

BTW Wellington Landfarm  
Monitoring Programme  
Annual Report  
2019-2020

Technical Report 2020-09

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## Executive summary

BTW Company Ltd (the Company) operated a landfarm (Wellington Landfarm) located on Brown Road, Waitara, in the Waitara catchment. The consent held by the Company allowed for the discharge of wastes from hydrocarbon exploration, well work-over, production and storage activities, onto and into land via landfarming.

This report for the period July 2019 to June 2020 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the Company's activities.

The Company holds one resource consent, which includes a total of 31 conditions setting out the requirements that the Company must satisfy.

### **During the monitoring period, the Company demonstrated an overall high level of environmental performance.**

The Council's monitoring programme for the year under review included one inspection, five water samples and two soil samples collected for physicochemical analysis.

The monitoring showed that the final landfarm area (area F12) reached the consent defined chemical criteria to allow it to be surrendered. This means all landfarmed areas are now compliant with the surrender conditions.

The groundwater analysis indicated that the elevated contaminates of benzene and total dissolved salts/solids (TDS) observed in monitoring wells GND2284 & 2285, had reduced to below the limit of detection (LOD) in the case of benzene, and below the consent limit in the case of TDS in both monitoring wells.

Trace values of toluene and o-xylene remain in GND228. However the concentrations recorded were below the value for 99% species protection for freshwater, as per the ANZG 2018 guidelines.

The consent holder has now satisfied all the remaining surrender related conditions associated with consent 7884-1.1 and accordingly the consent holder applied for surrender. This was surrendered in September 2020.

By comparison with previous years, the monitoring indicated an improvement in environmental condition, as discussed above. There were zero unauthorised incidents recording non-compliance in respect of this consent holder during the period under review.

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

For reference, in the 2019-2020 year, consent holders were found to achieve a high level of environmental performance and compliance for 81% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 17% 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 was at a high level in the year under review.

This report includes recommendations for the 2020-2021 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 2019 to June 2020 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by BTW Company Ltd (the Company). The Company operates a landfarm (Wellington Landfarm) situated on Brown Road, Waitara, in the Waitara Catchment.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consent held by the Company that relate to the discharges of drilling mud and associated 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 land, and is the eighth 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 through annual programmes;
- the resource consents held by the Company 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 2020-2021 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 2019-2020 year, consent holders were found to achieve a high level of environmental performance and compliance for 81% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 17% of the consents, a good level of environmental performance and compliance was achieved.

## 1.2 Process description

### 1.2.1 Hydrocarbon exploration and production wastes management

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.

### 1.2.2 Exploration wastes

#### 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. 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 are normally recovered from return flows during the drilling of a well, for re-use after separation from rock cuttings. They 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.

## 1.2.3 Production wastes

### Produced water

Produced water is subsurface water brought to the surface with oil and gas during the production of a well. It is primarily highly saline water, but its chemistry is altered through direct contact with geological formations and hydrocarbon reservoirs. The physical and chemical properties of produced water vary considerably depending on the geographic location of the field, geological formations, and the type of hydrocarbon product being produced.

Produced water is typically disposed of using deep well injection or similar disposal methods, but fixed quantities have on occasion been disposed of to land following evaluation of chemical concentrations.

### Fracturing return fluids

Water and sand (proppant) make up 98% to 99.5% of the fluid used in hydraulic fracturing. In addition, chemical additives are used. The exact formulation varies depending on the well. Chemicals serve many functions in hydraulic fracturing. From limiting the growth of bacteria to preventing corrosion of the well casing, chemicals are needed to ensure that the fracturing job is effective and efficient.

The number of chemical additives used in a typical fracture treatment depends on the conditions of the specific well being fractured. A typical fracture treatment will use very low concentrations of between 3 and 12 additive chemicals, depending on the characteristics of the water and the tight sand formations being fractured. Each component serves a specific, engineered purpose. For example, the predominant fluids currently being used for fracture treatments in gas shales are water-based fracturing fluids mixed with

friction-reducing additives (called slickwater). The addition of friction reducers allows fracturing fluids and sand, or other solid materials called proppants, to be pumped to the target zone at a higher rate and reduced pressure than if water alone were used.

In addition to friction reducers, other additives include: biocides to prevent microorganism growth which can interfere with the gel management system, and to reduce biofouling of the fractures and the production of sour gas; oxygen scavengers and other stabilisers to prevent corrosion of metal pipes; and sometimes acids that are used to remove drilling mud damage within the near-wellbore area. These fluids are used to create the fractures in the formation and to carry a propping agent (typically silica sand), which is deposited in the induced fractures to keep them from closing up.

The fracturing fluids disposed of to land through landfarming in Taranaki were return fluids following the completion of hydraulic fracturing jobs. The make-up of these fluids is altered during the fracturing process as these fluids interact with hydrocarbon reservoirs and varying geological formations. This material is tested for an extensive range of contaminants prior to storage and subsequent disposal.

Fracturing fluids are now disposed of in Taranaki via deep well re-injection. Discharge to land through landfarming of return fluids following the completion of hydraulic fracturing jobs in Taranaki had been consented and undertaken only at the Wellington Landfarm.

#### 1.2.4 Landfarming process description

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. Landfarming is a technology that uses natural and assisted bioremediation to reduce the concentration of petroleum compounds through degradation, while simultaneously utilising the drilling muds to stabilise poor quality sandy soils for subsequent land use.

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).



Figure 1 Landfarming at BTW Wellington Landfarm March 2013

The landfarming process utilised at this facility was on a single application basis. This means dedicated spreading areas each receive only a single application of waste. Basic steps in the landfarming process include:

1. Waste is transported from wellsites. 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 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, to reinstate and stabilise the site for future alternative use.

Consent 7884-1.1 allowed for the disposal of drilling wastes, oily wastes, contaminated soil, and production fluids including hydraulic fracturing return fluids.

When disposal is complete, the area is re-instated and the consents surrendered once proven to be suitable for uses such as grazing, following stabilisation and re-grassing. Suitability for return to pastoral use is proven by providing analytical evidence which will satisfy the specific consented conditions that dictate the acceptable level of certain contaminants in the soil.

### 1.2.5 Site description

The Wellington Landfarm is located on Brown Road, Waitara, on marginal coastal farm land situated on reworked dune fields. The predominant soil type has been identified as black loamy sand. Vegetation growth is primarily a mixture of pasture and dune grasses. Prior to the Wellington landfarm consent (7884-1) being exercised, there were areas of pine (Figure 2) which were subsequently removed and processed.



Figure 2 Aerial image Wellington Landfarm 2012



Figure 3 Aerial image Wellington Landfarm 2017

Average annual rainfall for the site is 1,383 mm (taken from nearby Motunui monitoring station). There are no significant surface water bodies located in the immediate vicinity of the areas that are landfarmed, other than small farm drains. Previous land use at the Wellington section of the landfarm has been a mixture of agriculture and small scale forestry. Further inland there are a number of commercial chicken sheds; one is located on the site (Figure 2 and 3).

