CD Boyd Drilling Waste and Stockpiling Landfarm and Landspreading Monitoring Programme Annual Report 2018-2019

Technical Report 2019-73

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Executive summary

Colin Boyd (the consent holder), in conjunction with MI SWACO (the operator), operate a drilling waste stockpiling facility (Surrey Road stockpiling facility) and a landspreading/landfarming operation on his property, near Inglewood. This site is located within the Waitara catchment. Previously, the consent holder operated another stockpiling facility (Derby Road stockpiling facility) also on his property. The Derby Road site was landfarmed in the 2017-2018 monitoring period. Stockpiled drilling mud from both Surrey Road and Derby Road sites is landfarmed on the consent holder's property. The consent holder also dewaters water treatment sludge in lagoons at two locations on his property. This material is then applied to land via landfarming.

This report for the period July 2018 to June 2019 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the consent holder'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 consent holder's activities.

The consent holder holds five resource consents, which include a total of 79 conditions setting out the requirements that the consent holder must satisfy. The consent holder held two consents to stockpile drilling waste, one consent to discharge drilling waste to land, one consent to discharge stormwater and one consent to store and discharge water treatment sludge to land. In this monitoring period one of the stockpiling consents (Derby Road, 6900-2) was surrendered along with the associated stormwater consent (Derby Road, 7911-1).

During the monitoring period, the consent holder demonstrated an overall poor level of environmental performance.

The Council's monitoring programme for the year under review included 10 inspections, 37 water samples and nine composite soil samples collected for physicochemical analysis. Four biomonitoring surveys of receiving waters were also undertaken.

Soil analysis from the former Derby Road site indicated that surrender of this area of land will not be possible for a few years while the site remediates. This site is now covered by the consent holder's main landfarming consent (7591-1.2). The Council will continue to assess this area until surrender criteria have been reached. Pasture will require re-seeding in the upcoming monitoring period as it did not strike to the degree required.

Inspections and monitoring of the Surrey Road site indicated that a new storage pit had been constructed of concrete to allow easier site operations. This is also proposed to mitigate the risk of damaging the liner during operations which would then lead to a discharge to groundwater. However, the excavated material from the new pit was discharged into a compromised storage pit liner. This resulted in an increase in salts in the discharge from the nova flow sampling location which flows from beneath the compromised storage pit.

On one occasion the irrigation pond was not operated as per consent condition. This resulted in a discharge into the stormwater system which in turn flowed to an unnamed tributary of the Mangatengehu Stream. The effects on the stream were of low impact, however the operator was not abiding by the consent and an infringement fine was issued.

An automatic pump was fitted to the irrigation pond to prevent a future occurrence. However the former storage pit material remained in the compromised pit with the operator considering options.

A decrease in MCI was observed in the biomonitoring locations below the discharge.

Landfarming/landspreading was undertaken on two occasions, across three paddocks during this monitoring year. The first exercise resulted in material stockpiled in paddock 87B. During this stockpiling period, stormwater, as consequence of rainfall, became entrained in the stockpiled material and then

discharged into a nearby farm drain and surface water. An abatement notice and infringement fine were issued. The abatement notice was immediately complied with. The second exercise was undertaken without issue.

Spreading procedures were updated to prevent stockpiling of waste on paddocks prior to spreading or landfarming.

Water treatment sludge remains lagooned in-situ at two locations on the consent holder's property.

By comparison with previous monitoring periods, the monitoring indicated a decline in site operations and landfarming while no individual non-compliant event had signified adverse environmental effects, operations there were three unauthorised incidents recording non-compliance in respect of this consent holder during the period under review.

During the year, the Company demonstrated a poor level of environmental performance and a good administrative performance with the resource consents.

For reference, in the 2018-2019 year, consent holders were found to achieve a high level of environmental performance and compliance for 83% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 13% 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 has deteriorated in the year under review.

This report includes recommendations for the 2019-2020 year.

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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 2018 to June 2019 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Colin Boyd (hereafter the consent holder) and his subsidiary company, Surrey Road Landfarms Ltd. The consent holder operates two stockpiling facilities, the now former Derby Road stockpiling facility and Surrey Road stockpiling facility; while Surrey Road Landfarms Ltd (the consent holder's subsidiary company) hold consent for the application of the material to land.

MI SWACO Company Ltd (the operator) operates the Surrey Road stockpiling facility and associated landspreading on behalf of the consent holder, whereas the Derby Road stockpiling facility, which has been closed to the receipt of new landfarmable material for the last four years, is managed by the consent holder. The stockpiling facilities are located in two locations: one on Surrey Road and the other in close proximity to Derby Road North. The application areas, in terms of where material is landfarmed/landspread, are located between these two stockpiling facilities (indicated as the red area in Figure 1).

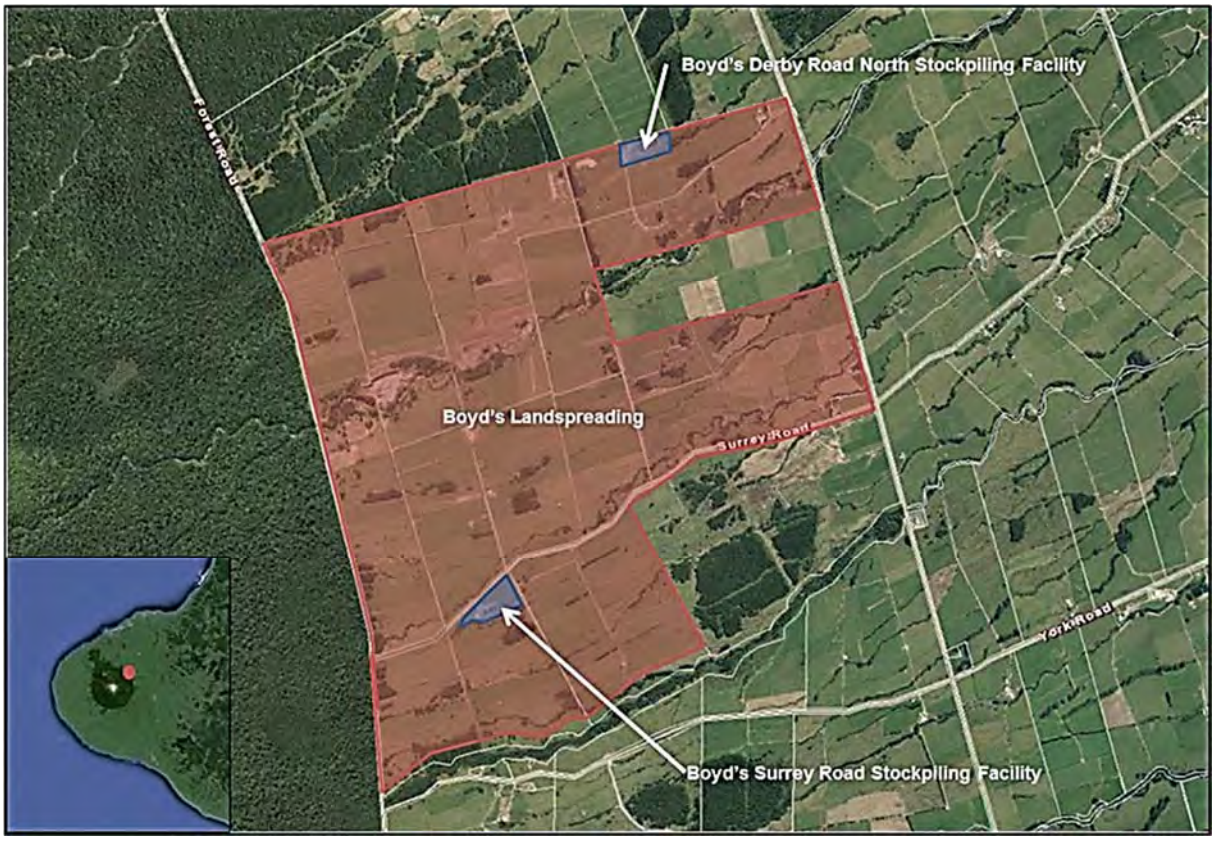

Figure 1 Surrey Road stockpiling facility and the former Derby Road stockpiling facility locations

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 the discharges of drilling wastes within the Waitara catchment.

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 10th combined annual report by the Council for the Company.

1.1.2 Structure of this report

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

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites though annual programmes;
- the resource consents held by the consent holder in the Waitara 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 2019-2020 monitoring year.

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

1.1.3 The Resource Management Act 1991 and monitoring

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

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

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

1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the Company, this report also assigns them a rating for their environmental and administrative performance during the period under review.

Environmental performance is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year. Administrative performance is concerned with the Company's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (that is a defence under the provisions of the RMA can be established) may be excluded with regard to the performance rating applied. For example loss of data due to a flood destroying deployed field equipment.

The categories used by the Council for this monitoring period, and their interpretation, are as follows:

Environmental Performance

High: No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving 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.

For reference, in the 2018-2019 year, consent holders were found to achieve a high level of environmental performance and compliance for 83% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 13% of the consents, a good level of environmental performance and compliance was achieved.[1]

1.2 Process description

1.2.1 Hydrocarbon exploration and production wastes

For the purposes of disposal to land, waste from the petroleum industry can be divided into two broad categories; exploration (drilling) wastes, and production wastes. The wastes disposed of through the consent holder's operations are primarily drilling waste. Fracture return fluids are not disposed of at these sites.

1.2.2 Drilling wastes

Waste drilling material is produced during well drilling for hydrocarbon exploration. The primary components of this waste are drilling fluids (muds) and rock cuttings.

1.2.3 Drilling fluids

Drilling fluids are engineered to perform several crucial tasks in the drilling of a hydrocarbon well. These include: transporting cuttings from the drill bit to the well surface for disposal; controlling hydrostatic pressure in the well; supporting the sides of the hole and preventing the ingress of formation fluids; and lubricating and cooling the drill bit and drill pipe in the hole. Oil and gas wells may be drilled with either synthetic based mud (SBM) or water based mud (WBM). As the names suggest, these are fluids with either water (fresh or saline) or synthetic oil as a base material, to which further compounds are added to modify the physical characteristics of the mud (for example mud weight or viscosity).

More than one type of fluid may be used to drill an individual well. In the past, oil based muds (diesel/crude oil based) have also been used. Their use has declined since the 1980s due to their ecotoxicity; they have been replaced by SBM. SBM use olefins, paraffins or esters as a base material. While this is technically still a form of oil based fluid, these fluids have been engineered to remove polynuclear aromatic hydrocarbons, reduce the potential for bioaccumulation and accelerate biodegradation compared with OBM.

Common constituents of WBM and SBM include weighting agents, viscosifiers, thinners, lost circulation materials (LCM), pH control additives, dispersants, corrosion inhibitors, bactericides, filtrate reducers, flocculants and lubricants. Of these, the naturally occurring clay mineral barite (barium sulphate) is generally the most common additive. It is added to most drilling muds as a wetting and weighting agent.

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[1] The Council has used these compliance grading criteria for 15 years. They align closely with the 4 compliance grades in the MfE Best Practice Guidelines for Compliance, Monitoring and Enforcement, 2018

Drilling fluids may be intentionally discharged in bulk for changes to the drilling fluid programme or at the completion of drilling. Depending on operational requirements and fluid type and properties, fluids may be re-used in multiple wells.

1.2.4 Cuttings

Cuttings are produced as the drill bit penetrates the underlying geological formations. They are brought to the surface in the drilling fluid where they pass over a shaker screen that separates the cuttings and drilling fluids. The drilling fluids are recycled for reuse within the drilling process, but small quantities of drilling fluids remain adhered to the cuttings. The cuttings and smaller particle material from the drill fluid treatment units drain into sumps. If sumps cannot be constructed, corrals or special bins are used. During drilling, this material is the only continuous discharge.

1.2.5 Landfarming process description

Basic steps in the landfarming process include:

1. Drilling waste is transported from a specific wellsite by truck (cuttings) or tanker (liquids). It is placed in a dedicated, fit for purpose, lined storage pit. At the consent holder's facilities cuttings arrive from site in metal 'D' bins directly collected from the wellsite. Material is subjected to an analytical screen undertaken in a registered laboratory. The analysis is dictated by specific consent conditions.
2. The required area is prepared by scraping back and stockpiling existing pasture/topsoil and levelling out uneven ground.
3. Waste is transferred to the prepared area by excavator and truck and spread out with a bulldozer. Liquids may be discharged by tanker or a spray system.
4. Waste is allowed to dry sufficiently before being tilled into the soil to the required depth with a tractor and discs.
5. The disposal area is levelled with chains or harrows.
6. Stockpiled or brought in topsoil/clay is applied to aid stability and assist in grass establishment.
7. Fertiliser may be applied and the area is sown in crop or pasture at a suitable time of year.

Consents 6900-2 and 7559-1.4 allow for the disposal of drilling waste from hydrocarbon exploration activities with WBM and SBM via the landfarming process outlined above.

Of note 6900-2 is directly concerned with stockpiling of material prior to application to land. Initial landfarming at the site revealed difficulties working with soils with higher baseline moisture content. As a result, consent 7591-1.2 was issued to allow for disposal via the process of landspreading.

The preferred method for the treatment and disposal of drilling material at the consent holder's property is via landspreading (under consent 7591-1). A large muck spreader (Photo 1), is used for this purpose.

Photo 1 The landspreading unit utilised by the consent holder

An auger in the base of the spreader conveys material back and through an opening (where the size is controlled by a sliding plate) where it contacts two rapidly rotating augers and is applied up to 10 m on either side. The deposition rate is controlled by the size of the opening at the rear of the unit and the speed of forward travel by the tractor. The waste is deposited onto existing pasture in small fragments, which are allowed some time to dry out before chain harrows and roman discs are used to till and break-up the waste which is dispersed back into the soil, as shown in Photo 2.

Photo 2 Tilling of the soil post landspreading

1.3 Resource consents

The Company held five 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 of this report.

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

Table 1 Summary of consents held by CD Boyd and Surrey Road Landfarms Ltd

Consent number	Purpose	Granted	Review	Expires
Discharge of stormwater				
7911-1	To discharge stormwater from a drilling waste storage site into an unnamed tributary of the Mangamawhete Stream, in the Waitara catchment.	27 Sep 2011	June 2021	1 June 2027
Surrendered 3 January 2019				
Discharges of waste to land				
6900-2	To discharge drilling wastes onto and into land for the purpose of stockpiling prior to disposal.	16 Feb 2011	June 2021	1 June 2027
Surrendered 3 January 2019				
7559-1.4	To discharge drilling waste cuttings from hydrocarbon exploration activities with water based muds and synthetic based muds onto and into land via landfarming and landspreading, injection spreading and irrigation.	20 Nov 2009 Change 20 November 2018	June 2019	1 June 2027
7591-1.2	To discharge drilling waste from hydrocarbon exploration activities onto and into land via landspreading.	21 Jan 2010 Change 20 November 2018	June 2019	1 June 2027
5821-2.2	To discharge sludge and other residuals from water treatment plants in the New Plymouth and South Taranaki Districts' onto and into land	14 Dec 2005	June 2021	1 June 2026

1.4 Monitoring programme

1.4.1 Introduction

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

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

The monitoring programme for the Derby, Surrey Road stockpiling facilities and the associated landspreading sites consisted of five primary components.

1.4.2 Programme liaison and management

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

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

1.4.3 Site inspections

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

1.4.4 Chemical sampling

The Council collected samples of soil and water (groundwater and surface water) throughout the monitoring period. This is to assess the compliance of the consent holder with the consented conditions and to assess for any adverse effects arising from the facilities or activities of the consent holder.

1.4.4.1 Soil

In total, 9 composite soil samples from specific disposal areas were collected by Council staff. The sampling methodology utilised is adapted from the Guidelines for the Safe Application of Biosolids to Land in New Zealand (2003). This is undertaken through the compositing of 10 soil cores (Photo 3) (400 mm+/- depth to encompass the zone of application) taken at 10 m intervals along transects through an application area.

Photo 3 An example of an extracted soil core

The analysis undertaken by the Council is described in Table 2. Each transect is GPS referenced to allow for areas to be characterised and repeat analysis when required.

1.4.4.2 Water

Compliance water analysis was undertaken across the following sources in this monitoring period:

- Surface water;
- Stormwater discharge; and
- Groundwater.

Surface water samples were also obtained on three separate occasions along the unnamed tributary of the Mangatengehu Stream (Figure 4) in relation to stormwater discharges from the Surrey Road stockpiling facilities.

Groundwater analysis results were obtained through the purpose installed groundwater monitoring bore network. Derby and Surrey Road facilities each have three groundwater monitoring bores. These bores were installed to quantify the quality of the groundwater and, specifically to understand if any adverse effects were permeating from either facility through the storage of material in lined storage pits in the case of Surrey Road and clay lined pits in the case of Derby Road.

The Council utilises a peristaltic low flow pump to collect the water samples. The samples are only collected post stabilisation of groundwater quality during pumping, and are obtained through a Yellow Springs Instrument (YSI) multi parameter probe and a flow through cell.

Surface water, groundwater, discharge and soil analytes are provided in Table 2 below.

Table 2 Chemical analytes

Surface / Discharge water analytes	
Barium (acid soluble)	Calcium
Benzene	Chloride
Toluene	Conductivity
Ethylene	Total petroleum hydrocarbons
Xylene M/O	Suspended Solids
Biological oxygen demand (BOD)	Total dissolved salts (TDS)
Biochemical oxygen demand (BCOD)	Temperature
	pH
Groundwater analytes	
Barium (acid soluble)	Sodium
Barium (dissolved)	Level
Benzene	Nitrite-nitrate nitrogen
Toluene	Total dissolved salts (TDS)
Ethylene	Temperature
Xylene M/O	Level
Chloride	Total petroleum hydrocarbon
Conductivity	Biochemical oxygen demand (BCOD)
Soil analytes	
Calcium	Ammoniacal nitrogen
Chloride	Nitrite-nitrate nitrogen
Magnesium	pH
Sodium	Total soluble salts
Conductivity	Total recoverable heavy metals
Potassium	Total petroleum hydrocarbons
Moisture factor	Polycyclic aromatic hydrocarbons
Sodium absorption ratio (SAR)	Monocyclic aromatic hydrocarbons

1.4.5 Biomonitoring surveys

Four biological surveys were performed during the monitoring period under review. These were split evenly across the two stockpiling facilities at Derby and Surrey Roads' respective unnamed tributaries.

The Surrey Road stockpiling facility is located in close proximity to the unnamed tributary of the Mangatengehu Stream. A Council Officer undertook a spring and a late summer survey of four specific monitoring sites on this tributary.

