
Total Recoverable Cadmium	mg/kg dry wt	0.11	0.11	0.13
Total Recoverable Chromium	mg/kg dry wt	22	23	19
Total Recoverable Copper	mg/kg dry wt	11	12	11
Total Recoverable Lead	mg/kg dry wt	13.9	14.5	12
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	17	17	15
Total Recoverable Zinc	mg/kg dry wt	68	68	63
Permethrin	mg/kg dry wt	-	< 0.003	< 0.003
Propiconazole	mg/kg dry wt	-	< 0.007	< 0.008
Tebuconazole	mg/kg dry wt	-	< 0.009	< 0.011
Sodium Absorption Ratio (SAR)		0.9	1	0.8

Irrigation area L5 (1.42 ha) is located to the east of the duck pond, in the centre of the site. This is also one of the newer irrigation areas.

Three samples have been collected from this area since 2020 (Table 29).

In terms of the analytical results:

- No significant change was recorded between the two monitoring periods.
- Notably, no permethrin, propiconazole or tebuconazole was recorded above the LOD.
- No petroleum hydrocarbon impacts were recorded above the LOD for PAHs or TPH (results not shown).
- The sodium absorption ratio remained low.

Irrigation area L6

Table 30 Irrigation area L6 soil monitoring 2021

Soil results	Area	L6	L6 shallow	L6	L6 shallow
Parameter	Unit/Date	5 Aug 21	5 Aug 21	15 Oct 21	15 Oct 21
Dry Matter (Env)	g/100 g as rcvd	75	50	77	57
Soluble Salts	g/100 g dry wt	< 0.05	< 0.05	< 0.05	0.09
Conductivity from soluble salts	mS/cm	< 0.2	< 0.2	< 0.2	0.3
Total Recoverable Barium	mg/kg dry wt	390	2,500	430	2,500
Total Recoverable Calcium	mg/kg dry wt	6,700	19,300	8,400	18,200
Total Recoverable Magnesium	mg/kg dry wt	7,700	5,200	8,800	5,800
Total Recoverable Potassium	mg/kg dry wt	1,310	2,100	1,410	2,100
Total Recoverable Sodium	mg/kg dry wt	210	390	350	310
Chloride	g/m ³	14	46	19	75
pH	pH Units	7.6	7.8	7.0	7.3
Total Recoverable Arsenic	mg/kg dry wt	4	7	4	7
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.18	< 0.10	0.17
Total Recoverable Chromium	mg/kg dry wt	23	19	21	20
Total Recoverable Copper	mg/kg dry wt	18	32	22	32
Total Recoverable Lead	mg/kg dry wt	13.6	30	14.8	40
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	17	14	17	15
Total Recoverable Zinc	mg/kg dry wt	70	121	73	126
Permethrin	mg/kg dry wt	< 0.003	< 0.004	< 0.003	< 0.003
Propiconazole	mg/kg dry wt	< 0.006	< 0.009	< 0.006	< 0.008
Tebuconazole	mg/kg dry wt	< 0.008	< 0.012	< 0.008	< 0.011
Pyrene	mg/kg dry wt	< 0.013	0.02	< 0.013	< 0.018
C7 - C9	mg/kg dry wt	< 8	< 12	< 20	< 30
C10 - C14	mg/kg dry wt	< 20	< 30	< 20	28
C15 - C36	mg/kg dry wt	47	360	83	197
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	380	< 80	230
Sodium Absorption Ratio (SAR)		1	1.2	0.9	0.9

Irrigation area L6 (2 ha) was constructed in the 2019-2020 monitoring period. It had not been utilised by the consent holder for irrigation prior to the soil sampling effort (Table 30).

The analysis indicated the following:

- Soluble salts and conductivity results from the soluble salts were both below the laboratory's LODs for three of the four samples. In the shallow sample from October 2021 soluble salts were recorded at 0.09 g/100 g while corresponding conductivity was 0.3 mS/m.
- TR barium results ranged between 390-2,500 mg/kg, noting the 2,500 mg/kg was collected via the shallow soil cores. The first high shallow barium result had been collected prior to any use of the area for irrigation. This raises concern that drilling mud has been utilised for the construction of this irrigation area by the consent holder. If so, this would have been a breach of consent.

- TR calcium results ranged 6,700-19,300 mg/kg. The latter result is the most elevated concentration in this monitoring period, across all irrigation areas. This also suggests drilling mud origin.
- TR magnesium ranged 5,200-8,800 mg/kg.
- TR potassium ranged 1,310-2,100 mg/kg.
- TR sodium ranged 210-390 mg/kg. These results are much higher than at similar sites L4 and L5, and similar to those at L2 and L3. This further suggests drilling wastes are present on the site.
- Chloride ranged 14-75 mg/kg.
- pH results were weakly basic, ranging 7.0-7.8 pH.
- TR arsenic ranged 4-7 mg/kg.
- TR chromium ranged 19-23 mg/kg.
- TR copper ranged 18-32 mg/kg. It is noted that the copper result for L6 shallow is the most elevated in the soil samples collected from any irrigation area during this monitoring period. This again suggests drilling wastes are present on the site.
- TR lead ranged 13.6-40 mg/kg.
- TR mercury was below the LOD in all samples.
- TR nickel ranged 14-17 mg/kg.
- TR zinc ranged 70-126 mg/kg. Noting the concentration, 126 mg/kg (L6 shallow), is the most elevated in the data set of this year's soil results.
- Permethrin, propiconazole and tebuconazole were not detected above the LOD.
- In terms of PAHs, no analytes were recorded above the LOD. These results have not been tabulated.
- For TPH, carbon chain C15-C36 was recorded in both samples from L6, ranging 47-360 mg/kg. While chain C10-14 was recorded in the shallow sample from October 2021 at 28 mg/kg. The concentrations of C15-C36 and total hydrocarbons in soil samples from this area were the highest of any measured for any of the irrigation areas. The detection of such elevated hydrocarbons in the soil on area L6 prior to the use of the area for wastewater irrigation again raises concern that drilling mud has been utilised for the construction of this irrigation area by the consent holder. If so, this would have been a breach of consent.
- Sodium absorption ratio remained low or close to 1.

2.6.4 Irrigation loading rates

Condition 8 of consent 5838-2.2 requires that:-

'The consent holder shall record the following information in association with irrigating wastewater to land:

- a. The date, time and hours of irrigation;
- b. The volume of wastewater irrigated to land;
- c. The conductivity of the irrigation fluid (measured in mS/m)
- d. The source of the wastewater (eg pond or wetland treatment system), and
- e. The location and extent where the wastewater was irrigated.

The above records shall be made available to the Chief Executive, Taranaki Regional Council, on request'.

The current (expired) consent does not impose a limit upon the annual mass loading of total nitrogen per area of irrigation field. Council officers recommended a limit of 400 kg N/ha/year at the Council hearing. This figure was consistent with other consents the Council has issued in recent years.

RNZ has stated that the average annual N loading in irrigated areas is 345.6 kg/ha/year¹¹.

RNZ have offered a limit to be imposed via consent, of 400 kg N/ha/year¹².

RNZ were asked to provide the above information for the July 2021- June 2022 period, on 11 August 2022, and the records were received on 5 September 2022. Data as provided by RNZ is reproduced in the two tables below.

RNZ provided data on the average monthly concentration of nitrogen in the irrigated wastewater. The mean of the monthly concentrations was 324 g/m³, and the range 162 to 561 g/m³. However, inspection of the monthly data supplied by RNZ shows that a generic default value was used for the first five months, of 250 g/m³. Therefore there must be doubt around the calculated nitrogen loadings the Company has provided. Excluding the generic data, the mean concentration of nitrogen was 377 g/m³, which is 16% higher. Notwithstanding the likelihood that the Company data under-reports the true nitrogen loading being applied to land in the Haehanga catchment, that data shows that in three irrigation areas, RNZ did not comply with the consent limit (Table 31 below), in area L2 by more than 25%. If RNZ have under-reported actual annual mean nitrogen concentrations by 16%, then the consent limit may also have reached or breached in areas L4 and L5.

The Council sampled the irrigation pond on five occasions during the year (Table 21 above, designated as Site IND002044). The average of the Council's results for total (kjeldahl method) nitrogen was 510 g/m³, and the range 260 to 950 g/m³. These monitoring results from the Council's own surveys are substantially higher than those provided to the Council by RNZ, by more than 50%. If the Council's data is taken as being representative, then RNZ would have breached the prospective consent limit of 400 kg N/ha on every irrigation area with the exception of U2 and L6 (the area used for only part of the year).

Table 31 Summary of nitrogen loadings per irrigation area (as supplied by RNZ. See text). Prospective consent limit 400 kg/ha/yr

Area	L1	L4	L2	L3	L5	L6 ³	U1	U2	U3
Nitrogen Loading Kg/ha/yr	419.64	340.67	505.61	303.01	345.22	56.37	428.74	193.85	266.08

Note 3: Use of Area L6 commenced in April 2022

¹¹ AEE revised in June 2020, Section 2.8.5.1 (pg 49), Table 7, At <https://www.trc.govt.nz/assets/Documents/Environment/Consent-applications/Remediation2019/June2020Revisions/RevisedAEE-June2020.PDF>

¹² Proposed consent limit of 400 kg N/ha/year. Email Colin Kay of Kay Consultants to Council counsel, 20 January 2023

Figure 17 Annual nitrogen loadings to irrigation areas (as supplied by RNZ. See text). Prospective consent limit 400 kg/ha/yr

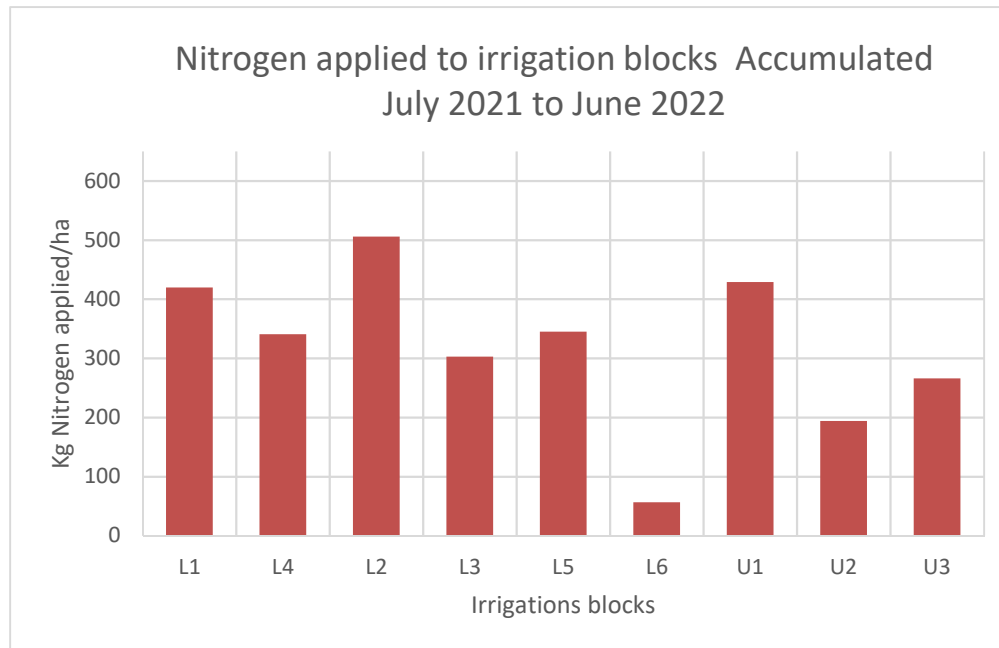


Table 32 below sets out a summary of monthly pumping and loading data provided by RNZ. Of significance, pumping was highest (as measured by hours of pumping and volume pumped) in winter 2021 and autumn 2022. This is at variance to accepted farm irrigation management, which promotes wastewater storage over winter and targets spring and summer for maximum irrigation discharge volumes and nitrogen loadings, which is when pasture is most able to take up nitrogen as new growth. This suggest that RNZ is using irrigation as a means to avoid the irrigation wastewater pond from overflowing, rather than as a means of providing effective nitrogen capture and utilisation.

Table 32 Summary of irrigation data (as supplied by RNZ. See text)

Month 2021-2022	Pump hrs	Volume irrigated ¹	Nitrogen applied ²
	2021-2022	2021-2022	2021-2022
Jul	90.0	1,800	450
Aug	76.0	1,520	380
Sept	114.0	2,280	570
Oct	77.5	1,550	388
Nov	43.0	1,187	297
Dec	70.0	2,024	337
Jan	34.0	969.0	157
Feb	4.0	80.0	19
Mar	11.0	253.0	122
Apr	35.0	761.3	427
May	26.0	520.0	269
Jun	36	720	364
	616.5	13,664.2	3,780.0

Notes 1: unit not stated. Presume m³

2: unit not stated. Presume kg nitrogen as N.

2.6.5 Incidents of land and soil contamination

23 September 2021

Testing of sawdust stockpiled at the site for extractable leachate found that copper, chromium, and arsenic were leached at quantifiable levels from two out of three samples of the sawdust. That confirmed that the metals previously detected in the mixed drilling wastes came from the treated sawdust, as ongoing analyses by the Council of drilling wastes disposed to land elsewhere in the region have not shown the same elevated heavy metal concentrations. It further means that the sawdust and the blends containing the sawdust will, over time, release these metals into the environment of the Haehanga Stream catchment under RNZ's current approach to stockpile management.

The two samples of chromated copper arsenate (**CCA**) sawdust both came from the large pile of sawdust on Pad 1 that has been accumulated on the Pad and used on an ongoing basis to be mixed with drilling wastes. The third sample was taken from a new sawdust stockpile (sourced from a different provider), and was not found to release CCA contaminants in an extraction test.

The Council had already issued an abatement notice to RNZ on 5 July 2021, requiring compliance with RNZ's resource consent in respect of the following:

Action 1. Undertake works to ensure that no treated sawdust is received at the composting facility in contravention of Resource Consent 5838-2.2.2.

Action 2. Undertake works to remove all treated sawdust from the site to ensure compliance with Resource Consent 5838-2.2.

Action 1 took immediate effect, while compliance with Action 2 was required by 16 August 2021. RNZ was not able to identify an offsite disposal by this deadline, and as an interim intervention the sawdust was instead baled with plastic sheeting to eliminate leaching, while a permanent solution was pursued.¹³

1 March 2022

On the evening of 1 March 2022, several complaints were received concerning odour emanating from the RNZ composting site. Investigation by Council officers detected odours off-site. The officer's assessment against odour determination factors found that the odours were in compliance with the conditions of resource consent 5839-2. However, inspection on the site found that an unauthorised load of beef lungs and livers had been deposited at the site. Receiving animal offal is in contravention of the conditions of resource consent 5838-2. RNZ subsequently confirmed they had accepted beef lungs and livers that had originated from the ANZCO meat processing facility at Eltham. ANZCO confirmed that it was the source, and that it had sent the wastes to RNZ's Urutū site in error, co-mingled with ox tails and animal facial material. A draft Site Practices Plan provided by RNZ specifies that *'The Site Manager is to ensure that all material entering the site... must comply with the approved inputs list....The site operations staff are to audit the incoming loads...If unauthorised material is dumped and the party responsible for it has left the site, they will be recalled to site, and the material reloaded for removal as above.'* The Council consequently issued RNZ with Infringement Notice EAC-24602.

March 2022

The Council was aware of an anecdotal report suggesting that, in addition to the large stockpile of drilling wastes on Pad 3 and the use by RNZ of some of this material to form the cold air bund halfway down the

¹³ As at the time of preparation of this report, this material remains on the RNZ Urutū site but the Council has been informed by RNZ that it has received a quotation for the removal of some of the baled sawdust.

valley towards the north, some drilling wastes had been re-located to form a bund or stop-bank on the northern side of RNZ's vermiculture beds, alongside an unnamed tributary of the Haehanga Stream.

This anecdotal report was brought to the attention of RNZ on 25 March and 28 March, 2022, The Council provided an aerial photograph identifying the alleged area of deposition. In response, RNZ stated *"The piles that were in the photo provided were of unscreened compost and contained no drilling mud/drilling related materials."* RNZ further stated that the compost material had been subsequently removed.

On 30 March 2022, a Council officer collected two samples of the solid material from the heap by the Council. The location of the heap and the sampling locations are shown in Figure 18. Subsequent analysis of the two samples found total recoverable barium (a definitive marker for drilling muds) at concentrations of 4,500 mg/kg and 5,000 mg/kg, respectively. These concentrations are at the higher end of those found in the stockpile of drilling wastes present on Pad 3, and far beyond background soil concentrations. A Council officer informed the on-site management staff of RNZ of the analytical results,, and instructed the RNZ staff that the stockpile was not to be disturbed, removed, or added to in the interim. This instruction was issued to avoid the possibility of exposed material falling or being washed into the adjacent tributary of the Haehanga Stream. Further testing of the soil found the fungicides and tanalising chemicals that the Council has previously detected in the sawdust stockpiles on the site and in the drilling wastes stockpile.