#### Site data

Location	
Word descriptor:	Brown Road, Waitara, Taranaki
Map reference:	E 1704599
(NZTM)	N 5683484
Mean annual rainfall:	1383 mm
Mean annual soil temperature:	~14.05°C
Mean annual soil moisture:	~33.06%
Elevation:	~10 m asl
Geomorphic position:	Dune backslope
Erosion / deposition:	Erosion
Vegetation:	Pasture, dune grasses
Parent material:	Aeolian deposit
Drainage class:	Free / well draining
Landuse:	Remediating

## 1.3 Resource consents

The Company holds one resource consent, the details of which are summarised in the table below. Summaries of the conditions attached to the permit are set out in Section 3 of this report.

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

Table 1 Resource consent held by the Company

Consent number	Purpose	Granted	Review	Expires
<i>Discharges of waste to land</i>				
<b>7884-1.1</b>	To discharge wastes from hydrocarbon exploration, well work-over, production and storage activities, onto and into land via landfarming.	July 2011	June 2021	June 2027

## 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 Wellington Landfarm consisted of three 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 Wellington Landfarm site was inspected on one occasion this monitoring. Further visits were also undertaken during monitoring rounds for soil and groundwater. The inspection focused on the receiving environment. Regard was given to the former landfarmed areas across the site. A visual assessment of the vegetation cover was undertaken. The shoreline was also assessed for any apparent discharges.

## 1.4.4 Chemical sampling

The Council undertook the sampling of groundwater and soil at the Wellington Landfarm this monitoring period.

### Groundwater

The Wellington Landfarm contains four groundwater monitoring wells (Figure 4). These wells were installed as a consent requirement to assess the groundwater in the near vicinity of the drilling mud storage cells.

The recommendations from the 2018-2019 monitoring period (Technical Report 2019-26) indicated that two of the four monitoring wells (GND2282 and 2283) were to be excluded from further monitoring as these monitoring locations were compliant with consent conditions. Both of these wells were located beyond the property boundary, and were continuing to show no detections of any contaminants.

The monitoring of the two remaining wells (GND2284 and 2285) was to continue in the current compliance monitoring programme. GND2285 was to be assessed at the beginning of the monitoring period as the values recorded in the 2018-2019 monitoring period indicated the monitoring location was close to being compliant with consent conditions. GND2284 however, was assessed until the consent conditions were satisfied.

The monitoring of groundwater was conducted with a low flow peristaltic pump and a YSI flow-through cell to assess for in-situ field parameters. The analytes assessed are provided in Table 2.

### Soil

The monitoring of soil was undertaken to assess concentrations of target contaminants within the soil over time which are a direct result of the landfarming process. As landfarms function as a bioremediation technology, assessing landfarmed areas over time allows for the target contaminants of concern to be monitored and the degree of reducing contamination to be evaluated.

In this monitoring period soil sampling was undertaken on the final landfarm area of F12 (Figure 5). In this period two composite soil samples were collected from the former landfarm area of F12. The soil samples were collected via a soil corer, which was inserted to a nominal depth of 400 mm below ground level (bgl) (which encompasses the zone of application) across a landfarmed area.

A GPS location is collected at the beginning and at the end of each transect, the transects are generally 100 m long, with a soil core extracted every ten metres across the application area. This method is slightly modified from that described in the *Guidelines for the Safe Application of Biosolids to Land in New Zealand* (2003).

The analytes assessed in soil are listed in the following table.

Table 2 Monitoring analytes by medium

Groundwater monitoring parameters		Soil monitoring parameters	
Barium (acid soluble)	Benzene	Calcium	Total petroleum hydrocarbons C <sub>7</sub> -C <sub>9</sub> , C <sub>10</sub> -C <sub>14</sub> , C <sub>15</sub> -C <sub>36</sub> , C <sub>7</sub> -C <sub>36</sub> .
Barium (dissolved)	Toluene	Chloride	Benzene
Chloride	Ethylbenzene	Conductivity	Ethylbenzene
Conductivity	Xylenes	Potassium	Toluene
Sodium	Total petroleum hydrocarbons C <sub>7</sub> -C <sub>9</sub> , C <sub>10</sub> -C <sub>14</sub> , C <sub>15</sub> -C <sub>36</sub> , C <sub>7</sub> -C <sub>36</sub> .	Moisture factor	Xylenes
Total dissolved salts	Polycyclic aromatic hydrocarbons	Magnesium	Ammoniacal nitrogen
		Sodium	Nitrite/nitrate nitrogen
		Sodium absorption ratio (SAR)	pH
		Total soluble salts	Benzo (a) pyrene (BaP)
		Naphthalene	Pyrene
		Cation exchange	



Figure 4 Groundwater monitoring well locations Wellington Landfarm

## 2 Results

### 2.1 Inspections

2 July 2019

No recent mud storage or land-farming activities have occurred at the site, no storage pits are present; previous spreading areas had good pasture cover which appeared healthy, no muds were identified at the surface, and the paddock was being grazed by beef cattle. The shoreline was inspected, no deleterious effects were observed. Iron oxide was prevalent in the discharge from the cliff face in two locations.

#### 2.1.1 Provision of consent holder data

Throughout the operational phase of this landfarm the consent holder provided the Council with regular updates on site operations. These updates were provided through work notification e-mails while the site was landfarming and an annual report. The work notification also provided the Council with chemical assessment of each drilling mud waste stream, as required by consent.

The annual report also documented internal analysis undertaken by the consent holder throughout the active landfarming process.

A summation of the landfarming locations, including dates and source of materials is provided in the following Table 3. The actual locations are provided in the following Figure 5.

Table 3 Consent holder provided landfarming information

ID	Mud Type	Date	Well Name
F1	WBM	March-April 2011	Cheal B (WBM, OBM), Sidewinder (WBM), Mckee Production Station (OBM), Copper Moki (WBM)
F2	WBM	May, 2011	Sidewinder 3&4, Cheal C
F3	WBM	July, 2011	Ruru, KA 4/14
F4	WWF	July, 2011	Waitui-1
F5	WBM	Nov, 2011	MPO (OBM), Copper Moki (WBM), Cheal C (WBM), Sidewinder Sidetrack 1 (WBM), Mangahewa-D (WBM), Mangahewa-C (CF), Mangahewa-A (WBM), Waitui (CO), Talon-1 (WBM)
F6	WW	Nov, 2011	Tank Farm (WW), KA 1/7 (CO), KA 4/14 (CF)
F7	WWF	Nov, 2011	Mangahewa-D (WWF)
F8	WWF	April, 2012	Mangahewa-D (WWF)
F9	CF	April, 2012	Tank Farm (WW), Pacific Chieftain - Maui-B (OBM), KA8/12/15/18
F10	OBM	April, 2012	Mangahewa-C (WBM, OBM, WW), Mangahewa A (WBM), Pacific Chieftain - Maui-B (OBM), Nobel Discoverer (OBM), Mamutu Rd Spill (CO), Cheal C (CF, CO), MPO(CO)
F11	WWF	May, 2012	Mangahewa-C
F12	OBM	Aug, 2012	Mangahewa-A (WBM, OBM, WW, CO), Mangahewa-C(OBM, WW),Mangahewa-D (WBW, OBM, CO), Copper Moki (WW, CO, OBM), Kea Puka/Douglas (OBM, WBM, OBM)
F13	OBM	Aug, 2012	Mangahewa-D(OBM, CO, WW)

ID	Mud Type	Date	Well Name
F14	OBM	Aug, 2012	KA 2 (CO) Maui B(OBM)
F15	WBM	Oct, 2012	Mangahewa-C
F16	CS	Mar,2013	KA 13
F17	CS	May, 2013	KA 3
F18	WWF	May, 2013	Todd MHW D
F19	WWF	May, 2013	Todd MHW D
F20	WWF	Aug, 2013	Todd MHW C9
F21	OBM	Aug, 2013	Todd MHW C9
F22	CS	Aug, 2013	KA 3, KA 6
F23	CS	Dec, 2013	KA 6
WWF: Well work over fluid; OBM: Oil based materials; WBM: Water based muds			
WW: Waste water; CS: Contaminated soil; CF: Contaminated Fluid; SBM: Synthetic based muds; CO contaminated oil.			