The Derby Road stockpiling facility is also located in close proximity to an unnamed tributary of the Mangamawhete Stream. As with the Surrey Road assessment, the Derby Road facility is assessed across four specific monitoring sites on the unnamed tributary of the Mangamawhete Stream.

Please note that the specific biomonitoring reports are now reported separately from this report, however a summary of each survey is provided in Section 2.1.3.4 and 2.2.3.3 respectively.

1.4.6 Review of consent holder provided data

In accordance with the consent conditions the consent holder or subsidiary must supply the Council with an annual report. The annual report is to contain information pertaining to the records kept by the consent holder and shall include but not be limited to:

- the location from which the drilling waste originated;
- the composition of the waste, including analytical analysis of a specified range of analytes;
- the stockpiling locations if utilised;
- volume of material;
- the areas landfarmed, including a map;
- volumes of wastes landfarmed; and
- details of monitoring undertaken.

In an active stockpiling year, MI SWACO would undertake pre-screening analysis of the material which they received on site. This includes the collection of representative samples of the material which are then analysed by an independent laboratory for specific analytes (RJ Hill laboratory in Hamilton in this case). This is undertaken for all drilling material brought to the primary stockpiling site of Surrey Road.

A letter report was provided by the operator this monitoring year. This is appended as appendix II.

2 Results

2.1 The former Derby Road stockpiling facility

Derby Road North stockpiling facility is located on the Taranaki ring plain bordering the Egmont National Park near Inglewood (Figure 2). In previous monitoring years this was the primary stockpiling site for muds and cuttings. At the beginning of the 2011-2012 monitoring year activity slowed at the site. During the 2012-2013 monitoring year the Surrey Road site became the primary site while the Derby Road site remained unused and on standby to receive waste as a contingency or secondary site if required. While the site remained unused in the 2016-2017 monitoring period it still contained approximately 1,000 m^3 of residual drilling material which needed to be landfarmed before the Council considered the site suitable for surrender.

The consent holder undertook a cleaning out operation towards the end of the 2016-2017 monitoring period, whereby the remaining drilling muds were consolidated into one pit. These consolidated materials were then sampled by the consent holder and analysed. During this period the site was also utilised by the consent holder for the storage of water treatment sludge.

In the 2017-2018 monitoring period the consent holder undertook landfarming at the Derby Road site. The remaining consolidated material (aged drilling mud) and water treatment sludge was spread across the site area and landfarmed.

The unnamed tributary of the Mangamawhete Stream flows adjacent to the Derby Road North stockpiling facility. The proximity of the site to this surface water body had been taken into account in the setting of buffer distances and location of the stockpiling facilities.

The predominant soil type has been identified as gravelly sand and the vegetation cover is pasture, recently converted from native bush. Average annual rainfall for the site is 1,942 mm (taken from the nearby 'Stratford' monitoring station).

No consents were initially held to discharge stormwater from this stockpiling site, as it was expected to comply with the permitted activity criteria in Rule 23 of the Regional Freshwater Plan (RFWP). However, a stormwater discharge consent was issued for the Derby Road North site (7911-1, 27 September 2011). The Derby Road facility also holds a discharge permit (6900-2) which permits the temporary stockpiling of blended waste prior to landfarm deployment.

In this monitoring period (2018-2019) the consent holder requested to surrender the consents held for Derby Road, which encompassed the discharge to land consent (6900-2) and the stormwater discharge consent (7911-1).

The decision was made to allow the consent holder to surrender the specific Derby Road consents, as the end point soil conditions would be covered by consent 7591-1.2 which is now in effect. These consents (6900-2 and 7911-1) were surrendered on 3 January 2019. The monitoring reported is strictly limited to between July 2018 and January 2019 in the following Derby Road related portion of this report.

Figure 2 Derby Road stockpiling facility with sample collection locations

Site data

Location	
Word descriptor:	Derby Road North, Inglewood, Taranaki
Map reference:	E 1702545
(NZTM)	N 5653650
Mean annual rainfall:	1,942 mm
Mean annual soil temperature:	-
Mean annual soil moisture: -	
Elevation:	~500 MASL
Geomorphic position:	Ring plain
Erosion / deposition:	Negligible
Vegetation:	Transitional-native bush to pasture
Parent material:	Tephra / volcaniclastic
Drainage class:	Free / well-draining

2.1.1 Inspections

17 July 2018

During the inspection the following was observed. No objectionable odours or visible emissions were found during the inspection. No disposal or storage of drilling wastes had occurred recently, no storage pits were present. The recently spread area was inspected and found to be satisfactory. The pasture strike was beginning to occur. On observation there was very little mud identified at the soil surface. The stormwater discharge from the final pond was clear and free of hydrocarbons. No adverse effects were observed in the receiving waters.

2.1.2 Results of abstraction and discharge monitoring

The Derby Road stockpiling facility is closed to the receipt of drilling material. In the 2017-2018 period the consent holder landfarmed the residual drilling material, which had been in storage for longer than four years and was estimated at 1,000 m^3, to land. This material was farmed inside the Derby Road stockpiling facility site boundaries. It also included water treatment sludge which the consent holder had been dewatering under the practice of lagooning.

For future monitoring, this area will be treated as a landfarmed area and will be monitored until consent surrender conditions are achieved as defined in consent 7591-1.2.

2.1.3 Results of receiving environment monitoring

2.1.3.1 Groundwater

Two groundwater monitoring wells currently remain active on the Derby Road site. GND2060 and GND2062 were sampled on two occasions this monitoring period. The analysis is provided in the following tables.

Table 3 GND2060 monitoring results 2018-2019

GND2060	Site	GND2060	GND2060
Parameter	**Unit/date**	**12 Sep 2018**	**07 Dec 2018**
Level	**m**	2.585	2.524
Temp	**°C**	10.9	11.9
Acid soluble barium	**g/m^3**	< 0.11	< 0.11
Dissolved barium	**g/m^3**	0.022	0.021
Electrical conductivity (EC)	**mS/m**	8	8
Chloride	**g/m^3**	8.2	7
Total sodium	**g/m^3**	5.6	5.1
Benzene	**g/m^3**	< 0.0010	< 0.0010
Toluene	**g/m^3**	< 0.0010	< 0.0010
Ethylbenzene	**g/m^3**	< 0.0010	< 0.0010
m&p-Xylene	**g/m^3**	< 0.002	< 0.002
o-Xylene	**g/m^3**	< 0.0010	< 0.0010
C_7-C_9	**g/m^3**	< 0.06	< 0.06
C_{10}-C_{14}	**g/m^3**	< 0.2	< 0.2
C_{15}-C_{36}	**g/m^3**	< 0.4	< 0.4
Total hydrocarbons (C_7-C_{36})	**g/m^3**	< 0.7	< 0.7
Nitrate-N + Nitrite-N	**g/m^3**	0.23	0.182
pH	**pH Units**	6.3	6.1
Total dissolved solids (TDS)	**g/m^3**	66	60

Table 4 GND2062 monitoring results 2018-2019

GND2062	Site	GND2062	GND2062
Parameter	Unit/date	12 Sep 2018	07 Dec 2018
Level	m	1.025	0.666
Temp	°C	12.1	14.5
Acid soluble barium	g/m^3	< 0.11	< 0.11
Dissolved barium	g/m^3	0.042	0.04
Electrical conductivity (EC)	mS/m	10.1	8.1
Chloride	g/m^3	11.8	8.1
Total sodium	g/m^3	5	5.1
Benzene	g/m^3	< 0.0010	< 0.0010
Toluene	g/m^3	< 0.0010	< 0.0010
Ethylbenzene	g/m^3	< 0.0010	< 0.0010
m&p-Xylene	g/m^3	< 0.002	< 0.002
o-Xylene	g/m^3	< 0.0010	< 0.0010
C_7-C_9	g/m^3	< 0.06	< 0.06
C_{10}-C_{14}	g/m^3	< 0.2	< 0.2
C_{15}-C_{36}	g/m^3	< 0.4	< 0.4
Total hydrocarbons (C_7-C_{36})	g/m^3	< 0.7	< 0.7
Nitrate-N + Nitrite-N	g/m^3	0.003	0.006
pH	pH Units	5.9	5.5
Total dissolved solids (TDS)	g/m^3	55	61

The analysis provided in Tables 3 and 4 indicated no values of concern, with the results demonstrating background groundwater conditions.

No concentrations of petroleum hydrocarbons were reported above the limit of detection across all carbon chains, C_7-C_9, C_{10}-C_{14}, C_{15}-C_{36} and C_7-C_{36}.

No benzene, toluene, ethylbenzene and xylenes (collectively known as BTEX) results were recorded above the limit of detection, across both wells through both monitoring rounds.

2.1.3.2 Stormwater

The facility held stormwater discharge consent 7911-1; to discharge stormwater from drilling waste storage into the unnamed tributary of the Mangamawhete Stream. In this monitoring period no discharge sample was collected as the ponds have been partially removed and the final pond collects rainwater before discharging to the Mangamawhete Stream.

2.1.3.3 Soil analysis

Four composite soil samples were collected from the former Derby Road stockpiling facility this period. The location of the soil sample transects are provided in Figure 3. The results are tabulated in Table 5 below.

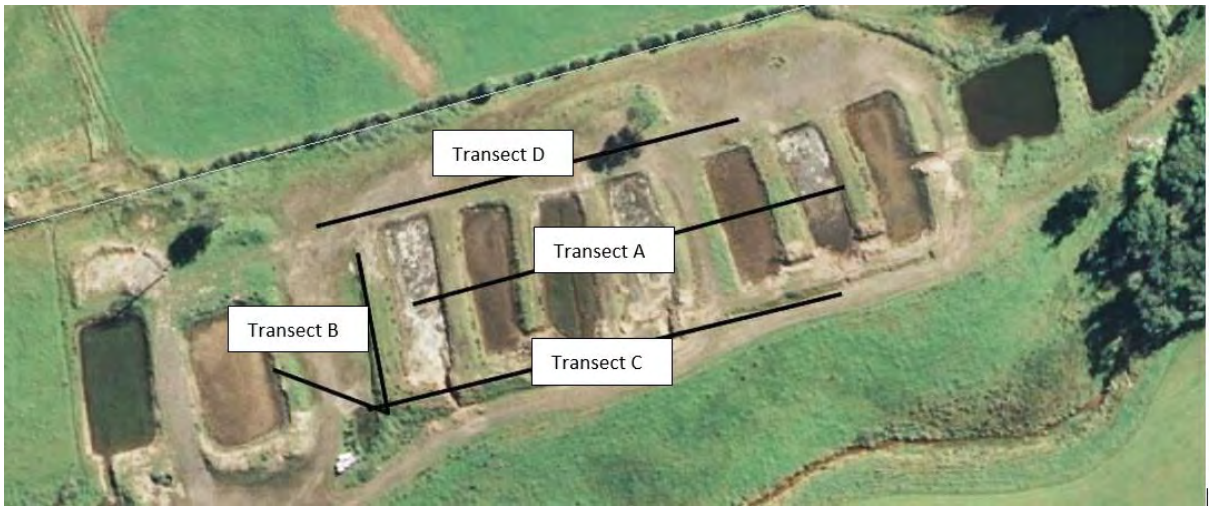

Figure 3 Derby Road soil transects 2018-2019

Table 5 Derby Road soil sample results 2018-2019

Derby Road 2018-2019	Location	Consent surrender	Transect A	Transect B	Transect C	Transect D
Parameter	Unit/Date	Limit 7591-1.2	19 Jun 2019	19 Jun 2019	19 Jun 2019	19 Jun 2019
1-Methylnaphthalene	mg/kg dry wt		0.136	0.019	0.023	0.115
2-Methylnaphthalene	mg/kg dry wt		0.22	0.024	0.041	0.141
Acenaphthene	mg/kg dry wt		< 0.014	< 0.015	< 0.014	0.022
Acenaphthylene	mg/kg dry wt		< 0.014	< 0.015	< 0.014	< 0.013
Anthracene	mg/kg dry wt		< 0.014	< 0.015	< 0.014	< 0.013
Benzo[a]anthracene	mg/kg dry wt		< 0.014	< 0.015	< 0.014	< 0.013
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.027	0.013	< 0.015	< 0.014	< 0.013
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt		< 0.04	< 0.04	< 0.04	< 0.04
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt		< 0.04	< 0.04	< 0.04	< 0.04
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt		< 0.014	< 0.015	< 0.014	< 0.013
Benzo[e]pyrene	mg/kg dry wt		< 0.014	< 0.015	< 0.014	< 0.013
Benzo[g,h,i]perylene	mg/kg dry wt		< 0.014	< 0.015	< 0.014	< 0.013
Benzo[k]fluoranthene	mg/kg dry wt		< 0.014	< 0.015	< 0.014	< 0.013
Chrysene	mg/kg dry wt		< 0.014	< 0.015	< 0.014	< 0.013
Dibenzo[a,h]anthracene	mg/kg dry wt		< 0.014	< 0.015	< 0.014	< 0.013
Dry matter (Env)	g/100g as rcvd		75	68	74	75
Fluoranthene	mg/kg dry wt		0.014	< 0.015	< 0.014	0.018
Fluorene	mg/kg dry wt		< 0.014	< 0.015	< 0.014	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt		< 0.014	< 0.015	< 0.014	< 0.013
Naphthalene	mg/kg dry wt	7.2	0.11	< 0.08	< 0.07	< 0.07
Perylene	mg/kg dry wt		0.019	< 0.015	< 0.014	< 0.013
Phenanthrene	mg/kg dry wt		0.059	< 0.015	0.015	0.055

Derby Road 2018-2019	Location	Consent surrender	Transect A	Transect B	Transect C	Transect D
Parameter	Unit/Date	Limit 7591-1.2	19 Jun 2019	19 Jun 2019	19 Jun 2019	19 Jun 2019
Pyrene	mg/kg dry wt	160	< 0.014	< 0.015	< 0.014	0.018
Total of Reported PAHs in Soil	mg/kg dry wt		0.6	< 0.4	< 0.4	0.5
Benzene	mg/kg dry wt	1.1	< 0.06	< 0.07	< 0.06	< 0.06
Toluene	mg/kg dry wt	82	< 0.06	< 0.07	< 0.06	< 0.06
Ethylbenzene	mg/kg dry wt	59	0.1	< 0.07	< 0.06	< 0.06
o-Xylene	mg/kg dry wt	59	< 0.06	< 0.07	< 0.06	< 0.06
m&p-Xylene	mg/kg dry wt	59	< 0.12	< 0.14	< 0.12	< 0.12
Calcium (Sat Paste)	mg/L		574	199	214	229
Magnesium (Sat Paste)	mg/L		19	9	10	10
Sodium (Sat Paste)	mg/L		62	18	25	30
Sodium absorption ratio (SAR)		8*	0.7	0.3	0.5	0.5
C_7-c_9	mg/kg dry wt	210	< 8	< 9	< 9	< 8
C_{10}-C_{14}	mg/kg dry wt	150	1220	53	340	530
C_{15}-c_{36}	mg/kg dry wt	1,300	19,200	1,000	6,300	9,000
Total hydrocarbons (C_7-C_{36})	mg/kg dry wt	20,000*	20,000	1,050	6,600	9,500
Total recoverable barium	mg/kg dry wt	10,000*	2,600	800	1,440	1,600
Total recoverable calcium	mg/kg dry wt		33,000	10,400	13,300	22,000
Chloride	mg/kg dry wt	700	540	92	133	179
Total recoverable magnesium	mg/kg dry wt		3,300	1,470	1,770	2,600
Total recoverable potassium	mg/kg dry wt		840	440	510	770
Total recoverable sodium	mg/kg dry wt	460	540	750	610	680
Soluble salts	g/100g dry wt	0.25	0.15	0.07	0.07	0.08
Ph	pH Units		7.7	7.3	7.5	7.6
Conductivity from soluble salts	mS/cm	2.9	0.4	0.2	0.2	0.2
Total recoverable arsenic	mg/kg dry wt	17*	4	< 2	2	3
Total recoverable cadmium	mg/kg dry wt	0.8*	< 0.10	< 0.10	< 0.10	< 0.10
Total recoverable chromium	mg/kg dry wt	600*	21	7	11	14
Total recoverable copper	mg/kg dry wt	100*	34	37	32	39
Total recoverable lead	mg/kg dry wt	160*	6.5	3.6	4	4.9
Total recoverable mercury	mg/kg dry wt	1*	< 0.10	< 0.10	< 0.10	< 0.10
Total recoverable nickel	mg/kg dry wt	60*	14	4	6	9
Total recoverable zinc	mg/kg dry wt	300*	46	32	31	39
*Denotes consent value which should not be exceeded						

Four composite soil samples were collected from the former Derby Road stockpiling facility in the 2018-2019 monitoring period. The data is presented above in Table 5. Included in this table is the consent defined surrender limit as defined by consent 7591-1.2.

Note that bar the heavy metal values, including barium, and a specific TPH loading rate, which should not be exceeded at any time during the landfarming process, other target contaminates may be above the surrender defined value until the area is to be assessed for surrender. The analysis indicated that this area is not ready to be surrendered, as the values exceed chemical surrender values, as defined by the consent. This will be discussed in more detail below.

The reported analysis indicated the following:

- Polycyclic aromatic hydrocarbons (PAH) recorded trace values across a few compounds in all four samples this period. Of particular note, the measured concentrations for the targeted PAHs of concern, benzo (a) pyrene, naphthalene and pyrene, were all below the surrender concentrations for these compounds.
- Benzene, toluene, ethylbenzene and xylenes (collectively known as BTEX) reported concentrations indicated the following;
    - Benzene values were below the limit of detection across all four samples.
    - Toluene values were similarly below the limit of detection, across all four samples.
    - Ethylbenzene values indicated one measurable result (0.1 mg/kg, transect A), while the remaining three transects did not report any values above the limit of detection.
    - Xylene values (m & p and O) were also below the limit of detection, across all samples.
- The associated sodium absorption ratio (SAR) across all four samples was below 1.0, with values ranging from 0.3-0.7 SAR. The value for surrender is equal to or below 8.
- Total petroleum hydrocarbons indicated the following:
    - Carbon chain C_7-C_9 indicated no values above the limit of detection across all four samples.
    - Carbon chain C_{10}-C_{14} were detected in all four samples. These values ranged from 53 mg/kg (transect B) through to 1,220 mg/kg (transect A). The consent defined value for surrender value for this parameter is set at 150 mg/kg. Only transect B was below this value.
    - Carbon chain C_{15}-C_{36} were detected in all four samples. The range across these samples was 1,000 mg/kg (transect B)-19,200 mg/kg (transect A). The consent defined value for surrender is set at 1,300 mg/kg. Only transect B was below this value.
- Total recoverable (TR) barium results indicated a range of values (800 mg/kg, transect B-2,600 mg/kg, transect A). The surrender value is set at 10,000 mg/kg, with all four samples below this value.
- TR calcium values ranged from 10,400 mg/kg (transect B) through to 33,000 mg/kg (transect A).
- Chloride values ranged from 92 mg/kg (transect B) through to 540 mg/kg (transect A). The surrender value is set at 700 mg/kg, with all four samples reporting values below this figure.
- TR magnesium values ranged from 1,470 mg/kg (transect B) through to 3,300 mg/kg (transect A).
- TR potassium values ranged from 440 mg/kg (transect B) through to 3,300 mg/kg (transect A).
- TR sodium values ranged from 540 mg/kg (transect A), though to 750 mg/kg (transect B). The value for surrender is set at 460 mg/kg, with all four samples above this value.
- Soluble salt values were all below the value for surrender, which is set at 0.25 g/100 g. Samples from 0.07 g/100 g (transects B and C) to 0.15 g/100 g (transect A).
- The soil pH ranged from 7.3 pH (transect B) through to 7.7 pH (transect A).
- Conductivity from the soluble salts ranged from 0.2 mS/cm (transects B, C, D) through to 0.4 mS/cm. Surrender value is set at 2.9 mS/cm.
- TR heavy metals were detected in all samples assessed. The results for arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc were all well below the consent defined value.