Following the end of the period under review, RNZ have committed to undertaking site investigations, to determine the location and significance of contamination across the property, and to ascertaining options for site rehabilitation. With the various stages required, these investigative works are to be completed by April 2023, and if an on-site disposal option is selected, a suitable location is to be identified by February 2024.



Figure 18 Location of sampling points in stockpiled waste heaps near paunch pad and vermiculture beds.
The tributary flows right to left, between the stockpiles and the bush

2.7 Incidents, investigations, and interventions- summary

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the Company. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach, that in the first instance avoids issues occurring, is favoured.

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

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

Table 33 below sets out details of any incidents recorded, additional investigations, or interventions required by the Council in relation to the Company's activities during the 2021-2022 period. This table presents a summary of events that required further investigation or intervention regardless of whether these were found to be compliant or not.

In January 2022, the Council determined that because of concerns over the safety of compliance officers when deployed to investigate odour complaints in the vicinity, there would not be a field response at the time of complaint if received outside normal working hours.

Table 33 Incidents, investigations, and interventions summary table

Date	Details	Compliant (Y/N)	Enforcement Action Taken?	Outcome
1, 2, 3, 7, 8, 9, 20, 27, 28 July 2021	Complaints were received regarding offensive odours	Odour surveys were undertaken on each occasion and no offensive or objectionable odour was detected beyond the site boundary	None	Ongoing reactive and proactive monitoring by Council
4, 9, 11, 13, 15, 19, 24 August 2021	Complaints were received regarding offensive odours	Odour surveys were undertaken on each occasion and no offensive or objectionable odour was detected beyond the site boundary	None	Ongoing reactive and proactive monitoring by Council
1, 3, 5, 14, 29 September 2021	Complaints were received regarding offensive odours	Odour surveys were undertaken on each occasion and no offensive or objectionable odour was detected beyond the site boundary	None	Ongoing reactive and proactive monitoring by Council
5, 5, 5, 6, 6, 11, 15, 20, 28 October 2021	Complaints were received regarding offensive odours	Odour surveys were undertaken on each occasion and no offensive or objectionable odour was detected beyond the site boundary	None	Ongoing reactive and proactive monitoring by Council
1, 5, 7, 8, 9, 10, 17, 25, 29 November 2021	Complaints were received regarding offensive odours	Odour surveys were undertaken on each occasion and no offensive or objectionable odour was detected beyond the site boundary	None	Ongoing reactive and proactive monitoring by Council

Date	Details	Compliant (Y/N)	Enforcement Action Taken?	Outcome
01/11/2021	Excessive application of irrigated wastewater	N	Infringement notice	Ongoing monitoring. Hydraulic loading rates and storage requirements under consideration in Environment Court
3, 7, 8, 14, 17, 22, 24 December 2021	Complaints were received regarding offensive odours	Odour surveys were undertaken on each occasion and no offensive or objectionable odour was detected beyond the site boundary	None	Ongoing reactive and proactive monitoring by Council
11, 14 January 2022	Complaints were received regarding offensive odours	Odour surveys were undertaken on each occasion and no offensive or objectionable odour was detected beyond the site boundary	None	Ongoing reactive and proactive monitoring by Council
3, 5, 8, 8, 9, 14, 14, 17, 22 February 2022	Complaints were received regarding offensive odours	Odour surveys were undertaken on each occasion and no offensive or objectionable odour was detected beyond the site boundary	None	Ongoing reactive and proactive monitoring by Council
01/03/2022	Receipt of unauthorised raw materials- beef lungs and livers	N	Infringement notice. Previous abatement notice still in effect.	RNZ adherence to Site Practices Plan to be monitored
11/03/2022	Seepage of contaminated groundwater into tributary of Haehanga Stream in vicinity of Pad 3	N	Yes Previous abatement notice still in effect.	Abatement notice under consideration at end of period
3, 10 March 2022	Complaints were received regarding offensive odours	Odour surveys were undertaken and no offensive or objectionable odour was detected beyond the site boundary	None	Ongoing reactive and proactive monitoring by Council
7 April 2022	Complaint was received regarding offensive odours	Odour survey was undertaken and no offensive or objectionable odour was detected beyond the site boundary	None	Ongoing reactive and proactive monitoring by Council

Date	Details	Compliant (Y/N)	Enforcement Action Taken?	Outcome
27/04/2022	Offensive and objectionable odour offsite	N	Infringement notice. Previous abatement notice still in effect	Ongoing Council monitoring. RNZ commitment to odour surveys
23/05/2022	Complaint was received regarding offensive odours	Odour survey was undertaken and no offensive or objectionable odour was detected beyond the site boundary	None	Ongoing reactive and proactive monitoring by Council
26/05/2022	N. Routine water quality sampling found very significant non-compliance of un-ionised ammonia (toxicity) and BOD (organic loading) throughout the lower Haehanga Stream catchment		Under consideration at end of period under review	Ongoing regular water quality surveys
15/06/2022	Complaint was received regarding offensive odours	Odour survey was undertaken and no offensive or objectionable odour was detected beyond the site boundary	None	Ongoing reactive and proactive monitoring by Council

3 Discussion

3.1 Discussion of site performance

Performance for discharge to land and water consent 5838-2

At the start of the year, 13.2 ha of the site was being used for wastewater irrigation (9.1 ha located to the northwest of the site- nearer the road; and 4.5 ha to the south-east, beyond the composting area). During the year, RNZ increased this to 15.96 ha. No further expansion was proposed. However, it should be noted that the adequacy of this area to comply with nitrogen loadings per hectare (for assimilation of nitrogen in pasture growth) and the hydraulic loadings to avoid surface runoff or odorous ponding was a matter for conferencing between the experts of the various parties during the Environment Court hearing of the consent decision appeal. If the ponds and pads are not as impermeable as originally suggested by RNZ, any works to prevent leakage would result in a greater volume of wastewater for irrigation.

RNZ advised the Council that all solid wastes received at the site would no longer be deposited into the drop-off pond adjacent to Pad 3, but rather deposited onto Pad 1 for immediate incorporation into composting windrows. This intention was actioned during the second half of calendar 2021. The drop-off pond and various other elements of the wastewater collection and treatment system were subsequently rehabilitated, with sludges and potentially contaminated soils placed onto the stockpile on Pad 3. Despite a directive from RNZ's air quality expert, the observations of Council officers on inspections was that this additional material generally remained uncovered, and it continued to be a source of odour and potential runoff for the remainder of the period.

As noted earlier, during the year the drop-off pond, truckwash collection pond, and several settling and skimming ponds were decommissioned and rehabilitated during the year, and aeration of the irrigation pond implemented. In particular, adequate aeration of the irrigation pond at desirable concentrations will reduce odours at source..

During discussions prior to the Environment Court hearing,, RNZ gave an undertaking to substantially reduce the size of the Pad 2 paunch dewatering pond, and in the future to accept only dewatered paunch and store it under shelter until such time as it is placed on the vermiculture beds. While initial works to reduce the Pad 2 pond were observed to be underway in March, later Council visits showed that no further works had been undertaken, and the works remained incomplete.

Likewise, RNZ indicated the intention to eliminate the discharge from the Wetland Treatment System on Pad 2 into the tributary of the Haehanga Stream. However, there has not been any subsequent action to initiate the works to achieve this other than as noted above. Termination of this direct discharge would mean there is no direct discharge into surface waters on the property of RNZ's wastewaters. Analysis of the discharge from the WTS into the Haehanga Stream shows that it is a major point source of pollution, with a mean annual concentration during the year for total ammoniacal nitrogen of 53 g/m³ (range 6 to 87 g/m³) and for *E. coli* of 3,800 cfu/100 mls (range 800 to 8,000 cfu/100 mls).

However, assessment of the surface water quality surveys shows that diffuse pollution of the Haehanga Stream is occurring throughout its length from the upper irrigation fields downstream. A breakout of contaminated groundwater into a tributary was discovered through routine Council monitoring in March 2022, and remained unresolved at the end of the period under review. Widespread pollution of the lower Haehanga Stream discovered in May was most likely caused by poor management of irrigation to or on the lower irrigation fields, and remained under active consideration at the end of the year by the Council for further enforcement action. The fact that the worst surface water quality was found in the last water quality sampling run of the year indicates that there is no clear sustained progress towards a sustained improvement in site management and environmental performance.

The average concentration of ammoniacal nitrogen in the irrigation wastewater retention pond during the 2021-2022 year was shown to be 450 g/m³. It is noted that RNZ have calculated the area of land needed for irrigation of wastewaters using a concentration of only 225 g/m³ or thereabouts.¹⁴ While the nitrogen concentration in irrigated wastewater, and the consequent nitrogen loading on irrigation fields, are not limited within the current (expired) consent, the discrepancy in these figures strongly suggests that RNZ have under-estimated the area of land they should be using, if excessively nitrogen loading (and hence risk of break-through into groundwater and eventually into the Haehanga Stream) is to be avoided.

This means that there is real risk that irrigation areas will be overloaded, both hydraulically and with respect to the ability of the pasture and soil to retain nitrogen.

Council staff have noted during the year that there are a couple of small silt traps in the vicinity of the turnaround area, but these do not comply with the Waikato Regional Council's Guidelines for sediment control, which is now a standard Council requirement.¹⁵ More generally, the inadequacy of stormwater management across the site was brought to the attention of the Site Manager in March 2022, and continued to be an issue. It is also a matter of discussion within the consent appeal proceedings.

Sampling of the drilling wastes stockpile on Pad 3 by RNZ's consultant established in particular that the concentrations of arsenic in the pile are above levels that are suitable for application to land without compromising future land uses. The future of the stockpile (and noting that this material has also been spread elsewhere on the property) remains a matter for resolution during the consent appeal proceedings.

RNZ have offered through the consent appeal proceedings to prepare a comprehensive suite of operational management, contingency, and environmental audit plans. These largely remain dependent upon the outcome of the consent appeal.

Performance for discharge to air consent 5839-2

RNZ have made a number of changes to site infrastructure and installed equipment during the year that could have the outcome of reducing incidents of offensive and objectionable odour beyond the site if given full effects. These include the removal and rehabilitation of a number of ponds within the wastewater system for Pads 1 and 3, that have meant the elimination of these sources of anaerobic wastewater and attendant unpleasant smells; more regular monitoring of composting processes; the installation of aeration and dissolved oxygen metering in the irrigation wastewater lagoon; and provision of three deodorisers for use when wind conditions are adverse in terms of odours migrating towards the local community.

In August 2021, RNZ advised the Council that, since the time of the Council hearing, it had been undertaking improved monitoring of the composting windrows on site to ensure that the temperature and oxygen levels within the composting process are maintained at optimum levels to encourage accelerated and effective composting. This would simultaneously reduce the potential for adverse odour generation. RNZ were also occasionally using bark as a biofilters material to cover the first two composting windrows. Composting odours are more intense from the initial stages of the composting process. The covering of the first two windrows is, therefore, expected to assist in reducing the odour emissions from the site. However, Council staff have observed that this practice is not consistently applied.

During pre-hearing discussions, RNZ have also given an undertaking that the windrows will not be turned when the wind is from the south (ie towards the main road and the local community) and gentle or calm.

¹⁴ Uruti Composting Facility Irrigation Block Nitrogen Balance Analysis, Kay Consulting, May 2020. Section 4.6

¹⁵ Guidelines for earthworks in the Taranaki region, at <https://www.trc.govt.nz/assets/Documents/Guidelines/Land/earthwork.pdf> and, at <https://waikatoregion.govt.nz/assets/WRC/WRC-2019/TR0902.pdf>.

During pre-hearing discussions between the respective air quality experts, RNZ promised to engage an independent observer to monitor odour beyond the site boundary, but failed to do so during the period under review. They gave an assurance after the end of the year that they were still committed to provide this monitoring programme.

However, it needs to be noted that operational good practice and supervision needs to accompany the obtaining of the appropriate equipment. In this regard there were issues throughout the year, such as the generator for the aerator being used only intermittently and on occasion being left to run out of fuel; delays in implementing instructions from the RNZ air quality consultant (eg to move the deodorisers to more effective locations and only intermittent instead of continuous use of odour-absorbing cover on the freshest windrows as was instructed); and the failure of RNZ to implement an intensive odour survey programme as agreed. In the second half of the year under review, the number and size of windrows increased significantly, which raised concern that composting processes might not be effective and therefore there would be increased odour release when windrows were turned or screened; and stagnant drainage water was left ponded around the bases of the windrows on Pad 1 instead of being emptied to the wastewater system for aeration and stabilisation.

Two incidents of particular concern involved mismanagement of site operations that could have had potential for unacceptable emissions to air.

On 1 November 2021 Council officers found excessive irrigation had been applied. Ponded wastewater is a potential source of odour, and the consent limits the extent to which ponding on fields is acceptable following irrigation events. An infringement notice was issued to RNZ for this incident. A second incident was when, in contravention of RNZ's own protocols as well as of the consent, a load of beef offal (lungs and livers) was dumped at the site at night and left uncovered and unblended. This incident was discovered on 1 March 2022. Unauthorised material such as the offal in question has potential for increased odour release during composting. An abatement notice issued in respect of a previous similar incident was still in effect. An infringement notice was issued because of the non-compliance.

Offensive and objectionable odours offsite are discussed in section 3.2 below.

[Performance for twin culverts consent 5938-2](#)

The management of the twin culverts was satisfactory during this monitoring period. The Council did not require any works or find any issues.

[Performance for single culvert in the Haehanga Stream consent 6212-1](#)

The management of the culvert was satisfactory during this monitoring period. The Council did not require any works or find any issues. Council officers have requested that RNZ ensure ongoing fish passage is provided for.

[Performance of the large culvert situated in the unnamed tributary of the Haehanga Stream consent 10547-1](#)

The RNZ management of the culvert was satisfactory during this monitoring period. The Council did not require any works or find any issues. Council officers have requested that RNZ ensure ongoing fish passage is provided for. During the year, stock were excluded from the area, which will provide additional security to the in-stream and streambank works.

[Performance to discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream consent 10063-1](#)

The quarry was not utilised by the Company for the entirety of the monitoring period. The area was naturally revegetating throughout the monitoring period.

While the quarry remained non-operational, RNZ staff were anticipating it re-opening. In preparation, they undertook various sediment control works, including re-contouring the access track, installing cut-off drains and sediment and stormwater capture works, and the diversion of runoff to swale for treatment.

[Performance of the realignment of two unnamed tributaries of the Haehanga Stream for land improvement purposes consent 10825-1](#)

The Company has developed an additional land disposal area (area L6) in close locality to the main gate. In doing so, two ephemeral tributaries of the Haehanga Stream were to be realigned along the southern edge of the new irrigation area. The batters of the realigned tributaries were found to have stabilised, with natural re-vegetation emerging. Riparian planting has been established on the true right bank and riparian planting planned for winter 2022 on the true left bank. Two pre-existing small slumps did not increase in size.

[Performance of the modification of an existing culvert to provide for fish passage into an unnamed tributary of the Haehanga Stream consent 10843-1](#)

The previous culvert was significantly perched. As such, with the proposed development of the lower irrigation area, the pre-existing culvert required replacement to enable fish passage.

The new culvert was installed in the 2020-2021 monitoring period, and the culvert and associated earthworks continued to settle during the year under review. Some headwall erosion including displacement of a concrete block occurred because of a rainfall event. Repair of this headwall remained an outstanding matter at the end of the period under review, because of the risk of further erosion in flood events. Maintenance of the culvert and associated earthworks will continue to be monitored in the future.

3.2 Environmental effects of exercise of consents

Environmental effects are discussed by consent.

[Environmental effects associated with the discharge to land and water consent 5838-2.2](#)

The primary potential environmental effects on water quality and stream health that might arise during the exercise of consent 5838 include:-

- effects upon a tributary of the Haehanga Stream due to direct discharges from the wetland treatment system (WTS) (primarily elevated ammonia, biochemical oxygen demand, and bacteriological contamination);
- diffuse runoff from all operational areas (primarily elevated ammonia, biochemical oxygen demand, chloride/salinity, dissolved oxygen depletion, suspended solids/turbidity, and bacteriological contamination);
- increases in nitrogen species percolating into groundwater due to any excessive wastewater irrigation to land;
- contaminant migration into soil and groundwater beneath the pads, wastewater collection and containment systems, and/or any storage areas for raw or processed materials, including but not limited to the drilling wastes stockpile on Pad 3 and other areas where these materials have been distributed around the property; and
- any point-source seepage or break-out of contaminated stormwater or leachate into freshwater.
- In terms of potential environmental effects on soil quality and health that might arise during the exercise of consent 5838, these include:-
 - potential for discharge to land of unauthorised materials that might cause soil or product pollution;

- the inadvertent or intentional re-distribution of contaminated materials around the property, as stockpiles or as material spread across land or as soluble contaminants in the irrigation waters; and
- the ongoing issues around the characterisation and management of the drilling wastes stockpile.