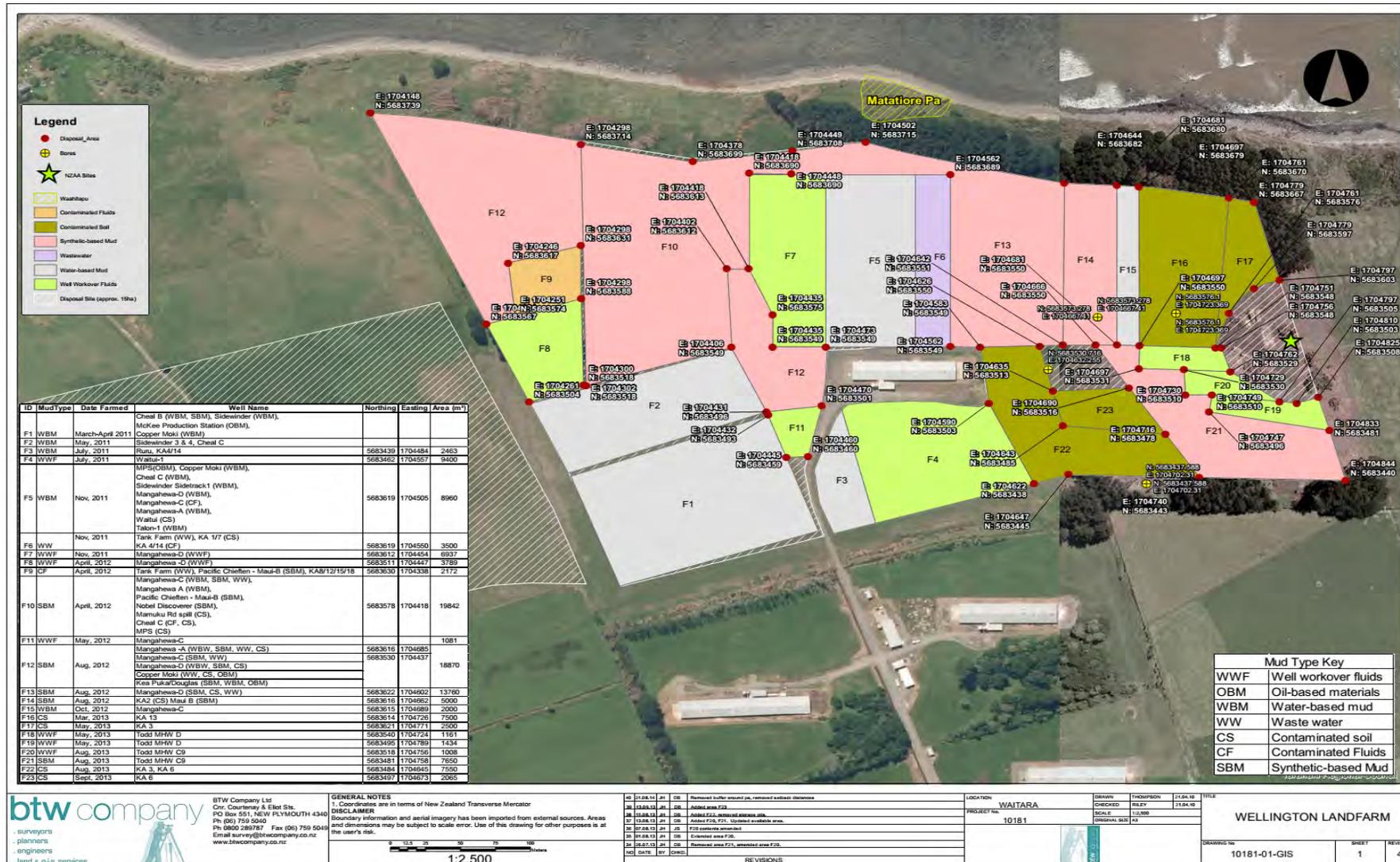


Figure 5 BTW Wellington Landfarm application areas

## 2.2 Results of receiving environment monitoring

### 2.2.1 Soil monitoring

Two composite soil samples were collected from landfarmed area F12 this monitoring period. For context, area F12 is the final landfarmed area to reach surrender concentrations, as defined by consent 7884-1.1. Area F12 was landfarmed in August 2012 and this parcel of land has been monitored by the Council since that date. The analysis as well as the consent defined surrender concentrations are provided in the following Table 4.

Included in the following table are the most recent soil samples collected from this area. These span two monitoring periods. The samples collected in this monitoring period were analysed for total petroleum hydrocarbons (C<sub>7</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub>, C<sub>15</sub>-C<sub>36</sub> and C<sub>7</sub>-C<sub>36</sub>) only. This was defined by the recommendations of the previous monitoring period's annual report (Technical Report 2019-26) as C<sub>10</sub>-C<sub>14</sub> was reported as marginally above the limit for surrender in the 2018-2019 monitoring period.

Table 4 Soil sampling of area F12 Wellington Landfarm 2018-2020

Wellington Landfarm	Collected	Consent limit surrender	2018-2019 monitoring				2019-2020 monitoring	
			14-Aug-18	14-Aug-18	26-Feb-19	26-Feb-19	05-Sep-19	05-Sep-19
Parameters	Time	7884-1.1	14:30	15:00	13:10	13:30	10:05	10:30
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.027	< 0.013	0.015	< 0.011	0.011	NR	NR
Naphthalene	mg/kg dry wt	7.2	< 0.07	< 0.07	< 0.06	< 0.06	NR	NR
Pyrene	mg/kg dry wt	160	0.019	0.029	< 0.011	< 0.011	NR	NR
Total of Reported PAHs in Soil	mg/kg	-	< 0.4	< 0.4	< 0.3	< 0.3	NR	NR
C <sub>7</sub> - C <sub>9</sub>	mg/kg dry wt	120	< 8	< 8	< 8	< 8	< 8	< 8
C <sub>10</sub> - C <sub>14</sub>	mg/kg dry wt	58	<u>180</u>	<u>146</u>	< 20	< 20	37	25
C <sub>15</sub> - C <sub>36</sub>	mg/kg dry wt	4,000	1,720	1,370	240	144	520	420
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	mg/kg dry wt	-	1,900	1,520	240	144	560	450
Benzene	mg/kg dry wt	1.1	< 0.06	< 0.06	< 0.05	< 0.05	NR	NR
Toluene	mg/kg dry wt	68	< 0.06	< 0.06	< 0.05	< 0.05	NR	NR
Ethylbenzene	mg/kg dry wt	53	< 0.06	< 0.06	< 0.05	< 0.05	NR	NR
m&p-Xylene	mg/kg dry wt	48	< 0.12	< 0.11	< 0.10	< 0.10	NR	NR
o-Xylene	mg/kg dry wt	48	< 0.06	< 0.06	< 0.05	< 0.05	NR	NR
Chloride	mg/kg	700	46	25	21	52	NR	NR
Electrical Conductivity (EC)	mS/cm	290	0.16	0.13	0.06	0.09	NR	NR
Sodium Absorption Ratio (SAR)		18	2.4	2	NR	NR	NR	NR
Soluble Salts (Field)	%	0.25	0.06	< 0.05	< 0.05	< 0.05	NR	NR
Total Base Saturation	%	-	100	100	100	100	NR	NR