2.1.3.4 Biomonitoring Mangamawhete Stream

Two macroinvertebrate surveys were performed in order to monitor the health of the macroinvertebrate communities of an unnamed tributary of the Mangamawhete Stream in relation to the stockpiling and discharge of drilling waste to land within its vicinity. This encompassed two scheduled surveys for the site in the 2018-2019 year.

Summary December 2018

A macroinvertebrate survey was performed on 3 December 2018, at four sites in an unnamed tributary of the Mangamawhete Stream, in relation to drilling waste stockpiling and landfarming activities at the Derby Road site. Taxa richnesses were moderate at all four sites, but were slightly lower at the upstream 'control' site. MCI scores indicated 'good' macroinvertebrate community health at sites 1, 3 and 4 and 'fair' health at site 2. MCI scores were similar to or higher than median scores for each site. $SQMCI_S$ scores increased in the downstream direction, with a significant increase between site 1 and site 4. Overall, the results of this survey provide no evidence of any recent significant detrimental effects on the macroinvertebrate communities of the unnamed tributary of the Mangamawhete Stream.

Summary February 2019

A macroinvertebrate survey was performed on 19 February 2019, at four sites in an unnamed tributary of the Mangamawhete Stream, in relation to drilling waste stockpiling and landfarming activities at the Derby Road site. Taxa richnesses were moderate across all four sites. MCI scores indicated 'fair' macroinvertebrate community health at sites 1 and 2 and 'good' macroinvertebrate community health at sites 3 and 4. MCI scores were not significantly different to median scores for each site. $SQMCI_S$ scores increased significantly between site 1 and site 4. Overall, the results of this survey provide no evidence of any recent significant detrimental effects on the macroinvertebrate communities of the unnamed tributary of the Mangamawhete Stream.

2.2 Surrey Road stockpiling facility

The Surrey Road stockpiling facility (Figure 4) is located on the Taranaki ring plain bordering the Egmont National Park near Inglewood. An unnamed tributary of the Mangatengehu Stream flows adjacent to the facility. The proximity of the site to this recognised ecosystem had been taken into account in the setting of buffer distances and location of the stockpiling facilities.

The predominant soil type has been identified as gravelly sand and vegetation growth consists of native bush which transitions into pasture. Average annual rainfall for the site is 1,942 mm (taken from the nearby 'Stratford' monitoring station).

The stockpiling facility located at Surrey Road is operated under one consent (7559-1.4). This consent allows the consent holder to discharge specific quantities of drilling related material (consisting of drilling cuttings, drilling fluids and muds, both WBM and SBM) onto land for stockpiling purposes.

The landfarming or landspreading of material is actioned under a separate consent (7591-1.2) which is discussed later in this report. No consents are held to discharge stormwater from this stockpiling site; it is expected to comply with the permitted activity criteria of Rule 23 in the Regional Freshwater Plan for Taranaki (RFWP). However contaminated stormwater is required to be pumped from the irrigation pit to the adjacent paddock.

Figure 4 Surrey Road stockpiling facility with associated sample locations

Site data	
Location	
Word descriptor:	Surrey Road, Inglewood, Taranaki
Map reference:	E 1701847
(NZTM)	N 5651476
Mean annual rainfall:	1,942 mm
Mean annual soil temperature:	-
Mean annual soil moisture: -	
Elevation:	~500 MASL
Geomorphic position:	Ring plain
Erosion / deposition:	Negligible
Vegetation:	Transitional-native bush to pasture
Parent material:	Tephra / volcaniclastic
Drainage class:	Free / well draining

2.2.1 Inspections

17 July 2018

During the inspection the following was observed. No objectionable odours or visible emissions were found during the inspection. No disposal or storage of drilling wastes had occurred recently. The storage pit liners

appeared in good repair, though the liner in the final pond remained inflated in places. All ponds on observation, appeared free of surface hydrocarbons and only contained residual muds. The skimmed oil remained on-site in the bulk storage tank. The vertical storage tanks remained empty. The cut-off drain had a visible though minor hydrocarbon sheen discharging into it. Stormwater discharge from the final pond was clear and free of hydrocarbons, and no adverse effects were observed in the receiving waters.

22 August 2018

During the inspection the following was noted. No recent mud deliveries or spreading activities had occurred. No additional muds were on-site, other than residuals from the previous campaigns. A meeting was held with MI SWACO staff to discuss the impending mud deliveries and site management. The current pit liners were unlikely to be fit for purpose and would require replacing or repairing.

The stormwater observed in the pits would be irrigated onto pasture prior to mud deliveries. MI SWACO staff outlined they would likely only have one pit in use. The stormwater from the mud pits would be irrigated onto pasture from pit 3. Pit 1 has an approximate surface area of 600 m^2, which generates 600 litres of water during a 1mm rain event. The Council staff suggested that more stormwater storage may be required if the current pit dimensions were to be maintained. Different options for covering the pits were being investigated. The vertical storage tanks were not likely to be used due to operational/management issues.

On observation, hydrocarbons were continuing to discharge from the nova flow pipe below the storage pits. Discussions were held in regard to remediating the area below the pits when the liners are replaced. The first receiving pond post this nova flow discharge was observed to contain hydrocarbons. Vegetation around pond fringes was dead from hydrocarbon evaporation. However, the discharge from final pond was clear and free of hydrocarbons. At the time, no adverse effects were observed in the receiving waters. Discussions were also held as to whether there could be a syphon effect with this discharge pipe.

The spreading requirements were outlined. It was communicated to the officer that injection spreading would most likely be the primary method of material application. The Council staff outlined the previous issues with the control of mud, especially buffer distances when using spreader method. A contractor suggested that an equipment modification may be possible to prevent unauthorised discharges into surrounding drains.

At the time, 2,000 litres of skimmed oil remained on-site, in the storage tank. It appeared secure at the time of inspection. The future use of the stored oil was unclear at present but was to be investigated by MI SWACO staff in due course. It was communicated that mud deliveries begin at the end of September 2018. Approximately 1000m^3 was programmed for receipt at that stage.

01 October 2018

During an inspection the following was observed. The site was unmanned and the main gates were closed. It was noted that works had occurred on the storage pits. A concrete liner had been used in one pit. The pit's discharge was directed into the adjacent pit which was fitted with a new HDPE liner. One other HDPE lined mud pit was in use. The final stormwater receiving pit was essentially empty, with inflated areas under the liner. Plenty of capacity was available at the time of inspection to cope with the current rain event.

No works appeared to have occurred to remediate the contamination under the pits, as a rainbow sheen was noted to be discharging into the drain. The first receiving pond had a visible hydrocarbon sheen. The final outlet (small pipe) was below the water level. The discharge was occurring through a larger pipe on the eastern wall. At the time no works had occurred to prevent syphoning from the pit through smaller pipe as discussed during previous site visit. At the time the receiving waters were high flow and observed as turbid. No adverse effects were observed from the site inputs. The water treatment sludge remained stockpiled in the bunds.

21 March 2019

During an inspection the following was observed. No objectionable odours or visible emissions were found during the inspection. A noticeable 'mud' type odour was noted directly downwind of the storage pits. The lined pits contained muds and storm water. On observation it was noted that very little surface hydrocarbons were present and all pits had available storage capacity.

The stormwater pond liner had inflated in places. No irrigation was occurring from the pit. Hydrocarbons were observed to be continuing to discharge from the nova flow under the storage pits. The first interceptor pond was containing them and the second pond was free of surface sheen. The discharge from the final pond was free of hydrocarbons. No adverse effects were observed within the receiving waters at the time of inspection.

08 April 2019

At the time of the inspection the following was observed. The site was un-manned. The first pit was essentially full of solids. The liquid portion was discharging into the adjacent liquid pit which had available storage capacity. The wash-pad was also full and discharging into the same pit. The third pit with the likely permeable liner had had muds and cuttings introduced and was well below the point of discharge.

No discharges were occurring into the stormwater receiving pit with the inflated liner were occurring but the pit was completely full. This pit was discharging at a high rate into the adjacent drain. The liquid had a clay/mud appearance and was being conveyed into the receiving storm water pond system. The discharge from the final stormwater pond was clear and free of hydrocarbon sheen. Samples of the discharge and receiving waters were collected.

The irrigation area was inspected. No irrigation was occurring at the time of inspection but appeared to have occurred earlier. The irrigator was turned on its side with the gun component detached. Some mud was present on the pasture around the irrigator, with clay coloured liquid ponding in places down-slope. It appeared that the irrigated liquid had not found its way into the adjacent paddock drain.

18 April 2019

At the time of the inspection the following was observed. No objectionable odours or visible emissions were found during the inspection. No discharges from the storage lined pits were occurring to the receiving drain and the irrigation pond had available storage capacity. No recent muds deliveries appeared to have been introduced.

The stormwater ponds were clear and the discharge was clear. No adverse effects were occurring in the receiving waters. No irrigation was occurring. The irrigator remained on its side with the gun detached. An inspection of the recent spreading areas found pasture had been sowed and was beginning to strike. There were essentially no muds visible at the soil surface. The old Derby Road storage area had also been worked again using harrows, discs and a roller, though no pasture strike had occurred as yet. All previous spreading areas had good pasture cover which appeared healthy.

2.2.2 Results of the abstraction and discharge monitoring

In this monitoring period the Surrey stockpiling facility received material from four locations, as described in Table 6. This information was provided by MI SWACO who manage the facility on behalf of the consent holder.

Table 6 Delivery information Surrey Road stockpiling facility 2018-2019

Operator/ provider	Well	Mud type	Volume	Status of material	Landfarmed location
AWE LTD	Kohatukai 1	WBM / SBM	1200m^3	Dec 2018	#87A, #87B, #87C
TODD ENERGY	Mangahewa 25	WBM / SBM	450m^3	Feb 2019	#86
	Mangahewa 26	WBM	230m^3	Stockpiled	
	Mangahewa 27	WBM	280m^3	Stockpiled	

2.2.3 Results of receiving environment monitoring

2.2.3.1 Groundwater monitoring: Surrey Road

The Surrey Road stockpiling facility contains a groundwater monitoring network comprised of three monitoring wells. In addition, a nova flow which flows from under the storage pits is also sampled. These four monitoring locations are sampled quarterly. Their locations are shown in Figure 4.

The reported analysis is provided in Tables 7-10.

Table 7 Monitoring location GND2165 2018-2019

Surrey Road	Site	GND2165	GND2165	GND2165	GND2165
Parameter	**Unit/date**	**12 Sep 2018**	**07 Dec 2018**	**29 Mar 2019**	**26 Jun 2019**
pH	**pH Units**	6.2	6.4	Well Dry	6.1
Temperature	**˚C**	11.1	13.8	No sample	12.4
Electrical Conductivity (EC)	**mS/m**	8.4	11.4	-	8
Acid Soluble Barium	**g/m^3**	< 0.11	< 0.11	-	< 0.11
Dissolved Barium	**g/m^3**	0.032	0.018	-	0.023
Chloride	**g/m^3**	8.3	4.7	-	7.4
Total Sodium	**g/m^3**	4.8	3.2	-	4.7
Nitrate-N + Nitrite-N	**g/m^3**	1.54	0.44	-	0.9
Total Dissolved Solids (TDS)	**g/m^3**	59	70	-	66
Benzene	**g/m^3**	-	< 0.0010	-	-
Toluene	**g/m^3**	-	< 0.0010	-	-
Ethylbenzene	**g/m^3**	-	< 0.0010	-	-
o-Xylene	**g/m^3**	-	< 0.0010	-	-
m&p-Xylene	**g/m^3**	-	< 0.002	-	-
C_7-C_9	**g/m^3**	-	< 0.06	-	-
C_{10}-C_{14}	**g/m^3**	-	< 0.2	-	-
C_{15}-C_{36}	**g/m^3**	-	< 0.4	-	-
Total hydrocarbons (C_7-C_{36})	**g/m^3**	-	< 0.7	-	-

Table 8 Monitoring location GND2166 2018-2019

Surrey Road	Site	GND2166	GND2166	GND2166	GND2166
Parameter	Unit/date	12 Sep 2018	07 Dec 2018	29 Mar 2019	26 Jun 2019
pH	pH Units	5.7	5.5	5.7	5.7
Temperature	°C	10.7	14.7	17	11.3
Electrical Conductivity (EC)	mS/m	6.6	11.6	11.2	6.1
Acid Soluble Barium	g/m^3	< 0.11	< 0.11	< 0.11	< 0.11
Dissolved Barium	g/m^3	0.016	0.047	0.037	0.014
Chloride	g/m^3	9.1	14.3	21	7.4
Total Sodium	g/m^3	5	9.4	9.4	5
Nitrate-N + Nitrite-N	g/m^3	1.37	3.8	2.4	1.32
Total Dissolved Solids (TDS)	g/m^3	49	80	82	46
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
o-Xylene	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
C_7-C_9	g/m^3	< 0.06	< 0.06	< 0.06	< 0.06
C_{10}-C_{14}	g/m^3	< 0.2	< 0.2	< 0.2	< 0.2
C_{15}-C_{36}	g/m^3	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C_7-C_{36})	g/m^3	< 0.7	< 0.7	< 0.7	< 0.7

Table 9 Monitoring location GND2167 2018-2019

Surrey Road	Site	GND2167	GND2167	GND2167	GND2167
Parameter	Unit/date	12 Sep 2018	07 Dec 2018	29 Mar 2019	26 Jun 2019
pH	pH Units	5.7	5.6	5.8	5.8
Temperature	°C	11.7	13.4	16	12.7
Electrical Conductivity (EC)	mS/m	13.4	10.4	10.6	16.2
Acid Soluble Barium	g/m^3	< 0.11	< 0.11	< 0.11	< 0.11
Dissolved Barium	g/m^3	0.086	0.061	0.051	0.085
Chloride	g/m^3	12.8	8.8	11.2	15.4
Total Sodium	g/m^3	8.6	6.7	8	12.2
Nitrate-N + Nitrite-N	g/m^3	4.8	1.43	2.8	6.8
Total Dissolved Solids (TDS)	g/m^3	93	59	65	112
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
o-Xylene	g/m^3	< 0.0010	< 0.0010	< 0.0010	< 0.0010

m&p-Xylene	g/m³	< 0.002	< 0.002	< 0.002	< 0.002
C_7-C_9	g/m³	< 0.06	< 0.06	< 0.06	< 0.06
C_{10}-C_{14}	g/m³	< 0.2	< 0.2	< 0.2	< 0.2
C_{15}-C_{36}	g/m³	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C_7-C_{36})	g/m³	< 0.7	< 0.7	< 0.7	< 0.7

Table 10 Monitoring location GND2517 2018-2019

Surrey Road	Site	GND2517	GND2517	GND2517	GND2517
Parameter	Unit/date	12 Sep 2018	07 Dec 2018	29 Mar 2019	26 Jun 2019
pH	pH Units	6.5	6.4	6.3	6.4
Temperature	°C	15.7	13.9	16.7	13.3
Electrical Conductivity (EC)	mS/m	24.1	43.6	361	108
Acid Soluble Barium	g/m³	0.12	0.38	5.8	0.68
Dissolved Barium	g/m³	0.116	0.37	5.8	0.66
Chloride	g/m³	23	57	910	200
Total Sodium	g/m³	9.1	13.5	66	24
Nitrate-N + Nitrite-N	g/m³	0.005	< 0.002	0.011	0.01
Total Dissolved Solids (TDS)	g/m³	137	240	2,300	890
Benzene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
o-Xylene	g/m³	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m³	< 0.002	< 0.002	< 0.002	< 0.002
C_7-C_9	g/m³	< 0.06	< 0.06	< 0.06	< 0.06
C_{10}-C_{14}	g/m³	0.6	0.6	< 0.2	1.2
C_{15}-C_{36}	g/m³	2	2.7	< 0.4	3.7
Total hydrocarbons (C_7-C_{36})	g/m³	2.6	3.3	< 0.7	4.9

The analysis indicated the following:

- No total petroleum hydrocarbons (TPH) results were reported above the limit of detection (LOD) in the three groundwater monitoring locations (GND2165, 2166 and 2167) this period.
    - Monitoring location GND2517 (Table 10), which is the nova flow from beneath the storage pits, reported low concentrations of mid-range TPH (C_{10}-C_{14}) and high range TPH (C_{15}-C_{36}) on three occasions (September 2018, December 2018 and June 2019). The values reported ranged from 0.6 g/m³ through to 1.2 g/m³ for C_{10}-C_{14}, while for C_{15}-C_{36}), the values ranged from 2.6 g/m³ through to 3.7 g/m³.
- Benzene, toluene, ethylbenzene and xylenes (m & p and O) analysis, collectively known as BTEX, did not reach any values above the LOD this monitoring period, across all four monitoring locations.
- Groundwater pH values ranged from 5.5 pH (GND2166) through to 6.4 pH (both GND2165 and GND2517).
- Groundwater temperature values ranged from 11.1°C (GND2165, September 2018) through to 17°C (GND2166, March 2019).

