

BTW Company Limited
Oeo Landfarm
Monitoring Programme
Annual Report
2014-2015

Technical Report 2015-97

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Executive summary

BTW Company Limited (hereafter the Company) operates a drilling waste disposal site located on South Road at Manaia. The site was operational from September 2012 to November 2013, when synthetic and water-based muds and rock cuttings were disposed of to land via the process of landfarming. Activity at the site ceased at the beginning of 2013, when available spreading area capacity was reached in the main area of the site, and the decision was made not to farm the smaller area east of the Rawa Stream. This report for the period July 2014 to June 2015, describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental performance during the period under review, and the results and environmental effects of the Company's activities.

The Company holds one resource consent, which includes a total of 23 conditions setting out the requirements that they must satisfy. This consent allows the Company to discharge drilling material onto and into land at this site.

During the monitoring period, the Company demonstrated an overall good level of environmental performance.

The Council's monitoring programme for the year under review included eight inspections, 17 water samples collected for physicochemical analysis, and six composited soil samples, in addition to a review of monitoring data provided by the Company.

The monitoring showed that the Company was able to manage the site as to ensure that there were limited measurable environmental effects as a result of the exercise of this consent. Soil sampling indicated that levels of contaminants of concern in the receiving soils were degraded towards background conditions in the majority of areas on the site. Surface water in the Rawa Stream was unaffected by site operations, however there still remain trace levels of hydrocarbons and elevated salinity in one of the groundwater monitoring bores, although these are showing a reducing trend. Site management, data supply, and reporting were all to a high standard. There were some ongoing minor environmental effects including difficulty establishing pasture on one of the spread areas, but the Company is working closely with the landowner to address this. As a result, the Company were able to demonstrate a good level of environmental performance and a high level of administrative performance with resource consents. There were no Unauthorised Incidents (UIs) recording non-compliance in respect of this consent holder during the period under review.

For reference, in the 2014-2015 year, 75% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 22% demonstrated a good level of environmental performance and compliance with their consents.

This report includes recommendations for the 2015-2016 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 2014-June 2015 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by BTW Company Limited (the Company). The Company operates a drilling material landfarm situated on South Road at Manaia (Oeo Landfarm).

The Oeo Landfarm site became operational in the 2012-2013 monitoring year; during which there were eight disposals of approximately 4,278 m³ of water/synthetic-based cuttings and fluid over a combined area of approximately 61,047 m². Operations at the site ceased in the 2013-2014 monitoring year, and the decision was made to not utilise the remaining small area available to spread to the east of the Rawa Stream. The Company and the Council will continue to monitor this site until surrender criteria are met and the resource consent may be surrendered.

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. The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consent held by the Company, to discharge drilling material onto and into land via landfarming. This is the third Annual Report to be prepared by the Council to cover the Company's discharges and their effects at this site.

1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about compliance monitoring under the RMA and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consent held by the Company, 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.

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 2015-2016 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);
- (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 consent holder during the period under review, this report also assigns a rating as to the Company’s environmental and administrative performance.

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

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

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

Environmental Performance

- **High:** No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving significant 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 in response to unauthorised incident reports, 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 in response to unauthorised incident reports. 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 in response to unauthorised incident reports. 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 2014-2015 year, 75% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 22% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Process description

1.2.1 Drilling waste

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

Drilling fluids

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 polycyclic 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.

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.

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.

1.2.2 Landfarming

The landfarming process has typically been used in the Taranaki region to assist the conversion of sandy coastal sites prone to erosion into productive pasture. Results of an independent research project conducted by AgKnowledge Ltd (2013) have indicated that the re-contoured sand dunes, after the inclusion of the drilling wastes (as per the consents), and with the addition of appropriate fertilisers and water (irrigation) are capable of producing high quality clover-based pastures and thus increasing the value of the land from about \$3-4,000/ha to \$30-40,000/ha (2013).

Landfarming uses natural and assisted bioremediation to reduce the concentration of petroleum compounds through degradation. The basic steps in the landfarming process are:

1. Drilling waste is transported from wellsites by truck (cuttings) or tanker (liquids). It may be discharged directly to land or placed in a dedicated storage pit.
2. The required area is prepared by scraping back and stockpiling existing pasture/topsoil and leveling 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 leveled 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.

The landfarming process utilised at the Oeo Landfarm was on a single application basis. This meant that dedicated spreading areas received only a single application of material. When disposal was complete, the area was reinstated and monitored until consent surrender criteria had been met.

1.3 Site location and description

The Company operates Oeo landfarm, situated off South Road, Manaia, identified in Figure 1. The consented site consists of two land parcels totalling 13.8 ha of available spreading area. The site is located on privately owned marginal coastal land situated on reworked dune fields. The predominant soil type has been identified as black loamy sand, and vegetation growth is primarily a mixture of pasture and dune grasses. Average annual rainfall for the site is 1,122 mm (taken from the nearby Glenn Road monitoring station). Two significant surface water bodies run adjacent to the spreading areas. The Waimate Stream flanks the north-western side of the main western site, whilst the Rawa Stream runs adjacent to the north-western side of the smaller eastern site. The Waimate Stream in the immediate vicinity of the site is essentially ephemeral and only flows during periods of prolonged wet weather. Prior to landfarming, the site had suffered from extensive dune ablation, visible in Figure 1. Basic subsurface soil stratigraphy is provided in Table 1.

Site data

Location

Word descriptor:	South Road, Manaia, Taranaki
Map reference:	E 1684821
(NZTM)	N 5621560
Mean annual rainfall:	1,122 mm
Mean annual soil temperature:	~26.2°C
Mean annual soil moisture:	~15.88%
Elevation:	~25 m asl
Geomorphic position:	Cliff / dune backslope
Erosion / deposition:	Erosion
Vegetation:	Pasture, dune grasses
Parent material:	Aeolian deposit
Drainage class:	Free / well draining
Previous Land use:	Dry stock grazing

Table 1 Bore construction data

Bore	Depth (m)	Drilling Formation
GND2286	0.00 – 0.50	Sandy topsoil
	0.50 – 2.00	Soft sandy clay
	2.00 – 10.00	Soft tephra
GND2287	0.00 – 0.50	Sandy topsoil
	0.50 – 3.00	Soft sandy clay
	3.00 – 10.50	Tephra
GND2288	0.00 – 0.50	Sandy topsoil
	0.50 – 2.50	Sandy soft clay
	2.50 – 10.00	Tephra
GND2350	0.00 – 0.50	Sandy topsoil
	0.50 – 3.50	Sandy clay
	3.50 – 5.00	Conglomerated sand, small gravels, hard
	5.00 – 7.50	Sandy clay
	7.50 – 8.50	Sandy clay, firm
	8.50 – 9.00	Solid rock
	9.00 – 10.50	Conglomerated sand, small gravels, firm



Figure 1 Aerial photograph showing the location and extent of the Oeo Landfarm and approximate regional location (inset)



Photo 1 Oeo Landfarm, western side, August 2015

1.4 Resource consents

1.4.1 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.

The Company holds discharge consent 7613-1, to discharge drilling wastes (consisting of drilling cuttings and fluids) from hydrocarbon exploration activities with water based muds and synthetic based muds, onto and into land via landfarming. This consent was issued by the Council on 23 March 2010 as a resource consent under Section 87(e) of the RMA. It is due to expire on 1 June 2024.

Condition 1 sets out definitions.

Condition 2 requires the consent holder to adopt the best practicable option to minimise any environmental effects.

Conditions 3 and 4 require notification and the provision of information and analytical data prior to receipt of wastes on site for stockpiling, and prior to discharge.

Condition 5 and 6 require the notification and the provision of information and analytical data, of which will be made available to the Council via report annually.

Conditions 7 to 9 stipulate the manner and dispersal of wastes, while condition 10 requires a buffer zone between areas of disposal and surface water bodies and site boundaries.

Conditions 11 to 13 specify further site management requirements.

Conditions 14 to 20 specify receiving environment limits for both soil and water.

Condition 21 concerns archaeological remains.

Conditions 22 and 23 concern lapse provisions and consent reviews.