NR= No result

The analysis provided by Table 4 indicated the following:

- Consent 7884-1.1 surrender defined concentrations for target contaminants within the soil have been met across all required parameters in area F12.
- The final parameter to remediate to below the consent defined limit was TPH carbon chain C<sub>10</sub>-C<sub>14</sub>. The limit for surrender is set <58 mg/kg. The values recorded in this monitoring period were 37 and 25 mg/kg respectively.
- For context,
  - In October 2013 TPH all chains (C<sub>7</sub>-C<sub>36</sub>) within area F12 held a concentration of 23,000 mg/kg,
  - In 2015-2016 monitoring period this value had reduced to 9,200 mg/kg.
  - In the 2016-2017 monitoring period the value for total TPH was recorded at 8,600 mg/kg.
  - In the 2017-2018 monitoring period, the samples collected ranged from 200-4,000 mg/kg TPH (C<sub>7</sub>-C<sub>36</sub>).
  - In the 2018-2019 period C<sub>7</sub>-C<sub>36</sub> ranged 144-1,900 mg/kg.
  - In the current monitoring period (2019-2020) the reported range for C<sub>7</sub>-C<sub>36</sub> was reported as 450-560 mg/kg, of which the carbon chain of concern (C<sub>10</sub>-C<sub>14</sub>) recorded values of 37 and 25 mg/kg.
- All previously landfarmed areas of Wellington Landfarm have now met their conditional limit for surrender.
- No further monitoring of previously landfarmed areas is required at Wellington Landfarm.
- Analysis of previously landfarmed areas at Wellington Landfarm can be sourced from Technical Reports listed in the bibliography/references section of this report.

## 2.2.2 Groundwater monitoring

The groundwater monitoring well network was installed (September 2012) to assess for impacts to groundwater in the vicinity of the drilling mud storage cells. The initial storage was undertaken in unlined storage cells, accordingly impacts to groundwater in close proximity to the cell locations occurred. The breadth of impacts to groundwater have been documented in previous technical reports. These can be referenced at the end of this report.

This monitoring period focused on the two remaining monitoring locations which had recorded impacts to groundwater in the 2018-2019 monitoring period (GND2284 and GND2285), as recommended in the 2018-2019 monitoring period.

It is noteworthy to mention that of the two monitoring wells, GND2285 is the less impacted of the two, historically it was the more impacted. The initial round of monitoring in this period indicated whether this well (GND2285) could be dropped from further monitoring if the consent conditions were met, which they were.

Provided in the following Table 5 are the final five monitoring rounds of GND2285. This includes a portion of the previous year's monitoring data for context.

Table 5 GND2285 monitoring data 2018-2020

BTW	Site	GND2285	GND2285	GND2285	GND2285	GND2285
Wellington LF	Collected	14 Aug 2018	08 Oct 2018	26 Feb 2019	08 May 2019	03 Sep 2019
Parameter	Time	13:00	10:40	11:30	11:15	10:10
Water level	m	0.774	1.476	2.01	1.596	1.19
pH	pH Units	6.2	6.3	6.3	6.3	6.3
Sample Temperature	°C	15	15.6	18.1	18	15.3
Acid Soluble Barium	g/m <sup>3</sup>	1.23	1.3	1.12	1.14	0.96
Dissolved Barium	g/m <sup>3</sup>	1.27	1.36	1.12	1.17	0.91
Electrical Conductivity (EC)	mS/m	410	440	376	325	345
Total Dissolved Solids (TDS)	g/m <sup>3</sup>	2,400	3,300	2,200	2,100	2,200
Total Sodium	g/m <sup>3</sup>	470	490	450	400	360
Chloride	g/m <sup>3</sup>	1,170	1,230	1,030	830	900
Benzene	g/m <sup>3</sup>	0.02	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Toluene	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Ethylbenzene	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m <sup>3</sup>	0.006	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
C <sub>7</sub> - C <sub>9</sub>	g/m <sup>3</sup>	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
C <sub>10</sub> - C <sub>14</sub>	g/m <sup>3</sup>	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C <sub>15</sub> - C <sub>36</sub>	g/m <sup>3</sup>	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	g/m <sup>3</sup>	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

The analysis provided in Table 5 indicated the following:

- pH results were stable across the five final monitoring rounds, ranging 6.2-6.3 pH.
- The temperature of the groundwater ranged 15-18.1°C across the five final monitoring rounds.
- Acid soluble barium demonstrated a reducing trend across the five monitoring rounds, 1.3 g/m<sup>3</sup>- 0.96 g/m<sup>3</sup>
- Dissolved barium also recorded a decreasing trend across the five rounds, 1.36 g/m<sup>3</sup> – 0.91 g/m<sup>3</sup>
- Electrical conductivity decreased across the five monitoring rounds, 440 through to 345 mS/m at 25°C.
- Total dissolved salts/ solids reduced to below its consent defined maximum of 2,500 g/m<sup>3</sup> in February 2019 with a value of 2,200 g/m<sup>3</sup>. It remained below the maximum allowable value of 2,500 g/m<sup>3</sup> in the following two monitoring rounds of May and September 2019.
- Total sodium demonstrated a reducing trend across the five monitoring rounds, ranging 490- 360 g/m<sup>3</sup>.
- Benzene was recorded on one occasion (August 2018, 0.02 g/m<sup>3</sup>). The subsequent monitoring rounds did not record benzene above the laboratory defined limit of detection (LOD), which was set at 0.001 g/m<sup>3</sup>.
- Toluene, ethylbenzene, and xylene-o, were all below the LOD which was set as 0.001 g/m<sup>3</sup>.
- Xylenes m & p record one low concentration (0.006 g/m<sup>3</sup>) in August 2018. The subsequent rounds were all below the LOD, which was set at 0.002 g/m<sup>3</sup>.

- No petroleum hydrocarbons C7-C9, C10-C14, C15-C36 and C7-C36 were recorded above the LOD which were set at 0.06, 0.2, 0.4 and 0.7 g/m<sup>3</sup> respectively.

Two contaminants had been specifically on the watch list for this monitoring location over time. They were benzene and total dissolved salts/solids respectively.