Over the last two monitoring periods, the identification and determination of the migration of unauthorised contaminants discovered in the sawdust stockpiles and sawdust-blended materials on site has been a particular issue. These toxic contaminants include metals (arsenic, copper, and chromium) and light organic solvent preservatives (LOSPs).

Compliance is assessed against the current conditions in consent 5838. However, the requirements of the NPS-Freshwater Management 2020 are also discussed below, as the Council is obliged to give effect to the attribute limits specified in the NPS and discussions in the Environment Court consent appeal hearing will address these national limits. In particular, the NPS-FM imposes a maximum allowable concentration of total ammonium nitrogen, to be calculated in terms of the equivalent toxicity of ammonium nitrogen at pH 8.

Surface water monitoring of the Haehanga Stream indicated that nitrogen impacts, in the form of un-ionised ammoniacal nitrogen, were of the greatest concern for the ecological health of the water course. There was regular non-compliance with the consent for this parameter at the site below the discharge from the Wetland Treatment System into a tributary of the Haehanga Stream, but there was also a break-out of contaminated groundwater into another tributary in March, and then widespread pollution of the lower Haehanga Stream in May 2022.

On four of six sampling surveys, a breach of the un-ionised ammonia limit in the consent was found. Every one of the six surface water monitoring rounds indicated ammoniacal nitrogen in excess of the NPS-FM national bottom line annual maximum at one site at least.

The worst water quality in the Haehanga Stream was found in May 2022, when there was widespread pollution in the lower catchment for un-ionised and total ammonia, biochemical oxygen demand, and faecal indicator bacteria.

On every occasion, contamination increased downstream for most pollutants surveyed. As an example, when data from the two upstream (baseline) sites HHG000090 and HHG000097 are compared with the bottom site (HHG000190) located near the boundary of Remediation NZ, the mean concentration of:-

- chloride more than tripled (9.3 g/m³ at HHG000090 and 9.9 at HHG000097, to 30.8 g/m³ at HHG000190);
- total ammoniacal nitrogen was increased by around 50 times (0.020 g/m³ at HHG000090 and 0.123 at HHG000097, to 5.1 g/m³ at HHG000190);
- conductivity was increased by more than 1.5 times (155 µS/cm at HHG000090 and 189 at HHG000097, to 322 µS/cm at HHG000190);
- *E coli* by between 14 and 25 times (1070 at HHG000090 and 390 at HHG000097, to 13,900 at HHG000190); and
- biochemical oxygen demand by at least a third (<1 g/m³ at HHG000090 and <1 at HHG000097, to 1.3 g/m³ at HHG000190).

The Mimitangiatua awa also showed evidence of deterioration in every survey, although the environmental significance of this was usually less than minor. The exception was in May, when the concentration of *E coli* bacteria downstream was increased 5-fold, to be far in excess of recognised guidelines for immersive use (although the awa was already above the guideline above the confluence).

Biological monitoring of the Haehanga Stream and associated unnamed tributaries was undertaken on one occasion (24 January 2022).

The lack of any significant impact on taxa richness or of taxa abundances indicates that no significant toxic discharges have recently occurred from the WTS that have been affecting the macroinvertebrate communities in the receiving tributary of the Haehanga catchment.

MCI scores indicated that sites in the main stem of the Haehanga were of 'poor' health and sites in the unnamed tributary flowing beside Pad 2 and receiving the WTS discharge were in 'fair' health. There were no significant differences in MCI scores among the main stem sites or between the two sites on the unnamed tributary. There were also no significant differences between current results and historical medians, which indicates at the time of the survey macroinvertebrate communities were in typical health.

The SQMCI can be more sensitive to nutrient enrichment compared with the MCI. SQMCI scores indicated that the site in the tributary above the WTS discharge was in 'good' health while the site below the WTS discharge was in 'fair' health (ie was significantly lower). In the main stem, the uppermost ('baseline') site and the lowest, together with the reference site RS, were in 'poor' health, and mid-catchment sites were in 'very poor' health. There were several significant differences in a downstream direction. Sites below the main RNZ facilities had significantly lower SQMCI values than the upstream or baseline sites. These results may indicate nutrient enrichment. The WTS discharge may have caused an increase in more pollution tolerant taxa; but given the MCI values recorded little difference between the two sites, any impact was at a more minor level.

Overall, macroinvertebrate community health in the main stem of the Haehanga Stream can be regarded as poor, being dominated by pollution tolerant taxa, which would be a direct result of poor habitat quality and conditions at the time of sampling. The unnamed tributary that receives the WTS discharge has better habitat quality and subsequently better macroinvertebrate health. There was a lack of evidence that indicates that Remediation NZ discharges were causing direct toxic effects as evidenced by taxa numbers and abundances. There was also no evidence based on MCI scores of any significant effects, but there was some evidence of effects based on SQMCI scores (particularly at mid-catchment sites below the composting area). However, given the lack of congruence with MCI scores and the poor habitat and conditions throughout the catchment at the time of sampling the results do not provide sufficient evidence to conclude that Remediation NZ discharges were having any obvious and significant effect on macroinvertebrate communities in the Haehanga catchment.

It should be noted that poor habitat conditions at the time of the survey could have masked any effects of direct or diffuse discharges from the activities of RNZ on the property, as sensitive taxa would be sparse or absent in any case (as was found to be the situation in this survey).

Treated sawdust had been utilised (unconsented) by the Company for composting drilling mud for an estimated 15 years. Routine surface water monitoring on 11 March 2022 detected a significant pollution event at site HHG000106. Subsequent analysis of the sample recorded trace concentrations of two of the LOSP pesticides (propiconazole and tebuconazole) that had been used to treat the sawdust. Their presence was also confirmed in the wastewater retention pond. In the case of propiconazole at site HHG000106, the concentration at site HHG000106 was below the Environmental Exposure Limit¹⁶ ($>0.0001 \text{ g/m}^3$ EEL) as defined by the NZ Environmental Protection Authority (although it was higher than the EEL in the retention pond).

Groundwater monitoring

No petroleum hydrocarbons, including BTEX compounds, were detected in any of the wells this monitoring period. There had been a detection in the 2020-2021 year.

¹⁶ The EPA has set maximum environmental exposure limits to define a maximum level of herbicide which must not exceeded in order to protect environmental health

Groundwater monitoring quality was seasonal, as it typical, with higher concentrations of conductivity and dissolved solids apparent in summer (when rainfall dilution is lower). The exception was GND3008, which had very high concentrations of markers such as conductivity and TDS at the start (winter) of the year. This suggested considerable application of irrigation wastewater prior to that sampling survey. This is contrary to good practice, which would be to maximise irrigation in summer and seek to avoid irrigation and to instead retain wastewater in the retention pond during winter, when pasture soil is sodden and runoff more likely to occur.

Groundwater bores 3009 (down gradient of the composting area and adjacent to area L3) and 2190 (irrigation area L2) continue to show the greatest impact by RNZ on the quality of groundwater in their vicinity, with some measures more than 10 times higher than those found at other bores. Management of the day to day and annual loadings of wastewater to each area remains a concern, if groundwater quality (and consequently the quality of the Haehanga Stream) is to be conserved.

GND3007 is located at the site entrance. All analytes remained of low concentrations, and with some reductions from the previous period. RNZ plan increased use of a new irrigation area, L6, and future patterns in this bore (which marks groundwater quality as it passes across the property boundary) will be closely watched.

Soil monitoring

The concentration of sodium in the wastewater irrigated to land is a particular focus of the Council's monitoring programme. Excessive soil sodicity can lead to:

- reduced flow of water through soil, which limits leaching and can cause salt to accumulate over time and the development of saline subsoils
- dispersion in the soil surface, causing crusting and sealing, which then impedes water infiltration
- dispersion in the subsoil, accelerating erosion, which can cause the appearance of gullies and tunnels
- dense, cloddy and structureless soils, as sodicity destroys aggregation.

Measurements of the concentrations of ionic sodium over the past decade show that concentrations have been steadily reducing, and have been consistently low since December 2020. Drilling wastes were no longer accepted since about this time.

Shallow and deep composite core samples were collected from all irrigation areas this monitoring period.

Soil chloride concentrations in irrigation areas were found to have been decreasing in area U1, L1, L2, L3, and L5, but increasing in area L4. Soil barium concentrations (a marker of the distribution of leachate from the drilling wastes stockpile on Pad 3) were found to have been increasing on areas U1, U3, L1, and L4. LOSP pesticides were not detected in any area. Hydrocarbons were widespread- they were found to be present in areas U2, U3, L1, L2, L3, L4, and L6.

Of concern was the detection of a number of markers of drilling wastes (barium, calcium, sodium, copper, and hydrocarbon groups) across area L6, prior to any known application of irrigation wastewaters. This strongly suggest drilling wastes have been transported from the stockpile on Pad 3 and distributed across this area, in contravention of the consent.

Environment effects associated with the discharge to air consent 5839-2

Emissions to air from the site continued to draw a number of complaints throughout the year. The Council could not investigate each complaint fully at the time of complaint because of concerns for the safety of Council officers. It is also acknowledged that between the time of complaint and the arrival of an officer on site, wind conditions and/or the source of odour release may change.

A total of 63 complaints were recorded by the Council during the year (83 in 2020-2021). One investigation, on 27 April 2022, led to the issue of an infringement notice to RNZ for causing offensive and objectionable odours beyond the boundary. In the 2020-2021 year, the Council had found cause to issue 5 infringement notices for the same reason.

During the latter part of the year under review, the Council undertook a series of proactive odour surveys. On a number of these, composting and similar odours emitted from RNZ were detected beyond the boundary, although not of a nature that meant they could be considered acutely offensive and objectionable, however, that raised the issue of whether odours from the site should be recognised as constituting a chronically offensive effect. In air quality it is recognised that odours may be offensive on either an acute (immediate and single event) or a chronic (ongoing and cumulative) basis.

[Environmental effects for the use of twin culverts 5938-2](#)

The primary concerns with culverts are if improperly installed or maintained, they may become a barrier to fish passage or promote bank erosion and collapse. No environmental effects were noted during inspections. The rock riffles installed downstream have improved the water level through the culverts, and water was seen to flow without obstruction.

No issues were reported and it is considered fish passage was maintained for the duration of the monitoring period.

[Environmental effects of instream culvert on the Haehanga Stream consent 6212-1](#)

The primary concerns with culverts are if improperly installed or maintained, they may become a barrier to fish passage or promote bank erosion and collapse. The large single culvert on the Haehanga Stream was found to be free from blockages with solid banks and no head wall erosion observed at any time throughout the monitoring period. Fish passage was maintained over the crucial summer period.

[Environmental effects in relation to the discharge of treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream consent 10063-1](#)

Minimal environmental effects were noted for this consent in this monitoring period. This is likely attributed to the non-operational nature of this consent during the monitoring period under review. Natural regrowth of vegetation was promoting site stability. RNZ staff constructed additional cut-off drains, silt controls, and a system for discharge to swale in anticipation of site activities recommencing. The Council considers these measures should serve to minimise potential environmental effects from sediment transport.

[Environmental effects of the large culvert situated in the unnamed tributary of the Haehanga Stream consent 10547-1](#)

The primary concerns with culverts are if improperly installed or maintained, they may become a barrier to fish passage or promote bank erosion and collapse. No environmental effects were noted in relation to this culvert, with stream flow through the culvert observed to be unobstructed and no evidence of bed or bank erosion.

[Environmental effects associated with the realignment of two unnamed tributaries of the Haehanga Stream for land improvement purposes consent 10825-1](#)

The potential was for excessive sedimentation transport into the stream during and following realignment works, with consequent effects on stream health and habitat. In the event, the land disturbed by the earthworks was stabilised, with the batters beginning to grow grass on the exposed areas. Two small slumps did not appear to increase, Continual monitoring for any channel slippage is still required, as this could cause a diversion of stormwater from around the irrigation area, to across it. No obstructions to stream flow were noted.

Some riparian planting has been undertaken on the realignment, though the true left bank requires further planting which will improve the stream as a habitat. The plantings are planned to be undertaken by the Company over winter 2022.

Environmental effects associated with the modification of an existing culvert to provide for fish passage into an unnamed tributary of the Haehanga Stream consent 10843-1

The primary concerns with culverts are if improperly installed or maintained, they may become a barrier to fish passage or promote bank erosion and collapse. As noted in previous annual reports, this culvert was considerably perched, which negated fish passage from achieving upstream movement. The former culvert was replaced in 2020-2021 with a fit for purpose culvert which allows for fish passage. Rock rip rap had been installed on either side and through the culvert, to enable climbing species access. During the year under review, some slumping of the upper head wall was found, and brought to the attention of RNZ staff for repair. While these works were still outstanding at the time of the last inspection for the year, and could be an issue in the case of flood events, the slumping was not observed to adversely affect the stream. It is considered there is good fish passage through the new culvert.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Table 34 to Table 41.

Table 34 Summary of performance for consent 5838-2.2

Purpose 5838-2.2: To discharge of waste material to land for composting; and 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		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adopt best practical option	Programme management/site inspections	<ul style="list-style-type: none"> - No - Acceptance of unauthorised material (beef livers and lungs) contrary to Site Practice Procedure - Soil analysis suggests drilling mud compost has been utilised in the creation of new irrigation are L6 due to elevated barium, copper and calcium - Elevated contaminants within the surface water (suspected over irrigation of paddocks leading to overland flow) - NPS-FM annual maximum exceedances for ammonia in surface water at multiple sites - Breakthrough of contaminated groundwater into tributary, breaching consent and previous abatement notice
2. Only acceptable waste accepted onto site	Site inspections/review of supplied records	<ul style="list-style-type: none"> - No - Unauthorised wastes accepted - Infringement fine issued

Purpose 5838-2.2: To discharge of waste material to land for composting; and 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

Condition requirement	Means of monitoring during period under review	Compliance achieved?
3. Representative sample of each type of drilling waste analysed for: a. Total petroleum hydrocarbons b. Benzene, toluene, ethylbenzene and xylenes c. Polycyclic aromatic hydrocarbons d. Heavy metals e. Chloride, nitrogen, pH, potassium and sodium	Records to be provided	<ul style="list-style-type: none"> - Yes - Drilling wastes ceased acceptance 31 December 2020 or shortly thereafter
4. DAF residue not to be accepted	Site inspections/review of supplied records not listed as accepted	<ul style="list-style-type: none"> - Yes - Records checked
5. Maintenance of stormwater systems	Inspections	<ul style="list-style-type: none"> - No - Pondered stormwater on Pads1 and 3 - Council has noted that compliance with stormwater guidelines across the site
6. Maintenance of treatment systems	Inspections	<ul style="list-style-type: none"> - No - Variable degree of aeration of irrigation pond - Concern over potential seepage from ponds
7. Adequate pond construction to prevent any leak to surface water or groundwater from any leachate or stormwater holding pond	Inspections and monitoring	<ul style="list-style-type: none"> - Yes, but potential seepage from ponds is to be investigated further
8. Keep and supply irrigation records	Supply of records	<ul style="list-style-type: none"> - Yes - Annual records supplied
9. No direct discharges to water to occur as a result of irrigation to land	Site inspections /sampling	<ul style="list-style-type: none"> - Suspected no - Contamination of surface waters found in May 2022- source not identified at time of reporting
10. Irrigated fluids not to exceed 5% hydrocarbon content or SAR of 18	Site inspections and sampling	<ul style="list-style-type: none"> - Yes - Sampling indicated the SAR was below the value of 18 on all monitored occasions - TPH in fluid has been below 5%

Purpose 5838-2.2: To discharge of waste material to land for composting; and 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