The permit is attached to this report in Appendix I.

1.5 Monitoring programme

1.5.1 Introduction

Section 35 of the RMA sets out obligations upon the Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region and report upon these.

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 Oeo Landfarm site consisted of four primary components.

1.5.2 Programme liaison and management

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

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

1.5.3 Site inspections

A single scheduled inspection was made of the site during the monitoring period, with regard to the consents for the discharge of drilling waste. Seven further inspections were conducted at the site during chemical sampling runs. Inspections focused on the following aspects:

- observable and/or ongoing effects upon soil and groundwater quality associated with the land disposal process
- effective incorporation of material, application rates and associated earthworks;
- integrity and management of storage facilities;
- dust and odour effects in proximity of the site boundaries
- housekeeping and site management and;
- the neighbourhood was surveyed for environmental effects.

1.5.4 Chemical sampling

During the monitoring period the Council collected six composite soil samples from the Oeo Landfarm site. The samples were analysed for chloride, conductivity, hydrocarbons, pH, sodium absorption ratio (SAR) and total soluble salts.

During the monitoring period, three of the four monitoring wells were each sampled four times, with the remaining well sampled three times. Samples were analysed for pH, temperature, conductivity, chloride, total dissolved solids, sodium, barium, TPH and BTEX.

The Rawa Stream was sampled twice at two sites (upstream and downstream) for standard surface water quality parameters and hydrocarbons.

1.5.5 Review of analytical results

The Council reviewed soil and surface water sampling results and the annual report provided by the Company on 4 August 2015. The Company collected receiving environment soil samples from the spreading area with the highest remaining soil contaminant concentrations. These samples were sent to an independent IANZ accredited laboratory for analysis for a wider range of contaminants. Chemical parameters tested were:

- pH
- chlorides
- potassium
- sodium
- total nitrogen
- barium
- heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg)
- BTEX
- PAHs
- TPH (and individual hydrocarbon fractions C7-C9, C10-C14, C15-C36)
- electrical conductivity
- sodium absorption ratio (SAR)
- total soluble salts (TSS)

2. Results

2.1 Water

2.1.1 Inspections

27 August 2014

An inspection was conducted in conjunction with groundwater sampling. The site remained inactive and had good pasture establishment, although a few barren patches were still evident.

16 September 2014

No recent disposal activities had occurred, and no pits were present at the site. Pasture cover across historic spreading areas was complete except for a few low points. A small patch of drilling mud was present at the soil surface in the south western (most recent) spreading area. Pondered rainwater around the area was clear and free of hydrocarbon sheen. Drilling muds were identifiable within the soil profile within test pits that were dug. No recent grazing had occurred.

15 October 2014

A site inspection was conducted in conjunction with soil sampling. Composite soil samples were taken from transects in spreading areas F2 and F3. Spreading area F3 had extensive barren patches amongst the pasture, these were very consolidated and difficult to penetrate with sampling equipment below 150 mm depth. Some drilling muds were visible in the cores.

19 November 2014

An inspection was conducted in conjunction with soil and surface water sampling. The site remained inactive. A soil transect was taken through spreading area F3, and large barren patches within this area were observed to have abundant drilling mud in cores.

17 December 2014

An inspection was conducted in conjunction with groundwater sampling while the landowner was onsite at the time. Pasture establishment was good, with no sign of recent grazing. One of the groundwater bores was unable to be accessed as the bore lid was jammed.

2 March 2015

A site inspection was carried out in conjunction with soil sampling. The site was inactive, and pasture was very dry due to drought conditions. The ground was very dry and difficult to penetrate with sampling equipment. Spreading areas F4 and F6 were sampled, with drilling mud present in some cores from the F4 transect. No odour was encountered in the samples.

10 March 2015

An inspection was conducted in conjunction with groundwater sampling. One of the bores had been damaged and was in need of repair.

13 May 2015

A site inspection was conducted in conjunction with groundwater sampling. Slight odour and foaming was apparent in samples from two of the four bores. The site was inactive, with no recent activity or sign of stock access. Pasture establishment over most

of the spreading areas was good, although there were some barren patches with poor pasture establishment present in the SW corner of the site.



Photo 2 View of spreading area F3 with patchy revegetation, August 2015

2.2 Results of discharge monitoring

There have been no new discharges at the site since it was decommissioned in the 2013/2014 monitoring period. Historical records of volumes and locations of material landfarmed are provided in the annual report supplied by the Company in Appendix II.

Ongoing monitoring continues to measure the receiving environment for potential adverse effects as a result of historical discharges at the site.

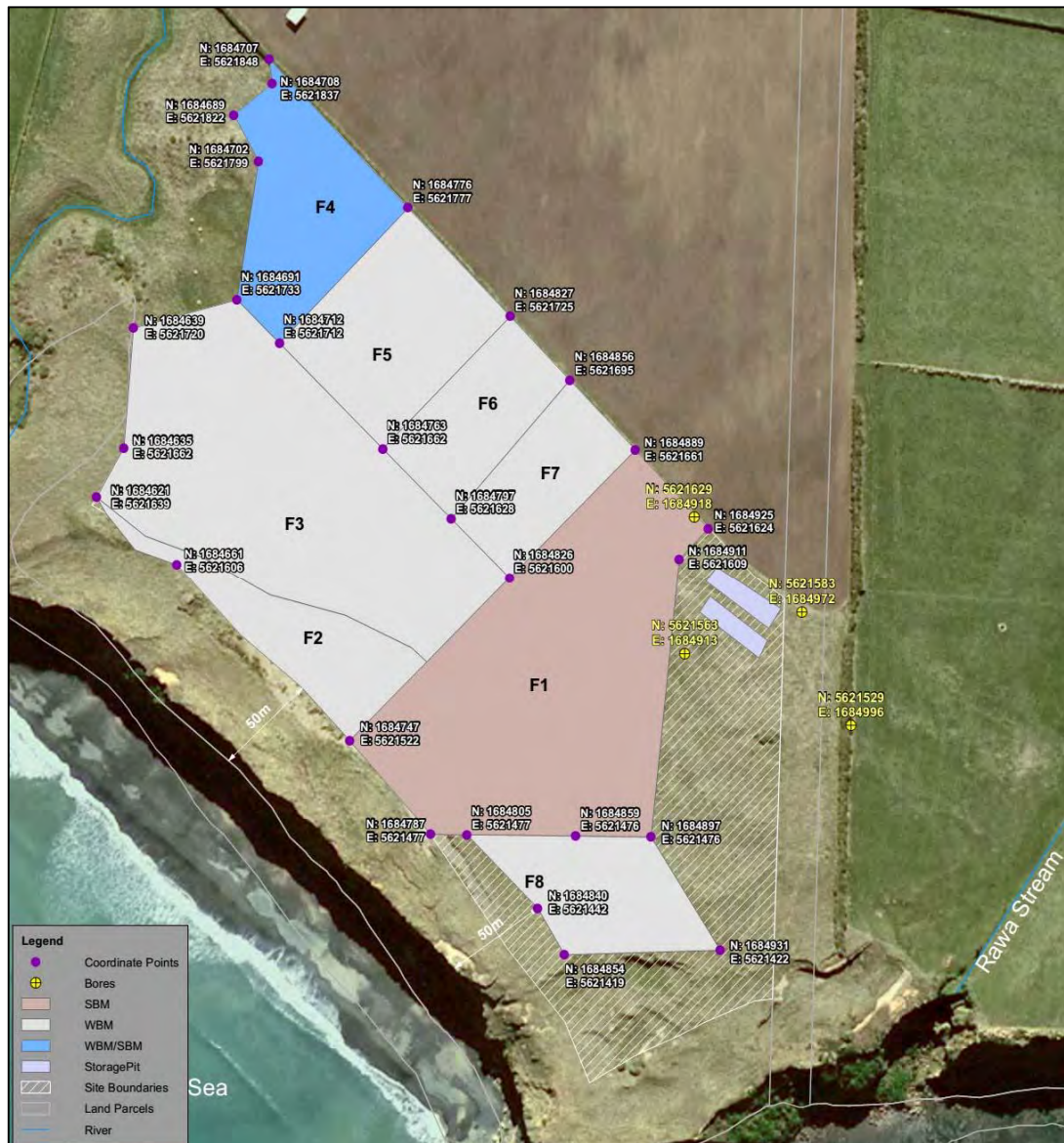


Figure 2 Company supplied final site map showing spreading areas 1-8 and pits A and B which were decommissioned in September 2013

2.3 Results of receiving environment monitoring

2.3.1 Council soil results

During the monitoring year, six composite soil samples were collected by sub-sampling along transects at 10 m intervals to a depth of approximately 400 mm in completed spreading areas F2 to F6 (Figure 3). The results are presented below in Tables 2 to 6.