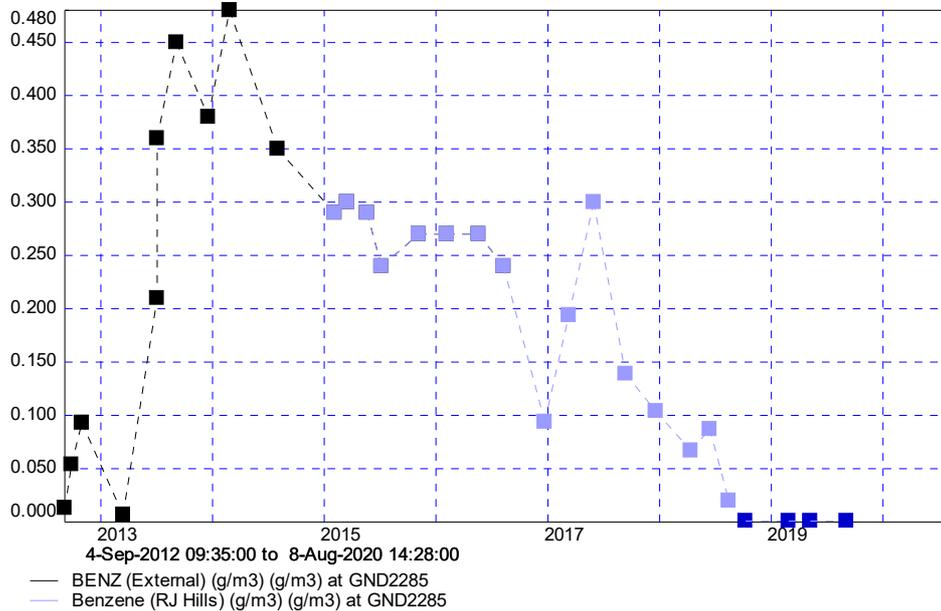


Figure 6 GND2285 Benzene monitoring September 2012 through to August 2020

Benzene had been monitored since September 2012 in the monitoring well GND2285 (Figure 6). The Council has observed a steady reduction in benzene results over time since this date. The closing data for this monitoring location indicated no recorded results above the LOD on four consecutive occasions.

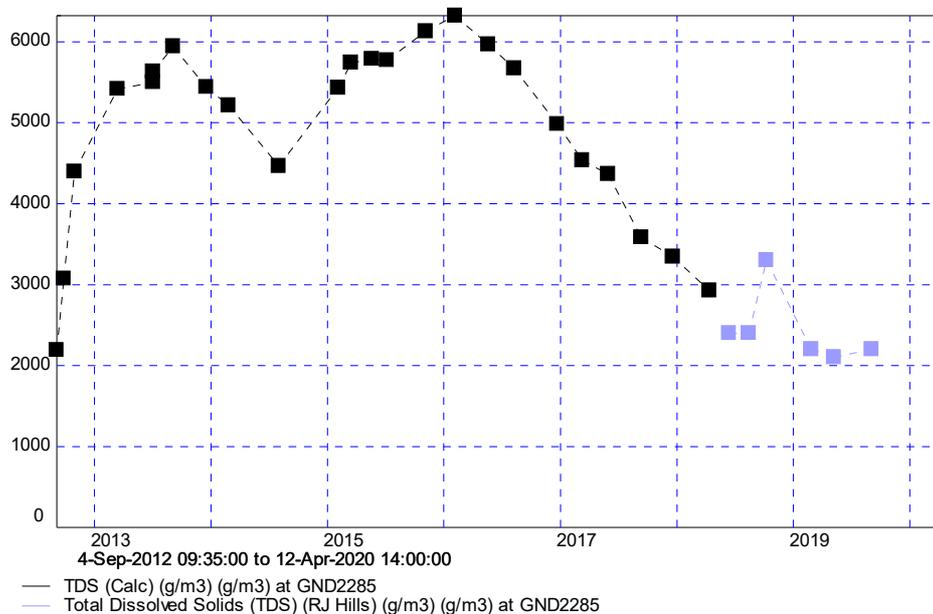


Figure 7 GND2285 total dissolved salts/ solids September 2012 through April 2020

Total dissolved salts/solids (TDS) concentrations in groundwater have a consent defined maximum allowable concentration. This is defined by consent 7884-1.1 condition 22, which states the exercise of consent shall not result in the concentration of total dissolved salts in any fresh water body exceeding 2,500 g/m<sup>3</sup>.

Long term analysis of GND2285 had recorded significant values for this analyte over time (Figure 7). However, the final three monitoring rounds indicated a reduction in values, to below the consented value (<2,500 g/m<sup>3</sup>).

Table 6 GND2284 monitoring data 2018-2020

BTW	Site	GND2284							
Wellington LF	Collected	14 Aug 2018	08 Oct 2018	26 Feb 2019	08 May 2019	03 Sep 2019	24 Mar 2020	25 May 2020	06 Jul 2020
Parameter	Time	12:15	11:45	10:45	10:30	10:52	09:20	14:30	14:10
Water level	m	1.183	1.898	2.361	1.808	1.8	1.92	1.763	1.63
pH	pH Units	5.8	4.4	6.1	6.1	6.2	6.2	6.2	6.3
Sample Temperature	°C	15.4	16.2	18.2	17.3	14.9	16.7	16.6	15.4
Acid Soluble Barium	g/m <sup>3</sup>	1.89	1.65	2.1	2.1	1.67	NR	1.16	1.1
Dissolved Barium	g/m <sup>3</sup>	1.94	1.77	2.2	2.1	1.63	1.25	1.11	1.12
Electrical Conductivity (EC)	mS/m	680	633	516	471	470	345	325	345
Total Dissolved Solids (TDS)	g/m <sup>3</sup>	3,900	3,600	3,000	2,900	3,000	1,960	1,780	2,000
Total Sodium	g/m <sup>3</sup>	550	510	450	350	370	280	300	290
Chloride	g/m <sup>3</sup>	2300	2100	1580	1130	1350	900	800	890
Benzene	g/m <sup>3</sup>	0.128	0.061	0.11	0.049	0.0187	0.001	< 0.0010	< 0.0010
Toluene	g/m <sup>3</sup>	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.0015
Ethylbenzene	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
m&p-Xylene	g/m <sup>3</sup>	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	g/m <sup>3</sup>	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.0011	0.0016	0.0016
C <sub>7</sub> - C <sub>9</sub>	g/m <sup>3</sup>	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.10	< 0.10	< 0.10
C <sub>10</sub> - C <sub>14</sub>	g/m <sup>3</sup>	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C <sub>15</sub> - C <sub>36</sub>	g/m <sup>3</sup>	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	g/m <sup>3</sup>	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

The analysis provided by Table 6 indicated the following:

- Electrical conductivity (EC) demonstrated a decreasing trend in values over the course of a 24 month period.
- pH values demonstrated a slight increasing trend over the course of the 24 month period.
- Groundwater temperatures ranged 14.9 -18.2 °C.
- Dissolved barium within the groundwater demonstrated a reducing concentration, 1.94 g/m<sup>3</sup> (August 2018) through to 1.12 g/m<sup>3</sup> (July 2020).
- Acid soluble barium also recorded a reduction across the monitoring rounds, 1.89 g/m<sup>3</sup> (August 2018) through to 1.1 g/m<sup>3</sup> (July 2020).
- Total petroleum hydrocarbons (TPH) C<sub>7</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub>, C<sub>15</sub>-C<sub>36</sub> and C<sub>7</sub>-C<sub>36</sub> did not record any values above the laboratory defined limit of detection (LOD) across the final eight monitoring rounds.
- Benzene analysis demonstrated a decreasing concentration with the final detection (0.001 g/m<sup>3</sup>) recorded in March 2020. The subsequent two monitoring rounds did not record this parameter above the LOD.