Condition requirement	Means of monitoring during period under review	Compliance achieved?
11. Discharges not to cause adverse effects at downstream of irrigation areas	Surface water sampling and inspections	<ul style="list-style-type: none"> - No - Water quality repeatedly impacted at one or more sampling sites - The biological monitoring of the Haehanga Stream did not find clear evidence of adverse effects below the irrigation areas due to RNZ activities
12. Soil sampling to be undertaken for TPH and BTEX	Soil sampling undertaken by the Council	<ul style="list-style-type: none"> - Yes
13. Soil sampling to be undertaken for chloride, sodium, magnesium, calcium, potassium, soluble salts and conductivity	Soil sampling undertaken by the Council	<ul style="list-style-type: none"> - Yes
14. Adhere to composting facility management plan	Inspections	<ul style="list-style-type: none"> - Pest animal culling undertaken - Irrigation areas extended significantly - Stormwater and leachate system improvements
15. Establish groundwater monitoring bores	Site inspections	<ul style="list-style-type: none"> - Yes - Additional monitoring wells have been installed
16. Groundwater monitoring wells installed as per standard	Undertaken	<ul style="list-style-type: none"> - Yes
17. Consent holder monitoring and record groundwater in each monitoring well each day for level, temperature, and conductivity	Not undertaken by consent holder	<ul style="list-style-type: none"> - No reports provided to Council
18. Groundwater sampled per six month interval: a. Total petroleum hydrocarbons b. BTEX	Undertaken by Council	<ul style="list-style-type: none"> - Yes
19. Groundwater samples shall be collected from all wells for chloride, sodium, magnesium, calcium, TDS and conductivity	Undertaken by Council	<ul style="list-style-type: none"> - Yes

Purpose 5838-2.2: To discharge of waste material to land for composting; and 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

Condition requirement	Means of monitoring during period under review	Compliance achieved?
20. Prepare Pond Treatment System Management Plan	Plan provided	<ul style="list-style-type: none"> - Yes - Draft leachate and stormwater management plan currently included in consent renewal
21. Adhere to Pond Treatment System Management Plan	Inspections	<ul style="list-style-type: none"> - Storage pits and ponds cleaned out during the year, and some have been infilled
22. Prepare Wetland Treatment System Management Plan	Management plan (Wetland Treatment Management Plan) submitted for consent renewal	<ul style="list-style-type: none"> - Yes
23. Adhere to Wetland Treatment System Management Plan	Inspections	<ul style="list-style-type: none"> - Yes
24. Wetland discharge not to exceed certain parameters	Sampling	<ul style="list-style-type: none"> - Yes
25. Wetland discharge not to cause certain effects at site HHG000103	Sampling	<ul style="list-style-type: none"> - No - Un-ionised ammonia twice exceeding and once on the limit - Biological monitoring suggests subtle adverse effects may be caused by this discharge
26. Maintain riparian plantings	Inspection identified that riparian planting is developing. This will be on-going	<ul style="list-style-type: none"> - Partial - Additional riparian planting undertaken - A significant portion still requires planting or re-planting.
27. Notify the Council of significant incidents on site	No notifications received	<ul style="list-style-type: none"> - No. No notification by RNZ to Council of non-compliant events
28. Prepare a Site Exit Plan prior to site closure	Not supplied	<ul style="list-style-type: none"> - Not applicable
29. Adhere to Site Exit Plan	N/A	<ul style="list-style-type: none"> - N/A
30. Optional Review	Consent renewal occurring	<ul style="list-style-type: none"> - N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Poor
Overall assessment of administrative performance in respect of this consent		Poor

Table 35 Summary of performance for consent 5839-2

Purpose 5839-2.0: <i>To discharge emissions to air at Mokau Road, Uruti</i>		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adopt best practical option	Programme management/site inspections	<ul style="list-style-type: none"> - No - Accepting items without authorisation - A number of recommendations from the RNZ expert were only partially implemented, or not at all
2. Composting area not to exceed certain limits	Programme management and site inspections	<ul style="list-style-type: none"> - No - Identified significant increase in the size of both pads, which have effectively doubled in size - This is to be dealt with during consent renewal
3. Only acceptable waste brought onto site	Site inspections and a review of records	<ul style="list-style-type: none"> - No - One incident of material accepted without authorisation
4. DAF residue not to be accepted	Site inspections/review of supplied records	<ul style="list-style-type: none"> - Yes
5. Maintain and supply an inwards good register	Inwards goods records supplied	<ul style="list-style-type: none"> - Yes - Data received and reviewed
6. Prepare a Site Practices Plan	Plan submitted with AEE	<ul style="list-style-type: none"> - Yes
7. Adhere to Site Practices Plan	Inspections	<ul style="list-style-type: none"> - No - Unauthorised received and left on site instead of being removed
8. Arrange professional assessment of Site Practices Plan	Supplied in 2010-2011 year.	<ul style="list-style-type: none"> - Yes
9. Submit Proposed Implementation Plan	Plans submitted to Court for appeal hearing	<ul style="list-style-type: none"> - Yes
10. Adhere to Proposed Implementation Plan		<ul style="list-style-type: none"> - Not assessed - Proposal adopted and incorporated into other plans - Defined in Technical report 2015-68
11. Dust deposition not to exceed certain limits	Not monitored	<ul style="list-style-type: none"> - Not assessed-dust not an issue during inspections
12. PM10 and suspended particulate not to exceed certain limits	Not monitored	<ul style="list-style-type: none"> - Not assessed

Purpose 5839-2.0: To discharge emissions to air at Mokau Road, Uruti		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
13. No offensive or objectionable odour beyond the boundary	Inspections	<ul style="list-style-type: none"> - No - One confirmed offensive odour incident (infringement notice) - 62 complaints not verified - Unresolved issue of chronic offensive odour
14. Install a weather station and provide data	Inspection and weather updates.	<ul style="list-style-type: none"> - Yes
15. Conduct odour surveys	Undertaken by the Council during inspections and during complaints	<ul style="list-style-type: none"> - No-RNZ failed to implement an intensive survey
16. Hold community meeting	Meeting held in 2011	<ul style="list-style-type: none"> - No community meeting held in this monitoring period
17. Notify the Council of onsite incidents	No notification received	<ul style="list-style-type: none"> - N/A
18. Prepare a Site Exit Plan prior to site closure	Included in Environment Court documentation	<ul style="list-style-type: none"> - yes
19. Adhere to Site Exit Plan upon site closure	N/A	<ul style="list-style-type: none"> - N/A
20. Optional review	A review was not required	<ul style="list-style-type: none"> - N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Poor
Overall assessment of administrative performance in respect of this consent		Poor

Table 36 Summary of performance for consent 5938-2

Purpose 5938-2.0: To use a twin culvert in the Haehanga Stream for vehicle access purposes		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Ensure stream bed downstream is adequately constructed and does not prevent fish passage	Site inspections	<ul style="list-style-type: none"> - Yes - Bed is adequately constructed and does not prevent fish passage. - Regular check undertaken during inspections
2. Maintains the structure so: <ul style="list-style-type: none"> a. It does not become blocked and is free flowing b. Any erosion or instability of the stream bank is remedied by the consent holder 	Site inspections	<ul style="list-style-type: none"> - Yes - Site inspections indicated the culvert is being maintained as required

Purpose 5938-2.0: To use a twin culvert in the Haehanga Stream for vehicle access purposes		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
3. Review condition	No review pursued	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall administrative performance with respect to this consent		High

Table 37 Summary of performance for consent 6212-1

Purpose 6212-1.0: To establish and maintain a culvert at Mokau Road, Uruti		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notification prior to commencement of works	Inspections	<ul style="list-style-type: none"> - Yes - The works will be assessed over time to make sure that adequate fish passage is maintained
2. Replacement of temporary culvert	N/A	<ul style="list-style-type: none"> - Yes
3. Construction in accordance with application	Site inspections	<ul style="list-style-type: none"> - Yes
4. Best practicable option	Inspections	<ul style="list-style-type: none"> - Yes
5. Minimisation of riverbed disturbance	Site inspections	<ul style="list-style-type: none"> - Yes
6. Provision of fish passage	Inspections	<ul style="list-style-type: none"> - Yes - Site inspections indicated that recent works are aiding with fish passage - Continual monitoring of this will be undertaken
7. Reinstatement of site	N/A	<ul style="list-style-type: none"> - N/A
8. Optional review of consent	No review due this period	<ul style="list-style-type: none"> - N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall administrative performance with respect to this consent		High

Table 38 Summary of performance for consent 10063-1.0

Purpose 10063-1.0: To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Authorises the discharge of treated stormwater into unnamed tributary of Haehanga Stream in line with the original application	Inspection	<ul style="list-style-type: none"> - Yes - Quarry was not operated this monitoring period, all stormwater directed to grassland off access track via cut-off drain
2. Notification of quarry works	Communication during inspections	<ul style="list-style-type: none"> - Yes
3. Adopt best practicable option	Inspection the quarry was not operated this monitoring period	<ul style="list-style-type: none"> - Yes - Cut-off drains inspected and found to be working well. Continually checked by site manager - the quarry was not operated this monitoring period, but may be in near future
4. Shall operate and progressively reinstate the quarry site in a manner which ensures exposed areas are kept to a minimum at all times	Not assessed as quarry not operational	<ul style="list-style-type: none"> - NA
5. Ensure no area greater than 1 ha is exposed at any one time	Online assessment	<ul style="list-style-type: none"> - Yes - Inspection and online review indicated the current quarry area is 6,000 m² - The access track is 4,000 m²
6. The stormwater discharged shall not exceed 4 ha	Not assessed this period	<ul style="list-style-type: none"> - NA
7. Stormwater treatment system shall be installed before any site works commence	Inspections	<ul style="list-style-type: none"> - Yes - Inspection indicated the stormwater cut-off drains and sediment traps have been upgraded - Continual maintenance is required
8. Stormwater treatment system shall be maintained for the life of the quarry operation	Inspection indicated that this is on-going	<ul style="list-style-type: none"> - Yes
9. All stormwater to be directed to stormwater treatment system prior to discharge to Haehanga Stream tributary	Inspection	<ul style="list-style-type: none"> - Yes - Discharge to be to grassed swales

Purpose 10063-1.0: To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream

Condition requirement	Means of monitoring during period under review	Compliance achieved?
10. Constituents of the discharge shall meet the following standards: a. pH: 6.0-9.0 b. suspended solids: <100g/m ³ c. total hydrocarbons: <15 g/m ³	Sampling	- Surface water monitoring at HHG000100 indicated compliance with this condition.
11. The pH may exceed 9.0 if the exceedance is the result of photosynthetic activity, however the discharge shall not alter the receiving waters by more than 0.5 pH after a mixing zone of 25 m	Sampling	- NA
12. After mixing the discharge shall not give rise to any of the following effects: d. Production of scums, films or foams e. Any conspicuous change in the colour or visual clarity f. Any emission of objectionable odour g. Rendering of fresh water unsuitable for farm animal h. Any significant adverse effects on aquatic life	Inspection and sampling	- Yes - Inspections and sampling did not indicate any of the prohibited effects as process of the quarry operations
13. The discharge shall not give rise to any of the following effects: i. A change in turbidity measurements upstream of the discharge point and below the discharge point of more than 5NTU j. A change in turbidity measurements of greater than 5 NTU as a result of the discharge	No turbidity monitoring undertaken this period	- NA
14. Maintain and update Contingency plan	Notification and supply of records	- Not supplied

Purpose 10063-1.0: <i>To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream</i>		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
15. Site shall be operated in a management plan which will contain the following: k. The loading and unloading of materials l. Maintenance of conveyance systems m. General housekeeping n. Management of the interceptor system	Supply of management plan-Not received	- No - Not received
16. Notification pertaining to the change of nature of discharge	Notification	- Nature of activities discussed at each inspection
17. Consent lapse	Consent in effect	- NA
18. Review condition	No review required.	- NA
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall administrative performance with respect to this consent		Good

Table 39 Summary of performance for consent 10547-1.0

Purpose 10547-1.0: <i>To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed</i>		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. The culvert pipe shall be a smooth bore plastic pipe and have an internal diameter of no less than 1 metre and be no longer than 40 m	Inspections	- Yes
2. The fill over the top of the culvert pipe shall be comprised of suitable soils free of wood, humus and other organic matter. The embankment shall be well compacted in uniform layers not exceeding 300 mm loose depth to achieve a compaction of at least 95 % of maximum dry density	Inspections	- Yes
3. The fill over the top of the culvert pipe shall be 2.3 m	Inspections	- Yes

Purpose 10547-1.0: To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed

Condition requirement	Means of monitoring during period under review	Compliance achieved?
above the invert of the culvert		
4. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 2 working days prior to the commencement of work	Notification received via inspectorate	- Yes
5. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water		- NA
<p>The consent holder shall take all practicable steps to minimise stream bed disturbance, sedimentation and increased turbidity during installation of the culvert, including by:</p> <ul style="list-style-type: none"> o. completing all works in the minimum time practicable; p. avoiding placement of excavated material in the flowing channel; q. keeping machinery out of the actively flowing channel, as far as practicable; and r. reinstating any disturbed areas as far as practicable 	Inspections	- Yes
6. A reinforced concrete headwall shall be installed at the inlet to the culvert	Inspections	- Yes
<p>7. A layer of rock riprap 1000 mm thick shall be installed in the stream bed. The riprap shall extend 5 m downstream of the culvert outlet and 1 metre up the banks on both sides of the stream. The rock shall have the following grading:</p> <ul style="list-style-type: none"> - 100% less than 800 mm diameter; 	Inspections	- Yes

Purpose 10547-1.0: To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed

Condition requirement	Means of monitoring during period under review	Compliance achieved?
<ul style="list-style-type: none"> - 50% greater than 600 mm diameter; - 90% greater than 350 mm diameter 		
8. The culvert shall not restrict fish passage	Not assessed	- Not assessed by the Council biologist, but considered not to restrict passage
9. The invert of the culvert shall be set below the existing stream bed by 200 mm so that it fills with bed material and simulates the natural bed	To be assessed	- NA
10. The gradient of the culvert shall be no steeper than the natural gradient of the stream bed at the site		<ul style="list-style-type: none"> - Yes - On observation this appears to be in line with the gradient
11. On completion of works, the banks of the channel upstream and downstream of the culvert shall be no steeper than the existing natural banks. Where the bank consists of fill, the fill must be well compacted with batter slopes no steeper than 2 horizontal to 1 vertical	Inspections	- Yes
12. The culvert shall remain the responsibility of the consent holder and be maintained so that: <ul style="list-style-type: none"> s. it does not become blocked, and at all times allows the free flow of water through it; and t. the consent holder repairs any erosion, scour or instability of the stream bed or banks that the culvert causes 	Inspections	<ul style="list-style-type: none"> - Yes - Maintenance undertaken when required - Regularly inspected
13. In the event that any archaeological remains are		- None reported.