- Electrical conductivity values (EC) ranged from 6.1 mS/m (GND2166, June 2019) through to 361 mS/m (GND2517, March 2019). GND2517 also recorded the highest four values in this monitoring period, with a range of 24.1-361 mS/m.
- Acid soluble barium analysis ranged from below the LOD, across the three groundwater monitoring wells (GND2165-2167) through to 5.8 g/m^3 in monitoring location GND2517. The value of 5.8 g/m3 for acid soluble barium was the highest value for this monitoring location since its inception in June 2015.
- Dissolved barium was identified in all four monitoring locations this period. These values ranged from 0.014 g/m^3 (GND2166, March 2019) through to 5.8 g/m^3 (GND2517 g/m^3, March 2019).
- Chloride values indicated low concentrations in the three groundwater monitoring wells (GND2165, 2166 and 2167). These low values ranged from 4.7 g/m^3 through to 21 g/m^3. GND2517 in comparison indicated elevated values when compared to the three groundwater monitoring wells, with a range of 23-910 g/m^3.
- Sodium values followed a similar theme to the chloride, with the three groundwater monitoring wells recording low values, ranging from 3.2 g/m^3 (GND2165, September 2018) through to 12.2 g/m^3 (GND2176, June 2019). GND2517 in comparison indicated a range of 9.1 g/m^3 through to 66 g/m^3.
- Nitrate-nitrite nitrogen values (NNN) indicated a range across the four monitoring locations. These were from below the LOD (<0.002 g/m^3, GND2517 December 2019) through to 6.8 g/m^3 (GND2167, June 2019). Note, the lower values were found closer to the storage areas.
- Total dissolved salt/ solid (TDS) results indicted a range of values, with the groundwater monitoring wells identifying TDS with a range of low concentrations, from 46 g/m^3 through to 112 g/m^3. Nova flow monitoring location GND2517 demonstrated a considerably higher range in comparison, from 137 g/m^3 through to 2,300 g/m^3. This elevated value (2,300 g/m^3, GND2517, March 2019) is close to the consent limit (<2,500 g/m^3) for impacts to groundwater (consent 7591-1.2, condition 22).

2.2.3.2 Surface water monitoring: Unnamed tributary of Mangatengehu Stream

Surface water monitoring of the unnamed tributary of the Mangatengehu Stream and the Surrey Road stormwater discharge location was performed on four occasions this monitoring period. The monitoring locations are shown in Figure 4. The facility does not hold a specific stormwater discharge consent. It is expected to comply with the Regional Freshwater Plan (RFWP) rule 23.

The results of the monitoring is provided in Tables 11-14.

Table 11 Surrey Road surface water monitoring 12 September 2018

Surrey Road sw/ds 2018-2019	Site	MTH000060	IND001067	MTH000064
Parameter	**Unit/date**	**12 Sep 2018**	**12 Sep 2018**	**12 Sep 2018**
Temperature	**°C**	9.9	11.9	10.2
Chloride	**g/m^3**	5.7	22	7.3
Dissolved C-Biochemical Oxygen Demand (CBOD5)	**g O_2/m^3**	< 1.0	< 1.0	< 1.0
Electrical Conductivity (EC)	**mS/m**	8.8	17.7	9.5
pH	**pH units**	6.8	6.9	7
Total Dissolved Solids (TDS)	**g/m^3**	82	111	101
Total Sodium	**g/m^3**	5.8	8.9	6.2
Total Suspended Solids	**g/m^3**	< 4	8	< 4
Acid Soluble Barium	**g/m^3**	-	0.19	-
Dissolved Barium	**g/m^3**	-	0.2	-

Surrey Road sw/ds 2018-2019	Site	MTH000060	IND001067	MTH000064
Parameter	Unit/date	12 Sep 2018	12 Sep 2018	12 Sep 2018
C_7-C_9	g/m³	-	< 0.06	-
C_{10}-C_{14}	g/m³	-	< 0.2	-
C_{15}-C_{36}	g/m³	-	< 0.4	-
Total hydrocarbons (C_7-C_{36})	g/m³	-	< 0.7	-
Benzene	g/m³	-	< 0.0010	-
Toluene	g/m³	-	< 0.0010	-
Ethylbenzene	g/m³	-	< 0.0010	-
m&p-Xylene	g/m³	-	< 0.002	-
o-Xylene	g/m³	-	< 0.0010	-

Table 12 Surrey Road surface water monitoring 29 March 2019

Surrey Road sw/ds 2018-2019	Site	MTH000060	IND001067	MTH000064
Parameter	Unit/date	29 Mar 2019	29 Mar 2019	29 Mar 2019
Temperature	°C	15	21.2	14.4
Chloride	g/m³	6.9	29	11
Dissolved C-Biochemical Oxygen Demand (CBOD5)	g O_2/m³	< 1.0	< 1.0	< 1.0
Electrical Conductivity (EC)	mS/m	8.8	18.2	10.6
pH	pH units	7.2	7.4	7.4
Total Dissolved Solids (TDS)	g/m³	71	116	89
Total Sodium	g/m³	6.5	11.3	7.1
Total Suspended Solids	g/m³	< 3	7	< 3
Acid Soluble Barium	g/m³	-	< 0.11	-
Dissolved Barium	g/m³	-	0.082	-
C_7-C_9	g/m³	-	< 0.06	-
C_{10}-C_{14}	g/m³	-	< 0.2	-
C_{15}-C_{36}	g/m³	-	< 0.4	-
Total hydrocarbons (C_7-C_{36})	g/m³	-	< 0.7	-
Benzene	g/m³	-	< 0.0010	-
Toluene	g/m³	-	< 0.0010	-
Ethylbenzene	g/m³	-	< 0.0010	-
m&p-Xylene	g/m³	-	< 0.002	-
o-Xylene	g/m³	-	< 0.0010	-

Table 13 Surrey Road surface water monitoring 2 May 2019

Surrey Road sw/ds 2018-2019	Site	MTH000060	IND001067	MTH000064
Parameter	Unit/date	02 May 2019	02 May 2019	02 May 2019
Temperature	°C	10.9	12.4	10.5
Chloride	g/m³	6.4	98	13.4
Dissolved C-Biochemical Oxygen Demand (CBOD5)	g O_2/m³	1.2	< 1.0	< 1.0
Electrical Conductivity (EC)	mS/m	9.5	44.9	12.1
pH	pH units	7.1	7.1	7.4
Total Dissolved Solids (TDS)	g/m³	70	280	97
Total Sodium	g/m³	6.2	11.9	6.9
Total Suspended Solids	g/m³	12	6	< 4
Acid Soluble Barium	g/m³	-	0.34	-
Dissolved Barium	g/m³	-	0.36	-
C_7-C_9	g/m³	-	< 0.06	-
C_{10}-C_{14}	g/m³	-	< 0.2	-
C_{15}-C_{36}	g/m³	-	< 0.4	-
Total hydrocarbons (C_7-C_{36})	g/m³	-	< 0.7	-
Benzene	g/m³	-	< 0.0010	-
Toluene	g/m³	-	< 0.0010	-
Ethylbenzene	g/m³	-	< 0.0010	-
m&p-Xylene	g/m³	-	< 0.002	-
o-Xylene	g/m³	-	< 0.0010	-

Table 14 Surrey Road surface water monitoring 19 June 2019

Surrey Road sw/ds 2018-2019	Site	MTH000060	IND001067	MTH000064
Parameter	Unit/date	19 Jun 2019	19 Jun 2019	20 Jun 2019
Temperature	°C	10.5	9.7	10.3
Chloride	g/m³	6.2	85	12.8
Dissolved C-Biochemical Oxygen Demand (CBOD5)	g O_2/m³	< 1.0	<1.0	< 1.0
Electrical Conductivity (EC)	mS/m	9.5	44.3	12.3
pH	pH units	7.1	6.7	7
Total Dissolved Solids (TDS)	g/m³	79	260	96
Total Sodium	g/m³	6.4	13.4	7.1
Total Suspended Solids	g/m³	< 4	5	<4
Acid Soluble Barium	g/m³	-	0.21	-
Dissolved Barium	g/m³	-	0.22	-
C_7-C_9	g/m³	-	< 0.06	-
C_{10}-C_{14}	g/m³	-	< 0.2	-

Surrey Road sw/ds 2018-2019	Site	MTH000060	IND001067	MTH000064
Parameter	Unit/date	19 Jun 2019	19 Jun 2019	20 Jun 2019
C_{15}-C_{36}	g/m^3	-	< 0.4	-
Total hydrocarbons (C_7-C_{36})	g/m^3	-	<0.7	-
Benzene	g/m^3	-	< 0.0010	-
Toluene	g/m^3	-	<0.0010	-
Ethylbenzene	g/m^3	-	<0.0010	-
m&p-Xylene	g/m^3	-	<0.002	-
o-Xylene	g/m^3	-	<0.0010	-

The analysis of the four rounds of surface water and discharge sampling indicated the following:

- No petroleum hydrocarbon results were recorded above the LOD in the discharge sample (IND001067), across the four rounds of monitoring this period.
- No benzene, toluene, ethylbenzene, or xylenes (m & p or O) (BTEX) values were recorded above the LOD this period.
- Dissolved barium results within the discharge ranged from 0.082 g/m^3 (March 2019, Table 12) through to 0.36 g/m^3 (May 2019, Table 13).
- Acid soluble barium results ranged from below the LOD (March 2019, table 12) through to 0.34 g/m^3 (May 2019, Table 13).
- Total suspended solid concentrations within the surface water monitoring locations (MTH000060 and MTH000064) ranged from below the LOD on three occasions (September 2018, March 2019 and June 2019) through to 12 g/m^3 (MTH000060, May 2019). The corresponding discharge values ranged from 5 g/m^3 (June 2019), through to 8 g/m^3 (September 2018, Table 11). The RWFP guideline rule 23 for the discharge is set at 100 g/m^3, with all recorded values in this period remaining below that value.
- Total sodium values remained at low concentrations across all monitoring rounds this period. The corresponding discharge values ranged from 8.9 g/m^3 through to 13.4 g/m^3. The largest increase between the upstream site (MTH000060) and the downstream site (MTH000064) was 0.7 g/m^3, recorded in the June 2019 sample round (Table 14).
- Total dissolved salt/ solid concentrations (TDS) ranged from 111 g/m^3 (September 2018) through to 280 g/m^3 (May 2019). The largest increase between the upstream site (MTH000060) and the downstream site (MTH000064) was 27 g/m^3, recorded in the May 2019 sample round.
- The corresponding pH of the discharge ranged between 6.7 pH to 7.4 pH. This was within RWFP plan rule 23 standard which require the discharge to be between 6.0-9.0 pH.
- Electrical conductivity values in the discharge ranged from 17.7 mS/m (September 2018, Table 12) through to 44.9 mS/m (May 2019, Table 13). In both May and June 2019, values were twice the values recorded in the earlier two earlier rounds.
- Dissolved carbonaceous oxygen demand results were all below the LOD, across all samples this period.
- Chloride values within the discharge (IND001067) ranged from 22 g/m^3 (September 2018) through to 98 g/m^3 (May 2019). The largest increase in this analytes within the receiving waters, post the discharge, was an increase of 7 g/m^3 (May 2019).

TDS and chloride values increased in the later three monitoring rounds. During this time the irrigation pond was observed to be discharging to the stormwater system (18 April 2019) which in turn then discharged diluted concentrations of fluid to the nearby unnamed tributary of the Mangatengehu Stream.

The consented method for stormwater disposal, as defined by consent (7591-1.2, condition 1b and 11), is to irrigate this material to land in a defined irrigation area, adjacent to the stockpiling facility. The operators were issued with an infringement fine for not abiding by their consent.

2.2.3.3 Biomonitoring Mangatengehu Stream

A macroinvertebrate survey was performed on two occasions during this monitoring period to monitor the health of the macroinvertebrate communities of an unnamed tributary of the Mangatengehu Stream. The site located off Surrey Road, receives drilling wastes, which are stored on site, and then eventually spread over land.

Drainage of water from the storage pits flows through at least two skimmer pits. From here, it is either pumped out for removal, or discharged to land, near the unnamed tributary. No consent is held to discharge to the tributary from the skimmer pits, as this discharge was meant to comply with permitted activity rule 23 of the Regional Fresh Water Plan for Taranaki. A condition of this permitted activity rule is that the discharge shall not give rise to (amongst other effects), any significant adverse effects on aquatic life.

Summary October 2018

Overall, the two potentially 'impacted' sites showed significant differences in taxa richness, MCI, and $SQMCI_S$ values compared with the 'control' sites at the time of the survey. Differences in periphyton cover and the amount of iron oxide deposits would explain some of the differences observed. Stockpiling activities are likely to have also contributed to low macroinvertebrate taxa richness, taxa abundances and MCI scores.

Further investigation into the extent to which stockpiling activities are responsible for the low taxa richness, abundances and MCI scores in the lower section of the tributary of the Mangatengehu Stream would be useful, particularly whether or not stockpiling activities were responsible for the high level of iron oxide deposits observed at the two 'impacted' sites.

Summary February 2019

Overall, the two potentially 'impacted' sites showed no significant differences in $SQMCI_S$ values compared with the 'control' sites at the time of the survey. However, MCI scores were significantly lower at site 3 and substantially lower at site 4. Differences in periphyton cover and amount of iron oxide deposits would explain some of the differences observed. In previous surveys, it has been suggested that stockpiling activities may have also contributed to low macroinvertebrate taxa richnesses, taxa abundances and MCI scores that have been recorded in the past.

It was recommended that further investigation take place to determine the extent to which stockpiling activities were responsible for the low taxa richnesses, abundances and MCI scores in the lower section of the tributary of the Mangatengehu Stream. In particular, investigation should assess whether or not stockpiling activities were responsible for the high level of iron oxide deposits observed at the two 'impacted' sites. If a return to less desirable conditions were to occur, this would be further investigated. This matter was being pursued at the end of the year under review.

2.3 Landspreading

The consent holder undertakes landspreading or landfarming of drilling waste material across a large consented area on the consent holder's farm (Figure 5). To date 60 paddocks have been landfarmed. In this monitoring period three paddocks were utilised by the consent holder for landfarming.

The consent holder received material from four well locations this monitoring period (Table 15). Of these four well locations, residues from two wells (Kohatukai 1 and Mangahewa 25) were landfarmed in this

monitoring period. Wastes from the remaining two wells (Mangahewa 26 and 27) remain stockpiled at the Surrey Road stockpiling facility.

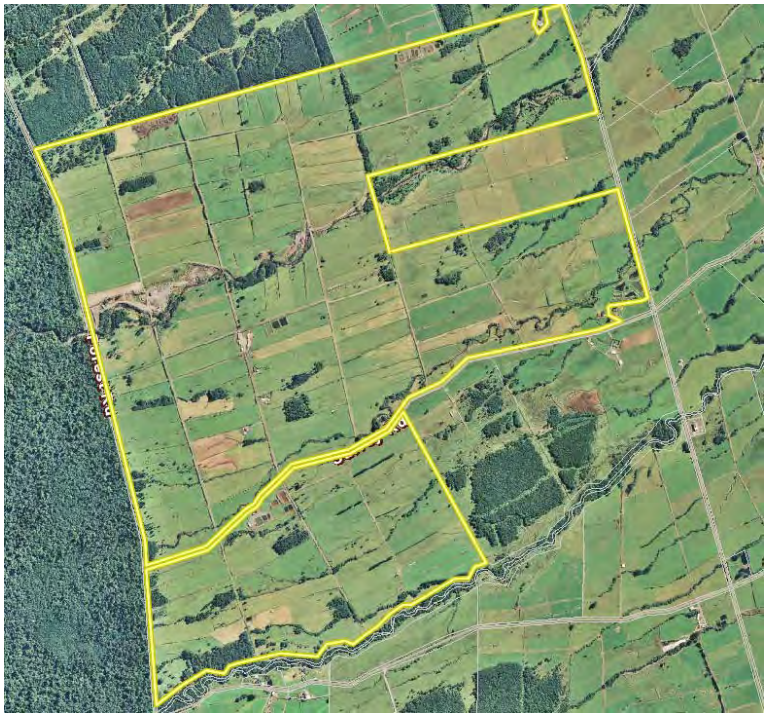

Figure 5 Consent 7591-1.2 landfarming/ landspreading consented application area (yellow)

Table 15 Consent holder defined summary activity 2018-2019

Operator	Well name	Mud type	Volume	Date spread	Paddock number
AWE	Kohatukai 1	WBM/SBM	1,200m^3	December 2018	87B and C
Todd Energy	Mangahewa 25	WBM/SBM	450m^3	February 2019	86
	Mangahewa 26	WBM/SBM	230m^3	Stockpiled	-
	Mangahewa 27	WBM/SBM	280m^3	Stockpiled	-

2.3.1 Inspections

26 November 2018

During an inspection of the landfarming areas the following was noted. The spreading of drilling mud had occurred in paddock 87. On observation, muds were present across the spreading area. At the time no works had occurred to incorporate the muds into the land. The slope of the land was towards the perimeter drain on the northern side of the paddock. Rain had preceded the inspection, and storm water was running through the drilling muds and as a process entraining hydrocarbons which were then discharging to surface water, at the time of inspection.

A follow up phone call meeting was held with MI SWACO staff. It was outlined that the muds were spread the previous week, however, due to a mechanical failure they were not incorporated. It was communicated that staff were due to arrive on that day to undertake remedial works to bund and contain the run-off or incorporate the muds/hydrocarbons into the soil profile.

28 November 2018

In respect of the findings of the inspection undertaken two days prior, a follow up inspection was undertaken with the consent holder. This was to assess the degree of response to hydrocarbon run-off from paddock 87. The abatement notice EAC 22343 was hand delivered to the consent holder.

On observation remedial works had been undertaken. It was outlined that works had occurred in the afternoon of 26 November. A bulldozer blade had been used to create a bund around the drilling muds which were noted on the surface of the paddock. At the time no run-off was occurring, and no ponded water was present around the areas.

Discussions were then held regarding timeframes for mud incorporation. It was suggested to the consent holder that due to the nature of the material (synthetic based mud) that it should be incorporated as soon as possible. It was further communicated that rain was predicted to be prevalent the next week and while the muds remained on the surface the risk of hydrocarbons discharging into surface water was considered high.

Abatement notice EAC 22343 was issued.

ENF-21788 Infringement fine was issued.

Abatement notice EAC 22343 was complied with at the time of inspection.

21 March 2019

During an inspection the following was noted. The recent landfarming operations were inspected. Two adjacent paddocks had been worked and continue to be worked. It was observed that the muds had been very well incorporated and none were found at the surface. At the time areas were yet to be sown into pasture.

All adjacent drains appeared free of muds or hydrocarbons and no sediment run-off was found. The historical application areas held healthy looking pasture and no muds were found at the surface. No irrigation was occurring from the storage pits at the time of inspection and storage capacity was available within the lined pit.

2.3.2 Soil analysis

Five compliance soil samples were collected from three landfarmed paddocks (Figure 6) this period (paddock 86 and 87B and C). The reported analysis is provide in Table 16.