- Toluene was recorded at trace (inconsequential) concentrations in the final monitoring round (0.0015 g/m<sup>3</sup>). Prior to this, the last detection was recorded in February 2019 (0.0011 g/m<sup>3</sup>).
- Ethylbenzene and m & p Xylene were not recorded above the LOD in any of the last eight monitoring rounds of this location.
- O-xylene recorded three trace values across the final three monitoring rounds 0.0011 – 0.0016 g/m<sup>3</sup>, in March, May and July 2020.
- Total dissolved solids/ salts demonstrated a decreasing concentration, the consent requirement is for no value greater than 2,500 g/m<sup>3</sup>. Three rounds have been completed which recorded values below this limit. March through to July 2020.
- Chloride analysis indicated a decrease in results across the eight monitoring rounds, reducing from 2,300 g/m<sup>3</sup> (August 2018) through to 890 g/m<sup>3</sup> (July 2020).
- Total sodium analysis also recorded reducing concentrations 550 g/m<sup>3</sup> (August 2018) through to 290 g/m<sup>3</sup> (July 2020)

Contaminates of concern in regard to GND2284. Specifically benzene and total dissolved salts/ solids (TDS) were the main chemical constituents which were elevated in the groundwater. These chemicals within the groundwater were the result of legacy effects. This has been reported in previous technical reports.

The monitoring detailed in this report indicated a reduction in the concentration of the analyte benzene to below the LOD which was set at 0.001 g/m<sup>3</sup> by the laboratory. The final two monitoring rounds (May and July 2020) recorded values below the LOD. Long-term analysis of benzene is provided in the following Figure 8.

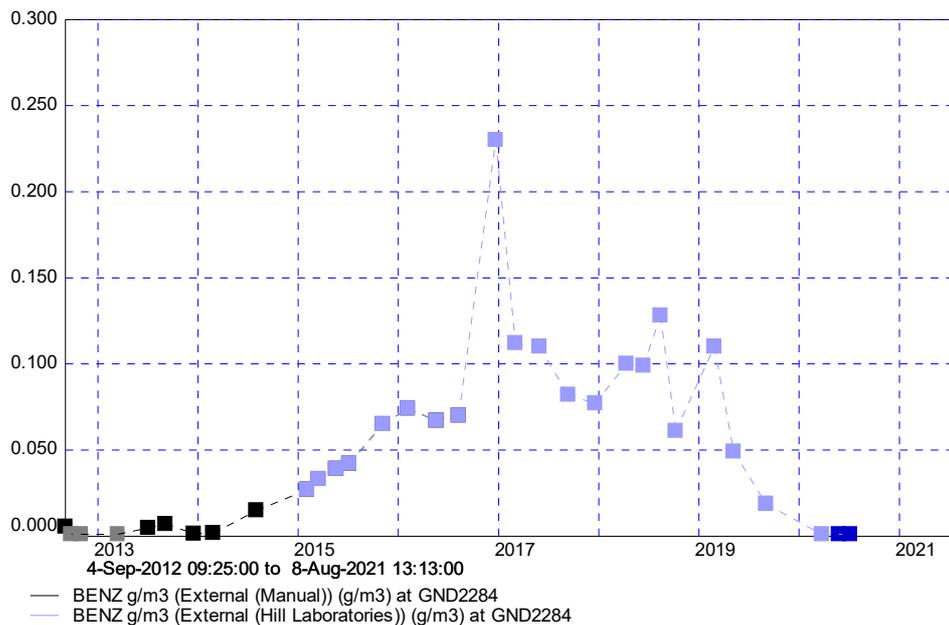


Figure 8 Long-term monitoring of benzene GND2284

TDS, which is required by consent to not exceed a value of 2,500 g/m<sup>3</sup>, was recorded below this value in the March 2020 monitoring round. The last time this was below the consented value was March 2014. The final three monitoring rounds were below this value, as indicated in Figure 9.

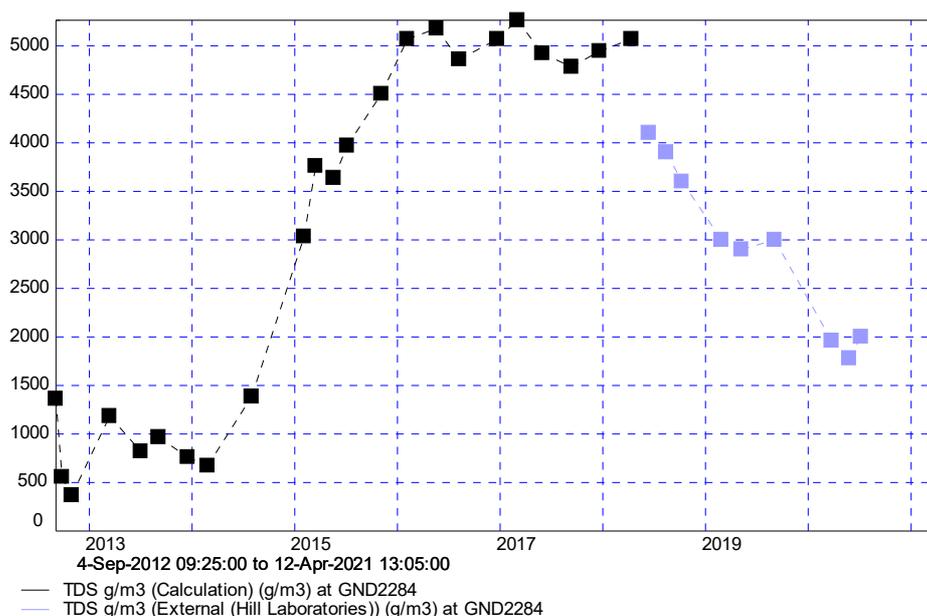


Figure 9 Long-term monitoring of TDS GND2284

Reported in the final two monitoring rounds of GND2284 were trace concentrations of O-xylene (0.0016 g/m<sup>3</sup>) and toluene (0.0015 g/m<sup>3</sup>). While these values were measurable, they were very close to the limit of detection (0.0010 g/m<sup>3</sup>) and are of no consequence. The ANZG 2018<sup>1</sup> default guideline values for 99% species protection in freshwater for these two parameters O-xylene (0.2 g/m<sup>3</sup>) and toluene (0.11 g/m<sup>3</sup>) are significantly higher than the recorded values in GND2284 for the two analytes.

## 2.3 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 Company. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach, that in the first instance avoids issues occurring, is favoured.

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

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

In the 2019-2020 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.

<sup>1</sup> <https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants/search>

## 3 Discussion

### 3.1 Discussion of site performance

In this monitoring period the final piece of landfarmed land at the Wellington Landfarm (area F12), was found to be within criteria to be surrendered. This location had been monitored since 2012. This is the final piece of the 23 portions of land which had been utilised for landfarming at the Wellington Landfarm to reach criteria for surrender from consent.

Soil surrender criteria related and long term analysis of the other 22 portions of land utilised for landfarming can be referenced in previous monitoring reports, these are provided in the bibliography section of this report.