Purpose 10547-1.0: <i>To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed</i>		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
discovered as a result of works authorised by this consent, the works shall cease immediately at the affected site and tangata whenua and the Chief Executive, Taranaki Regional Council, shall be notified within one working day. Works may recommence at the affected area when advised to do so by the Chief Executive, Taranaki Regional Council		- Note this was a replacement culvert
14. This consent shall lapse on 31 March 2023, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991		- Exercised
15. Review condition	Not required currently.	- NA
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall administrative performance with respect to this consent		High

Table 40 Summary of performance for consent 10843-1

Purpose 10843-1.0: <i>To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream, including associated disturbance of the stream bed</i>		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. The culvert pipe shall have a diameter no less than 900 mm and be no longer than 10 m	Inspections	- Yes
2. The fill over the top of the culvert pipe shall be comprised of suitable soils free of wood, humus and other organic matter. The embankment shall be well compacted in uniform layers not exceeding 300 mm loose depth to	Inspections	- Yes

Purpose 10843-1.0: To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream, including associated disturbance of the stream bed

Condition requirement	Means of monitoring during period under review	Compliance achieved?
achieve a compaction of at least 95% of maximum dry density		
3. The fill over the top of the culvert pipe shall be no less than 4 m		- Yes
4. No less than 2 and no more than 20 working days before commencing work the consent holder shall notify the Chief Executive, Taranaki Regional Council ('the Chief Executive')	Inspections	- Yes
5. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water	Notification received via inspectorate	- Yes
6. The consent holder shall take all practicable steps to minimise stream bed disturbance, sedimentation and increased turbidity during installation of the culvert, including by: a) completing all works in the minimum time practicable; b) avoiding placement of excavated material in the flowing channel; c) keeping machinery out of the actively flowing channel, as far as practicable; and d) reinstating any disturbed areas as far as practicable		- NA
7. A layer of rock riprap 900 mm thick shall be installed in the stream bed. The riprap shall extend 3 m upstream of the culvert inlet and 5 m downstream of the culvert outlet and - up the banks on both sides of the	Inspections	- Yes

Purpose 10843-1.0: To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream, including associated disturbance of the stream bed

Condition requirement	Means of monitoring during period under review	Compliance achieved?
stream. The rock shall have the following grading: (a) 100% less than 600 mm diameter; (b) 50% greater than 450 mm diameter; (c) 90% greater than 20 mm diameter		
8. At all times after 1 May 2021 the culvert shall provide for fish passage	Not assessed	- Not assessed by the Council biologist
9. The invert of the culvert shall be set below the existing stream bed by 225 mm that it fills with bed material and simulates the natural bed	To be assessed	- NA
10. The gradient of the culvert shall be no steeper than the natural gradient of the stream bed at the site		- Yes - On observation this appears to be in line with the gradient
11. On completion of works, the banks of the channel upstream and downstream of the culvert shall be no steeper than the existing natural banks. Where the bank consists of fill, the fill must be well compacted with batter slopes no steeper than 2 horizontal to 1 vertical	Inspections	- Yes
12. The culvert shall remain the responsibility of the consent holder and be maintained so that: a) it does not become blocked, and at all times allows the free flow of water through it; and b) the consent holder repairs any erosion, scour or instability of the stream bed or banks that the culvert causes	Inspections	- Yes - Maintenance undertaken when required - Regularly inspected
13. This consent lapses 5 years after its commencement date (shown on the front of		- Exercised

Purpose 10843-1.0: To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream, including associated disturbance of the stream bed		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
this document), unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period in accordance with section 125(1)(b) of the Resource Management Act 1991		
14. Review condition	Not required currently.	- NA
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall administrative performance with respect to this consent		High

Table 41 Summary of performance for consent 10825-1.0

Purpose 10825-1: To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. This consent authorises the permanent diversion of the full stream flow through two sections of reconstructed channel on two unnamed tributaries, between grid references: Please consent for reference	Inspections	- Yes
2. The new stream channels shall have a flow capacity no less than that of the existing stream channels	Inspections	- Yes
3. No less than 2 and no more than 20 working days before commencing work the consent holder shall notify the Chief Executive, Taranaki Regional Council ('the Chief Executive')	Inspections	- Yes
4. The consent holder shall take all practicable steps to minimise stream bed disturbance, sedimentation and increased turbidity during installation of the culvert, including by:	Inspections	- Yes - Council informed during the development

Purpose 10825-1: To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
a) completing all works in the minimum time practicable; b) avoiding placement of excavated material in the flowing channel; c) keeping machinery out of the actively flowing channel, as far as practicable; and reinstating any disturbed areas as far as practicable		
5. The channels shall be constructed to include sequences of runs and riffles that simulate the natural bed where the original stream bed is no longer present or stable	Inspections	- Yes
6. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water.	Notification received via inspectorate	- Yes
7. The consent holder shall prepare and implement a fish recovery plan that has been certified by the Chief Executive of the Taranaki Regional Council. The plan shall detail how the impacts on fish during culvert installation are avoided as far as practical, and shall include as a minimum how fish will be salvaged, how often fish will be salvaged, and recording the number and types of fish salvaged	Provided to the Council	- Yes
8. The new channel shall not restrict fish passage	Inspections	- Yes
9. At all times during the works the consent holder shall ensure that the stream flow downstream of the affected reach is not significantly diminished	Inspections	- Yes

Purpose 10825-1: To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
10. On completion of the realignment work: a) the banks of the reconstructed channel shall have a slope no steeper than 1.5 horizontal to 1 vertical; and b) the bed of the reconstructed channel shall be at an appropriate grade so as to provide for upstream fish passage	Inspections	- Yes
11. The consent holder shall ensure that rock riprap is placed in the stream bed at all bends in the new channels. The riprap shall be placed within the entire bed width and up the banks of the new stream channel	Inspections	- Yes
12. The rock riprap shall be no less than 0.9 metres thick, and of the following grading: a) 100% less than 600 mm diameter; b) 50% greater than 450 mm diameter; c) 90% greater than 200 mm diameter	Inspections	- Yes
13. The consent holder shall maintain the realigned channel by repairing any erosion, scour or instability of the stream bed or banks	Inspections	- Yes
14. The consent holder shall undertake and maintain riparian fencing and planting on the tributaries affected by the realignment, in accordance with the Riparian Management Plan for the property. An area of not less than 5 m shall be planted between the stream bed and fence	Inspections	- No. Further riparian development is required, and is planned by the consent holder

Purpose 10825-1: To realign a section of two unnamed tributaries of the Haehanga Stream for land improvement purposes		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
15. The fencing and riparian planting required in condition 14 shall be completed before August 2021	Inspections	- No. Further riparian management is planned for winter 2022.
16. To remedy and mitigate the adverse environmental effects of this consent, the consent holder shall establish and maintain riparian planting and a wetland as detailed in the 'Wetland Restoration Management Plan' provided with the application and attached as Appendix 1. The works shall be undertaken within the timeframes specified in that plan	Inspections	- This is planned to be achieved over a three year period.
17. All earthwork areas shall be stabilised as soon as is practicable immediately following completion of soil disturbance activities	Inspections	- Yes
18. This consent lapses 5 years after its commencement date (shown on the front of this document), unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period in accordance with section 125(1)(b) of the Resource Management Act 1991		- Exercised
19. Review condition	Not required currently.	- NA
Overall assessment of consent compliance and environmental performance in respect of this consent Overall administrative performance with respect to this consent		Good High

Table 42 Summary of performance for all consents

Consent	Environmental Performance	Administrative performance
5838-2.2 (Discharge waste to land and water, Uruti)	Poor	Poor
5839-2 (Discharge emissions to air, Uruti)	Poor	Poor

Consent	Environmental Performance	Administrative performance
5938-2.0 (Twin culvert Uruti)	High	High
6212-1 (Culvert, Uruti)	High	High
10063-1.0 Quarry discharge	High	Good
10547-1.0 Culvert unnamed tributary	High	High
10843-1.0 To modify a culvert to provide for fish passage	High	High
10825-1.0 To realign a section of two unnamed tributaries	Good	High

The overall gradings that the Council has assigned to RNZ over the last ten years are set out below in Table 43. There has been an overall continuing deterioration in RNZ's environmental performance and administrative delivery of consent requirements for the last six years.

Table 43 Evaluation of environmental performance over the last ten years

Monitoring period	Compliance status
July 2021- June 2022	Poor
July 2020 – July 2021	Poor
July 2019 – July 2020	Poor
July 2018 – July 2019	Improvement required
July 2017 – July 2018	Improvement required
July 2016 – July 2017	Good
July 2015 – July 2016	Improvement required
July 2014 – July 2015	Improvement required
July 2013 – July 2014	Poor
July 2012 – July 2013	Good

During the year, the Company demonstrated a poor level of environmental and a poor level of administrative performance with the resource consents, as defined in Appendix II. During the year under review three infringement notices together with abatement notices were issued for matters related to unauthorised discharges to land, surface water, and air. Further alleged non-compliant events remained under review at the end of the year. Abatement notices issued in previous years continue in force, but were breached in any case.

3.4 Recommendations from the 2020-2021 Annual Report

In the 2020-2021 Annual Report, it was recommended:

1. THAT in the first instance, monitoring of consented activities at Uruti composting in the 2021-2022 year continue at the same level as in 2020-2021 with the addition of the following:
Multi-parameter sonde to be installed in the Haehanga Stream to continuously monitor electrical conductivity, temperature and level. Further parameters can be added to this device in future monitoring periods. This data will be telemetered directly to the Council. Consideration will be given to monthly monitoring should the probe identify issues;

Organonitro and phosphorus pesticide screening has been added to the monitoring of groundwater (all wells), and surface water (nine of 18 sites). Soil monitoring will also include these analytes.

2. The Waitara Road facility will be reported separately, at the request of the Company.
3. Two sites, located on the Mimitangiatua River, have been added to the surface water monitoring.
4. Calibrated field pH results (collected by YSI multi parameter field probe) will be utilised for ammonia pH modification to pH 8, as required for comparison to the NPS-FM guideline.
5. Bacteriological samples are now collected during the surface water monitoring rounds.
6. Dissolved reactive phosphorus has been added to the surface water monitoring.
7. Summer monitoring will attempt to target worst-case scenario pH results. These will likely be mid to late afternoon. Though courier pick up time will cap how late in the afternoon the samples can be collected and then sent, as they will contain bacteriological samples, which have a time period.
8. THAT should there be issues with environmental or administrative performance in 2021-2022, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

Preparations continue at the time of report preparation to install a multi-parameter continuous water quality measuring device at the bottom of the catchment. Delays were due to Covid-related supply issues.

Additional parameters were added to surface water, soil, and groundwaters analyses as recommended.

Separate monitoring reports are now being prepared by the Council, for the two Taranaki facilities of RNZ.

Additional water quality sites, within the Mimitangiatua awa, have been incorporated into monitoring programmes as recommended.

Field pH values are being determined as recommended.

An all-day DO and pH survey was undertaken.

A number of additional surveys and investigations were necessitated because of environmental or site management issues.

3.5 Alterations to monitoring programmes for 2022-2023

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

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

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki exercising resource consents.

A planned change for 2022-2023 monitoring programme includes the commissioning of the multi-parameter continuous water quality monitoring device at the bottom of the catchment, as well as the continuation of the broader suites of parameters implemented in the 2021-2022 year. The Court has directed RNZ to commission site investigation and remediation plans, and the Council will review those as they are provided. Further changes are contingent upon any decision of the Court.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site in question. The Council reserves the right to subsequently adjust the programme

from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2022-2023.

3.6 Renewal of consents

The application by RNZ to the Environment Court for renewal of consents 5838 and 5839 remains in the hands of the Court at the time of this report's preparation. Indications are that it will be well into calendar year 2023 before this might be resolved.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities at the Uruti facility of Remediation New Zealand in the 2022-2023 year be amended from that undertaken in 2021-2022, by commissioning of a multi-parameter continuous water quality monitoring device at the bottom of the Haehanga Stream.
2. THAT should there be issues with environmental or administrative performance in 2022-2023, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

Glossary of common terms and abbreviations

The following abbreviations and terms may be used within this report:

As*	Arsenic.
Biomonitoring	Assessing the health of the environment using aquatic organisms.
BOD	Biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate.
BODF	Biochemical oxygen demand of a filtered sample.
Bund	A wall around a tank to contain its contents in the case of a leak.
CBOD	Carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate.
cfu	Colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample.
COD	Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 25°C and expressed in $\mu\text{S}/\text{cm}$.
Cu*	Copper.
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
<i>E.coli</i>	<i>Escherichia coli</i> , an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
Ent	Enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample.
FC	Faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
FNU	Formazin nephelometric units, a measure of the turbidity of water.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m^3	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.

Incident register	The incident register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m ²	Square metres.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
Mixing zone	The zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point.
MPN	Most Probable Number. A method used to estimate the concentration of viable microorganisms in a sample.
µS/cm	MicroSiemens per centimetre, a measure of conductivity.
NH ₄	Ammoniacal nitrogen, also referred to as ammonium, normally expressed in terms of the mass of nitrogen (N).
NH ₃	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
NO ₃	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NPS-FM	National Policy Statement for Freshwater Management 2020.
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
Pb*	Lead.
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
PM ₁₀ , PM _{2.5} , PM _{1.0}	Relatively fine airborne particles (less than 10 or 2.5 or 1.0 micrometre diameter, respectively).
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	<i>Resource Management Act 1991</i> and including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU or FNU.
Zn*	Zinc.

*an abbreviation for a metal or other analyte may be followed by the letters 'As', to denote the amount of metal recoverable in acidic conditions. This is taken as indicating the total amount of metal that might be

solubilised under extreme environmental conditions. The abbreviation may alternatively be followed by the letter 'D', denoting the amount of the metal present in dissolved form rather than in particulate or solid form.

For further information on analytical methods, contact an Environment Quality Manager.

Bibliography and references

- Ministry for the Environment. 2018. A Guide to Attributes In Appendix 2 of the National Policy Statement for Freshwater Management 2014 (as amended 2017) , Wellington, Ministry for the Environment.
- Ministry for the Environment. 2018b. Best Practice Guidelines for Compliance, Monitoring and Enforcement under the Resource Management Act 1991. Wellington: Ministry for the Environment.
- Ministry for the Environment. 2016. Good practice guide for assessing and managing odour. Wellington: Ministry for the Environment.
- New Zealand Government National Policy Statement for Freshwater Management 2020 (August 2020).
- Taranaki Regional Council: Sutherland,DS157: 2022 Biomonitoring of the Haehanga Stream in relation to discharges from the Remediation (NZ) Limited composting site at Uruti, January 2022.
- Taranaki Regional Council 2022: Remediation NZ Ltd Uruti composting facility Monitoring Programme Annual Report 2020-2021 Technical Report 2021-81. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2020: Remediation NZ Ltd Uruti and Waitara Road Monitoring Programme Annual Report 2019-2020 Technical Report 2020-84. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2019: Remediation NZ Ltd Uruti Waitara and Pennington Road Monitoring Programme Annual Report 2018-2019 Technical Report 2019-50. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2018: Remediation NZ Ltd Uruti Waitara and Pennington Road Monitoring Programme Annual Report 2017-2018 Technical Report 2018-79. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2017: Remediation NZ Ltd Monitoring Programme Annual Report 2016-2017 Technical Report 2017-11. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2016: Remediation NZ Monitoring Programme Annual Report 2015-2016. Technical Report 2016-83. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2015: Remediation NZ Monitoring Programme Annual Report 2014-2015. Technical Report 2015-68. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2014: Remediation NZ Monitoring Programme Annual Report 2013-2014. Technical Report 2014-53. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2013: Remediation NZ Monitoring Programme Annual Report 2012-2013. Technical Report 2013-64. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2011: Remediation NZ Monitoring Programme Annual Report 2011-2012. Technical Report 2012-39. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2011: Remediation NZ Monitoring Programme Annual Report 2010-2011. Technical Report 2011-44. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2010: Remediation NZ Monitoring Programme Annual Report 2009-2010. Technical Report 2010-44. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2009: PEL Waste Services/Remediation NZ Monitoring Programme Annual Report 2008-2009. Technical Report 2009-49. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2009: PEL Waste Services Limited (formerly Perry Environmental Limited) Monitoring Programme Annual Report 2007-2008. Technical Report 2008-94. Taranaki Regional Council, Stratford.

- Taranaki Regional Council 2007: PEL Waste Services Limited (formerly Perry Environmental Limited) Monitoring Programme Annual Report 2006-2007. Technical Report 2007-112. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2006: Perry Environmental Limited Monitoring Programme Annual Report 2005-2006. Technical Report 2006-26. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2005: Perry Environmental Limited Monitoring Programme Annual Report 2004-2005. Technical Report 2005-12. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2004: Perry Environmental Limited Monitoring Programme Annual Report 2003-2004. Technical Report 2004-26. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2003: Perry Environmental Limited Monitoring Programme Annual Report 2002-2003. Technical Report 2003-37. Taranaki Regional Council, Stratford.
- Taranaki Regional Council 2002: Global Vermiculture Limited Monitoring Programme Annual Report 2001-2002. Technical Report 2002-25. Taranaki Regional Council, Stratford.

Appendix I

Resource consents held by Remediation New Zealand Ltd

(Uruti composting, vermiculture, and quarrying site)

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

Water abstraction permits

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

Water discharge permits

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

Air discharge permits

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

Discharges of wastes to land

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

Land use permits

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

Coastal permits

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

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

Name of
Consent Holder: Remediation (NZ) Limited
PO Box 8045
New Plymouth 4342

Decision Date
(Change): 20 August 2015

Commencement Date
(Change): 20 August 2015 (Granted Date: 27 May 2010)

Conditions of Consent

Consent Granted: To discharge:
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

Expiry Date: 1 June 2018

Review Date(s): June 2016, June 2017

Site Location: 1450 Mokau Road, Uruti

Legal Description: Sec 34 Pt Sec 4 Blk II Upper Waitara SD (Discharge site)

Grid Reference (NZTM) Between 1731656E-5686190N, 1733127E-5684809N,
1732277E-5685101N, 1732658E-5684545N &
1732056E-5684927N

Catchment: Mimi

Tributary: Haehanga

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

General condition

- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

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

Acceptable wastes

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 treatment plants;
 - Mechanical pulping pulp and paper residue (excluding any pulping wastes that have been subject to chemical pulping or treated or mixed with any substance or 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 content within 3 days of being brought onto the site;
 - Produced water from hydrocarbon exploration;
 - Vegetable waste solids (being processing 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 only occur 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.

Consent 5838-2.2

3. Before bringing waste to the site the consent holder shall take a representative sample of each type of drilling waste permitted under condition two from each individual source, and have it analysed for the following:
 - a. total petroleum hydrocarbons (C₆-C₉, C₁₀-C₁₄, C₁₅-C₃₆);
 - b. benzene, toluene, ethylbenzene, and xylenes;
 - c. polycyclic aromatic hydrocarbons screening;
 - d. heavy metals screening; and
 - e. chloride, nitrogen, pH, potassium, and sodium.