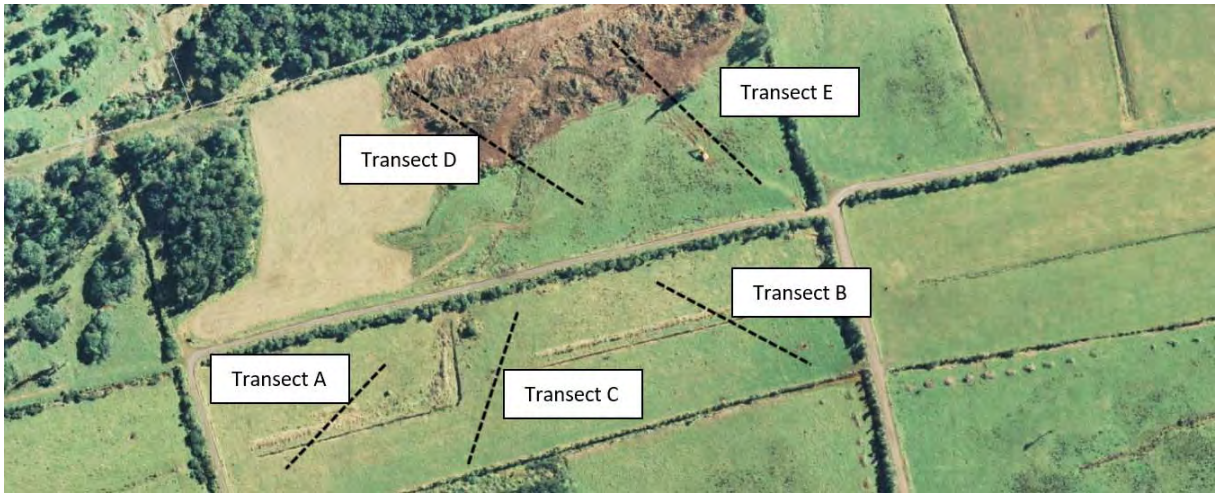

Figure 6 Soil samples transect locations Landspreading 2018-2019

Table 16 Landspreading soil analysis 2018-2019 monitoring period

Landspread soil 2018-2019	Location	Consent Surrender	Transect A P 86	Transect B P 86	Transect C P 86	Transect D P 87B	Transect E P 87C
Parameter	Unit/date	Limit 7591-1.2	28 Jun 2019	28 Jun 2019	28 Jun 2019	28 Jun 2019	28 Jun 2019
1-Methylnaphthalene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
2-Methylnaphthalene	mg/kg dry wt		< 0.016	0.021	< 0.015	< 0.015	< 0.015
Acenaphthene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Acenaphthylene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Anthracene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Benzo[a]anthracene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.027	< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt		< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt		< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Benzo[e]pyrene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Benzo[g,h,i]perylene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Benzo[k]fluoranthene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Fluoranthene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Fluorene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Dibenzo[a,h]anthracene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Chrysene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Naphthalene	mg/kg dry wt	7.2	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Perylene	mg/kg dry wt		0.078	0.062	< 0.015	0.049	0.027
Phenanthrene	mg/kg dry wt		< 0.016	< 0.015	< 0.015	< 0.015	0.018
Pyrene	mg/kg dry wt	160	< 0.016	< 0.015	< 0.015	< 0.015	< 0.015
Total of Reported PAHs in Soil	mg/kg dry wt		< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Benzene	mg/kg dry wt	1.1	< 0.08	< 0.07	< 0.07	< 0.07	< 0.07
Toluene	mg/kg dry wt	82	< 0.08	< 0.07	< 0.07	< 0.07	< 0.07
Ethylbenzene	mg/kg dry wt	59	< 0.08	< 0.07	< 0.07	< 0.07	< 0.07
m&p-Xylene	mg/kg dry wt	59	< 0.15	< 0.14	< 0.14	< 0.14	< 0.13
o-Xylene	mg/kg dry wt		< 0.08	< 0.07	< 0.07	< 0.07	< 0.07
Calcium (Sat Paste)	mg/L		250	120	209	482	1,263

Landspread soil 2018-2019	Location	Consent Surrender	Transect A P 86	Transect B P 86	Transect C P 86	Transect D P 87B	Transect E P 87C
Parameter	Unit/date	Limit 7591-1.2	28 Jun 2019	28 Jun 2019	28 Jun 2019	28 Jun 2019	28 Jun 2019
Magnesium (Sat Paste)	mg/L		15	13	13	28	42
Sodium (Sat Paste)	mg/L		68	42	63	140	313
Sodium Absorption Ratio (SAR)		8*	1.1	1	1.1	1.7	2.4
C_7-C_9	mg/kg dry wt	210	< 10	< 9	< 9	< 9	< 9
C_{10}-C_{14}	mg/kg dry wt	150	1,170	260	< 20	1,850	6,400
C_{15}-C_{36}	mg/kg dry wt	1,300	2,700	1,070	< 40	6,600	16,500
Total hydrocarbons (C_7-C_{36})	mg/kg dry wt	20,000*	3,900	1,340	< 70	8,500	**23,000**
Total Recoverable Barium	mg/kg dry wt	10,000*	3,100	1,570	3,400	5,200	4,900
Total Recoverable Calcium	mg/kg dry wt		7,100	5,800	10,300	11,800	22,000
Chloride	mg/kg dry wt	700	730	380	340	780	1,040
Conductivity from soluble salts	mS/cm		0.5	0.3	0.6	0.6	1.2
Total Recoverable Magnesium	mg/kg dry wt		1,650	1,030	2,700	1,950	2,700
Total Recoverable Potassium	mg/kg dry wt		1,730	930	1,790	1,270	1,360
Total Recoverable Sodium	mg/kg dry wt	460	650	760	620	760	750
Soluble Salts	g/100g dry wt	0.25	0.19	0.11	0.19	0.22	0.42
pH	pH Units		6.5	6	6.6	7.2	7.2
Dry Matter (Env)	g/100g as rcvd		62	68	67	67	68
Total Recoverable Arsenic	mg/kg dry wt	17*	2	< 2	3	3	3
Total Recoverable Cadmium	mg/kg dry wt	0.8*	< 0.10	< 0.10	< 0.10	< 0.10	0.12
Total Recoverable Chromium	mg/kg dry wt	600*	10	7	10	10	11
Total Recoverable Copper	mg/kg dry wt	100*	49	43	33	41	40
Total Recoverable Lead	mg/kg dry wt	160*	6.5	5.3	14.4	8.7	20
Total Recoverable Mercury	mg/kg dry wt	1*	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	60*	6	3	7	6	8
Total Recoverable Zinc	mg/kg dry wt	300*	39	35	41	42	46
*Denotes consent values which should not be exceeded							

The results of the five soil samples from the landspreading/ landfarming area indicated the following

- Polycyclic aromatic hydrocarbons (PAH) were found at trace levels in four of five soil samples. Of note all PAH results relevant to consent surrender criteria were below the laboratory limit of detection (LOD) in all five soil samples. The trace PAH detections were as follows:
    - 2-methylnapthelene with a value of 0.021 mg/kg in transect B (Paddock 86).

    - Perylene ranged from below the LOD (transect C, Paddock 86) to 0.078 mg/kg (transect C, also paddock 86).
    - Phenanthrene was recorded in one sample (transect C, Paddock 87C) with a trace value of 0.018 mg/kg.
- Results for Benzene, toluene, ethylbenzene and xylenes (m & p and O), collectively known as BTEX, were all below the LOD.
- Sodium absorption ratio (SAR) results were found to be low (range 1-2.4 SAR), well below the consented maximum which allows up to 8.
- Total petroleum hydrocarbons results (TPH) indicated the following:
    - C_7-C_9 results were below the LOD.
    - C_{10}-C_{14} results were measurable in four of five samples. Transect C was below the LOD, while the remaining four transects indicated a range of 260-6,400 mg/kg. The surrender concentration is set at 150 mg/kg. These four samples were above this value.
    - C_{15}-C_{36} results were measurable in four of five soil samples. Transect C was again below the LOD, while the four remaining transects indicated a range of values of 1,070-16,500 mg/kg. The value for surrender is set at 1,300 mg/kg, with two transects reporting values below this value.
    - C_7-C_{36} results, which represent the sum of all the TPH compounds compiled to gain one result, indicated that one sample (transect E, P87C) held a value in excess of the consent defined inclusion limit of 2% (note 2% TPH equates to 20,000 mg/kg). The value was 23,000 mg/kg which is a marginal exceedance of consent 7591-1.2, condition 16.
- Total recoverable (TR) barium results were measurable in all five soil samples. These values ranged from 1,570 mg/kg (transect B) through to 5,200 mg/kg (transect D). The consent limit of barium is set at 10,000 mg/kg and this limit must not be exceeded at any time during the landfarming process.
- TR calcium values ranged across all five samples from 5,800 mg/kg (transect B) through to 22,000 mg/kg (transect E).
- Chloride was recorded in all five samples, ranging from 340 mg/kg (transect C) through to 1,040 mg/kg (transect E). The limit at time of surrender is set at 700 mg/kg. Three samples were above this value, transects A, D and E.
- TR sodium recorded values in all five samples. The limit at time of surrender is set at 460 mg/kg. All five samples exceeded this value, ranging from 650 mg/kg-760 mg/kg.
- Soluble salt results indicated a range of values, 0.11 g/100g (transect B) through to 0.42 g/100g (transect E). The limit at time of surrender is set at 0.25 g/100g. One result (transect E) exceeding this value.
- Heavy metal analysis indicated no consent exceedance. The analysis indicated the following:
    - TR arsenic indicated trace concentrations in four of five samples, while the remaining transect did not record this element above the LOD (transect B). Transects A, C, D and E each recorded low values of 3 mg/kg.
    - TR cadmium values were below the LOD in four of five samples. Only Transect E indicated a value marginally above the LOD with a value of 0.12 mg/kg.
    - TR chromium results ranged steady across all five samples, ranging 7 mg/kg-11 mg/kg.
    - TR copper results were similar to the chromium in remaining quite steady across all samples, ranging from 33 mg/kg-49 mg/kg.
    - TR lead results ranged from 5.3 mg/kg (Transect B) through to 20 mg/kg (Transect E).
    - TR mercury results were below the LOD.
    - TR nickel results were stable across all samples, ranging from 3 mg/kg through to 8 mg/kg.
    - TR zinc results were also quite consistent across all five samples, ranging from 35 mg/kg through to 46 mg/kg.

2.3.3 Surface water sampling

Surface water sampling was undertaken in relation to the areas landfarmed during this monitoring period. In total, six surface water samples (Figure 7) were collected from unnamed tributaries and drains surrounding these landfarmed areas. The analysis of these six surface water samples is provided in Table 17.

Table 17 Landspreading surface water samples 2018-2019

Landspreading surface water 2018-2019	Site	SW 1 U/S P86	SW 2 P86	SW 3 P86	SW 4 P87B	SW 5 P87C	SW 6 D/S P87C
Parameter	**Collected**	**26 Jun 2019**	**26 Jun 2019**	**26 Jun 2019**	**26 Jun 2019**	**26 Jun 2019**	**26 Jun 2019**
Temperature	**°C**	10.2	10.2	9.8	13.8	10.4	10.4
Acid Soluble Barium	**g/m³**	< 0.11	< 0.11	< 0.11	0.17	< 0.11	< 0.11
Dissolved Barium	**g/m³**	0.025	0.042	0.062	0.093	0.038	0.047
Chloride	**g/m³**	4.4	17.1	15.1	16.9	10.9	10.3
Electrical Conductivity (EC)	**mS/m**	11.3	18.5	17.2	22.3	16.4	16
pH	**pH Units**	6.8	6.4	7	6.9	7.3	7.3
Total Dissolved Solids (TDS)	**g/m³**	95	149	140	170	134	135
Benzene	**g/m³**	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	**g/m³**	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	**g/m³**	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	**g/m³**	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	**g/m³**	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
C_7-C_9	**g/m³**	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
C_{10}-C_{14}	**g/m³**	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C_{15}-C_{36}	**g/m³**	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C_7-C_{36})	**g/m³**	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

The analysis provided in Table 17 indicated the following:

- No total petroleum hydrocarbon (TPH) results (all chains C_7-C_9, C_{10}-C_{14} and C_{15}-C_{36}) were reported above the limit of detection (LOD) across all six surface water samples.
- No benzene, toluene, ethylbenzene or xylenes (m & p and O) (BTEX) were recorded above the LOD, across all six surface water samples.
- Total dissolved solid/salt (TDS) concentrations ranged from 95 g/m³ (SW1) through to 170 g/m³ (SW4). Note that SW1 was collected upstream of the landfarmed areas. In comparison SW4 was collected from landfarmed paddock 87B from a surface water drain.
- pH of surface waters ranged from 6.4 pH (SW2, P86) through to 7.3 pH (SW5 and SW6). There was a slight increase in pH values as the surface water travelled down through the paddocks.
- Electrical conductivity values followed a similar theme to the TDS, with SW1 demonstrating a background concentration of 11.3 mS/m. SW4 held the highest value with a doubling in conductivity values when compared to SW1, with value of 22.3 mS/m.
- Chloride values ranged 4.4 g/m³ (SW1), through to 17.1 g/m³ (SW2, paddock 86).
- Dissolved barium results ranged from 0.025 g/m³ (SW1), through to 0.093 g/m³ (SW4, paddock 87 B).
- Acid soluble barium results indicated one result above the LOD this period, SW4 (paddock 87B) indicated a value marginally above the LOD with a value of 0.17 g/m³.

- Surface water temperatures ranged from 9.8°C (SW3, paddock 86) through to 13.8 °C (SW4, paddock 87B).

Overall, the analysis indicated that the landfarmed areas were having a minor impact on the surface waters on the date of sampling, with a slight increase in salinity observed across the length of these paddocks. Earlier in the monitoring (November 2018) period the Council inspector had identified material which had not been incorporated into the soil in paddock 87B. Stormwater was observed entraining muds and hydrocarbons to surface water.

An abatement notice had been issued to mitigate the issue, which was complied with on re-inspection two days later. An infringement fine was also issued.

Figure 7 Landspreading surface water monitoring locations 2018-2019 monitoring period

2.4 Water treatment sludge disposal

The consent holder holds water treatment sludge (WTS) which is lagooned at two locations on his property. These locations are situated on the Surrey Road. One of them is located within the site boundary of the Surrey Road stockpiling facility, as shown in Figure 8.

In the previous monitoring period the consent holder exercised their consent in relation to WTS which was held at the Derby Road stockpiling facility. The locations no longer discharge. The Council mainly assesses these areas through inspections, while inspecting the consent holder's wider landfarming areas. For more information on the Derby Road site WTS, please refer to Technical report 2018-41.

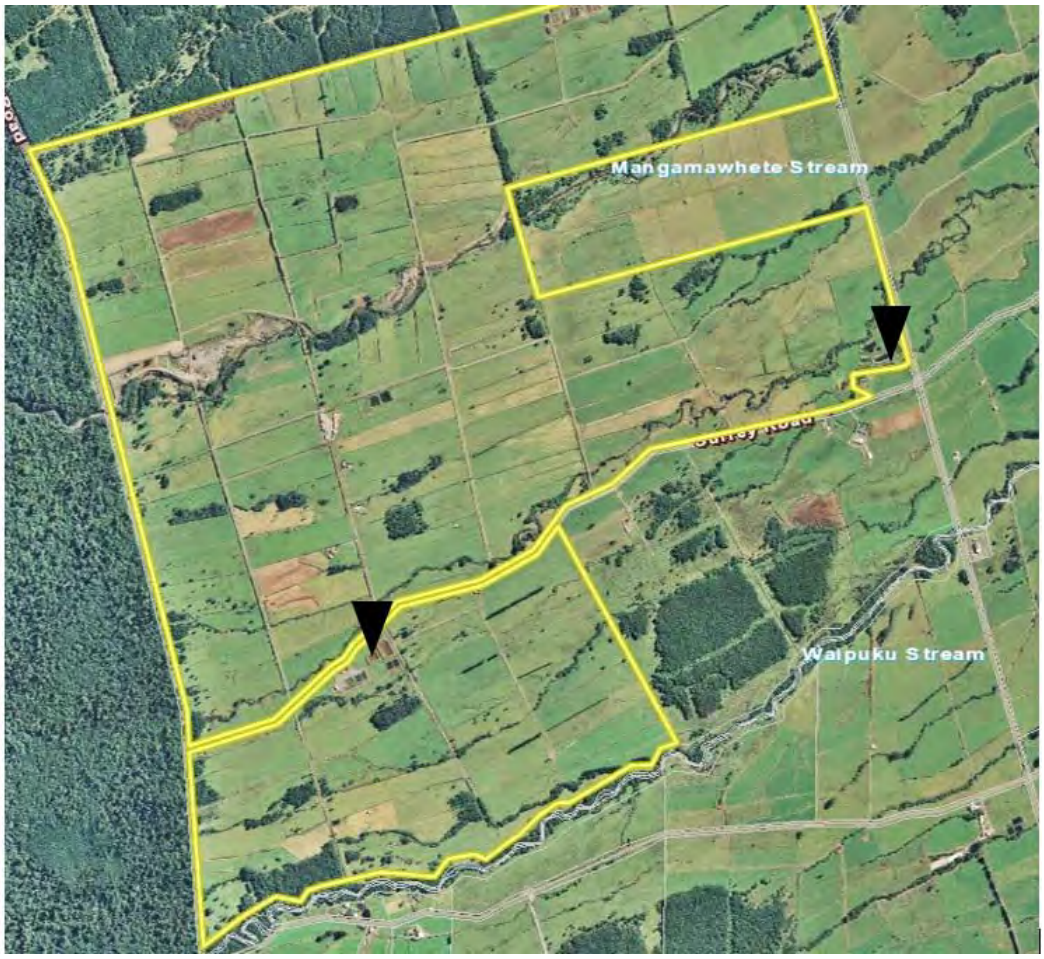

Figure 8 Location of the WTS storage locations on the consent holder's property

2.4.1 Inspections

1 October 2018

During an inspection the following was observed. No spreading works had occurred recently. The stockpiled muds remained stored at the land-farm storage pits and at the corner of Derby and Surrey Roads. All pits had plenty of available storage capacity for rain ingress and no discharges were occurring.

8 April 2019

During an inspection the following was observed. Pasture strike at the Derby Road spreading area was slow to establish. The sludge remains stockpiled in bunds at two locations. The material was essentially dry and cracked. No discharges from the storage pits were occurring.

2.5 Incidents, investigations, and interventions

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 consent holder. 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 18 below sets out details of any incidents recorded, additional investigations, or interventions required by the Council in relation to the consent holders activities during the 2018-2019 period. This table presents details of all events that required further investigation or intervention regardless of whether these were found to be compliant or not.