As the landfarm was in its final stages of remediation this monitoring period, not much was required from a consent holder perspective, as the areas of land utilised for landfarming have all been revegetated, with no muds visible in any of the previous areas. The storage pits had been removed during an earlier monitoring year with the area of land revegetated. The four groundwater monitoring wells remain on site.

The consent holder applied for the consent (7884-1.1) to be surrendered, which occurred 9 September 2020.

### 3.2 Environmental effects of exercise of consents

Environmental effects associated with this consent were centred on a legacy impact to groundwater, arising when the consent holder had discharged drilling mud into unlined storage cells. Consequently, impacts to groundwater occurred, August 2012.

The groundwater effects were in the form of elevated petroleum and saline related contaminants recorded in the groundwater. Notably, none of these contaminants were recorded off-site. Earlier monitoring reports reference an annual marine intertidal survey which was discontinued at the end of the 2014-2015 monitoring year. This was due to the monitoring of that annual marine ecological survey not finding any detectable adverse effects on the intertidal reef communities.

Since these impacts occurred, the Council has monitored the groundwater and recorded the decrease in associated contaminants over time. In this monitoring period the remaining parameters of concern, benzene and total dissolved salts/solids (TDS), in monitoring wells GND2284 and 2285, had reduced to below the limit of detection in the case of benzene, and in the case of TDS to below the consent defined limit of 2,500 g/m<sup>3</sup>. Trace values for toluene and xylene still remain in one monitoring well, GND2284, however these contaminant concentrations were well below the guideline value for 99% species protection in freshwater, as per the ANZG 2018 guidelines.

One area of land, area F12, was the final portion of landfarmed land to meet its chemical criteria for surrender. It did so in this monitoring period, with the final contaminate, total petroleum hydrocarbon C<sub>10</sub>-C<sub>14</sub>, recording values below the set surrender criteria limit, which is <58 mg/kg. This was recorded on four consecutive samples of the area F12.

### 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 9, the environmental performance over time for this consent holder is provided in Table 10.

Table 7 Summary of performance for consent 7884-1.1

<b>Purpose: To discharge wastes from hydrocarbon exploration, well work-over, production and storage activities, onto and into land via landfarming</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Consent application definition	Not applicable	N/A
2. Definitions which apply to the consent	Not applicable	N/A
3. Best practicable option to be adopted	Inspections and liaison with consent holder	Yes
4. Only specified wastes to be discharged	Not applicable as no deliveries in this monitoring period	N/A
5. Notification 48 hours prior to stockpiling	Not applicable as no deliveries in this monitoring period	N/A
6. Notification 48 hours prior to landfarming	Not applicable as no landfarming operations in this monitoring period	N/A
7. Sample of wastes from each individual source to be collected and analysed	Not applicable as no landfarming operations have been undertaken since September 2013	N/A
8. Keep records relating to wastes, areas, compositions, volumes, dates, treatments and monitoring	Information provided by consent holder	Yes
9. Report on records in to Council by 31 August	No report received, consent now surrendered, previous report received 27 August 2019	N/A
10. Well work-over fluids to be stored in tank or pit	Inspections and information provided by consent holder indicated WWF was stored in a lined cell. Though no longer stockpiling. Landfarming completed in September 2013	N/A
11. Liquid oily wastes to be stored in tank or mixed into pit	None received during monitoring period	N/A
12. All wastes landfarmed ASAP or within 12 months	Inspections and information provided by consent holder	Yes
13. Well work-over fluids to be kept separate from other waste types	Inspections and information provided by consent holder	Yes
14. No waste to be discharged into F1 and F2 areas	Inspections and information provided by consent holder	Yes
15. Solid waste to be applied either 100 mm or 50 mm thick depending on hydrocarbon concentration	Inspections and information provided by consent holder	Yes
16. Parameters for rate of liquid waste application	Inspections and information provided by consent holder	Yes

<b>Purpose: To discharge wastes from hydrocarbon exploration, well work-over, production and storage activities, onto and into land via landfarming</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
17. Incorporation of solid wastes to a depth of at least 250 mm ASAP	Inspections and information provided by consent holder	Yes
18. Hydrocarbon concentration shall not exceed 50,000 mg/kg dry weight	Sampling and information provided by consent holder	Yes
19. Single application of wastes to each area of land	Inspections and information provided by consent holder	Yes
20. No discharge within 25 m of a water body, property boundary or within 50 m of the Tasman Sea	Inspections and information provided by consent holder	Yes
21. Re-vegetate landfarmed areas as soon as practicable	Inspections and information provided by consent holder	Yes
22. Total dissolved salts in surface water or groundwater shall not exceed 2,500 g/m <sup>3</sup>	Monitoring indicated that this has been achieved	Yes
23. Contaminants in surface or groundwater not to exceed background concentrations	Trace values of toluene and o-xylene in one well (GND2284), in close proximity to former storage cells though these do not exceed 99% species protection for freshwater quality (ANZG2018)	Yes
24. Conductivity must be less than 400 mS/m. If background conductivity exceeds 400 mS/m, then increase shall not exceed 100 mS/m	Sampling	Yes
25. 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
26. Concentration of metals in soil to comply with guidelines	Long term analysis of soil metal concentration indicated compliance with this condition	Yes
27. Levels of contaminants prior to expiry, cancellation, or surrender of consent	Monitoring of final landfarmed area F12 indicated compliance with this condition as did the groundwater which enabled this consent to be surrendered.	Yes
28. Consent may not be surrendered until condition 27 is satisfied	Consent surrendered 22/07/2020	N/A
29. Notification of discovery of archaeological remains	None found	N/A
30. Consent to lapse in 2016 unless given effect to	Consent exercised	N/A
31. Optional review provision re environmental effects	Next optional review in June 2015	N/A

Purpose: To discharge wastes from hydrocarbon exploration, well work-over, production and storage activities, onto and into land via landfarming		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
Overall assessment of environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>

Table 8 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2011-2012	7884-1		1		
2012-2013	7884-1				1
2013-2014	7884-1		1		
2014-2015	7884-1.1		1		
2015-2016	7884-1.1		1		
2016-2017	7884-1.1		1		
2017-2018	7884-1.1		1		
2018-2019	7884.1.1	1			
Totals		0	6	0	1

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

### 3.4 Recommendations from the 2018-2019 Annual Report

In the 2018-2019 Annual Report, it was recommended:

1. THAT in the first instance, monitoring of consented activities at Wellington Landfarm in the 2019-2020 year be amended from that undertaken in 2018-2019, by the following:
2. The monitoring of groundwater monitoring wells GND2282 and GND2883 will cease.
3. The monitoring of groundwater monitoring wells GND2284 and GND2885 will continue until conditional limits for surrender are met.
4. The monitoring of area F12 (final area) will continue for one more round of two composite soil samples for total petroleum hydrocarbons only. The results of these proposed soil samples will determine whether further soil sampling is required. If these result in elevated contaminants of concern then further soil sampling will be required.
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.

Recommendations 1- 4 were undertaken, recommendation 5 was not required.

### 3.5 Alterations to monitoring programmes for 2020-2021

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 2020-2021 that the monitoring of the consent ceases as the consent was successfully surrendered in July 2020.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site(s) 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 2020-2021.

## 4 Recommendations

1. That the monitoring of the Wellington Landfarm in the 2020-2021 monitoring period cease, as the consent has been successfully surrendered.