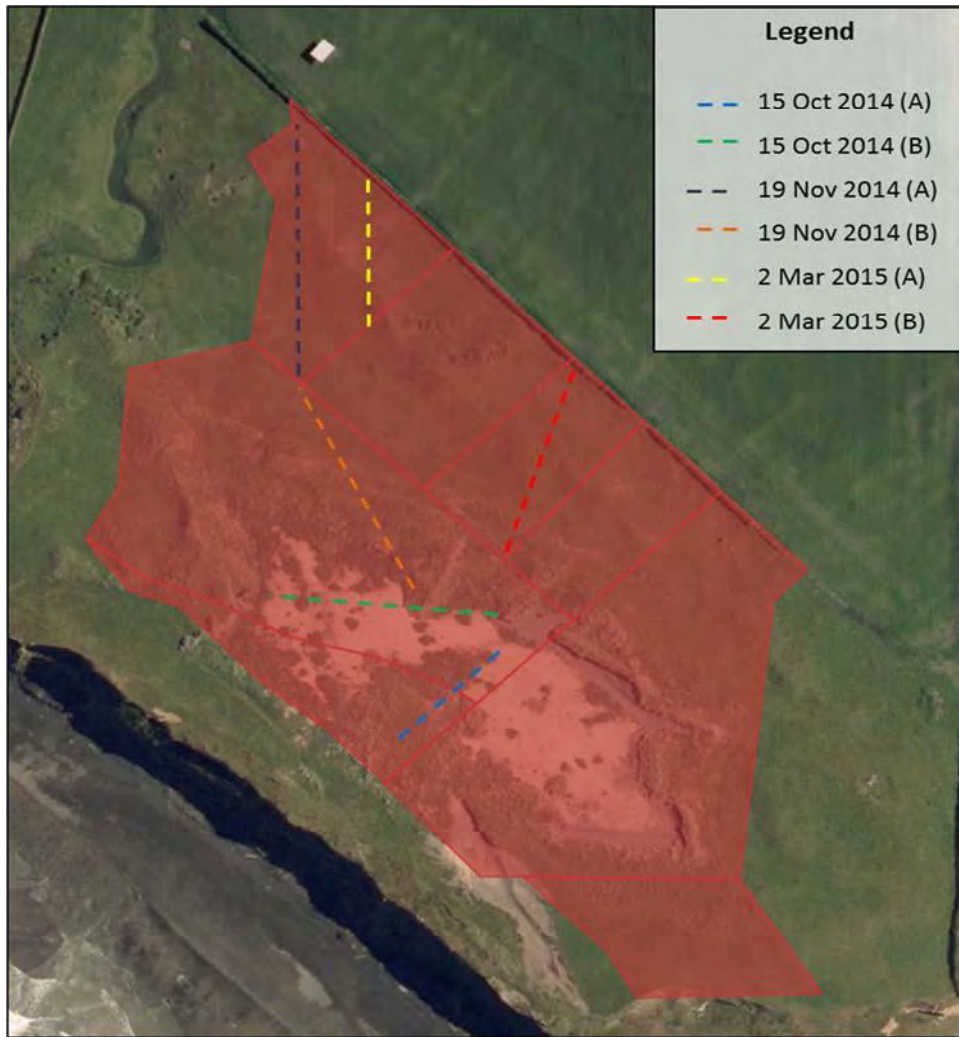


Figure 3 Council soil sampling transect locations, areas F2 to F6

Table 2 Soil sampling results, Oeo Landfarm

Parameter	Unit	15 Oct 2014	15 Oct 2014	19 Nov 2014	19 Nov 2014	02 Mar 2015	02 Mar 2015
		F2/F3	F3	F3	F4	F4	F6
Calcium	mg/kg	29	65	154	35	105	25
Chloride	mg/kg DW	133	622	180	58	64	37
Conductivity	mS/m@20C	76	264	144	41	89	30
Hydrocarbons	mg/kg DW	1,674	18,144	6,129	930	514	20
Magnesium	mg/kg	4.6	6	12	7	16	6.2
Moisture factor	Nil	1.012	1.019	1.022	1.02	1.028	1.018
pH	pH	7.1	7.4	7.5	6.7	6.8	6.3
Potassium	mg/kg	151	467	258	39	56	54
SAR	None	3.894	11.27	3.423	2.272	1.626	1.596
Sodium	mg/kg	86	355	164	56	68	35
TSS	mg/kg	594	2,069	1,128	319	696	235

The Council soil sample results detail compliance with all consent limits for all areas sampled, however there are still reasonably high hydrocarbon concentrations in spreading area F3. Note that the analysed concentrations are still within the application limit (50,000 mg/kg). This level is reducing over time, as evidenced by further

sampling in the following monitoring period. Chloride and sodium levels are relatively low, as are sodium absorption ratios and total soluble salt concentrations in all areas except F3, where concentrations remain relatively elevated.

2.3.2 Council groundwater results

During the monitoring year, groundwater sampling was conducted at quarterly intervals from four bores at the site, located in Figure 4, below. The results from each of the bores are presented in Tables 3 to 6 respectively.



Figure 4 Groundwater monitoring bore locations, Oeo Landfarm

Table 3 Groundwater monitoring results for bore GND2286

Parameter	Unit	27 Aug 2014	17 Dec 2014	10 Mar 2015	13 May 2015
Benzene	g/m ³	<0.0010	0.003	<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
meta-Xylene	g/m ³	<0.002	<0.002	<0.002	<0.002
ortho-Xylene	g/m ³	<0.0010	0.0011	<0.0010	<0.0010
Hydrocarbons	g/m ³	<0.7	<0.7	<0.7	<0.7
C7-C9	g/m ³	<0.10	<0.10	<0.10	<0.10
C10-C14	g/m ³	<0.2	<0.2	<0.2	<0.2
C15-C36	g/m ³	<0.4	<0.4	<0.4	<0.4
Barium (acid soluble)	g/m ³	0.14	0.22	0.1	0.12
Barium (dissolved)	g/m ³	0.14	0.22	0.07	0.08

Parameter	Unit	27 Aug 2014	17 Dec 2014	10 Mar 2015	13 May 2015
Chloride	g/m ³	480	589	310	536
Conductivity	mS/m@20°C	178	200	124	185
pH	pH	6.5	6.3	6.4	6.3
Sodium	g/m ³	273	275	157	246
Static water level	m	3.93	4.125	4.809	4.364
Temperature	°C	13.9	15.5	17.6	16.3
Total dissolved solids	g/m ³	1,377	1,547	959	1,431

Bold text indicates results of interest

Table 4 Groundwater monitoring results for bore GND2287

Parameter	Unit	27 Aug 2014	17 Dec 2014	10 Mar 2015	13 May 2015
Benzene	g/m ³	<0.0010	0.0061	0.0023	<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
meta-Xylene	g/m ³	<0.002	<0.002	<0.002	<0.002
ortho-Xylene	g/m ³	<0.0010	<0.0010	<0.0010	<0.0010
Hydrocarbons	g/m ³	<0.10	4.3	4.2	<0.7
C7-C9	g/m ³	<0.10	0.15	<0.10	<0.10
C10-C14	g/m ³	<0.2	0.8	0.7	<0.2
C15-C36	g/m ³	<0.4	3.4	3.6	<0.4
Barium (acid soluble)	g/m ³	0.09	0.75	1.1	0.16
Barium (dissolved)	g/m ³	0.08	0.68	0.88	0.16
Chloride	g/m ³	204	1180	1700	377
Conductivity	mS/m@20°C	152	438	577	199
pH	pH	7.2	6.5	6.5	6.7
Sodium	g/m ³	338	544	628	365
Static water level	m	4.046	4.858	5.585	4.379
Temperature	°C	15.3	15.9	18.1	16.6
Total dissolved solids	g/m ³	1,176	3,389	4,464	1,540

