

Greymouth Petroleum Limited
Ngatoro-G Exploration Wellsite
Monitoring Programme Report
2011-2013

Technical Report 2013–35

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Executive summary

Greymouth Petroleum Limited established a hydrocarbon exploration site located on Bedford Road, within the Inglewood district, in the Waitara catchment. The site is called Ngatoro-G wellsite. This report covers the period from October 2011 – June 2013. During this period, a wellsite was established, drilled, and tested. The wellsite is now in production.

This report; for Greymouth Petroleum Limited describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess Greymouth Petroleum Limited's environmental performance in relation to drilling operations at the Ngatoro-G wellsite during the period under review, and the results and environmental effects of Greymouth Petroleum Limited's activities.

Greymouth Petroleum Limited holds a total of 6 resource consents for the activities at the Ngatoro-G wellsite, which include a total of 59 consent conditions setting out the requirements that Greymouth Petroleum Limited must satisfy. Greymouth Petroleum Limited holds consent 7936-1 to take groundwater; consent 7935-1 to take surface water; consent 7938-1 to discharge emissions to air associated with production activities; consent 7933-1 to discharge stormwater and sediment from earthworks during construction onto and into land; consent consent 7937-1 to discharge emissions to air associated with exploration testing; and consent 7934-1 to discharge treated stormwater and produce water associated with exploration activities to land and into an unnamed tributary of the Ngatoronui stream.

The Council's monitoring programme for the period under review included 29 inspections of the site and surrounding environment, at approximately fortnightly intervals.

The monitoring showed that, in general, good processes and procedures were implemented. A strong focus on the environment by all personnel ensured that the site was mostly clean and tidy.

Any spills on-site were quickly cleaned up to avoid the potential for a contaminant to travel to surface water. The site's stormwater system worked effectively.

Owing to the distance of the wellsite to the nearest stream being approximately 13 metres, the stream was visually inspected by an Inspecting Officer on each occasion. Chemical analysis or a biomonitoring survey were unnecessary as no evidence of effects on the stream environment were observed by the Inspecting Officer.

Staff on-site were cooperative with requests made by officers of the Council, with any required works being completed quickly and to a satisfactory standard. Flaring was carried out onsite during the well clean up and testing phase. No complaints were received from nearby residents in relation to smoke issues. The drilling fluids and cuttings were disposed off site.

During the monitoring period, Greymouth Petroleum Limited demonstrated a good level of environmental performance and compliance with the resource consents. The site was generally neat, tidy, and well maintained.

This report includes recommendations for future drilling operations at this and other sites.

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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 October 2011 – June 2013 by the Taranaki Regional Council (the Council) on the monitoring programme associated with recourse consent held by Greymouth Petroleum Limited. During the period under review, established a wellsite, drilled and tested a well.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by Greymouth Petroleum Limited that relate to exploration activities at Ngatoro-G wellsite located off Bedford Road, in the Inglewood District.

One of the intents of the Resource Management Act 1991 (the Act) 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 Greymouth Petroleum Limited's use of water, land, and air, and is the first report by the Council for the 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 Act and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consent held by Greymouth Petroleum Limited in the Waiau catchment, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted at the Ngatoro-G wellsite during exploration activities.

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

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

Section 4 presents recommendations to be implemented during future drilling operations.

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 Resource Management Act 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 a discharger, and may include cultural and socio-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 (eg, 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 Taranaki Regional Council is recognising the comprehensive meaning of 'effects' inasmuch as is appropriate for each discharge source. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the Resource Management Act to assess the effects of the exercise of consents. In accordance with section 35 of the Resource Management Act 1991, the Council undertakes compliance monitoring for consents and rules in regional plans; and maintains an overview of performance of resource users against regional plans and consents. Compliance monitoring, including impact monitoring, also enables the Council to continuously assess its own performance in resource management as well as that of resource users particularly consent holders. It further enables the Council to continually re-evaluate its approach and that of consent holders to resource management, and, ultimately, through the refinement of methods, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental and consent 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 an overall rating. The categories used by the Council, and their interpretation, are as follows:

- a **high** level of environmental performance and compliance indicates that essentially there were no adverse environmental effects to be concerned about, and no, or inconsequential (such as data supplied after a deadline) non-compliance with conditions.
- a **good** level of environmental performance and compliance indicates that adverse environmental effects of activities during the monitoring period were negligible or minor at most, or, 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, or, there were perhaps some items noted on inspection notices for attention but these items were not urgent nor critical, and follow-up inspections showed they have been dealt with, and any inconsequential non-compliances with conditions were resolved positively, co-operatively, and quickly.
- **improvement required (environmental)** or **improvement required (compliance)** (as appropriate) indicates that the Council may have been obliged to record a verified unauthorised incident involving measurable environmental impacts, and/or, there were measurable environmental effects arising from activities and intervention by Council staff was required and there were matters that required

urgent intervention, took some time to resolve, or remained unresolved at end of the period under review, and/or, there were on-going issues around meeting resource consent conditions even in the absence of environmental effects. Abatement notices may have been issued.