Table 18 Incidents, investigations, and interventions summary table

Date	Details	Compliant (Y/N)	Enforcement Action Taken?	Outcome
26 November 2018	During routine monitoring it was found that hydrocarbons were discharging from a landfarming area into a nearby waterbody. Muds had been spread on paddock 87B and had not been incorporated into the soil due to a mechanical failure. Stormwater, as a process of heavy rainfall, was entraining the muds which also contained hydrocarbons. This contaminated stormwater was observed to be discharging into nearby surface water. An abatement notice was issued requiring the discharge to cease.	No	Abatement notice and infringement notice issued	Re-inspection found that the abatement notice was being complied with. The pile of stockpiled material in paddock 87B was bunded and further discharges were mitigated. This area was landfarmed in December 2018. The operator who undertakes the landfarming on behalf of the consent holder indicated that post the incident, they had updated their procedures, to not stockpile material in landfarming areas. Material would be spread immediately after removal from stockpiling pits.
18 April 2019	During a routine compliance monitoring inspection the following was found. Contaminated stormwater was observed to be discharging from the lined storage pit (termed irrigation pit 4) into the stormwater ponds, and then into an unnamed tributary of the Mangatenghu Stream. Note this is proposed to be irrigated to land, rather than discharged to surface water. In addition, material excavated from pit 1 had been discharged into a storage pit which had a compromised pit liner (pit 3).	No	Infringement notice issued	Since the issuance of the infringement the consent holder had installed an automatic pump from pit 4. It is proposed that this will prevent any future occurrence. At the end of the monitoring period no works had been undertaken to mitigate the material discharged into the pit with the suspected compromised storage liner. It should be noted that the operator had inquired about their options which were provided by the Council 6 June 2019.

Date	Details	Compliant (Y/N)	Enforcement Action Taken?	Outcome
June 2019	Compliance soil sampling indicated that a landfarmed area (87C) had marginally exceeded a consent defined condition for maximum allowable TPH post soil inclusion. Consent 7591-1.2 condition 16 allows up to a maximum of 20,000 g/m^3 TPH (C_7-C_{36}). Reported was 23,000 g/m^3 C_7-C_{36}.	No	No	This a marginal exceedance with the direct result being that the area of land will take longer to remediate, which will mean monitoring will last longer.

3 Discussion

3.1 Discussion of site performance

Site performance will be discussed by facility.

Derby Road stockpiling facility

In the 2017-2018 monitoring period the site area, including the remaining residual drilling material which was contained within the storage pits, was landfarmed within the site boundary. Included in this landfarming exercise was water treatment sludge which was in a portion of the storage pits. Vegetation strike was observed to occur. It was patchy at best, with the consent holder communicating that additional seeding would be required.

In the current monitoring period vegetation strike continued to be patchy. The seeding exercise was unsuccessful and some top soil, including the grass seed, was lost due to stormwater erosion. This remains an item which will required to be rectified and the consent holder intends to continue with reseeding in the spring of 2019-2020.

The specific consent in relation to the Derby Road facility has been surrendered, though this area is now covered by the consent holder's main landspreading/ landfarming consent (7591-1.2). This consent dictates the requirement to establish pasture or crop cover, as well as specific soil related conditions. The parameters will continue to be monitored moving forward.

Surrey Road stockpiling facility

The Surrey Road stockpiling facility received material from four different well locations this period. Two shipments were landfarmed during the monitoring period. In this period the consent holder removed the storage pit liner from pit 1 and constructed a semi concreted pit which allowed for solids to be kept separate from the liquid component of the drilling waste. This marks a change from the previous construction materials, whereby pits were excavated and lined with synthetic materials such as a HDPE liner.

The HDPE construction method could fail if operators with heavy machinery punctured the liner when retrieving stored material. The proposed concrete method is aimed at enabling operators an easier method of retrieving the material. It is also expected to be harder wearing than the HDPE method, as over time empty HDPE-lined pits may be subject to wind erosion and tear or inflate in places, which would render them ineffective at holding fluid without leakage.

Through the construction of the new pit 1, two portions now exist, a solid side (termed pit 1) and a liquid side (termed pit 2). The material excavated from the former pit 1 was discharged into pit 3. Pit 3 was noted during the inspections to be likely permeable, as it was torn in places. The operator was informed of this and specifically reminded that pits utilised for holding material must do so in a manner which prevents leakages. The operator is still considering options for this material. Landfarming the material is an option, though the operator communicated that landfarming in the winter months was not achievable. Thus storage appears to be the option taken.

The forth pit, which is termed the irrigation pit, collects stormwater from all three storage pits. Historically this would discharge into the stormwater system and then to the unnamed tributary of the Mangatengehu Stream. This process was modified to prevent this occurrence in the 2014-2015 monitoring period, as the biological monitoring indicated a decline in species richness and abundance as a consequence of the discharge. To mitigate this, a pump was installed to the irrigation pit and this was pumped to a specific irrigation paddock on the other side of the unnamed tributary. During an inspection (April 2019) pit 4 was noted to be discharging to the stormwater system. In addition the associated irrigator was also observed to be lying on its side, inoperative. The operators were issued with an infringement fine for this action.

Post the incident the operator installed an automatic pump to the irrigation pond to prevent future occurrences.

Notifications as required by the consent including requisite analyses were supplied by the operator this period, this included the annual report information. Material from two other well-sites remains in storage at the Surrey Road stockpiling facility and these will be landfarmed in the upcoming monitoring period.

Landspreading

Three areas were landfarmed this monitoring period. Paddocks 86, 87B and 87C were utilised. These activities were undertaken in two separate farming operations (November 2018 and March 2019). In addition, paddock 47 will continue to be utilised to dispose of the fluid/ stormwater component of the storage pits by irrigator.

One on occasion (November 2018) an inspection identified synthetic based mud had been stockpiled in paddock 87B, this material was due to spread and farmed, but due to equipment failure, this was not possible. On observation of this stockpile, the inspector noted that rainwater/ stormwater had flowed through the stockpiled material and in doing so had entrained drilling material, including hydrocarbons which then discharged into a nearby farm drain and surface water.

An abatement notice and infringement fine were issued for this occurrence. On re-inspection the abatement notice had been complied with. The area had been bunded prior to farming, which was undertaken once the equipment had been repaired (December 2018). It was also communicated by the operator that since this incident the company procedures were updated to not allow stockpiling prior to landfarming in a paddock area. All future material will be spread immediately once removed from the storage pits.

The second farming exercise (March 2019) was inspected by the Council officer and it was noted that the material had been well incorporated into the soil with minimal material noted present at the soil surface. Historical spreading areas were also observed and found to be stable with good pasture cover. However, this does not include the former Derby Road site which was discussed earlier in this section.

Water treatment sludge (WTS) disposal

WTS remained lagooned at two locations on the consent holder's property. These are located on the corner of Surrey Road and Derby Road and also within the Surrey Road stockpiling facility. Both current WTS locations were regularly inspected during the monitoring period, however there is not a great deal to report until they have been incorporated into land. Noting there is no time frame for the consent holder to undertake the land incorporation.

3.2 Environmental effects of exercise of consents

Derby Road stockpiling facility

The analysis of the soils from the former Derby site (Section 2.1.3.3) reported elevated petroleum hydrocarbons within the soil structure. The range of 1,050-20,000 mg/kg reported for TPH C_7-C_{36}, indicated this area will be remediating for a long period of time prior to being considered acceptable for surrender. Noted in the soil survey was the application thickness which was greater than 100 mm. This will result in a longer residence time for the petroleum related compounds to remediate. The Council will continue to monitor this area until surrender concentrations defined within the consent are met. Vegetation cover, as previous discussed, will also be a main consideration for the upcoming monitoring period.

Overall, the results of the biomonitoring surveys provide no evidence of any recent significant detrimental effects on the macroinvertebrate communities of the unnamed tributary of the Mangamawhete Stream.

Surrey Road stockpiling facility

Petroleum hydrocarbons continue to be detected at monitoring location GND2517. This site is the exit from the nova flow which flows from under the storage pits. The range reported this period (<0.7 g/m^3-4.9 g/m^3) was lower than the previous monitoring period (<0.7 g/m^3-24 g/m^3), though still detectable in three of four sampling rounds. While the concentration of TPH may be lower, the corresponding TDS concentration showed some significant increases (138 g/m^3-277 g/m^3 2017-2018, through to 137 g/m^3-2,300 g/m^3 2018-2019). A similar increase in the highest concentrations was also noted in the chloride analyses.

Acid soluble barium from this monitoring location also recorded a significant result, with the March 2019 result (5.8 g/m^3) the most elevated result in this data set to date (2015-2019). It should also be noted that the results on the more elevated side were reported in the final two monitoring rounds of the monitoring period.

The nova flow drain discharges into the stormwater system, which after a three pond treatment system, discharges into an unnamed tributary of the Mangatengehu Stream. The analysis of the corresponding discharge location did not identify any petroleum related impacts in the four monitoring rounds undertaken this period. Of note, was an increase in the conductivity of the discharge, which effectively doubled in concentration in the final two monitoring rounds when compared to the previous two rounds. Chloride values were observed to double in the surface water, post the discharge, when comparing the upstream site with the downstream site across the last two rounds.

Assessment of site performance, as described in the above section, coupled with a review of enforcement action did identify two actions which were undertaken on the site this period. The first was the modification of pit 1 to a concrete pit, whereby the excavated materials were discharged into a reportedly compromised storage pit liner (pit 3). This may have contributed to the increased salt impacts of barium, TDS and chloride recorded in the nova flow (GND2517).

The second was the observed overflow of the irrigation pond to the stormwater system, in disregard of the normal procedure which is to irrigate to pasture. This would have contributed to the increased cations and anions reported in the discharge. The corresponding surface water analysis did detect an increase between upstream and downstream sites, which as defined by consent 7559-1.4, condition 8 is a technical breech. The differences were not necessarily excessive. However, the consented process (consent 7591-1.2, condition 1 b and 11) is this contaminated stormwater should be irrigated to pasture and the operators should give effect to this, as it is a known issue. This has been observed in previous monitoring periods, since the 2014-2015 period.

The bio-monitoring did indicate a decrease in MCI below the discharge at sites 3 and 4. This was particularly evident in the early spring monitoring and less so in the late summer survey. The use of the pump to irrigate the stormwater from the pits was proposed to prevent this occurrence. This is further discussed in TRC Technical Report 2017-10, which is referenced.

Landspreading

Effects associated with landfarming this monitoring period were identified as follows:

Surface water impacts were observed by the inspecting officer during the November 2018 inspection. As previously stated, material was stockpiled in paddock 87B and then stormwater entrained the stockpiled material and as a process discharged diluted portions to surface water. This was recorded as an illegal discharge of contaminants to surface water and the operators were issued an abatement notice to cease the discharge. This was immediately complied with, with the area bunded and the discharged stopped. They were also issued an infringement fine.

Routine compliance surface water sampling of the area, undertaken in June 2019, did identify slight increases in conductivity and salinity along the length of the spreading area. However, these values returned close to background concentrations below the downstream extent of these areas.

Soil sampling in relation to the landfarmed areas did indicate that paddock 87C held a value of TPH C_7-C_{36} in excess of the 2% TPH (20,000 mg/kg) post inclusion soil concentration limit.

This is a technical breach of the proposed incorporation condition (consent 7591-1.2, condition 16) which states that material once farmed to a depth of 250 mm bgl should not exceed 2% TPH. The rationale for the 2% TPH, post inclusion limit, is to reduce the time required for the area to remediate and to ensure effective biodegradation commences immediately.

Water treatment sludge disposal (WTS)

The two lagooned areas which hold WTS no longer discharge to the receiving waters. They remained lagooned this period, as in the previous monitoring period. This is a process of dewatering by evaporation. These areas will be further reported on when they are finally spread on land.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 19-24.

Table 19 Summary of performance for consent 6900-2

Purpose: ***To discharge drilling waste (consisting of drilling cuttings and drilling fluids from water based muds and synthetic based muds), onto and into land for the purpose of temporary stockpiling prior to disposal***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adoption of the best practicable option	Inspection, sampling and liaison with consent holder	Yes
2. Notify TRC 48 hours prior receiving waste onto site for stockpiling	No material received in relation to this consent, though notification to spread the final consolidated material was given	Yes
3. Records to be kept by consent holder and made available to the Council	Records received in the previous monitoring period when stockpiling	Not applicable in this period as no new material has been received since 2012
4. Consent holder to report to Council by 31 August each year on records specified in condition 3	No report received	N/A
5. No discharge within 25 m of surface water or property boundaries	Inspection	Yes
6. Stockpiled material to be landspread under consent 7591-1 within 12 months of arrival on site	Inspection and consent holders records	Residual material finally spread in 2017-2018
7. Total dissolved solids in any fresh water body not to exceed 2,500 g/m^3	Monitoring of groundwater	Yes
8. No contamination of groundwater or surface water to exceed background concentrations	Sampling	Yes Groundwater and long term surface

Purpose: *To discharge drilling waste (consisting of drilling cuttings and drilling fluids from water based muds and synthetic based muds), onto and into land for the purpose of temporary stockpiling prior to disposal*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
		water indicated minimal impacts
9. Concentrations in soil to be met prior to expiry	Monitoring indicated concentrations still elevated	This consent has now been surrendered January 2019 Soil concentration analysis covered under 7591-1.2
10. Consent may not be surrendered until compliance with SC9	Landfarmed area now covered under consent 7591-1.2	Soil concentration analysis covered under 7591-1.2
11. Optional review provision re environmental effects	Not to be undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent Overall assessment of administrative performance in respect of this consent		**Good** **High** **Note: Consent surrendered January 2019**

Table 20 Summary of performance for consent 7911-1

Purpose: *To discharge stormwater from a drilling waste storage site into an unnamed tributary of the Mangawhete Stream in the Waitara River*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adoption of the best practicable option	Inspection and liaison with consent holder	Yes
2. Stormwater discharged shall be from a catchment area not exceeding 1.5 hectares	Inspection and liaison with consent holder	Yes
3. Discharges shall meet the following: • pH 6.0-9.0 • Suspended solids • <100 g/m^3 • Total recoverable hydrocarbons <15 g/m^3	Sampling	N/A The final pond was observed to be collecting rainwater Inspection indicated a clear discharge, no samples collected as long term monitoring indicated minimal effects on

Purpose: *To discharge stormwater from a drilling waste storage site into an unnamed tributary of the Mangawhete Stream in the Waitara River*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
		parameters of interest Site closed in 2013
4. 25m downstream of the initial discharge point, discharges shall not exceed: BOD5 <2 g/m^3 Chloride <50 g/m^3	Inspections	N/A Long term surface water sampling indicated no reasons for concern. Site closed 2013
5. After allowing for reasonable mixing, within a mixing zone extending 25 metres downstream of the discharge point, the discharge shall not, either by itself or in combination with other discharges, give rise to any or all of the following effects in the receiving water: • 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.	Inspections	Yes Inspections and long term sampling of area indicated no causes for concern No significant issues reported in biomonitoring
6. Consent holder shall maintain a contingency plan	Inspection and liaison with consent holder	Yes
7. Optional review provision re environmental effects	Next option for review in June 2015	N/A
Overall assessment of environmental performance and compliance in respect of this consent Overall assessment of administrative compliance in respect of this consent		**High** **High** **Note: Consent surrendered January 2019**

Table 21 Summary of performance for consent 7559-1.4

Purpose: *To discharge drilling wastes [consisting of drilling cuttings and drilling fluids] from hydrocarbon exploration activities with WBM and SBM onto and into land for the purpose of storage prior to disposal*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Shall adopt best practicable option	Inspections	No Stormwater pit discharging into drain and not pumped to paddock as defined in consent Irrigator observed lying on side and discharging across paddock Excavated former storage pit material discharged into compromised liner Infringement fine issued
2. Install fit for purpose high grade synthetic liners for storage pits	Inspections	Yes New pit/ pit 1 liner constructed of concrete with solid and liquid divider No Pit 3 observed to be compromised Infringement issued
3. Notify Council 48 hours prior to stockpiling wastes	Notification provided	Yes
4. Limited to wastes generated in Taranaki including the offshore region	Review of delivery records	Yes
5. No hydraulic fracturing fluids contained within wastes	Review of delivery records	Yes
6. Volume of material stored shall not exceed 4,000 m^3 at any one time	Review of delivery records and annual report documentation	Yes
7. All material spread under consent 7591 within a 12 month period	Inspections indicated material landfarmed within 12 months	Yes Current stored material will be required to be landfarmed within the next 12 months

Purpose: *To discharge drilling wastes [consisting of drilling cuttings and drilling fluids] from hydrocarbon exploration activities with WBM and SBM onto and into land for the purpose of storage prior to disposal*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
8. No contamination of groundwater or surface water to exceed background concentrations	Groundwater and surface water monitoring	No Monitoring of GND2517 indicated petroleum hydrocarbons and elevated total dissolved salts/solids Surface water discharge monitoring indicated an increase in TDS downstream of discharge when compared to upstream of 27 g/m^3 May 2019
9. Consent holder shall keep records of the waste from each well including the following. • Specific analysis • Storage commencement • Monitoring details, locations, methods	Records kept	Yes
10. The consent holder shall provide a report each year which includes information as per condition 9	Letter report provided	Yes
11. Review condition	Not required	N/A
Overall assessment of environmental performance and compliance in respect of this consent Overall assessment of administrative performance in respect of this consent		**Improvement required** **Good**

Table 22 Summary of performance for consent 7591-1.2

Purpose: *To discharge drilling waste from hydrocarbon exploration activities onto and into land via landspreading*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Landfarming/ landspreading definition	N/A	N/A

Purpose: *To discharge drilling waste from hydrocarbon exploration activities onto and into land via landspreading*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
2. Adoption of the best practicable option	Inspection identified issue	No Landfarming material stockpiled in paddock 87B and due to equipment failure was left for a period of time Stormwater entrained hydrocarbons and mud and egressed into surface water Abatement notice issued Infringement issued
3. Prior to the exercise of this consent a management plan must be submitted	Plan submitted November 2009	Yes
4. Notify Council 48 hours prior to landspreading/ landfarming	Notifications to Council	Yes
5. Limited to wastes generated in Taranaki including the Taranaki basin	Consent holder's records	Yes
6. No hydraulic fracturing material in waste discharged	Consent holder's records	Yes
7. Consent authorises landfarming/ landspreading as per appendix I of consent	Consent holder's records	Yes
8. Waste application layer shall not exceed: • 100 mm for TPH content of <50,000 mg/kg • 50 mm for TPH >50,000 mg/kg • In a rate and manner where no ponded liquids remain	Inspections and soil sampling	Former Derby Road site contains a waste layer greater than 100 mm, though concentration less than 5% TPH, mixed with water treatment sludge Other landfarming areas close to 100 mm Consent holder to comply with application thickness moving forward