Bold text indicates results of interest

Table 5 Groundwater monitoring results for bore GND2288

Parameter	Unit	27 Aug 2014	10 Mar 2015	13 May 2015
Benzene	g/m ³	<0.0010	<0.0010	<0.0010
Toluene	g/m ³	<0.0010	<0.0010	<0.0010
Ethylbenzene	g/m ³	<0.0010	<0.0010	<0.0010
meta-Xylene	g/m ³	<0.002	<0.002	<0.002
ortho-Xylene	g/m ³	<0.0010	<0.0010	<0.0010
Hydrocarbons	g/m ³	<0.7	<0.7	<0.7
C7-C9	g/m ³	<0.10	<0.10	<0.10
C10-C14	g/m ³	<0.2	<0.2	<0.2
C15-C36	g/m ³	<0.4	<0.4	<0.4
Barium (acid soluble)	g/m ³	0.045	0.07	0.054

Parameter	Unit	27 Aug 2014	10 Mar 2015	13 May 2015
Barium (dissolved)	g/m ³	0.039	0.048	0.054
Chloride	g/m ³	222	306	278
Conductivity	mS/m@20°C	96	116	114
pH	pH	6.5	6.3	6.2
Sodium	g/m ³	97.5	126	124
Static water level	m	3.17	3.96	3.35
Temperature	°C	13.8	17.7	15.7
Total dissolved solids	g/m ³	739	898	882

Bold text indicates results of interest

Table 6 Groundwater monitoring results for bore GND2350

Parameter	Unit	11 Sep 2014	17 Dec 2014	10 Mar 2015	13 May 2015
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
meta-Xylene	g/m ³	<0.002	<0.002	<0.002	<0.002
ortho-Xylene	g/m ³	<0.0010	<0.0010	<0.0010	<0.0010
Hydrocarbons	g/m ³	<0.7	<0.7	<0.7	<0.7
C7-C9	g/m ³	<0.10	<0.10	<0.10	<0.10
C10-C14	g/m ³	<0.2	<0.2	<0.2	<0.2
C15-C36	g/m ³	<0.4	<0.4	<0.4	<0.4
Barium (acid soluble)	g/m ³	0.08	0.16	0.12	0.055
Barium (dissolved)	g/m ³	0.080	0.160	0.100	0.055
Chloride	g/m ³	572	562	506	278
Conductivity	mS/m@20°C	205	211	190	117
pH	pH	6.7	6.5	6.4	6.5
Sodium	g/m ³	392	372	326	224
Static water level	m	4.778	5.013	5.388	4.372
Temperature	°C	15.7	15.6	18.7	15.5
Total dissolved solids	g/m ³	1,586	1,633	1,470	905

Bold text indicates results of interest

Monitoring bores GND2286 and GND2288 both showed slight increases in the concentrations of salinity parameters (chloride, sodium, and total dissolved solids) compared to the 2013/2014 monitoring period. These were still within typical coastal groundwater concentrations, as were the related standard water quality parameters (conductivity and pH). GND2288 was not sampled on 17 December 2014 due to an incorrectly aligned bore lid that became jammed during attempts to remove it.

Bore GND2350 showed decreasing trends in salinity parameters, and all samples were within or close to standard water quality parameters for coastal groundwater.

Bore GND2287 showed decreases in salinity parameters and hydrocarbon concentrations were not detected in August 2014 or May 2015 samples, but the December 2014 and March 2015 results were still elevated. The hydrocarbon results in

particular are only just above detection limits and they detail a decreasing trend. The salt concentration and specifically the TDS will continue to be monitored moving forward.

2.3.3 Council surface water results

The Rawa stream was sampled twice during the monitoring period at two sampling sites, one upstream and one downstream of the spreading areas. Sampling sites are identified in Figure 5. Samples were analysed for similar parameters to the groundwater samples, and results are presented below in Table 7.



Figure 5 Surface water sample locations Rawa Stream

Table 7 Surface water sampling results for Rawa Stream Oeo Landfarm

Parameter	Unit	RWA000095		RWA000098	
		11 Sep 2014	19 Nov 2014	11 Sep 2014	19 Nov 2014
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
meta-Xylene	g/m ³	<0.002	<0.002	<0.002	<0.002
ortho-Xylene	g/m ³	<0.0010	<0.0010	<0.0010	<0.0010
Hydrocarbons	g/m ³	<0.7	<0.7	<0.7	<0.7
C7-C9	g/m ³	<0.10	<0.10	<0.10	<0.1
C10-C14	g/m ³	<0.2	<0.2	<0.2	<0.2
C15-C36	g/m ³	<0.4	<0.4	<0.4	<0.4
Barium (acid soluble)	g/m ³	0.028	0.023	0.026	0.024
Chloride	g/m ³	51	48.1	51.7	47.7

Parameter	Unit	RWA000095		RWA000098	
		11 Sep 2014	19 Nov 2014	11 Sep 2014	19 Nov 2014
Conductivity	mS/m@20°C	28.0	27.9	28.0	27.9
pH	pH	7.7	7.6	7.7	7.6
Sodium	g/m ³	28.6	-	28.7	-
Temperature	°C	12.3	14.7	12.3	14.3
Total dissolved solids	g/m ³	217	216	217	216

To date there has been no measureable adverse effect on the Rawa Stream as a result of landfarming activities at the site. No hydrocarbons were detected in any samples, and the other water quality parameters measured were within typical ranges for coastal freshwater sites in Taranaki.

2.4 Review of analytical results

The Company supplied receiving environment soil results throughout the monitoring year, and also as a summary table in their supplied annual report (Appendix II).

The Company collected a total of five composite samples from area F3 during the monitoring period. The soil results, including all results to date, are attached in Table 4.1, Section 4 of the Company supplied annual report, Appendix II.

Their results for the 2014-2015 monitoring year are compliant with all application limits excluding the C10-C14 hydrocarbon fraction on three occasions. No significant polycyclic or monocyclic aromatic hydrocarbons or heavy metals have been detected in any of the samples in the current or previous monitoring period.

The Company also sampled the Rawa Stream on one occasion, in April 2015. These results are similar to the findings of the Council in its biannual sampling of the Rawa, in as much as they do not highlight any adverse effects.

The results of this are presented in Appendix C of the Company supplied annual report. No hydrocarbons were detected in the sample and all other measured parameters are typical of the coastal reaches of a small stream in a Taranaki dairy catchment.

2.5 Investigations, interventions, and incidents

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 courses of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

The Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The Incident Register (IR) includes events where the Company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

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

In the 2014-2015 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with the Company's conditions in resource consents or provisions in Regional Plans.

3. Discussion

3.1 Discussion of site performance

During the monitoring period the Company maintained ongoing monitoring of soil and water resources as is their commitment until the site is surrendered. The site was well-managed and sample results indicated a successful assimilation and degradation of waste in all areas except F3.

The vegetation establishment continued to improve across the site during the monitoring period. All areas apart from F3 now meet surrender criteria, along with two of the four groundwater bores that have shown no measureable impact from landfarming activities.

A change of consent that was processed during the 2015-2016 monitoring period saw the surrender of all spreading areas excluding F3; where monitoring will continue until soil conditions meet surrender criteria. The Company undertook additional work to help increase the bio-remediation in area F3; in doing so demonstrated a proactive response.

Groundwater monitoring bores GND2288 and GND2350 are to be excluded from the monitoring programme moving forward. Bores GND2286 and GND2287 will continue to be sampled due to the fluxing salt concentration and above detection limit hydrocarbon results which has been observed through sampling in this monitoring period.

The record keeping and reporting has been of a very high standard, effective and concisely demonstrating compliance with consent conditions. The Company has monitoring and site management procedures in place which have worked well to address the issues encountered in previous years. No incidents have been recorded at the site during the 2014-2015 monitoring period.