The results of the analysis require by this condition shall be forwarded to the Chief Executive, Taranaki Regional Council every three months or upon request.

4. Material produced as a result of a dissolved air flotation process shall not be accepted on site.

Maintenance of measures

5. All sediment ponds and silt traps on site, that are located upstream of the pond treatment system or wetland treatment system, shall be managed so that they are no more than 20% full of solids at any one time.

Note: For the purposes of this condition, the location of the pond treatment system and wetland treatment system are shown on Figure 1, attached as Appendix 1 of this consent.

6. All treatment measures on site shall be implemented and maintained so that:
 - clearwater runoff is prevented from entering Pad 1, Pad 2 and the Drill Mud Pad; and
 - all stormwater and/or leachate from Pad 1, Pad 2, the Drill Mud Pad and any other exposed areas within the composting site is directed for treatment through the Pond or Wetland Treatment System.

Note: For the purposes of this condition, the location and extent of Pad 1, Pad 2 and the Drill Mud Pad are shown on Figure 1, attached as Appendix 1 of this consent.

7. Any pond(s) used on site for the purposes of stormwater and leachate treatment shall be constructed and maintained in a manner which prevents the seepage of wastewater through the pond liners entering surface water or groundwater.

Irrigation

8. The consent holder shall record the following information in association with irrigating wastewater to land:
 - a) the date, time and hours of irrigation;
 - b) the volume of wastewater irrigated to land;
 - c) the conductivity of the irrigation fluid (measured in mS/m);
 - d) the source of the wastewater (e.g. Pond or Wetland Treatment System); and
 - e) the location and extent where the wastewater was irrigated.

The above records shall be made available to the Chief Executive, Taranaki Regional Council, on request.

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.

Soil quality

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.
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, total, soluble salts, and conductivity.
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 Chief Executive, Taranaki Regional Council, acting in a certification capacity. The plan shall be adhered to and reviewed on an annual basis (or as required) and any changes shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity. 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 groundwater data analysis.

Groundwater quality

15. The consent holder shall establish and maintain at least one groundwater monitoring well at each of the following locations for the purpose of monitoring the effect of the wastewater discharges on groundwater quality:
- up gradient of the irrigation areas in an un-impacted area;
 - down gradient of the extent of the irrigation of each area;
 - down gradient of the duck pond and drill mud pits and up gradient of irrigation area H for the purpose of assessing integrity clay liners of drilling waste treatment ponds, and
 - at NZTM 1731518N-5686536E (approximately 40 metres south of SH3) for the purpose of assess groundwater near the northern boundary.

For the purposes of clarification this condition requires four new bores to be installed for the purposes of establishing irrigation areas F & E and in accordance with the Uruti Composting Facility Management Plan 2015 supplied with application 5838-2.2.

16. Any new groundwater monitoring wells required by condition 15 shall be installed to the following standards;
- Prior to installation of any new wells, confirmed NZTM GPS locations shall be provided to the Taranaki Regional Council for approval;
 - All new wells shall be at least 25 metres from any water way (unless otherwise authorised by a separate consent) and be accessible by vehicle;
 - All new wells shall be installed by a qualified driller and designed to encounter groundwater and accommodate expected annual fluctuations in water level -i.e. screened sections and filter packs to be located next to the water bearing horizons;
 - Soils encountered during installation shall be logged by a suitably qualified and graphic logs of the soils and well construction are to be supplied to the Taranaki Regional Council;
 - All new wells shall be surveyed for topographical elevation by a suitably qualified person;
 - All wells shall completed with an appropriate riser, riser cap, toby and be fenced to prevent stock access;
 - Prior to any irrigation occurring in any new irrigation area, a groundwater sample shall be collected from the down gradient well by a suitably qualified person, using a method approved by the Chief Executive of the Taranaki Regional Council and analysed and analysed for sodium, calcium, magnesium, nitrate, ammoniacal nitrogen, pH, chloride, and conductivity.

Adherence to New Zealand Standard 4477:2001 will ensure compliance with this condition.

17. The consent holder shall undertake weekly groundwater level, temperature, and conductivity readings from each well within a single eight hour period using a method approved by the Chief Executive, Taranaki Regional Council. Results shall be recorded in a cumulative spread sheet, a copy of which shall be forwarded to the Taranaki Regional Council every three months, or upon request.

18. 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; total petroleum hydrocarbons, benzene, toluene, ethylbenzene, xylene, lead and arsenic.
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.

Pond Treatment System

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 Chief Executive, Taranaki Regional Council, acting in a certification capacity, 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 site boundary will be avoided in accordance with condition 13 of consent 5839-2.
21. Operations on site shall be undertaken in accordance with the Pond Treatment System Management Plan, approved under condition 20 above, except in circumstances when the Proposed Implementation Plan, approved under condition 9 of consent 5839-2, specifies otherwise.

Wetland Treatment System

22. The consent holder shall prepare a Wetland Treatment System Management Plan that details management practices undertaken to maximise treatment capabilities of the system. The plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, 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 which will trigger management, and the frequency of undertaking the identified measures or procedures; and
- b) how plant die-off within the system will be managed, and the frequency and/or timing of undertaking the identified measures or procedures.

Consent 5838-2.2

23. Operations on site shall be undertaken in accordance with the Wetland Treatment System Management Plan, approved under condition 22 above.
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.

Riparian planting

26. 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.

Incident notification

27. The consent holder shall keep a permanent record of any incident related to this consent that results, or could result, in an adverse effect on the environment. The consent holder shall make the incident register available to the Taranaki Regional Council on request.

Details of any incident shall be forwarded to the Taranaki Regional Council immediately. At the grant date of this consent, the Taranaki Regional Council's phone number is 0800 736 222 (24 hour service).

Site reinstatement

28. The consent holder shall prepare a Site Exit Plan which details how the site is going to be reinstated prior to the consent expiring or being surrendered. The Plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, at least 6 months prior to this consent expiring or being surrendered.

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

- a) How the site will be reinstated so that no raw materials listed or approved under condition 2 of this consent remain on site;
- b) How the site will be reinstated so that no partially decomposed material remains on site;

Consent 5838-2.2

- c) How any remaining leachate or sludge, resulting from the operation, will be either removed from the site, buried, treated or otherwise to avoid any adverse effects on groundwater or surface water;
- d) The remediation of irrigated soils and groundwater; and
- e) Timeframes for undertaking the activities identified in association with a) to c) above.

Note: The requirement of this condition shall not apply if the consent holder applies for a new consent to replace this consent when it expires.

- 29. The consent holder shall reinstate the site in accordance with the plan approved under condition 28 above prior to this consent expiring or being surrendered.

Review

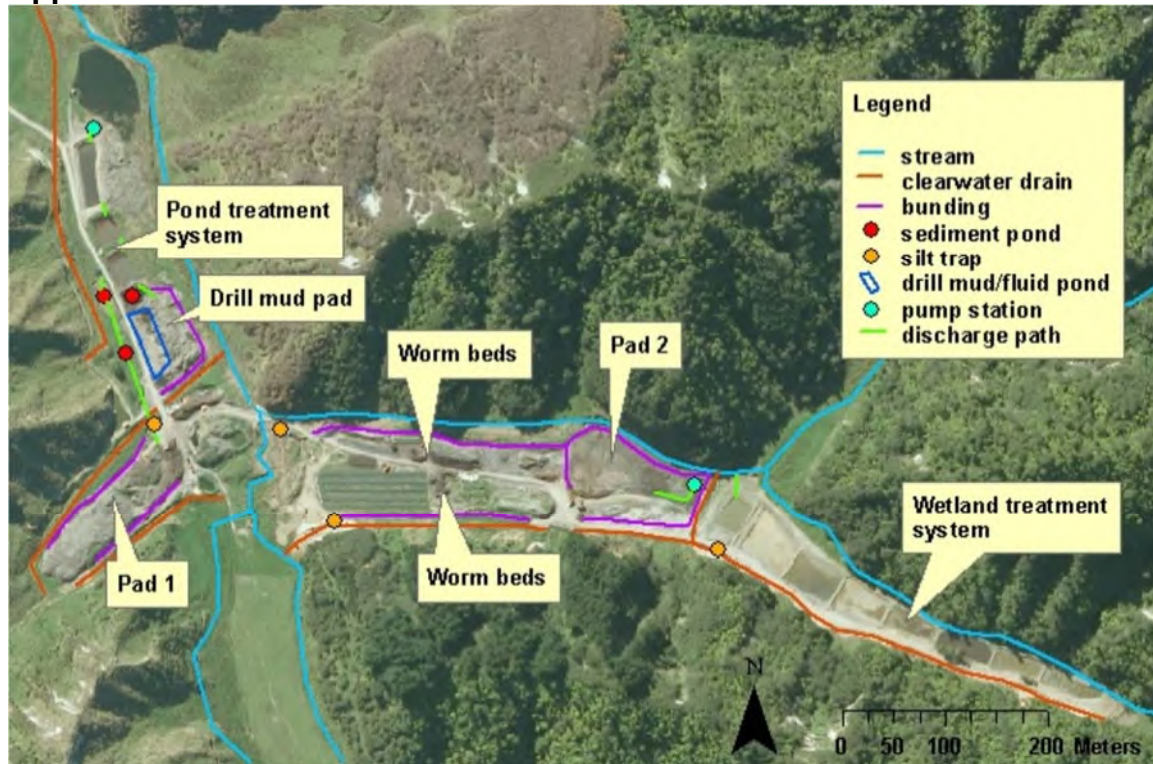
- 30. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review within one month of approving the plan required under condition 9 of consent 5839-2 and/or during the month of June in any year for any of the following purposes:
 - a) Ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, and in particular to address any more than minor adverse effects relating to odour discharges from the site and/or water quality issues;
 - b) To incorporate into the consent any modification to the operation and maintenance procedures or monitoring that may be necessary to deal with any adverse effects on the environment arising from changes in association with condition 9 of consent 5839-2; and
 - c) To determine any measures that may be appropriate to comply with condition 1 of this consent, and which are necessary to address any adverse effects relating to the wastewater discharges and/or odour from the site.

Signed at Stratford on 20 August 2015

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Appendix 1 of consent 5838



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

Name of
Consent Holder: Remediation (NZ) Limited
P O Box 8045
NEW PLYMOUTH 4342

Decision Date: 27 May 2010

Commencement
Date: 18 June 2010

Conditions of Consent

Consent Granted: 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

Expiry Date: 1 June 2018

Review Date(s): June 2011, June 2012, June 2013, June 2014, June 2015, June 2016, June 2017

Site Location: 1450 Mokau Road, Uruti

Legal Description: Sec 34 Pt Sec 4 Blk II Upper Waitara SD

General condition

- a. The consent holder shall pay to the Taranaki Regional Council [the Council] all the administration, monitoring and supervision costs of this consent, fixed in accordance to section 36 of the Resource Management Act.

General

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.
2. The surface areas of Pad 1 and Pad 2 shall not exceed 3,500 m² and 4,000 m², respectively.

Note: For the purposes of this condition, the location and extent of Pad 1 and Pad 2 are shown on Figure 1, attached as Appendix 1 of this consent.

Incoming material

3. 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 treatment plants;
 - Mechanical pulping pulp and paper residue [excluding any pulping wastes that have been subject to chemical pulping or treated or mixed with any substance or 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 content within 3 days of being brought onto the site;
 - Produced water from hydrocarbon exploration;
 - Vegetable waste solids [being processing 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 only occur 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.

4. Material produced as a result of a dissolved air flotation process shall not be accepted on site.

5. The consent holder shall record the following information in association with accepting all incoming material on site:
- a) the date and time that the material is accepted;
 - b) description of the material; and
 - c) the approximate volumes of material.

The above records shall be made available to the Chief Executive, Taranaki Regional Council, on request.

Management practices

6. The consent holder shall prepare a Site Practices Management Plan which details management practices undertaken to ensure that offensive or objectionable odours at or beyond the site boundary will be avoided in accordance with condition 13 of this consent. The plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, 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) identification of all activities on site which have the potential to generate odour [e.g. turning compost piles, removing sludge from ponds];
 - b) the conditions and/or time of day when activities identified under a) above should be undertaken [e.g. during favourable weather conditions and the identification of those conditions] and/or measures that shall be implemented to avoid odours arising [e.g. containment measures];
 - c) measures undertaken to minimise odours during receiving and storing material on Pad 1 and Pad 2 and throughout the composting and vermiculture processes [e.g. method[s] used to cover material once received, how anaerobic conditions are maintained];
 - d) measures undertaken to minimise odours arising in the Wetland Treatment System, and identification of the time of year and/or frequency when undertaken;
 - e) measures undertaken to minimise odours arising in the Pond Treatment System and associated treatment measures [e.g. silt traps located upstream], and identification of the time of year and/or frequency when undertaken; and
 - f) details of how a complaint investigation procedure shall operate, including what data shall be collected and what feedback is to be provided to the complaint.
7. Operations on site shall be undertaken in accordance with the Site Practices Management Plan, approved under condition 6 above, except in circumstances when the Proposed Implementation Plan, approved under condition 9 of this consent, specifies otherwise.

Site audit and implementation

8. The consent holder shall engage a suitably qualified and experienced professional to prepare and submit an Odour Assessment Report for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within three months of the commencement date of this consent. The professional that the consent holder engages shall be to the reasonable approval of the Chief Executive, Taranaki Regional Council.

The report shall include, but not necessarily be limited to, the following:

- a) The appropriateness of the management practices and control measures undertaken in avoiding offensive and/or objectionable odours arising beyond the property boundary in association with the composting processes on Pad 1;
- b) Recommendations in association with a) above;
- c) The appropriateness of the design and management of the Pond Treatment System and associated pre-treatment devices (e.g. silt ponds) in effectively managing odours arising from treating leachate derived from Pad 1 and avoiding offensive and/or objectionable odours arising beyond the property boundary; and
- d) Recommendations in association with c) above.

For assisting with the above assessment, the consent holder shall provide a copy of the documents listed below to the engaged and approved professional:

- The Taranaki Regional Council final officers report and hearing decision report for applications 5276 and 5277;
- Consent certificates [including conditions] for consents 5838-2 and 5839-2;
- The Pond Treatment System Management Plan approved under condition 18 of consent 5838-2; and
- The Site Practices Management Plan approved under condition 6 of this consent.

9. The consent holder shall prepare and submit a Proposed Implementation Plan for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, within one month of the Odour Assessment Report being approved under condition 8 above.

The Plan shall include, but not necessarily be limited to, the following:

- a) Management practices and/or control measures proposed to be implemented in association with the composting processes on Pad 1, of which are from the recommendations of the Odour Assessment Report, approved in accordance with condition 8;
- b) Management practices and/or control measures proposed to be implemented in association with the Pond Treatment System, of which are from the recommendations of the Odour Assessment Report, approved in accordance with condition 8;
- c) The reasons for the chosen practices and/or measures identified in accordance with a) and b) above
- d) A timeframe by when each of the practices and/or measures identified in accordance with a) and b) above will be implemented

Consent 5839-2

- e) Identification of appropriate management practices to ensure the on-going functionality of any chosen control measures identified in accordance with a) and b) above
10. Operations and activities on site shall be undertaken in accordance with the Proposed Implementation Plan, approved under condition 9 above.

Dust

11. The dust deposition rate beyond the boundary of the consent holder's site arising from the discharge shall be less than 4.0 g/m²/30 days.

Note: For the purposes of this condition, the consent holder's site is defined as Sec 34 Pt Sec 4 Blk II Upper Waitara SD.

12. Any discharge to air from the site shall not give rise to any offensive, objectionable, noxious or toxic levels of dust at or beyond the boundary of the consent holder's site, and in any case, total suspended particulate matter shall not exceed 120 µg/m³ as a 24 hour average [measured under ambient conditions] beyond the boundary of the consent holder's site.

Note: For the purposes of this condition, the consent holder's site is defined as Sec 34 Pt Sec 4 Blk II Upper Waitara SD.

Odour

13. The discharges authorised by this consent shall not give rise to an odour at or beyond the boundary of the consent holder's site that is offensive or objectionable.

Note: For the purposes of this condition:

- The consent holder's site is defined as Sec 34 Pt Sec 4 Blk II Upper Waitara SD; and
- Assessment under this condition shall be in accordance with the *Good Practice Guide for Assessing and Managing Odour in New Zealand, Air Quality Report 36, Ministry for the Environment, 2003.*

Monitoring

14. The consent holder shall install a monitoring device that continuously records wind speed and direction in the area of the composting activity. The device shall be capable of logging collected data for at least six months and shall be installed and be operational within three months of the commencement date of this consent.