Purpose: *To discharge drilling waste from hydrocarbon exploration activities onto and into land via landspreading*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
9. The exercise of this consent shall not results in chloride exceeding 800 kg/ ha	Consent holder records	Not calculated in year under review
10. Nitrogen loading shall not exceed 1,000 kg/Ha over any five year period	Consent holder records	Not calculated in year under review
11. Landspreading of liquid faction or the stormwater component of the storage pits shall be undertaken through a landspreader, injection spreader or irrigator	Inspection	No Irrigation of stormwater component of the storage pits not undertaken by consent holder on one occasion
12. Areas where any discharge has occurred may receive future applications if the following conditions are met: 17, 19, 20, 21	Inspections indicated no areas reused in the year under review	Yes
13. Areas landfarmed must be re-sown into pasture or crop as soon as practicable. If not achieved within two months additional measure must be undertaken	Inspections	Former Derby Road site experiencing re-vegetation issues and reseeding is on-going Other recently landfarmed areas developing vegetation Old landfarming areas hold good pasture
14. No waste shall be applied within: • 12 m of boundaries • 12 m of named streams • 6 m of other water courses	Inspections	No Stockpiled material discharged into surface water Abatement notice and infringement notice issued
15. Liquid wastes which may flow overland shall not be discharged within 25 m of boundaries or water courses	Inspection	No Stockpiled material discharged into surface water Abatement notice and infringement notice issued

Purpose: *To discharge drilling waste from hydrocarbon exploration activities onto and into land via landspreading*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
16. Post application the material must be incorporated to a depth of 100 mm and the TPH concentration must be below 2% TPH	Inspections and sampling	No paddock 87C held TPH concentration of 23,000 mg/kg (>2%)
17. After March 2027 constituents in the soil at any depth less than 500mm shall meet the following standards • prior to areas being reused for disposal • at the time of expiry/canpitation/surrender	Inspections and sampling	Not required at present
18. The consent may not be surrendered unless the standards specified in condition 17 are met		Not required at present
19. Concentration of metals in soil must comply with set guidelines	Sampling	Yes
20. Conductivity must be less than 400 mS/m. If background soil conductivity greater than 400 mS/m, then waste application shall not increase conductivity by more than 100 mS/m	Sampling	Yes
21. Sodium absorption ratio [SAR] must be less than 8. If background soil SAR is greater than 8, then waste application shall not increase SAR by more than 1	Sampling	Yes
22. Total dissolved solids in surface water or groundwater shall not exceed 2,500 g/m^3	Sampling	Yes
23. No contamination of groundwater or surface water to exceed background concentrations	Sampling	No Surface water impact associated with stockpiled material discharging to surface water through stormwater from paddock 87B and Surrey Road stockpiling facility irrigation pump not working on one occasion leading to entrainment in stormwater system

Purpose: *To discharge drilling waste from hydrocarbon exploration activities onto and into land via landspreading*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
24. Records to be kept by consent holder and made available to the Council	Records provided on request	Yes
25. Consent holder to report to Council by 31 August each year on records specified in condition 24	Letter report provided though late 23/09/2019	Yes
26. Optional review provision re environmental effects	Not required	N/A
Overall assessment of environmental performance and compliance in respect of this consent		**Poor**
Overall assessment of administrative performance in respect of this consent		**Good**

Table 23 Summary of performance for consent 5821-2

Purpose*: To discharge sludge and other residuals from water treatment plants in the New Plymouth and South Taranaki districts onto and into the land*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adoption of best practicable option	Inspection	Yes
2. Exercise undertaken in accordance with application	Inspection and monitoring	Yes
3. Notification to be provided prior to exercise of consent	Notification provided	Yes
4. Notification 48 hours prior to undertaking disposal of sludge to site	No deliveries in period under review	Yes
5. Sludge to be spread as per application	Inspection	Yes
6. Ensure sludge stockpiles areas adequately bunded and no discharge of leachate to any water course	Inspection indicated no discharge at either of the two current storage sites	Yes
7. No discharge of sludge to land within 25 meters of any water course, including farm drains	Inspection. Derby Road site spread with landfarming material 2017-2018 monitoring period	Yes
8. Shall not exceed a total aluminium concentration of 55 µg/L within specific stream, farm drains or water course	Monitoring not required, no discharge	N/A
9. No area of land stripped for application may exceed 40 acres	Inspection	Yes

Purpose: *To discharge sludge and other residuals from water treatment plants in the New Plymouth and South Taranaki districts onto and into the land*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
10. Post application, the area of land must be contoured and sown into pasture	Inspection indicated contouring and pasture strike	Yes
11. Exercise of consent shall not result in contamination of groundwater/ surface water or change in suitability of the water source	Monitoring and inspection	Yes
12. The exercise of consent shall not result in effects in surface water	No discharge to receiving waters in year under review	Yes
13. Is a lapse condition	Not applicable, consent in effect	N/A
14. Is a review condition	Not required at present	N/A
Overall assessment of environmental performance and compliance in respect of this consent Overall assessment of administrative compliance in respect of this consent		**High** **High**

Table 24 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2013-2014	6900-2	1			
	7911-1		1		
	7559-1			1	
	7591-1	N/A			
2014-2015	6900-2	1			
	7911-1	1			
	7559-1		1		
	7591-1.1	1			
2015-2016	6900-2	1			
	7911-1	1			
	7559-1.3		1		
	7591-1.1		1		
2016-2017	6900-2	1			
	7911-1		1		
	7559-1.3			1	
	7591-1.1		1		
2018-2019	6900-2		1		

Year	Consent no	High	Good	Improvement req	Poor
	7911-1	1			
	7559-1.3			1	
	7591-1.1				1
	5821-2	1			
Totals		9	8	3	

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

3.4 Recommendations from the 2017-2018 Annual Report

In the 2017-2018 Annual Report, it was recommended:

1. THAT, monitoring of consented activities at Derby Road stockpiling facility in the 2018-2019 year continue at the same level as in 2017-2018.
2. THAT, monitoring of consented activities at Surrey Road stockpiling facility in the 2018-2019 year continue at the same level as in 2017-2018, with provision for quarterly surface water analysis.
3. THAT, monitoring of consented activities for landspreading/ landfarming in the 2018-2019 year continue at the same level as in 2017-2018, with the provision for an increase in the number of soil samples to account for historical paddocks and surrender analysis.
4. THAT, monitoring of consented activities for water treatment sludge disposal in the 2018-2019 year continue at the same level as in 2017-2018.
5. THAT, should there be issues with environmental or administrative performance in 2018-2019, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.
6. THAT the option for a review of resource consents in June 2019, as set out in condition 20 of the 7591-1.1 and condition 27 of 7559-1.3 not be exercised, on the grounds that conditions on both consents are fit for purpose.

Recommendation 1 was partially implemented due the consent holder surrendering the specific Derby Road stockpiling facility consents of 6900-2 and 7911-1. This occurred in January 2019. The area is now covered by the consent holders other consent 7591-1.2.

Recommendation 2 was implemented.

Recommendation 3 was partially implemented, as monitoring continued as per the previous monitoring period, the council is preparing a monitoring programme to assess previously landfarmed paddocks, which now number 60.

Recommendation 4 was implemented.

Recommendation 5 was implemented with the investigating officer identifying consent breaches in this period.

Recommendation 6 was not required.

3.5 Alterations to monitoring programmes for 2019-2020

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

- the extent of information already made available through monitoring or other means to date;

- its relevance under the RMA;
- the Council's obligations to monitor consented activities and their effects under the RMA;
- the record of administrative and environmental performances of the consent holder; and
- reporting to the regional community.

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

It is proposed that for 2019-2020 monitoring period:

- The specific consent monitoring of Derby Road stockpiling facility 6900-2 and 7911-1 will cease as these consents were surrendered in January 2019. The land area covered by the consent holder's other consent 7591-1.2 and the conditions of this consent must be met prior to the area being excluded from consent 7591-1.2.
- The monitoring of Surrey Road stockpiling facility will continue as per the 2018-2019 monitoring period.
- The monitoring of landspreading /landfarming will continue as per the 2018-2019 monitoring period. A proposal will be drawn up to begin the assessment of previously landfarmed areas on the consent holder's property. This will begin the assessment of these areas for surrender potential.
- The monitoring of the water treatment sludge storage areas will continue as per the 2018-2019 monitoring period until these areas have been re-instated to land.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the sites 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 2019-2020.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities at Derby Road stockpiling facility will cease due to the specific consents being surrendered. Compliance soil sampling will be covered under the landspreading consent 7591-1.2 in the 2019-2020 monitoring period.
2. THAT monitoring of Surrey Road stockpiling facility will continue as per the 2018-2019 monitoring period.
3. THAT monitoring of landspreading /landfarming will continue as per the 2018-2019 monitoring period. A proposal will be drawn up to begin the assessment of previously landfarmed areas on the consent holder's property. This will begin the assessment of these areas for surrender potential.
4. THAT monitoring of the water treatment sludge storage areas will continue as per the 2018-2019 monitoring period until these area have been re-instated to land.
5. THAT should there be issues with environmental or administrative performance in 2019-2020, 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.
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 µS/cm or mS/m.
Cu*	Copper.
Cumec	A volumetric measure of flow- 1 cubic metre per second (1 m^3s^{-1}).
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
$g/m^2/day$	grams/$metre^2$/day.
g/m^3	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually been determined.
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.
mS/m	Milliesiemens per meter.
µS/cm	Microsiemens per centimetre.
NH_4	Ammonium, normally expressed in terms of the mass of nitrogen (N).
NH_3	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
NO_3	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
Pb*	Lead.
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	*Resource Management Act 1991* and 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.
Zn*	Zinc.

*an abbreviation for a metal or other analyte may be followed by the letters 'As', to denote the amount of metal recoverable in acidic conditions. This is taken as indicating the total amount of metal that might be solubilised under extreme environmental conditions. The abbreviation may alternatively be followed by the letter 'D', denoting the amount of the metal present in dissolved form rather than in particulate or solid form.

For further information on analytical methods, contact a Science Services Manager.

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Appendix I

Resource consents held by CD Boyd

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

Consent number	Purpose	Granted	Review	Expires
7911-1	To discharge stormwater from a drilling waste storage site into an unnamed tributary of the Mangamawhete Stream, in the Waitara catchment.	27 Sep 2011	June 2021	1 June 2027
6900-2	To discharge drilling wastes onto and into land for the purpose of stockpiling prior to disposal.	16 Feb 2011	June 2021	1 June 2027
7559-1.3	To discharge drilling waste cuttings from hydrocarbon exploration activities with water based muds and synthetic based muds onto and into land via landfarming and landspreading, injection spreading and irrigation.	20 Nov 2009	June 2019	1 June 2027
7591-1.1	To discharge drilling waste from hydrocarbon exploration activities onto and into land via landspreading.	21 Jan 2010	June 2019	1 June 2027
5821-2.2	To discharge sludge and other residuals from water treatment plants in the New Plymouth and South Taranaki Districts' onto and into land	14 Dec 2005	June 2021	1 June 2026

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:	New Plymouth District Council Private Bag 2025 NEW PLYMOUTH 4342
Decision Date [Change]:	30 May 2011
Commencement Date [Change]:	30 May 2011 [Granted: 14 December 2005]

Conditions of Consent

Consent Granted:	To discharge sludge and other residuals from water treatment plants in the New Plymouth District onto and into land at or about (NZTM) 1701925E-5652253N
Expiry Date:	1 June 2026
Review Date(s):	June 2009, June 2015, June 2021
Site Location:	Surrey Road, Inglewood [Property owner: C Boyd]
Legal Description:	Secs 9, 10 & Pt Sec 13 Blk XII Egmont SD Lot 2 DP 344156 Blk XII Egmont SD Secs 17 & 18 Blk XVI Egmont SD [Discharge sites]
Catchment:	Waitara
Tributary:	Mangamawhete Mangatengehu Waipuku

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

General conditions

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

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

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

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

Special conditions

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

2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of applications 4067 and 6784. In the case of any contradiction between the documentation submitted in support of application 4067 and 6784, and the conditions of this consent, the conditions of this consent shall prevail.

3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least seven days prior to the exercise of this consent.

4. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to the transportation of the sludge to the disposal site, and again at least 48 hours prior to beginning the actual disposal operation.

5. The sludge shall only be spread in the areas specified in application 4067 and 6784.

6. The consent holder shall ensure that sludge stockpiles are adequately bunded to ensure that there is no stormwater or leachate runoff to any surface watercourse, including farm drains.

7. The sludge shall not be deposited within 25 metres of the Mangamawhete Stream, the Mangatengehu Stream or the Waipuku Stream, or within 10 metres of any open drain or other watercourse.

8. The exercise of the consent shall not result in a total aluminium concentration exceeding 55ug/L in the Mangamawhete Stream, the Mangatengehu Stream or the Waipuku Stream or any open drain or watercourse including farm drains.

9. The area of bare land, stripped for receipt of the residuals, exposed at any particular time shall not exceed 40 acres.

10. As soon as practicable following discharge and incorporation, the discharge area shall be contoured and sown into pasture.

11. The exercise of this consent shall not result in any adverse impacts on groundwater as a result of leaching, or on surface water including aquatic ecosystems, and/or result in a change to the suitability of use of the receiving water as determined by the Chief Executive, Taranaki Regional Council.

12. The exercise of this consent shall not result in any of the following effects on surface water:

    a) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended material;
    b) Any conspicuous change in the colour or visual clarity
    c) Any emission of objectionable odour;
    d) The rendering of freshwater unsuitable for consumption by farm animals;
    e) Any significant adverse effects on aquatic life.

13. This consent shall lapse on the expiry of five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

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 2009 and/or June 2015 and/or June 2021, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 30 May 2011

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:	Colin David Boyd P O Box 44 INGLEWOOD 4347
Decision Date:	16 February 2011
Commencement Date:	16 February 2011

Conditions of Consent

Consent Granted:	To discharge drilling wastes [consisting of drilling cuttings and drilling fluids from water based muds and synthetic based muds], onto and into land for the purpose of temporary stockpiling prior to disposal at or about (NZTM) 1702545E-5653650N
Expiry Date:	1 June 2027
Review Date(s):	June 2015, June 2021
Site Location:	Derby Road North, Inglewood
Legal Description:	Lot 2 DP 344156 [Discharge site]
Catchment:	Waitara
Tributary:	Manganui Mangamawhete

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 [the Council] all the administration, monitoring and supervision costs of this consent, fixed in accordance to section 36 of the Resource Management Act.

Special conditions

1. The consent holder shall adopt the best practicable option [as defined section 2 of the Resource Management Act 1991] to prevent or minimise any actual or potential effects on the environment arising from the discharge.

Notifications, monitoring and reporting

2. The consent holder shall notify the Chief Executive, Taranaki Regional Council, [by emailing worknotification@trc.govt.nz.] at least 48 hours prior to permitting drilling wastes onto the site for stockpiling, from each well drilled. Notification shall include the following information:

    a) the consent number;
    b) the name of the well[s] from which the waste was generated;
    c) the type of waste to be stockpiled; and
    d) the volume of waste to be stockpiled.

3. The consent holder shall keep records of the following:

    a) wastes from each individual well;
    b) composition of wastes [including concentrations of chloride, nitrogen and total petroleum hydrocarbons];
    c) stockpiling area[s];
    d) volumes and weights of material stockpiled;
    e) dates of commencement and completion of stockpiling events;
    f) the results of analysis;

    and shall make the records available to the Chief Executive, Taranaki Regional Council.

4. The consent holder shall provide to the Chief Executive, Taranaki Regional Council, by 31 August of each year, a report on all records required to be kept in accordance with condition 3, for the period of the previous 12 months, 1 July to 30 June.

Operational requirements

5. There shall be no discharge of drilling waste to land, within 25 metres of surface water or of property boundaries.

6. All material must be spread on to land in accordance with consent 7591-1 as soon as practicable, but no later than twelve months after being brought onto the site.

Receiving environment limits - water

7. The exercise of this consent shall not result in the concentration of total dissolved salts in any fresh water body exceeding 2500 g/m^3.

8. Other than as provided for in condition 7, the exercise of this consent shall not result in any contaminant concentration, within surface water or groundwater, which after reasonable mixing, exceeds the background concentration for that particular contaminant.

Receiving environment limits - soil

9. From 1 March 2027 [three months prior to the consent expiry date], constituents in the soil of previously landfarmed areas shall not exceed the standards shown in the following table:

Constituent	Standard
conductivity	290 mS/m
chloride	700 mg/kg
sodium	460 mg/kg
total soluble salts	2500 mg/kg
MAHs PAHs TPH	Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand [Ministry for the Environment, 1999]. Tables 4.12 and 4.15, for soil type sand.

MAHs - benzene, toluene, ethylbenzene, xylenes
PAHs - napthalene, non-carc. [pyrene], benzo(a)pyrene eq.
TPH - total petroleum hydrocarbons [C_7-C_9, C_{10}-C_{14}, C_{15}-C_{36}]

The requirement to meet these standards shall not apply if, before 1 March 2027, the consent holder applies for a new consent to replace this consent when it expires.

10. This consent may not be surrendered at any time until the standards in condition 9 have been met.

Review

11. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2015 and/or June 2021, 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 16 February 2011

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:	Colin David Boyd PO Box 44 Inglewood 4347	
Decision Date (Change):	20 December 2018	
Commencement Date (Change):	20 December 2018	(Granted Date: 20 November 2009)

Conditions of Consent

Consent Granted:	To discharge drilling wastes (consisting of drilling cuttings and drilling fluids) from hydrocarbon exploration activities with water based muds and synthetic based muds, onto and into land for the purpose of storage prior to disposal
Expiry Date:	1 June 2027
Review Date(s):	June 2019, June 2025
Site Location:	Surrey Road, Inglewood
Grid Reference (NZTM)	1701847E-5651476N & 1701850E-5651480N
Catchment:	Waitara
Tributary:	Manganui Mangamawhete Mangatengehu

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.

2. All waste shall be stored in pits that are lined with 'fit for purpose' high-grade synthetic liner or equivalent and the consent holder shall demonstrate, that the lined pits are suitable for storing liquid without leakage through the base or side walls. The consent holder shall monitor the integrity of the pit liners and repair or replace liners as required.

Notification and sampling requirements prior to discharge

3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing worknotification@trc.govt.nz) at least 48 hours prior to bringing wastes onto the site. Notification shall include the following information:

    a. the consent number;
    b. the name of the well(s) from which the waste was generated;
    c. the type of waste; and
    d. the volume of waste.