3.2 Environmental effects of exercise of consents

The results of the monitoring conducted during the 2014-2015 period indicated that no significant adverse environmental effects have occurred at the Oeo Landfarm site from activities conducted over the previous year.

However, there still exists a slight legacy issue in that one specific monitoring well does require further monitoring. This well detailed a trace level of hydrocarbons (note that this was localised). This concentration denoted a decreasing trend throughout the year (Table 4). These levels are of no environmental significance as they are low and are localised. It is expected these concentrations will continue to reduce to background levels over time as was seen in the final analysis of the year.

The same well also detailed a saline impact from total dissolved salts (TDS), the condition for the consent detailed that the Company shall not increase the concentration of salts in the groundwater above 2500 g/m³. In this monitoring period two results were above this conditional value (Table 4). Of note, the final analysis undertaken in May 2015 was below the conditional limit, and as such it is reducing and localised.

The soil results were all compliant with surrender consent criteria with the exception of area F3. Although the concentration was quite low, follow up analysis required the Council to submit the soils to be analysed for TPH fractionation, whereby the carbon chains were analysed, as required by the MfE guidelines. The results of this analysis detailed that the area of F3 was close to surrender criteria; however it was not achievable during this round of monitoring. The Council will undertake follow up analysis in the following period whereby it should be acceptable, following the requisite results.

No effects have been noted in the Rawa Stream from the exercise of this consent.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Table 8.

Table 8 Summary of performance for consent 7613-1

Purpose: To discharge drilling material (consisting of drilling cuttings and drilling fluids) from hydrocarbon exploration activities with water based muds and synthetic based muds, onto and into land via landfarming		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Definitions which apply to the consent	N/A	N/A
2. Best practicable option to be adopted	Inspections and liaison with consent holder	Yes
3. Notify TRC in writing prior to stockpiling	Notifications received	N/A
4. Notify TRC in writing prior to landfarming	Notifications received	N/A
5. Keep records relating to wastes, areas, compositions, volumes, dates, treatments and monitoring	Company records	Yes
6. Report on records in condition 5 to Council by 31 August each year	Report received 4 August 2015	Yes
7. Discharge depth limited to 100 mm for waste with hydrocarbons <5%, or 50 mm for waste with hydrocarbons >5%	Company records and inspection	N/A
8. Incorporation into soil as soon as practicable so that top 250 mm layer contains less than 5% hydrocarbons	Inspection and sampling	N/A
9. Single application of wastes to each area of land	Company records and inspection	N/A
10. No discharge within 25 m of a water body or property boundaries	Inspection	N/A
11. Maximum volume of stockpiling 6,000 m ³ , discharge within 12 months of arrival on site	Company records and inspection	N/A

Purpose: To discharge drilling material (consisting of drilling cuttings and drilling fluids) from hydrocarbon exploration activities with water based muds and synthetic based muds, onto and into land via landfarming		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
12. Re-vegetate landfarmed areas as soon as practicable	Company records and inspection	Yes
13. No destabilisation of neighbouring land	Inspection	Yes
14. Total dissolved salts in any fresh water body shall not exceed 2,500 g/m ³	Sampling	Exceeded in bore GND2287
15. Disposal of waste shall not lead to contaminants entering surface water or groundwater exceeding background concentrations	Sampling	Some contaminants still elevated from previous period in bore GND2287 and GND2286
16. Conductivity must be less than 400 mS/m. If background conductivity exceeds 400 mS/m, then increase shall not exceed 100 mS/m	Sampling	Still elevated in GND2287
17. Sodium absorption ratio [SAR] must be less than 18.0, if background SAR exceeds 18.0 then increase shall not exceed 1.0	Sampling	Yes
18. Levels of metals in soil shall comply with guidelines	Sampling	Yes
19. Prior to expiry/cancellation of consent these levels must not be exceeded: a. conductivity, 290 mSm ⁻¹ b. chloride, 700 g/m ³ c. dissolved salts, 2,500 g/m ³ d. sodium, 460 g/m ³	Sampling prior to surrender	N/A
20. If condition 19 not met, consent cannot be surrendered	Sampling	N/A
21. Notification of discovery of archaeological remains	None found	N/A
22. Lapse condition	Inspection for evidence of exercise	N/A
23. Optional review provision re environmental effects	Next optional review June 2018	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

During the year, the Company demonstrated a good level of environmental and high level of administrative performance with the resource consent as defined in Section 1.1.4. During the year under review the Company managed the site well and there were no incidents recorded. Pasture strike at the site has continued to improve towards satisfactory conditions, and the groundwater results from bore GND2287 were still

showing trace levels of hydrocarbons and had exceeded the TDS limit. These are likely due to activities conducted during previous years, but continue to be observed during the 2014-2015 year. For this reason, the overall site rating is 'good'.

Ratings are as defined in Section 1.1.4

3.4 Recommendations from the 2013-2014 Annual Report

In the 2013-2014 Annual Report, it was recommended:

1. THAT monitoring of consented activities at Oeo landfarm in the 2014-2015 year continue at the same level as scheduled in 2013-2014.

This recommendation was implemented.

3.5 Alterations to monitoring programmes for 2015-2016

In designing and implementing the monitoring programmes for air/ water discharges in the region, the Council has taken into account the extent of information made available by previous authorities, its relevance under the RMA, its obligations to monitor emissions/ discharges and effects under the RMA, and report 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 emitting to the atmosphere/ discharging to the environment.

It is proposed that for 2015-2016 the monitoring programme be adjusted to reflect the change to consent 7613-1.1 processed in October 2015. All spreading areas excluding F3 are to be surrendered, and soil sampling is to continue in F3 until all soil parameters meet surrender criteria. Groundwater monitoring bores GND2288 and GND2350 are also to be surrendered, having met the criteria set out in Special Conditions 14 and 15. Ongoing monitoring of hydrocarbons will continue in GND2287, and monitoring of salinity parameters in GND2286 will also continue. A recommendation to this effect is attached to this report.

4. Recommendations

1. THAT monitoring of consented activities at Oeo Landfarm in the 2015-2016 year be amended from that undertaken in 2014-2015, by restricting groundwater monitoring to bores GND2286 and GND2287 only, and restricting soil sampling to the F3 spreading area only.

Glossary of common terms and abbreviations

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

Al*	Aluminium.
As*	Arsenic.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
Cu*	Copper.
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
FC	Faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
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 occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
IR	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.
m ²	Square Metres.
mS/m	Millisiemens per metre.
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	<i>Resource Management Act</i> 1991 and including all subsequent amendments.
SS	Suspended solids.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
UI	Unauthorised Incident.
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 the Council's laboratory.

Bibliography and references

Ministry for the Environment 1999: Guidelines for assessing and managing petroleum hydrocarbon contaminated sites in New Zealand.

Ministry for the Environment and New Zealand Water and Wastes Association 2003: Guidelines for the safe application of biosolids to land in New Zealand.

Taranaki Regional Council (2014): *BTW Company Ltd Oeo Landfarm Monitoring Programme Annual Report 2013-2014*. Technical Report 2014-39

Taranaki Regional Council (2013): *BTW Company Ltd Oeo Landfarm Monitoring Programme Annual Report 2012-2013*. Technical Report 2013-54

Appendix I

Resource consents held by BTW Company Limited

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

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

Name of
Consent Holder: BTW Company Limited
P O Box 551
Taranaki Mail Centre
NEW PLYMOUTH 4340

Consent Granted
Date: 23 March 2010

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 via landfarming at or about (NZTM) 1684821E-5621560N

Expiry Date: 1 June 2024

Review Date(s): June 2012, June 2018

Site Location: South Road, Manaia [Property owner: C & D Putt]

Legal Description: Sec 2 & 3 Blk III Oeo SD

Catchment: Rawa
Waimate

General conditions

- a. The consent holder shall pay to 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. For the purposes of this consent the following definitions shall apply:
 - a) stockpiling means a discharge of drilling wastes from vehicles, tanks, or other containers onto land, but without subsequently spreading, or incorporating the discharged material into the soil within 24 hours; and
 - b) landfarming means the discharge of drilling wastes onto land, subsequent spreading and incorporation into the soil, and includes any stripping and relaying of topsoil.
2. 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

3. 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;
 - d) the volume of waste to be stockpiled; and
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 stockpiled material. 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 landfarmed;
 - d) the volume and weight of the waste to be landfarmed;
 - e) the concentration of chlorides, nitrogen and hydrocarbons in the waste; and
 - f) the specific location and area over which the waste will be landfarmed.
5. 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];

Consent 7613-1

- d) volumes of material stockpiled;
- e) landfarming area[s], including a map showing individual disposal areas with GPS co-ordinates;
- f) volumes and weights of wastes landfarmed;
- g) dates of commencement and completion of stockpiling and landfarming events;
- h) dates of sowing landfarmed areas;
- i) treatments applied;
- j) 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.