The data shall be provided telemetrically to the Taranaki Regional Council. If this method is not technically feasible, the data shall be provided to the Taranaki Regional Council at a frequency and a form advised by the Chief Executive, Taranaki Regional Council until such a time it is technically feasible to telemetric the data.

Odour surveys

15. The consent holder shall undertake an odour survey within six months of the Plan approved under condition 9 of this consent being implemented and thereafter at yearly intervals during periods when metrological conditions are most likely to result in offsite odour. The methodology for the survey shall be consistent with German Standard VDI 3940 "Determination of Odorants in Ambient Air by Field Inspection", or similar. Prior to the survey being carried out, the methodology shall be approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity.

The results of the survey shall be provided to the Chief Executive, Taranaki Regional Council, within three months of the survey being completed.

Community liaison

16. The consent holder and the Director – Resource Management, Taranaki Regional Council, or his delegate, shall meet locally as appropriate, six monthly or at such other frequency as the parties may agree, with submitters to the application of this consent and any other interested party at the discretion of the Chief Executive, Taranaki Regional Council, to discuss any matter relating to the exercise of this consent, in order to facilitate ongoing community consultation.

Incident notification

17. The consent holder shall keep a permanent record of any incident related to this consent that results, or could result, in an adverse effect on the environment. The consent holder shall make the incident register available to the Taranaki Regional Council on request.

Details of any incident shall be forwarded to the Taranaki Regional Council immediately. At the grant date of this consent, the Council's phone number is 0800 736 222 [24 hour service].

Site reinstatement

18. The consent holder shall prepare a Site Exit Plan which details how the site is going to be reinstated prior to the consent expiring or being surrendered. The Plan shall be submitted for approval to the Chief Executive, Taranaki Regional Council, acting in a certification capacity, at least 3 months prior to this consent expiring or being surrendered.

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

- a) How the site will be reinstated so that no raw materials listed or approved under condition 3 of this consent remain on site;
- b) How the site will be reinstated so that no partially decomposed material remains on site;
- c) How any remaining leachate or sludge, resulting from the operation, will be either removed from the site, buried, treated or otherwise to avoid any adverse effects on groundwater or surface water; and

Consent 5839-2

- d) Timeframes for undertaking the activities identified in association with a) to c) above.

Note: The requirement of this condition shall not apply if the consent holder applies for a new consent to replace this consent when it expires.

- 19. The consent holder shall reinstate the site in accordance with the Plan approved under condition 18 above prior to this consent expiring or being surrendered.

Review

- 20. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review within one month of approving the plan required under condition 9 of this consent and/or during the month of June in any year for any of the following purposes:

- a) Ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, and in particular to address any more than minor adverse effects relating to odour discharges from the site;
- b) To incorporate into the consent any modification to the operation and maintenance procedures or monitoring that may be necessary to deal with any adverse effects on the environment arising from changes in association with condition 9 of this consent; and
- c) To determine any measures that may be appropriate to comply with condition 1 of this consent, and which are necessary to address any adverse effects of odour from the site.

Signed at Stratford on 27 May 2010

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Appendix 1 of consent 5839-2

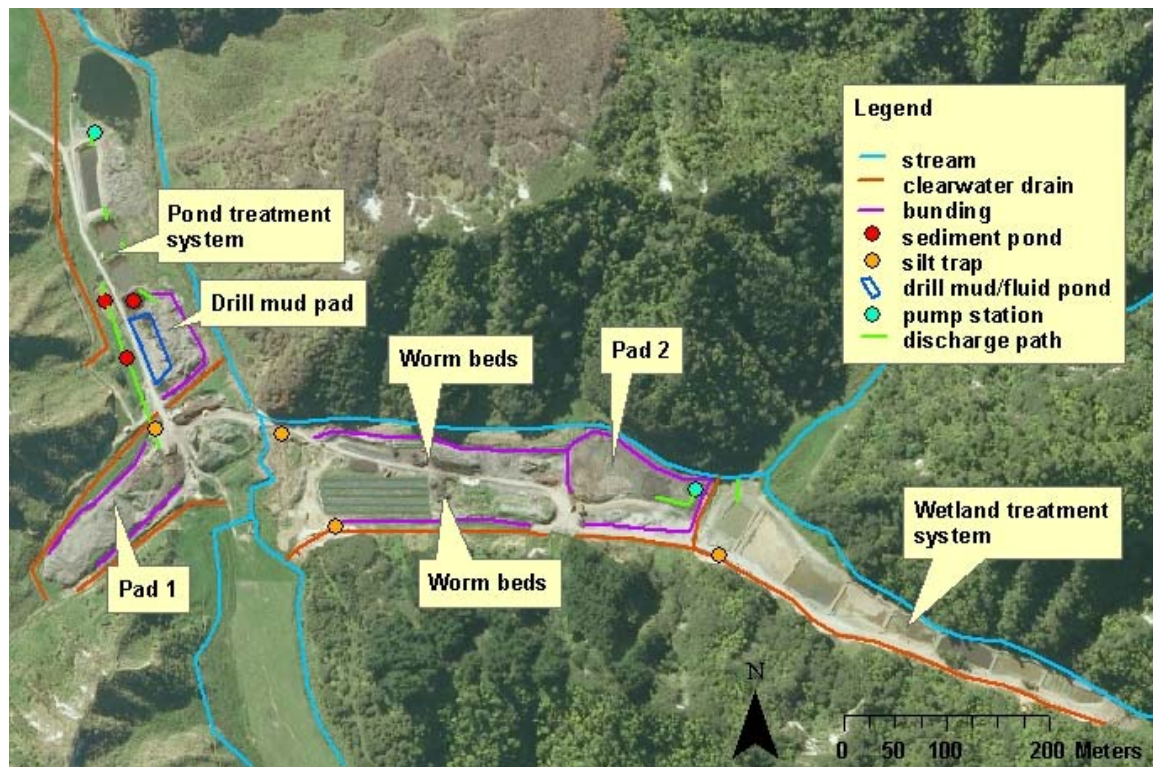


Figure 1 The location and extent of the composting operation including Pads 1 and 2.

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

Name of
Consent Holder: Remediation (NZ) Limited
PO Box 8045
New Plymouth 4342

Decision Date: 01 September 2015

Commencement Date: 01 September 2015

Conditions of Consent

Consent Granted: To use a twin culvert in the Haehanga Stream for vehicle access purposes

Expiry Date: 01 June 2033

Review Date(s): June 2021 and June 2027

Site Location: 1460 Mokau Road, Uruti

Legal Description: Sec 34 Pt Sec 4 Blk II Upper Waitara (site of structure)

Grid Reference (NZTM) 1731706E - 5685779N

Catchment: Mimi

Tributary: Haehanga

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

General condition

- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. The consent holder shall ensure that the stream bed downstream from the structure is built up with appropriate material before 31 March 2016 to allow for fish passage and from this date forward the structure shall not prevent the passage of fish.
2. The consent holder shall maintain the structure so that:
 - (a) it does not become blocked and at all times allows the free flow of water through it;
 - (b) any erosion, scour or instability of the stream bed or banks is remedied by the consent holder.
3. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2021 and/or June 2027, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 01 September 2015

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

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

Name of
Consent Holder: Remediation (NZ) Limited
P O Box 8045
NEW PLYMOUTH 4342

Consent Granted
Date: 26 September 2003

Conditions of Consent

Consent Granted: To realign and divert the Haehanga Stream in the Mimi catchment for land improvement purposes at or about (NZTM) 1732402E-5684777N

Expiry Date: 1 June 2021

Review Date(s): June 2009, June 2015

Site Location: 1460 Mokau Road, Uruti

Legal Description: Pt Sec 4 Blk II Upper Waitara SD

Catchment: Mimi

Tributary: Haehanga

General conditions

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

Special conditions

1. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to and upon completion of any subsequent maintenance works that would involve disturbance of or deposition to the riverbed or discharges to water.
2. The realignment authorised by this consent shall be undertaken generally in accordance with the documentation submitted in support of the application and shall be maintained to ensure the conditions of this consent are met.
3. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise erosion and scouring as a result of channel realignment.
4. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.
5. The consent holder shall ensure that the area and volume of riverbed disturbance shall, so far as is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.

Consent 6211-1

6. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 22 September 2008

For and on behalf of
Taranaki Regional Council

Director-Resource Management

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

Name of
Consent Holder: Remediation (NZ) Limited
 P O Box 8045
 NEW PLYMOUTH 4342

Consent Granted 26 September 2003
Date:

Conditions of Consent

Consent Granted: To erect, place, use and maintain a culvert and associated
 structure[s] in the bed of the Haehanga Stream in the Mimi
 catchment for access purposes at or about (NZTM)
 1732402E-5684777N

Expiry Date: 1 June 2021

Review Date(s): June 2009, June 2015

Site Location: 1460 Mokau Road, Uruti

Legal Description: Pt Sec 4 Blk II Upper Waitara SD

Catchment: Mimi

Tributary: Haehanga

General conditions

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

Special conditions

- 1. The consent holder shall notify the Taranaki Regional Council in writing at least 48 hours prior to the commencement and upon completion of removal of the temporary culvert [being the 800mm diameter culvert] and installation of the permanent culvert and associated structures, and again at least 48 hours prior to and upon completion of any subsequent maintenance works which would involve disturbance of or deposition to the riverbed or discharges to water.
- 2. The consent holder shall replace the existing temporary culvert with a permanent culvert and associated structure[s] by 1 April 2004. Prior to the installation of the permanent culvert and associated structure[s] the consent holder shall forward designs of the proposed culvert and associated structure[s] for the written approval of the Chief Executive.
- 3. The structures authorised by this consent shall be constructed generally in accordance with the documentation submitted in support of the application and shall be maintained to ensure the conditions of this consent are met.
- 4. The consent holder shall adopt the best practicable option to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.
- 5. The consent holder shall ensure that the area and volume of riverbed disturbance shall, so far as is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.
- 6. The structures, which are the subject of this consent, shall not obstruct fish passage.
- 7. The structures authorised by this consent shall be removed and the area reinstated if and when the structures are no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to structures removal and reinstatement.

Consent 6212-1

8. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 22 September 2008

For and on behalf of
Taranaki Regional Council

Director-Resource Management

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

Name of
Consent Holder: Remediation New Zealand
107 Corbett Road
Bell Block 4373

Decision Date: 09 March 2015

Commencement Date: 09 March 2015

Conditions of Consent

Consent Granted: To discharge treated stormwater from a quarry site, into an unnamed tributary of the Haehanga Stream

Expiry Date: 01 June 2033

Review Date(s): June 2021 and/or June 2027

Site Location: 1460 Mokau Road, Uruti

Legal Description: Sec 34 Pt Sec 4 Blk II Upper Waitara SD (Discharge source & site)

Grid Reference (NZTM) 1732059E-5684796N

Catchment: Mimi

Tributary: Haehanga

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

General condition

- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. This consent authorises the discharge of treated stormwater into an unnamed tributary of the Haehanga Stream, as described in the information provided with the application, and specifically:
 - a) The Assessment of Environmental Effects prepared by BTW Company Limited dated 9 January 2015; and
 - b) Additional Information prepared by BTW Company Limited dated 16 February 2015.

In the case of any contradiction between the details of information provided and the conditions of this consent, the conditions of this consent shall prevail.

2. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing, at least 48 hours prior to the exercise of this consent (including vegetation removal). Notification shall include:
 - a) the consent number;
 - b) a brief description of the activity consented; and
 - c) the extent or stage of the activity to be commenced.

Notification shall be emailed to worknotification@trc.govt.nz.

3. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.
4. The consent holder shall operate and progressively reinstate the quarry site in a manner which ensures that the area of exposed, un-vegetated earth, within the quarry's stormwater catchment is kept to a minimum at all times.
5. The consent holder shall ensure that no area greater than 1 ha is exposed at any one time.
6. The stormwater discharged shall be from a catchment area not exceeding 4 ha.
7. This stormwater treatment system shall be installed before any site works commences.
8. The stormwater treatment system shall be maintained for the life of the quarry operation.
9. All stormwater shall be directed for treatment through the stormwater treatment system prior to discharge into the Haehanga Stream tributary.

10. Constituents of the discharge shall meet the standards shown in the following table.

Constituent	Standard
pH	Within the range 6.0 to 9.0
suspended solids	Concentration not greater than 100 gm ⁻³
total hydrocarbons	Concentration not greater than 15 gm ⁻³

This condition shall apply before entry of the treated stormwater into the receiving waters at a designated sampling point approved by the Chief Executive, Taranaki Regional Council.

11. The pH may exceed 9.0 if the exceedance is a result photosynthetic activity within the detention ponds, but in any case the discharge shall not result in the pH of the receiving water increasing by more than 0.5 pH units after allowing for a mixing zone of 25 metres.
12. After allowing for reasonable mixing, within a mixing zone extending 500 metres downstream of any discharge point, the discharge shall not give rise to any of the following effects in the receiving waters:
- the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
 - any conspicuous change in the colour or visual clarity;
 - any emission of objectionable odour;
 - the rendering of fresh water unsuitable for consumption by farm animals;
 - any significant adverse effects on aquatic life.
13. After allowing for reasonable mixing, within a mixing zone extending 500 metres downstream of any discharge point, the discharge shall not give rise to any of the following effects in the receiving waters:
- an increase in the suspended solids concentration within the unnamed tributary of the Haehanga Stream in excess of 10 grams per cubic metres when the turbidity as measured immediately upstream of the discharge point is equal to or less than 5 NTU (nephelometric turbidity units); or
 - an increase in the turbidity within the unnamed tributary of the Haehanga Stream of more than 50%, where the stream turbidity measured upstream if the discharge is greater than 5 NTU, as determined using NTU (nephelometric turbidity units).
14. The consent holder shall maintain and regularly update a 'Contingency Plan' that details measures and procedures that will be undertaken to prevent, and to avoid environmental effects from, a spillage or any discharge of contaminants not authorised by this consent. The plan shall be approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity.

15. The site shall be operated in accordance with a 'Management Plan' prepared by the consent holder and approved by the Chief Executive, Taranaki Regional Council, acting in a certification capacity. The plan shall detail how the site is to be managed to minimise the contaminants that become entrained in the stormwater and shall include as minimum:
- a) the loading and unloading of materials;
 - b) maintenance of conveyance systems;
 - c) general housekeeping; and
 - d) management of the interceptor system.

A Stormwater Management Plan template is available in the Environment section of the Taranaki Regional Council's web site www.trc.govt.nz.

16. The consent holder shall notify the Chief Executive, Taranaki Regional Council, prior to making any changes to the processes or operations undertaken at the site, or the chemicals used or stored on site that could alter the nature of the discharge. Any such change shall then only occur following receipt of any necessary approval under the Resource Management Act. Notification shall include the consent number, a brief description of the activity consented and an assessment of the environmental effects of any changes, and be emailed to consents@trc.govt.nz.
17. This consent shall lapse on 31 March 2020, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
18. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2021 and/or June 2027, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 09 March 2015

For and on behalf of
Taranaki Regional Council



A D McLay
Director - Resource Management

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

Name of
Consent Holder: Remediation (NZ) Limited
PO Box 8045
New Plymouth 4342

Decision Date: 02 March 2018

Commencement Date: 02 March 2018

Conditions of Consent

Consent Granted: To replace an existing culvert in an unnamed tributary of the Haehanga Stream, including the associated disturbance of the stream bed

Expiry Date: 01 June 2033

Review Date(s): June 2021 and or June 2027

Site Location: 1460 Mokau Road, Uruti

Grid Reference (NZTM) 1732180E-5685096N

Catchment: Mimi

Tributary Haehanga

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

General condition

- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. The culvert pipe shall be a smooth bore plastic pipe and have an internal diameter of no less than 1 metre and be no longer than 40 metres.
2. The fill over the top of the culvert pipe shall be comprised of suitable soils free of wood, humus and other organic matter. The embankment shall be well compacted in uniform layers not exceeding 300 mm loose depth to achieve a compaction of at least 95 % of maximum dry density.
3. The fill over the top of the culvert pipe shall be 2.3 m above the invert of the culvert.
4. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 2 working days prior to the commencement of work. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.
5. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water.
6. The consent holder shall take all practicable steps to minimise stream bed disturbance, sedimentation and increased turbidity during installation of the culvert, including by:
 - a) completing all works in the minimum time practicable;
 - b) avoiding placement of excavated material in the flowing channel;
 - c) keeping machinery out of the actively flowing channel, as far as practicable; and
 - d) reinstating any disturbed areas as far as practicable.
7. A reinforced concrete headwall shall be installed at the inlet to the culvert.
8. A layer of rock riprap 1000 mm thick shall be installed in the stream bed. The riprap shall extend 5 metres downstream of the culvert outlet and 1 metre up the banks on both sides of the stream. The rock shall have the following grading:
 - 100% less than 800 mm diameter;
 - 50% greater than 600 mm diameter;
 - 90% greater than 350 mm diameter.
9. The culvert shall not restrict fish passage.
10. The invert of the culvert shall be set below the existing stream bed by 200 mm so that it fills with bed material and simulates the natural bed.
11. The gradient of the culvert shall be no steeper than the natural gradient of the stream bed at the site.