Discharge limits

4. Subject to condition 5, the exercise of this consent is limited to waste generated in the Taranaki region, including from outside the 12 nautical mile maritime limit within the Taranaki Basin.

5. Waste brought to the site shall not contain any hydraulic fracturing fluids.

6. The volume of material stored on the site shall not exceed 4000 m^3 at any one time.

7. All material must be spread onto land in accordance with consent 7591 as soon as practicable, but no later than 12 months after being brought onto the site.

Receiving environment limits for water

8. The exercise of this consent shall not result in any contaminant concentration, within surface water or groundwater, which after reasonable mixing, exceeds the background concentration for that particular contaminant.

Monitoring and reporting

9. The consent holder shall keep records of the wastes from each individual well, including:

    a) composition of wastes, including concentrations of Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), Salts (Barium, Calcium, Chloride, Magnesium, Sodium, Potassium), Hydrocarbons (Total Petroleum Hydrocarbons, Mono Cyclic Aromatic Hydrocarbons and Poly Cyclic Aromatic Hydrocarbons) and Nitrogen;
    b) dates of commencement of storage;
    c) details of monitoring, including sampling locations, sampling methods and the results of analysis;

    and shall make the records available to the Chief Executive, Taranaki Regional Council on request.

10. The consent holder shall provide to the Chief Executive, Taranaki Regional Council, by 31 August of each year, a report on all records required to be kept in accordance with condition 9, for the period of the previous 1 July to 30 June.

Review

11. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2019 and/or June 2025, 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 20 December 2018

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director - Resource Management

Discharge Permit

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

Name of Consent Holder:	Surrey Road Landfarms Limited PO Box 44 Inglewood 4347	
Decision Date (Change):	20 December 2018	
Commencement Date (Change):	20 December 2018	(Granted Date: 21 January 2010)

Conditions of Consent

Consent Granted:	To discharge drilling waste cuttings (consisting of drilling cuttings and drilling fluids) from hydrocarbon exploration activities with water based muds and synthetic based muds onto and into the land via landfarming, landspreading, injection spreading and irrigation
Expiry Date:	1 June 2027
Review Date(s):	June 2019, June 2025
Site Location:	Surrey Road, Inglewood
Grid Reference (NZTM)	1701750E-5652370N & 1701750E-5652370N
Catchment:	Waitara
Tributary:	Manganui Mangawmawhete Mangatengehu Waipuku

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

General condition

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

Special conditions

1. For the purposes of this consent the following definitions shall apply:
    a. landfarming means the discharge of drilling wastes from vehicles, tanks, or other containers onto and into land, with spreading, or incorporation into the soil as soon as practicable; and
    b. landspreading means the discharge to land of the liquid fraction of drilling wastes. This includes the stormwater component of the storage cells through the use of a landspreader and/or irrigator and/or injection spreader. Throughout the application of the liquid fraction the consent holder shall maintain pasture cover at all times.

2. 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. For the purpose of this consent, the best practicable option will include undertaking the landfarming/landspreading/injection spreading of drilling waste during extended periods of dry weather.

3. Prior to the exercise of this consent, the consent holder shall provide, to the written satisfaction of the Chief Executive, Taranaki Regional Council, a landfarming management plan to demonstrate the activity will be conducted to comply with all of the conditions of this consent. The management plan shall be reviewed annually and shall include as a minimum:
    a) control of site access;
    b) procedures for notification to Council of disposal activities;
    c) procedures for the receipt and stockpiling of drilling wastes onto the site;
    d) procedures for the management of stormwater recovered from, or discharging from, the drilling waste stockpiling area;
    e) methods used for the mixing and testing of different waste types;
    f) procedures for landfarming drilling wastes (including means of transfer from stockpiling area, means of spreading, and incorporation into the soil);
    g) contingency procedures;
    h) sampling regime and methodology; and
    i) post-landfarming management, monitoring and sites reinstatement.

4. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing worknotification@trc.govt.nz) at least 48 hours prior to landfarming/landspreading/injection spreading waste from each separate storage cell. Notification shall include the following information:

   a) the consent number;
   b) the name of the well(s) from which the waste was generated;
   c) the type of waste to be applied;
   d) the volume of waste to be applied;
   e) the specific concentrations of Metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), Salts (Barium, Calcium, Chloride, Magnesium, Sodium, Potassium). Hydrocarbons (Total Petroleum Hydrocarbons, Mono Cyclic Aromatic Hydrocarbons and Poly Cyclic Aromatic Hydrocarbons) and Nitrogen in the waste prior application to land;
   f) the specific location and area over which the waste will be applied; and
   g) the method of application.

   In order to demonstrate compliance with conditions 8, 9, 10, 11, 16, 19, 20, and 21 of this consent.

5. Subject to condition 6, the exercise of this consent is limited to waste generated in the Taranaki Region, and from outside the 12 nautical mile maritime limit, within the Taranaki Basin.

6. Waste discharged shall not contain any hydraulic fracturing fluids.

7. This consent authorises the application of material to land only within the area indicated on the attached map (Appendix 1).

Discharge limits

8. For the purposes of landfarming, wastes shall be applied to land in a layer not exceeding:

   a) 100 mm thick for wastes with a hydrocarbon concentration less than 50,000 mg/kg dry weight; or
   b) 50 mm thick for wastes with a hydrocarbon concentration equal to or greater than 50,000 mg/kg dry weight; and
   c) in a rate and manner such that no ponded liquids remain after one hour, for all wastes.

9. The exercise of this consent shall not result in a chloride loading exceeding 800 kg/ha.

10. The nitrogen loading (including that from any application of nitrogen fertiliser) over any area where drilling wastes are applied, shall not exceed 1000 kilograms per hectare over any 5 year period.

11. Landspreading of liquid fraction of drilling wastes and or stormwater component of the storage cells shall be undertaken through the use of a landspreader or injection spreader or irrigator. Throughout the application of the liquid fraction the consent holder shall maintain pasture cover at all times.

12. The areas where any discharge has occurred may receive future applications of material only if they meet the standards defined by conditions 17, 19, 20, 21 of this consent.

13. As soon as practicable following the landfarming of wastes the discharge area shall be re-sown into pasture (or into crop). If revegetation cannot be established within two months of the discharge, the consent holder shall undertake appropriate land stabilisation measures to minimise wind and/or stormwater erosion.

14. No waste shall be discharged within:

    a) 12 metre(s) of property boundaries; or
    b) 12 metre(s) of the Mangamawhete, Mangatengehu and Waipuku Streams; or
    c) 6 metre(s) of any other surface water course (including farm drains).

15. Any liquid drilling waste which may flow over land, shall not be discharged within 25 metre(s) of property boundaries or surface water courses (including farm drains).

Receiving environment limits for soil

16. As soon as practicable following the application of drilling wastes to land, the consent holder shall incorporate the material into the soil to a depth of at least 250 mm for landfarming and 100 mm for the injection spreader, so that the hydrocarbon concentration at any point in the soil/waste mix is equal to or less than 20,000 mg/kg (2%) dry weight at any point.

17. After 1 March 2027 (three months before the consent expiry date), constituents in the soil at any depth less than 500 mm shall meet the standards shown in the following table:

Constituent	Standard
Conductivity	Not greater than 290 mS/m
Chloride	Not greater than 700 mg/kg
Sodium	Not greater than 460 mg/kg
Total Soluble Salts	Not greater than 2500 mg/kg
TPH Fraction	Guideline Value Agricultural Ecological Direct Soil Contact (Fine Sand) From table 5.2
F1 (C6-C10)	210
F2 (>C10-C16)	150
F3 (>C16-C34)	1300
F4 (>C34)	5600
Canadian Council of Ministers of the Environment (CCME), in the document Canada Wide Standard for Petroleum Hydrocarbons (PHC) in Soil: Scientific Rationale, 2008. Table 5.2	
Soil Type/ Contaminant	Depth of contamination
	Surface (<1m) (mg/kg)
SANDY Silt	
MAHs	
Benzene	1.1
Toluene	82
Ethylbenzene	59
Xylene	59
PAHs	
Naphthalene	7.2
Non-carc (Pyrene)	160
Benzo(a)pyrene	0.027
Table 4.12 SANDY SILT Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE 1999)	

The requirement to meet these standards shall not apply if, before 1 March 2027, the consent holder applies for a new consent to replace this consent when it expires, and that the application is not subsequently withdrawn. These conditions also apply:

a) prior to drilling wastes being discharged onto an area that has previously been used for the disposal of drilling wastes; and
b) at the time of expiry, cancellation, or surrender of this consent.

18. This consent may not be surrendered unless the standards specified in condition 17 have been met.

19. The concentration of metals and salts in the soil layer containing discharged material shall comply with the following criteria:

Metal/ Salt	Maximum value (mg/kg)
Arsenic [1]	17
Barium – Barite [2]	10,000
Cadmium [1]	0.8
Chromium [3]	600
Copper [3]	100
Lead [1]	160
Nickel [3]	60
Mercury	1
Zinc [3]	300
[1]SCS – Rural Residential MfE 2011b; [2] Alberta Environment 2009; [3] NZWWA 2003, lowest of protection of human health and ecological receptors. (Biosolids to land)	

20. The conductivity of the soil layer containing discharged material shall be less than 400 mS/m, or alternatively, if the background soil conductivity exceeds 400 mS/m, the application of waste shall not increase the soil conductivity by more than 100 mS/m.

21. After incorporation of the waste within the soil, the sodium absorption ratio (SAR) of the waste soil mix shall not be more than 3 units higher than background soil SAR, or exceed a SAR of 8. Alternatively if the soil SAR exceeds 8, the application of the waste shall not increase the SAR by more than 1.

Receiving environment limits for water

22. The exercise of this consent shall not result in a level of total dissolved salts within any surface water or groundwater of more than 2500 g/m^3.

23. The exercise of this consent shall not result in any contaminant concentration, within surface water or groundwater, which exceeds the background concentration for that particular contaminant, as determined by the Chief Executive, Taranaki Regional Council.

Monitoring and reporting

24. For all waste discharged, the consent holder shall keep records of the following:

    a) the source i.e. the well from which it originated;
    b) composition of wastes, as analysed in condition (4 e);
    c) application areas, including a map showing individual disposal areas with GPS co-ordinates;
    d) volume of wastes applied;
    e) dates of commencement and completion of application events;
    f) details of monitoring, including sampling locations, sampling methods and the results of analysis;

    and shall make the records available to the Chief Executive, Taranaki Regional Council on request.

25. The consent holder shall provide to the Chief Executive, Taranaki Regional Council, by 31 August of each year, a report on all records required to be kept in accordance with condition 24, for the period of the previous 1 July to 30 June.

Lapse and review

26. 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 2016 and/or June 2017 and/or June 2018 and/or June 2019 and/or June 2025 for the purpose of ensuring that the conditions area 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, or to take into account any Act of Parliament, regulations, national policy statement, and national environmental standard which is relevant to this consent.

Signed at Stratford on 20 December 2018

For and on behalf of
Taranaki Regional Council

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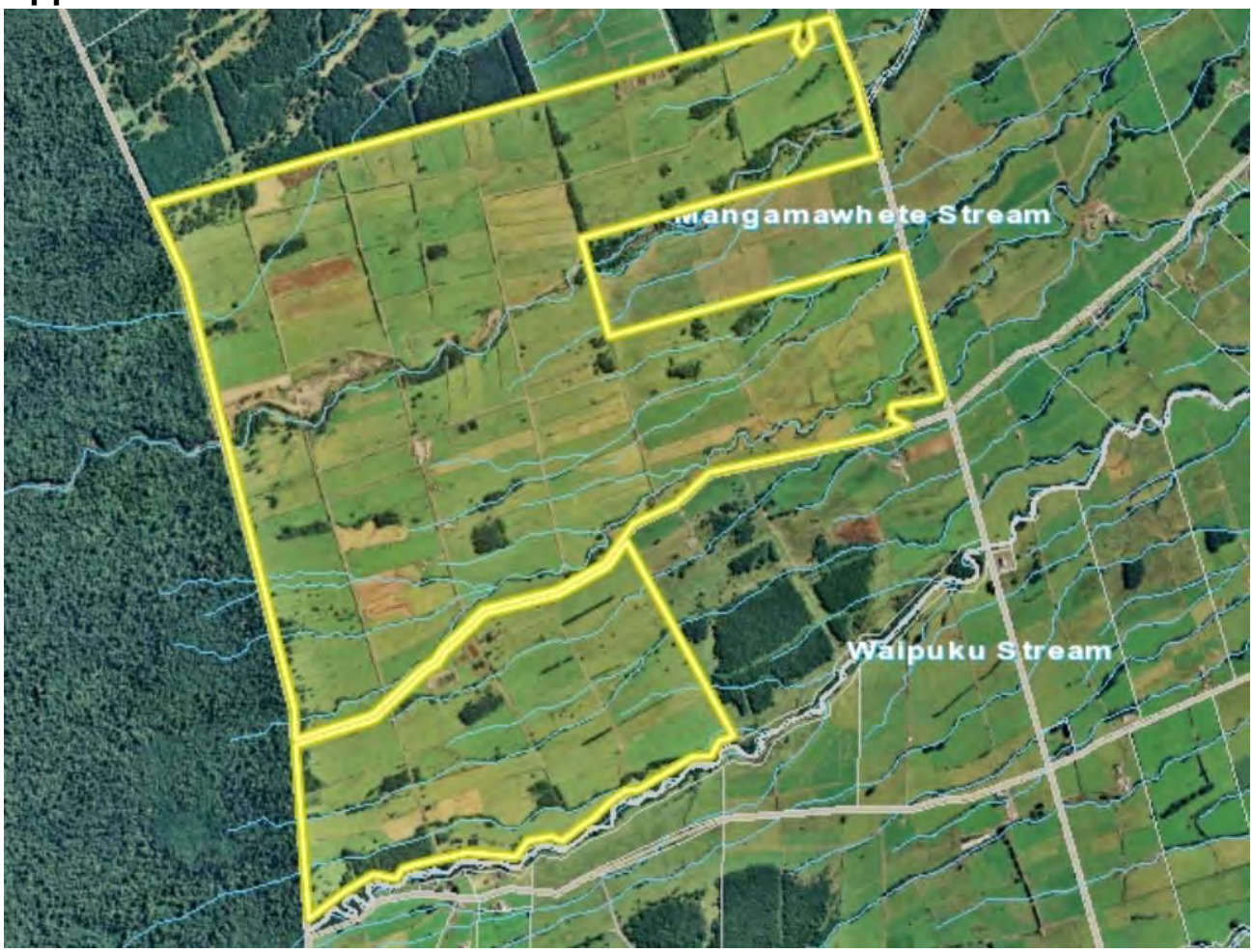
A D McLay
Director - Resource Management

Appendix 1



Discharge Permit

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

Name of Consent Holder:	Colin David Boyd P O Box 44 INGLEWOOD 4347
Decision Date:	27 September 2011
Commencement Date:	27 September 2011

Conditions of Consent

Consent Granted:	To discharge stormwater from a drilling waste storage site into an unnamed tributary of the Mangamawhete Stream in the Waitara River at or about (NZTM) 1702717E-5653665N
Expiry Date:	1 June 2027
Review Date(s):	June 2013, June 2015, June 2021
Site Location:	Derby Road North, Inglewood
Legal Description:	Lot 2 DP 344156 [Discharge source & site]
Catchment:	Waitara
Tributary:	Manganui Mangamawhete

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

General condition

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

Special conditions

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

2. The stormwater discharged shall be from a catchment area not exceeding 1.5 hectares.

3. 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 recoverable 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.

4. After allowing for reasonable mixing, within a mixing zone extending twenty five metres downstream of the discharge point to the unnamed tributary of the Mangamawhete Stream, the discharge shall not, either by itself or in combination with other discharges, cause the following:

   a) the carbonaceous filtered biochemical oxygen demand [BOD_5] to exceed 2 gm^{-3}, or
   b) the chloride concentration to exceed 50 gm^{-3}.

5. After allowing for reasonable mixing, within a mixing zone extending twenty five metres downstream of the discharge point, the discharge shall not, either by itself or in combination with other discharges, give rise to any or all of the following effects in the receiving water:

   a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
   b) any conspicuous change in the colour or visual clarity;
   c) any emission of objectionable odour;
   d) the rendering of fresh water unsuitable for consumption by farm animals;
   e) any significant adverse effects on aquatic life.

6. The consent holder shall maintain a contingency plan. The contingency plan shall be adhered to in the event of a spill or emergency and shall, to the satisfaction of the Chief Executive, Taranaki Regional Council, detail measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not authorised by this consent and measures to avoid, remedy or mitigate the environmental effects of such a spillage or discharge.

7. 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 2015 and/or June 2021, 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 27 September 2011

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Appendix II

MI SWACO Annual Report Letter
2018-2019 Monitoring Period

Nathan Crook

From: Ruka Te Moana <RTeMoana@miswaco.slb.com>
Sent: Monday, 23 September 2019 10:48 AM
To: Nathan Crook
Cc: Nigel Black; Laura Fagg; Katrina Corbett; Richard Taylor; Marcus Jesen
Subject: TRC Annual Summary 7559-1.4 and 7591-1.2 Surrey Road Land Farm 2018-2019

Importance: High

Good morning Nathan,

Please see the summary of activity at Surrey Road from July 2018 to July 2019:

OPERATOR	WELL	TYPE		VOLUME	DATE SPREAD	PADDOCK
AWE LTD	Kohatukai 1	WBM / SBM		1200m3	Dec 2018	#87A, #87B, #87C
TODD ENERGY	Mangahewa 25	WBM / SBM		450m3	Feb 2019	#86
	Mangahewa 26	WBM		230m3	Stockpiled	
	Mangahewa 27	WBM		280m3	Stockpiled	

Non-Compliance 26th November 2018:
Stockpiled SBM cuttings on paddock prior to spreading. The digger broke down. The heavy rain caused SBM contaminated water to flow into adjacent drains on the paddock.
Our procedures were updated immediately to ensure that there would be NO STOCKPILING of drilled cuttings on any of the paddocks. All cuttings will be spread immediately once transported out of the stockpiling pits..

Non-Compliance Notice 8th April 2019:
Heavy rain caused the stormwater irrigation pond to overflow into the adjacent drain. Dis-coloured rainwater seen discharging into the drain.
We have installed an automatic, float start, irrigation pump which prevents the pit from overflowing and ensures that all water is irrigated.

Please let me know if you have any further questions from your end in terms of your annual report.

Regards,

Ruka Te Moana
M-I SWACO Project Engineer / CEC
Schlumberger NZ
rtemoana@slb.com
+64 274370998