6. 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 5, for the period of the previous 1 July to 30 June.

Discharge limits

7. For the purposes of landfarming, drilling 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;
- prior to incorporation into the soil.
8. As soon as practicable following the application of drilling wastes to land in accordance with condition 7 of this consent, the consent holder shall incorporate the wastes into the soil to a depth of at least 250 mm, so that the hydrocarbon concentration at any point in the soil/waste mix is less than 50,000 mg/kg dry weight, anywhere in the 250 mm layer below the topsoil layer.
9. An area of land used for the landfarming of drilling wastes in accordance with conditions 7 and 8 of this consent, shall not be used for any subsequent discharges of drilling waste.
10. No discharge shall take place within 25 metres of surface water or property boundaries.

Operational requirements

11. The stockpiling of material authorised by this consent is limited to a maximum volume of 6000 cubic metres at any one time on the property. All stockpiled material must be landfarmed as soon as practicable, but no later than twelve months after being brought onto the site.

Consent 7613-1

12. As soon as practicable following landfarming, areas shall be sown into pasture [or into crop]. The consent holder shall monitor revegetation and if adequate establishment is not achieved within two months of sowing, shall undertake appropriate land stabilisation measures to minimise wind and stormwater erosion.
13. The exercise of this consent shall not result in the destabilisation of neighbouring land.

Receiving environment limits - water

14. The exercise of this consent shall not result in the concentration of total dissolved salts in any fresh water body exceeding 2500 g/m³.
15. 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

16. The conductivity of the soil/waste layer after landfarming shall be less than 400 mS/m, or alternatively, if the background soil conductivity exceeds 400 mS/m, the landfarming of waste shall not increase the soil conductivity by more than 100 mS/m.
17. The sodium absorption ratio [SAR] of the soil/waste layer after landfarming shall be less than 18.0, or alternatively if the background soil SAR exceeds 18.0, the landfarming of waste shall not increase the SAR by more than 1.0.
18. The concentration of metals in the soil shall at all times comply with the guidelines for heavy metals in soil set out in Table 7.1, Section 7 of the Guidelines for the safe application of biosolids to land in New Zealand [Ministry for the Environment and New Zealand Water & Wastes Association, 2003].
19. From 1 March 2024 (three months prior to the consent expiry date), constituents in the soil shall not exceed the standards shown in the following table:

<u>Constituent</u>	<u>Standard</u>
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 - naphthalene, non-carc. (pyrene), benzo(a)pyrene eq.

TPH - total petroleum hydrocarbons (C₇-C₉, C₁₀-C₁₄, C₁₅-C₃₆)

The requirement to meet these standards shall not apply if, before 1 March 2024, the consent holder applies for a new consent to replace this consent when it expires.

20. This consent can not be surrendered until the standards in condition 19 are being met.

Archaeological remains

21. In the event that any archaeological remains are discovered as a result of works authorised by this consent, the works shall cease immediately at the affected site and tangata whenua and the Chief Executive, Taranaki Regional Council, shall be notified within one working day. Works may recommence at the affected area when advised to do so by the Chief Executive, Taranaki Regional Council. Such advice shall be given after the Chief Executive, Taranaki Regional Council, has considered: tangata whenua interest and values, the consent holder's interests, the interest of the public generally, and any archaeological or scientific evidence. The New Zealand Police, Coroner, and Historic Places Trust shall also be contacted as appropriate, and the work shall not recommence in the affected area until any necessary statutory authorisation or consent has been obtained.

Lapse and review

22. This consent shall lapse on 31 March 2015, 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.
23. 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 2012 and/or June 2018, 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 23 March 2010

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Appendix II

Company supplied annual report

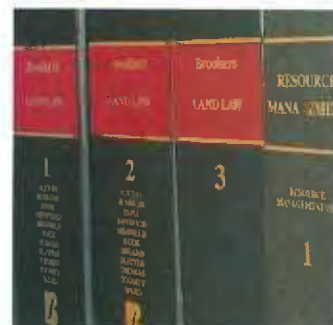
Annual Report

Special Condition 6 - Monitoring and Reporting

Oeo Land Farm Annual Report -
Consent 7613

by *BTW Company*

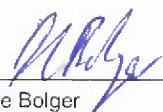
btw company
surveyors . planners . engineers . land & g.i.s services

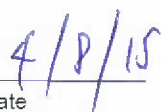


Oeo Land Farm Annual Report - Consent 7613 09389

Reviewed


Report Author


Dave Bolger


Date

Reviewed by


Cameron Twigley


Date

09389
4/08/2015

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1 INTRODUCTION

1.1 Special Condition 6

In accordance with Special Condition 6 (SC6) of resource consent 7613-1 it is a requirement that:

The consent holder 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 Special Condition 5 (SC5), for the period of the previous 1 July to 30 June.

This report therefore includes all information related to activities provided for under consent 7613-1 from 1 July 2014 to 30 June 2015 as well as monitoring required under SC 14-20.

1.2 July 2014 to June 2015 - Summary

The site was completely decommissioned during the previous monitoring period (2013-14). Therefore no new material has been taken to the site during this monitoring period and no areas were landfarmed during this monitoring period.

In general the pasture establishment has been excellent across the site, especially considering the exposed nature of the site. The only area to demonstrate patchy vegetation establishment was the F3 area. It has been identified in the past the F3 area had isolated hotspots of hydrocarbons and a significant iron pan runs through this section which also creates difficult conditions such as ponding for pasture establishment.

The F3 area was re-worked during the monitoring year. With hot spot areas turned and aerated and the addition of straw to assist with aeration and stimulate microbial breakdown of the hydrocarbons. This additional treatment has been very successful with a significant reduction in the hydrocarbon values within the soil in this area, and now the F3 area meets surrender criteria.

During the monitoring period all the soil areas met the soil surrender criteria as stipulated on the consent and now the consent holder has submitted a surrender application with the TRC. Currently this application is being processed by the TRC.

A significant number of the native plants that were planted along the coastal buffer zone and the Waimate stream edge have survived. It is considered over time the establishment of these native species will provide some natural habitat and protection from the harsh elements at this location, this is seen as a positive along this section of coast.

1.3 Records required under Special Condition 5

The consent holder shall keep records of the following:

- a) wastes from each individual well;*

composition of waste (including concentrations of chloride, nitrogen and total petroleum hydrocarbons)

- b) stockpiling area(s);*
- c) volume of material stored;*
- d) landfarming areas, including a map showing individual disposal area with GPS co-ordinates;*
- e) volumes and weight of wastes landfarmed;*
- f) dates of commencement and completion of storage and landfarming events;*
- g) dates of sowing landfarming areas;*
- h) treatment applied;*
- i) 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.

1.4 Report Overview

The following information has been collated for the purpose of demonstrating compliance with Special Condition (SC)6 of consent 7613-1. Information is supplied generally in the order as requested within SC5 a-j.

- Records required under SC 5 condition a) Wastes from each individual well and b) Composition of waste, is provided in Appendix A of the Report. Appendix A provides a list of all chemical products and lists of possible constituents which may be added to alter the consistency of drilling mud stored on well sites.

Condition b) is also addressed in Section 4 of the report.