12. On completion of works, the banks of the channel upstream and downstream of the culvert shall be no steeper than the existing natural banks. Where the bank consists of fill, the fill must be well compacted with batter slopes no steeper than 2 horizontal to 1 vertical.
13. The culvert shall remain the responsibility of the consent holder and be maintained so that:
 - a) it does not become blocked, and at all times allows the free flow of water through it; and
 - b) the consent holder repairs any erosion, scour or instability of the stream bed or banks that the culvert causes.
14. In the event that any archaeological remains are discovered as a result of works authorised by this consent, the works shall cease immediately at the affected site and tangata whenua and the Chief Executive, Taranaki Regional Council, shall be notified within one working day. Works may recommence at the affected area when advised to do so by the Chief Executive, Taranaki Regional Council. Such advice shall be given after the Chief Executive has considered: tangata whenua interest and values, the consent holder's interests, the interests of the public generally, and any archaeological or scientific evidence. The New Zealand Police, Coroner, and Historic Places Trust shall also be contacted as appropriate, and the work shall not recommence in the affected area until any necessary statutory authorisations or consents have been obtained.
15. This consent shall lapse on 31 March 2023, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
16. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2021 and/or June 2027, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 02 March 2018

For and on behalf of
Taranaki Regional Council



Director - Resource Management

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

Name of
Consent Holder: Remediation (NZ) Limited
PO Box 8045
New Plymouth 4342

Decision Date 24 June 2020

Commencement Date 24 June 2020

Conditions of Consent

Consent Granted: To realign a section of two unnamed tributaries of the
Haehanga Stream for land improvement purposes

Expiry Date: 1 June 2039

Review Date(s): June 2027, June 2033

Site Location: 1460 Mokau Road, Urenui

Grid Reference (NZTM) Between:
1731695E-5686147N & 1731840E-5686084N; and
1732341E-5685496N & 1732422E-5685525N

Catchment: Mimi

Tributary: Haehanga

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

General condition

- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. This consent authorises the permanent diversion of the full stream flow through two sections of reconstructed channel on two unnamed tributaries, between grid references:
 - (NZTM) 1731695E-5686147N and 1731840E-5686084N; and
 - (NZTM) 1732341E-5685496N and 1732422E-5685525N.
2. The new stream channels shall have a flow capacity no less than that of the existing stream channels.
3. No less than 2 and no more than 20 working days before commencing work the consent holder shall notify the Chief Executive, Taranaki Regional Council ('the Chief Executive'). Notification shall include the consent number, a brief description of the work, and the intended commencement date. Unless the Chief Executive advises that an alternative method is required this notice shall be served by completing and submitting the 'Notification of work' form on the Council's website (<http://bit.ly/TRCWorkNotificationForm>).
4. The consent holder shall take all practicable steps to minimise sedimentation and increased turbidity of the stream during the construction, implementation and maintenance of the works, including:
 - (a) completing all works in the minimum time practicable;
 - (b) avoiding placement of excavated material in the flowing channel; and
 - (c) keeping machinery out of the actively flowing channel, as far as practicable.
5. The channels shall be constructed to include sequences of runs and riffles that simulate the natural bed where the original stream bed is no longer present or stable.
6. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water.
7. The consent holder shall prepare and implement a fish recovery plan that has been certified by the Chief Executive of the Taranaki Regional Council. The plan shall detail how the impacts on fish during culvert installation are avoided as far as practical, and shall include as a minimum how fish will be salvaged, how often fish will be salvaged, and recording the number and types of fish salvaged.
8. The new channel shall not restrict fish passage.

Consent 10825-1.0

9. At all times during the works the consent holder shall ensure that the stream flow downstream of the affected reach is not significantly diminished.
10. On completion of the realignment work:
 - (a) the banks of the reconstructed channel shall have a slope no steeper than 1.5 horizontal to 1 vertical; and
 - (b) the bed of the reconstructed channel shall be at an appropriate grade so as to provide for upstream fish passage.
11. The consent holder shall ensure that rock riprap is placed in the stream bed at all bends in the new channels. The riprap shall be placed within the entire bed width and up the banks of the new stream channel.
12. The rock riprap shall be no less than 0.9 metres thick, and of the following grading:
 - (a) 100% less than 600 mm diameter;
 - (b) 50% greater than 450 mm diameter;
 - (c) 90% greater than 200 mm diameter.
13. The consent holder shall maintain the realigned channel by repairing any erosion, scour or instability of the stream bed or banks.
14. The consent holder shall undertake and maintain riparian fencing and planting on the tributaries affected by the realignment, in accordance with the Riparian Management Plan for the property. An area of not less than 5 metres shall be planted between the stream bed and fence.
15. The fencing and riparian planting required in condition 14 shall be completed before August 2021.
16. To remedy and mitigate the adverse environmental effects of this consent, the consent holder shall establish and maintain riparian planting and a wetland as detailed in the 'Wetland Restoration Management Plan' provided with the application and attached as Appendix 1. The works shall be undertaken within the timeframes specified in that plan.
17. All earthwork areas shall be stabilised as soon as is practicable immediately following completion of soil disturbance activities.

Note: For the purpose of this condition "stabilised" in relation to any site or area means inherently resistant to erosion or rendered resistant, such as by using indurated rock or by the application of basecourse, colluvium, grassing, mulch, or another method to the reasonable satisfaction of the Chief Executive, Taranaki Regional Council and as specified in Guidelines for Soil Disturbing Activities- Waikato Regional Council. Where seeding or grassing is used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once, on reasonable visual inspection by an Investigating Officer, Taranaki Regional Council, an 80% vegetative cover has been established.

Consent 10825-1.0

18. This consent lapses 5 years after its date of commencement, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
19. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2027 and/or June 2033, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 24 June 2020

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Appendix 1

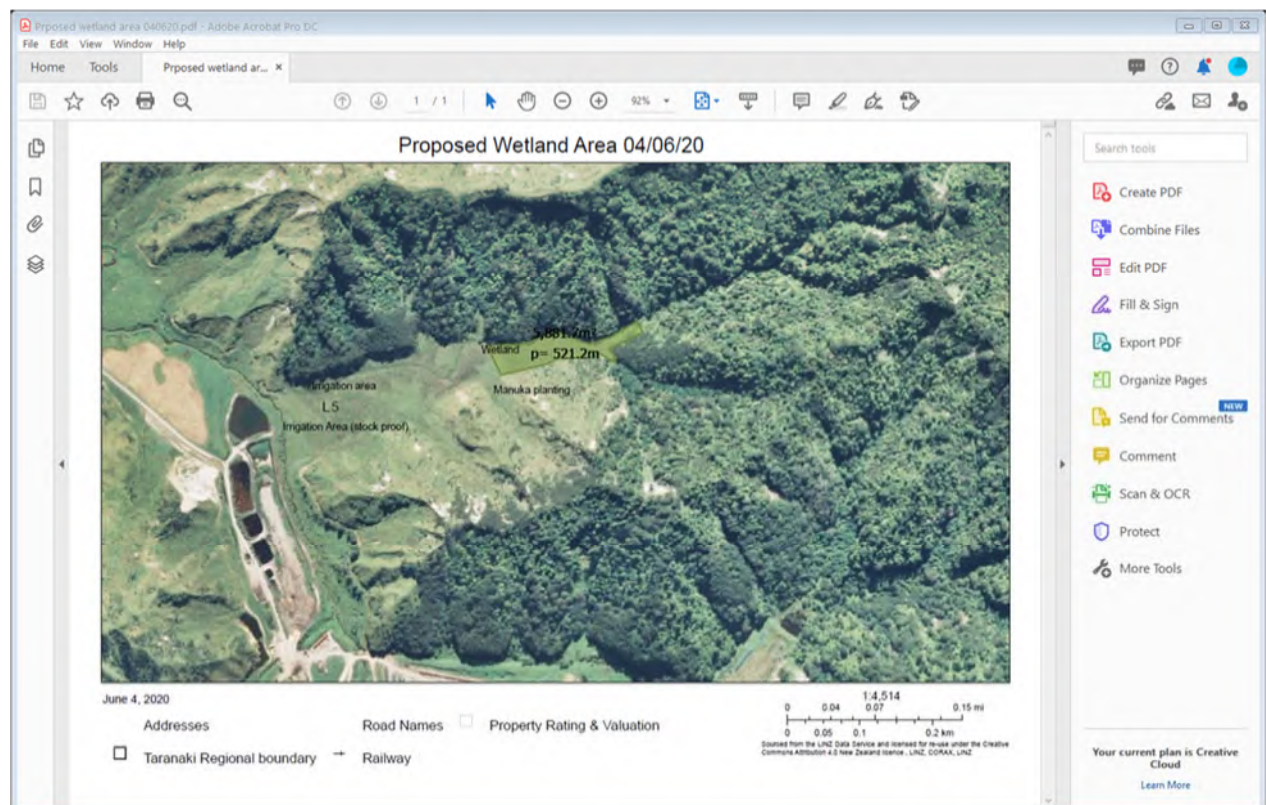
Wetland Restoration/Management Plan-Remediation (NZ) Ltd Uruti Site

13.1 Location

It is proposed to carry out a wetland restoration project on Remediation (NZ) Ltd land situated at 1460 Mokau Road.

The location of the proposed wetland is upstream of the L5 irrigation area. The wetland will have an approximate area of 0.588ha.

Diagram 1-Site of proposed wetland



Regenerative native bush is to the north and east of the proposed wetland. It is proposed to plant manuka on the southern hillside. To the western side of the proposed wetland is irrigation area L5.

The proposed wetland area has been grazed in the past and has little or no swamp vegetation. There is *Juncus* sp. growing in the wetland area.

It has been suggested by Sophie Arnoux (TRC Land Management Officer) that the proposed wetland area was likely to have been kahikatea/pukatea swamp forest (email dated 13/5/2020).

13.2 Description of water flow and drainage

There is a defined tributary of the Haehanga Stream to the west of the wetland. There is no defined stream through the wetland, with water flow either overland in periods of heavy rain, and underground during periods of no rain. Water seeps from the downstream bank that the wetlands have created which then forms the over ground tributary that runs between the irrigation area and bush margin.

13.3 Enhancement Proposal

It is proposed to replant the wetland area so as to re-create a kahikatea/pukatea swamp forest that would have been found in this area. Flax, cabbage tree, manuka and carex will also be planted. On the hill sides to the south of the wetland it is planned to plant manuka. The wetland and lower irrigation area will be fenced off summer 2020/21.

13.4 Plant numbers and plant spacing

The planting area is 5,880 m². Distance between plants will be 2 m. 5,880 divided by 2, divided by 2 again is 1,470 plants required to fill the area. There will be spacing of 1 m between sedges on the wetland margin.

Table 1: Planting

Location	Species	Spacing	Number
Centre area	Kahikatea	3 m	30 (year 3-4)
Centre area	Pukatea	3 m	30 (year 3-4)
Outer areas	Cabbage Tree	2 m	100
Outer areas	Flax	2 m	300
Outer areas	Manuka	2 m	500
Dispersed	Carex secta	1 m	150
Dispersed	Carex virgate	1 m	150

Plants will be sourced from local native plant nurseries, with planting out being carried out by Remediation staff. Weeding around plants will be carried out on an annual basis. Any regenerating native plants will be encouraged with these filling up the area.

13.5 Animal Pest Control

Goats and possums are the two pests that will need to be kept under control. Remediation has a contract with a goat culler to ensure the population of goats is kept under control. Possum traps will be set around the wetland area.

13.6 Timing

Ideally we would like to start planting this year. This may be flax and carex around the perimeter of the area. Planting of trees will occur in year 3 and remainder of planting in year 4.

Year 1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pest Control									x			
Pre planting herbicide							x					
Planting								x				
Post planting release											x	

Year 2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pest Control			x					x				
Pre planting herbicide				X								
Planting						X						
Post planting release											x	

Year 3	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pest Control			x					x				
Pre planting herbicide				X								
Planting						X						
Post planting release											x	

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

Name of
Consent Holder: Remediation (NZ) Limited
PO Box 8045
New Plymouth 4342

Decision Date 24 June 2020

Commencement Date 24 June 2020

Conditions of Consent

Consent Granted: To modify a culvert to provide for fish passage, in an unnamed tributary of the Haehanga Stream, including associated disturbance of the stream bed

Expiry Date: 1 June 2039

Review Date(s): June 2027, June 2033

Site Location: 1460 Mokau Road, Uruti

Grid Reference (NZTM) 1731692E-5686143N

Catchment: Mimi

Tributary: Haehanga

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

General condition

- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. The culvert pipe shall have a diameter no less than 900 mm and be no longer than 10 metres.
2. The fill over the top of the culvert pipe shall be comprised of suitable soils free of wood, humus and other organic matter. The embankment shall be well compacted in uniform layers not exceeding 300 mm loose depth to achieve a compaction of at least 95% of maximum dry density.
3. The fill over the top of the culvert pipe shall be no less than 4 metres.
4. No less than 2 and no more than 20 working days before commencing work the consent holder shall notify the Chief Executive, Taranaki Regional Council ('the Chief Executive'). Notification shall include the consent number, a brief description of the work, and the intended commencement date. Unless the Chief Executive advises that an alternative method is required this notice shall be served by completing and submitting the 'Notification of work' form on the Council's website (<http://bit.ly/TRCWorkNotificationForm>).
5. Between 1 May and 31 October no work shall be undertaken on any part of the stream bed that is covered by water.
6. The consent holder shall take all practicable steps to minimise stream bed disturbance, sedimentation and increased turbidity during installation of the culvert, including by:
 - (a) completing all works in the minimum time practicable;
 - (b) avoiding placement of excavated material in the flowing channel;
 - (c) keeping machinery out of the actively flowing channel, as far as practicable; and
 - (d) reinstating any disturbed areas as far as practicable.
7. A layer of rock riprap 900 mm thick shall be installed in the stream bed. The riprap shall extend 3 metres upstream of the culvert inlet and 5 metres downstream of the culvert outlet and - up the banks on both sides of the stream. The rock shall have the following grading:
 - (a) 100% less than 600 mm diameter;
 - (b) 50% greater than 450 mm diameter;
 - (c) 90% greater than 20 mm diameter.

Note: The rock riprap shall be installed so that smaller grade rocks and gravels are placed within the larger rock to create a lasting stream bed appropriate for fish passage.
8. At all times after 1 May 2021 the culvert shall provide for fish passage.
9. The invert of the culvert shall be set below the existing stream bed by 225 mm that it fills with bed material and simulates the natural bed.

Consent 10843-1.0

10. The gradient of the culvert shall be no steeper than the natural gradient of the stream bed at the site.
11. On completion of works, the banks of the channel upstream and downstream of the culvert shall be no steeper than the existing natural banks. Where the bank consists of fill, the fill must be well compacted with batter slopes no steeper than 2 horizontal to 1 vertical.
12. The culvert shall remain the responsibility of the consent holder and be maintained so that:
 - (a) it does not become blocked, and at all times allows the free flow of water through it; and
 - (b) the consent holder repairs any erosion, scour or instability of the stream bed or banks that the culvert causes.
13. This consent lapses 5 years after its commencement date (shown on the front of this document), unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period in accordance with section 125(1)(b) of the Resource Management Act 1991.
14. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2027 and/or June 2033, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 24 June 2020

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

Appendix II

Categories used to evaluate environmental and
administrative performance

Categories used to evaluate environmental and administrative performance

Environmental performance is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year. Administrative performance is concerned with the Company's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (that is a defence under the provisions of the RMA can be established) may be excluded with regard to the performance rating applied. For example loss of data due to a flood destroying deployed field equipment.

The categories used by the Council for this monitoring period, and their interpretation, are as follows:

Environmental Performance

High: No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.

Good: Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self-reports, or during investigations of incidents reported to the Council by a third party but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

For example:

- High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
- Strong odour beyond boundary but no residential properties or other recipient nearby.

Improvement required: Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self-reports, or during investigations of incidents reported to the Council by a third party. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.

Poor: Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self-reports, or during investigations of incidents reported to the Council by a third party. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

Administrative performance

High: The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.

Good: Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively

adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

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

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