## 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.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 25°C and expressed in $\mu\text{S}/\text{cm}$ .
Cu*	Copper.
Cumec	A volumetric measure of flow- 1 cubic metre per second ( $1 \text{ m}^3\text{s}^{-1}$ ).
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
$\text{g}/\text{m}^3$	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
Incident register	The incident register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
$\text{m}^2$	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.
$\mu\text{S}/\text{cm}$	Microsiemens per centimetre.
$\text{NH}_4$	Ammonium, normally expressed in terms of the mass of nitrogen (N).
$\text{NH}_3$	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
$\text{NO}_3$	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 1991</i> and including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
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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Taranaki Regional Council, 2014: BTW Company Ltd Brown Road Landfarm Monitoring Programme Annual Report 2013-2014. Technical Report 14-66.

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# Appendix I

## Resource consents held by BTW Company Ltd

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

### Water abstraction permits

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

### Water discharge permits

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

### Air discharge permits

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

### Discharges of wastes to land

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

### Land use permits

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

### Coastal permits

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

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

Name of  
Consent Holder:           BTW Company Limited  
                                    PO Box 551  
                                    New Plymouth 4340

Decision Date               19 March 2015  
(Change):

Commencement Date       19 March 2015                   (Granted Date: 8 July 2011)  
(Change):

**Conditions of Consent**

Consent Granted:           To discharge wastes from hydrocarbon exploration, well  
                                    work-over, production and storage activities, onto and into  
                                    land via landfarming

Expiry Date:                1 June 2027

Review Date(s):            June 2015. June 2016, June 2021

Site Location:              70 Brown Road, Waitara  
                                    (Property owner: HV & MC Wellington)

Legal Description:         Lot 1 DP 5462 Blk III Paritutu SD (Discharge site)

Grid Reference (NZTM)    1704600E-5683480N

Catchment:                 Waitara

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

**General condition**

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

**Special conditions**

1. This consent applies only to areas F12 and F18, as detailed in attached drawing no 10181-01-GIS Revision 40.
2. For the purposes of this consent the following definitions shall apply:
  - a) Landfarming means the discharge of wastes onto land, subsequent spreading and incorporation into the soil, for the purpose of attenuation of hydrocarbon and/or other contaminants, and includes any stripping and relaying of topsoil.
  - b) Storage means a discharge of wastes from vehicles, tanks, or other containers onto land for the purpose of temporary storage prior to landfarming, but without subsequently spreading onto, or incorporating the discharged material into the soil within 48 hours.
3. 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.
4. Only those wastes specified in application 6815 shall be discharged.

**Notifications, monitoring and reporting**

5. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing [worknotification@trc.govt.nz](mailto:worknotification@trc.govt.nz)) at least 48 hours prior to permitting wastes onto the site. Notification shall include the following information:
  - a) the consent number;
  - b) the name of the well and wellsite, or other source, from which the waste was generated;
  - c) the type of waste to be stored; and
  - d) the volume of waste to be stored.
6. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing [worknotification@trc.govt.nz](mailto:worknotification@trc.govt.nz)) at least 48 hours prior to landfarming wastes. Notification shall include the following information:
  - a) the consent number;
  - b) the name of the well and wellsite, or other source, from which the waste was generated;
  - c) the type of waste to be landfarmed;
  - d) the volume of the waste to be landfarmed;
  - e) the concentration of hydrocarbons in the waste; and
  - f) the specific location and area over which the waste will be landfarmed.

## Consent 7884-1.1

7. The consent holder shall take a representative sample of the wastes from each individual source and have it analysed for the following:
- total petroleum hydrocarbons (C<sub>6</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub>, C<sub>15</sub>-C<sub>36</sub>);
  - benzene, toluene, ethylbenzene, and xylenes;
  - polycyclic aromatic hydrocarbons screening;
  - chloride, nitrogen, pH, potassium, and sodium; and
  - for well work-over fluids only, ethylene glycol, gluteraldehyde, hexavalent chromium and methanol;

and shall provide the results to the Chief Executive, Taranaki Regional Council, prior to landfarming the wastes.

8. The consent holder shall keep records of the following:
- composition of wastes;
  - storage area(s);
  - volumes of material stored;
  - landfarming area(s), including a map showing individual disposal areas with GPS co-ordinates;
  - volumes and weights of wastes landfarmed;
  - dates of commencement and completion of storage and landfarming events;
  - dates of sowing landfarmed areas;
  - photographic evidence of pasture establishment;
  - treatments applied;
  - 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.

9. 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 8, for the period of the previous 12 months, 1 July to 30 June.

### **Storage**

10. Well work-over fluids requiring storage prior to landfarming, shall be stored in a tank, or in a pit with an impermeable synthetic liner.
11. Liquid oily wastes shall be either:
- stored in a tank, or in a pit with an impermeable synthetic liner; or
  - mixed directly into a pit containing a suitable volume of water based mud waste, in a manner that prevents the liquid oily wastes entering the ground.
12. All wastes must be landfarmed as soon as practicable, but no later than twelve months after being brought onto the site.

**Discharge limits**

13. Well work-over fluids shall be kept separate and distinct from other waste types.
14. No wastes shall be discharged in the F1 and F2 areas landfarmed under consent 7670-1.
15. For the purposes of landfarming, solid 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.
16. For the purposes of landfarming, liquid wastes shall be applied to land:
  - a) at a rate not exceeding 1 cubic metre of waste per 4 square metres of land; and
  - b) at a rate such that there is no overland flow of liquids; and
  - c) at a rate such that no ponded liquids remain after one hour, after application.
17. As soon as practicable following the application of solid wastes to land, the consent holder shall incorporate the wastes into the soil to a depth of at least 250 mm.
18. The hydrocarbon concentration in the soil over the landfarming area shall not exceed 50,000 mg/kg dry weight at any point where:
  - a) liquid waste has been discharged; or
  - b) solid waste has been discharged and incorporated into the soil.
19. Any areas of land used for the landfarming of wastes in accordance with conditions 15-17 of this consent, shall not be used for any subsequent discharges of waste.
20. No discharge shall take place within 25 metres of surface water courses or of property boundaries, or within 50 metres of Mean High Water Springs.
21. 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.

**Receiving environment limits - water**

22. The exercise of this consent shall not result in the concentration of total dissolved salts in any fresh water body exceeding 2500 g/m<sup>3</sup>.
23. Other than as provided for in condition 22, 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**

- 24. 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.
- 25. 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.
- 26. 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 for the Environment and New Zealand Water & Wastes Association’s Guidelines for the safe application of biosolids to land in New Zealand (2003).
- 27. From 1 March 2027 (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 (C<sub>7</sub>-C<sub>9</sub>, C<sub>10</sub>-C<sub>14</sub>, C<sub>15</sub>-C<sub>36</sub>)

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 application is not subsequently withdrawn.

- 28. This consent may not be surrendered at any time until the standards in condition 27 have been met.

**Archaeological remains**

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

**Lapse and review**

30. This consent shall lapse on 30 September 2016, 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.
31. 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 2016 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 19 March 2015

For and on behalf of  
Taranaki Regional Council

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A D McLay  
**Director - Resource Management**

Consent 7884-1.1