- A map of the site showing individual disposal areas, GPS co-ordinates and stockpiling areas is located in Appendix B displaying compliance with SC5 c), e) & g). This includes:
 - *stockpiling Area's;*
 - *landfarming areas, including a map showing individual disposal area with GPS co-ordinates;*
 - *dates and commencement and completion of storage and landfarming events.*
- Section 2 provides the information related to the recording of details required within conditions d), f), h), and i) of SC5 which are listed below;
 - *volumes of material stored;*
 - *volumes and weights of wastes landfarmed;*
 - *dates of sowing landfarmed areas;*
 - *treatments applied.*

Material volumes have been calculated based on the area of disposal and the thickness of disposal which has been undertaken. This information is available on the site map provided in Appendix B.

- Section 3 provides details of monitoring, including sampling locations and sampling methods as required by SC5, condition j.
- Section 4 provides the results of analysis as required by SC5, condition j. Special Conditions 14-20 of Consent 7613-1 are also addressed in this section.

2 MATERIAL STORAGE AND TREATMENT

The following section provides the information related to recording of details required within conditions d), f), h), and i) of SC5 which are listed below;

- *volumes of material stored;*
- *volumes and weights of wastes landfarmed;*
- *dates of sowing landfarmed areas;*
- *treatments applied.*

2.1 Material Volumes

No new material was disposed of or stockpiled during the monitoring year. The site was totally decommissioned during the previous monitoring period.

Historical volumes of material landfarmed can be ascertained in previous annual monitoring reports and also on the site map provided in Appendix B.

2.2 Sowing and Treatments

An application of fertiliser over the whole site did take place over the monitoring period, and some additional sowing of permanent pasture.

It was also identified by the consent holder that the breakdown of hydrocarbons in the soil at the F3 area was very slow and there appeared to be isolated hot spot areas that would benefit from some additional treatment. The additional treatment of these hot spot areas was a re working of the soil to aerate the soil and the addition of straw to also help with aeration and stimulate microbe break down of the hydrocarbon concentrations. The treatment was a completely natural process which would essentially speed up the natural bio-remediation process within this specific area. As demonstrated in table 4.1 the additional treatment of the F3 area has been a benefit, with a significant reduction in the hydrocarbon level within the soil. See Figure 2.1 below, which shows the additional treatment process to the specific hotspot areas in the F3 area.



Figure 2.1: Re-working hot spot areas in F3 area.

The site is now completely re-vegetated apart from some minor areas that have been reworked recently (F3 area), however pasture establishment is likely in these areas during the spring time if favourable weather conditions allow.



Figure 2.2: Pasture Establishment Oeo Landfarm 10-11-14

3 MONITORING INFORMATION

The following section provides the details of soil and surface monitoring, including sampling locations and sampling methodology.

3.1 Monitoring

Monitoring of the landfarmed area begins within the first month of topsoil being re-applied to the landfarmed area. At this point, an entire suite of tests is undertaken to assess the receiving environment against consent conditions. For WBM material, monitoring is undertaken every six months for the first year following application, and then 6-monthly sampling continues until compliance with consent conditions is achieved. For SBM material, monitoring is undertaken every three months for the first year following application, and then 6-monthly until compliance is achieved. Within the first year, if results are compliant with surrender conditions, monitoring ceases.

Monitoring results have been provided in a spread sheet form to assist with compliance and consent requirements for surrender (See Section 4).

The results demonstrate that all areas landfarmed now meet soil surrender criteria. No further soil sampling will take place by the consent holder as the soil surrender criterion has been met as demonstrated in section 4 of this report.

All receiving environment samples are tested by Hill Laboratories and sampling methodology is in accordance with the TRC landfarm sampling procedures.

As part of the monitoring programme the consent holder has also sampled the Rawa Stream on one occasion during the monitoring year. The Rawa stream has been tested for a wide range of contaminants that can be associated with drilling material. The results of the sampling are contained in Appendix C and demonstrate compliance with special condition 14 and 15.

3.2 Sampling Locations

Specific land farmed areas are located through the use of a GPS navigational system. These co-ordinates are contained within the "Oeo Landfarm Area and Track Access" plan (Appendix B) which shows areas of disposal and is updated following landfarming events. A central point is located within each area and a composite sample retrieved in a transect line from the central point. The line direction is dependent on the underlying orientation of the landfarmed material.

3.3 Methods

Sampling involves collecting a composite of 10 sub-samples along a transect line from the central GPS point on the specific landfarmed area. Typically, samples are retrieved from an approximate depth of 250mm but this can vary depending on the location of the drilling mud layer.

Once the 10 sub samples have been collected the soil is mixed together and the appropriate sampling containers are filled and sent to Hill Laboratories for testing for specific constituents as required by the consent.

The sampling methodology is consistent with the TRC methodology. The goal is to achieve a representative sample of each specific landfarmed area. As the actual level of constituents is known in the materials to be landfarmed via the pre disposal sampling, it is considered this methodology provides a representative sample of the material once mixed (power harrowed into the soil) on the land farming area, and also gives data on constituent levels within the top 250mm of the soil profile, which in essence is for the protection of human and livestock health.

3.4 **Inspection Notices**

All routine site inspections by TRC compliance officers have found activities on the site to **comply** with conditions of consent 7942-1.

3.5 **Infringement Notices**

No infringement notices have been issued by the TRC for this site.

3.6 **Abatement Notices**

No abatement notices have been issued by the TRC for this site.

4 ANALYSIS OF RESULTS

The following Table 4.1 provides a summary of the monitoring results undertaken for the Oeo Landfarm during the reporting period. Please note we have provided the complete sampling results from the initial soil sampling at the site, we believe this is useful to observe trends of constituent breakdowns over time at the site. Analysis of the results of monitoring are required by SC5, condition j. Special Conditions 14-20 of Consent 7613-1 are also addressed in this section.

We have colour coded table 4.1 for ease of quick interpretation. Green indicates that the level of a specific constituent meets consent surrender criteria, and red indicates that surrender criteria has not been met yet. As demonstrated in table 4.1 all areas now have met the surrender criteria from the consent holder.

Analysis of the monitoring results is undertaken over the following Sections 4.1 and 4.2, with a summary proved in Section 5.

Table 4.1: Monitoring Results from Oeo Landfarm

4.1 Compliance with SC's 14 and 15

Conditions 14-15 require:

14. The exercise of this consent shall not result in the concentration of total dissolved salts in any fresh water body exceeding 2500 g/m³

15. Other than as provided for in condition 15, the exercise of this consent shall not result in any containment concentration, within surface water or groundwater, which after reasonable mixing, exceeds the background concentration for that particular contaminant.

Compliance with SC's 14-15 is contained in Appendix C with the results of the Rawa Stream.

4.2 Compliance with SC's 16 - 20

4.2.1 Condition 16 – Soil Conductivity

For the monitoring period all landfarmed area's demonstrated compliance with consent conditions and meet surrender criteria, as demonstrated in table 4.1 above.

Area/s not within consent surrender limits: **None**

4.2.2 Condition 17 – SAR

Condition 17 requires:

17. The sodium absorption ratio (SAR) of the soil / waste layer after landfarming shall be less than 18.0, or alternatively if the background SAR exceeds 18.0, the landfarming of waste shall not increase the SAR by more than 1.0.

As shown in table 4.1 above, all the landfarmed areas are within the surrender criteria for the consent.

Area/s not within consent surrender limits: **None**

4.2.3 Condition 18 – Heavy Metals

Condition 18 requires:

18. The concentration of metals in the soil shall at all times comply with the guidelines for heavy metals in soil set out in Table 7.1, Section 7 of the Ministry of the Environment and New Zealand Water and Wastes Association's Guidelines for the safe application of biosolids to land in New Zealand (2003)

As shown in Table 4.1, all metal concentrations are compliant with Table 7.1, Section 7 of the Ministry of the Environment and New Zealand Water and Wastes Association's Guidelines for the safe application of biosolids to land in New Zealand (2003).

4.2.4 Condition 19 and 20 – Constituent Closure Criteria

Condition 19 requires:

19. From 1 March 2024 (Three months prior to the consent expiry date), constituents in the soil shall not exceed the standards shown in the following table:

Table 4.2: Consent Surrender Limits

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 – naphthalene, non coarc. (Pyrene) benzo(a)pyrene eq.

TPH – Total petroleum hydrocarbons (C₇-C₉, C₁₀-C₁₄, and C₁₅-C₃₆).

The requirement to meet these standards shall not apply if, before 1 March 2028, the consent holder applies for a new consent to replace this consent when it expires.

20. This consent may not be surrendered at any time until the standards in condition 19 are being met.

The monitoring data of these constituent surrender levels has been met as demonstrated in table 4.1 above. These guideline values are still considered the most appropriate values to protect livestock and public health.

4.2.5 Chloride

As shown in table 4.1 above, all landfarmed areas meet consent surrender criteria for Chloride.

4.2.6 Sodium

As shown in table 4.1, consent surrender requirements for Sodium have been reached for all monitored areas of the landfarm.

4.2.7 Dissolved Salts

As shown in table 4.1, consent surrender requirements for Dissolved Salts have been reached for all monitored areas of the landfarm

4.2.8 TPH C7 – C9

As shown in table 4.1, all results for TPH C7-C9 at the Oeo landfarm were within the consent surrender limits for all areas.

4.2.9 TPH C10 – C14

As shown in table 4.1, all landfarmed areas meet surrender limits. The F3 area has taken some time to meet the surrender limit, however we note a significant reduction since the hot spots in this area were re worked and straw was added to stimulate bio- remediation of the C10 – C14 hydrocarbon chain.

4.2.10 TPH C15 – C36

Table 4.1 above shows results for TPH C15-C36 for all sites. All areas are now within the surrender criteria for the consent.

5 SUMMARY

The monitoring of the Oeo landfarm site has shown pleasing results over the last year. There has been a significant reduction of hydrocarbon levels in areas that had previously showed elevated levels above consent surrender. From the consent holders latest suite of soil sampling all areas now meet the soil surrender criteria.

The areas that have been landfarmed have only ever shown background levels of heavy metals as demonstrated in the comprehensive suite of sampling of heavy metals at the site over time.

It is worth noting the surrender criterion on the consent is a stringent standard to meet. These guidelines are set by the Ministry for the Environment to ensure constituents in the soil are at a level that poses negligible risk to agricultural activities, this includes pathways such as ingestion by stock. This standard is more stringent than what is required for soil acceptance criteria for residential activities.

As demonstrated in the consent holders comprehensive suite of soil sampling at the site, all constituents required to be tested as part of the consent conditions have now met consent surrender criteria. The consent holder has now submitted an application with the TRC to surrender the consent.

The consent holder has ceased the monitoring at the site as consent surrender conditions have been met.

APPENDIX A COMPOSITION OF WASTE

WBM – TYPICAL CHEMICALS

Table 1: Typical Chemicals used in Drilling

Chemical Description	Use	Phase
Sodium Sulphite with 2% Cobalt Chloride catalyst	Oxygen scavenger	Solid
Non-ionic Isothiazolin Solid	Biocide	Solid
Cationic Polymer	Shale stabiliser	Liquid
Sodium Hydroxide	PH control	Solid
Sodium Montmorillonite	Viscosifier	Solid
Polyanionic Cellulose	Filtrate control	Solid
Xanthan Gum	Viscosifier	Solid
Calcium Hydroxide	Flocculant	Solid
Ground Peanut Shells (Liquid casing)	Lost circulation material	Solid
Ammonium thiocyanate	Tracer in well	Solid
Potassium Chloride		

Table 2: Drilling Fluid Contingency Items

Chemical Description	Use	Phase
Zinc Oxide	Sulphide scavenger	Solid
Alcohol ethoxylate blend	Defoamer	Liquid
Sodium Bicarbonate	Calcium precipitation	Solid
Sodium Chloride	Clear Brine	Solid
Poly-glycol/Poly-glycollether Surfactant blend	Well lubricant	Liquid
Calcium Carbonate	Lost circulation material	Solid
Acrylamide acrylate polymer	Shale encapsulator	Solid/Liquid
Polymino Acid	Shale Stabiliser	Liquid
Barium Sulfate (barite)	Inert weighting agent	Solid
Citric Acid	PH control	Solid
Mica	Lost circulation material	Solid
Ground Walnut Shells	Lost circulation material	Solid
Sodium Carbonate	Calcium precipitation	Solid
Chrome free Lignosulfonate	Dispersant	Solid
Surfactant/Emulsifier blend	Stuck pipe compound	Liquid
Blended filming amines	Corrosion Inhibitor	Liquid
Phosphate ester salt	Corrosion Inhibitor	Liquid
Sodium Silicate (Cementing)	Lost circulation material	Solid
Calcium Chloride (cementing)	Inhibitor	Solid

Legend

- Coordinate Points
- Bore
- SBM
- WBM
- WBM/ SBM
- Storage PI
- Site Boundary
- Land Parcel
- River

Table 1: Well Data

ID	Well Type	Date Formed	Well Name	Northings	Eastings	Area
F1	SBM	September, 2012	Mangahewa D	5621582	1684847	18.50
F2	WBM	November, 2012	Mangahewa B (WBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621571	1684723	4300
F3	WBM	December, 2012	Mangahewa B (SBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621543	1684715	16000
F4	WBM/ SBM	March, 2013	Mangahewa D (WBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621777	1684724	6300
F5	WBM	April, 2013	STOS KADSA (GW) Mangahewa D (WBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621749	1684764	4100
F6	WBM	April, 2013	STOS KADSA (GW) Mangahewa D (WBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621677	1684810	2000
F7	WBM	April, 2013	STOS KADSA (GW) Mangahewa D (WBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621629	1684858	2000
F8	WBM	April, 2013	STOS KADSA (GW) Mangahewa D (WBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621629	1684858	2000

Table 2: Well Data

ID	Well Type	Date Formed	Well Name	Northings	Eastings	Area
F1	SBM	September, 2012	Mangahewa D	5621582	1684847	18.50
F2	WBM	November, 2012	Mangahewa B (WBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621571	1684723	4300
F3	WBM	December, 2012	Mangahewa B (SBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621543	1684715	16000
F4	WBM/ SBM	March, 2013	Mangahewa D (WBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621777	1684724	6300
F5	WBM	April, 2013	STOS KADSA (GW) Mangahewa D (WBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621749	1684764	4100
F6	WBM	April, 2013	STOS KADSA (GW) Mangahewa D (WBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621677	1684810	2000
F7	WBM	April, 2013	STOS KADSA (GW) Mangahewa D (WBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621629	1684858	2000
F8	WBM	April, 2013	STOS KADSA (GW) Mangahewa D (WBM, OS, WBM) Mangahewa C (WBM, SBM) Ches B & C (WBM) Mau B (SBM) Ches A (OS)	5621629	1684858	2000

APPENDIX C COMPLIANCE WITH SC'S 14 AND 15 - RAWA STREAM



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BETTER TESTING BETTER RESULTS

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ANALYSIS REPORT

Page 1 of 1

Client:	BTW Company Limited	Lab No:	1408157	SPV1
Contact:	Dave Bolger	Date Registered:	04-Apr-2015	
	C/- BTW Company Limited	Date Reported:	14-Apr-2015	
	PO Box 551	Quote No:	67954	
	NEW PLYMOUTH 4340	Order No:	09389	
		Client Reference:		
		Submitted By:	Dave Bolger	

Sample Type: Aqueous						
Sample Name:		Rawa Stream				
		01-Apr-2015				
		12:30 pm				
Lab Number:		1408157.1				
Individual Tests						
pH	pH Units	7.7	-	-	-	-
Total Dissolved Solids (TDS)	g/m ³	230	-	-	-	-
Chloride	g/m ³	65	-	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m ³	< 0.10	-	-	-	-
C10 - C14	g/m ³	< 0.2	-	-	-	-
C15 - C36	g/m ³	< 0.4	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m ³	< 0.7	-	-	-	-

APPENDIX D PHOTOGRAPHIC RECORD OF LANDFARMING



November 2014 Pasture establishment

Coastal Planting along buffer zone June 2014