- **poor performance (environmental) or poor performance (compliance)** indicates generally that the Council was obliged to record a verified unauthorised incident involving significant environmental impacts, or there were material failings to comply with resource consent conditions that required significant intervention by the Council even in the absence of environmental effects. Typically there were grounds for either a prosecution or an infringement notice.

For reference, in the 2012-2013 year, 35% 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 59% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Process description

Site management

Greymouth Petroleum Limited holds a 40 year Petroleum Mining Permit No. 38148 to prospect, explore, and mine for condensate, gas, LPG, oil and petroleum within an area of 89 Km². The Ngatoro-G wellsite is one of many sites within this area that have been established in order to explore, evaluate and produce hydrocarbons.

The Ngatoro-G wellsite is located approximately 3.7 km along Bedford Road, approximately 5.5 km from Inglewood.

The Ngatoro-G wellsite was established in 2012 and involved the removal of topsoil to create a firm level platform on which to erect a drilling rig and house associated equipment. Site establishment also involved the installation of:

- Wastewater control, treatment and disposal facilities;
- A system to collect and control stormwater and contaminants;
- A flare pit; and
- Other on-site facilities such as accommodation, parking and storage.

The nearest residence is approximately 270 m away from the wellsite. Bunding, earthworks and good site location helped minimise any potential for off-site effects for the neighbours.

Well creation

The process of drilling a well can take a few weeks to several months, depending on the depth of the well, the geology of the area, and whether the well is vertical or horizontal.

Drilling fluids, more commonly known as 'drilling muds', are required in the drilling process for a number of reasons, including:

- As a safety measure to ensure that any pressurized liquids encountered in the rock formation are contained;
- To transport drill cuttings to the surface;
- To cool and lubricate the drilling bit;
- To provide information to the drillers about what is happening down hole and the actual geology being drilled; and
- To maintain well pressure and lubricate the borehole wall to control cave-ins and wash-outs.

The well is drilled progressively using different sized drill bits. The width of the well is widest at the surface as smaller drill bits are used as the well gets deeper. Once each section of the well is drilled, a steel casing is installed. Cement is then pumped down the well to fill the annulus (the space between the steel casing and the surrounding country rock). This process is repeated until the target depth is reached, with each section of steel casing interlocked with the next.

Production tubing is then fitted within the steel casing to the target depth. A packer is fitted between the production tubing and casing to stop oil/gas/produced water from entering the annulus. The packer is pressure tested to ensure it is sealed.

The construction aspects that are most important for a leak-free well include the correct composition and quality of the cement used, the installation method, and the setting time. The aim is to ensure that the cement binds tightly to the steel casing and the rock, and leaves no cavities through which liquids and gases could travel.

Once the well is sealed and tested the casing is perforated at the target depth, allowing fluids and gas to flow freely between the formation and the well.

Management of stormwater, wastewater and solid drilling waste

The Ngatoro-G wellsite is located approximately 13m to the west of the nearest waterbody which is an unnamed tributary of the Waitara catchment.

Management systems were put in place to avoid any adverse effects on the surrounding environment from exploration and production activities on the wellsite. There are several sources of potential contamination from water and solid waste material which require appropriate management. These include:

- Stormwater from 'clean' areas of the site [e.g. parking areas] which run off during rainfall. There is potential that this runoff will pick up small amounts of hydrocarbons and silt due to the nature of the activities on-site;
- Stormwater which collects in the area surrounding the drilling platform and ancillary drilling equipment. This stormwater has a higher likelihood of contact with potential contaminants, particularly drilling mud;
- Produced water which flows from the producing formation and is separated from the gas and water phase at the surface; and
- Drill cuttings, mud and residual fluid which are separated from the liquid waste generated during drilling.

An important requirement of the site establishment is to ensure that the site is contoured so that all stormwater and any runoff from 'clean' areas of the site flow into

perimeter drains. The drains direct stormwater into a skimmer pit system on-site consisting of two settling ponds. Any hydrocarbons present in the stormwater float to the surface and can be removed. The ponds also provide an opportunity for suspended sediment to settle. Treated stormwater is then discharged from the wellsite onto and into land, and consequently into an unnamed tributary in the Waiau catchment.

Drilling mud and cuttings brought to the surface during drilling operations are separated out using a shale shaker. The drilling mud and some of the water is then reused for the drilling process. Cuttings were collected in bins located at the base of the shaker and disposed of offsite at a consented facility.

Flaring from exploration activities

It is possible that flaring may occur during the following activities:

- Well testing and clean-up;
- Production testing;
- Emergencies; and
- Maintenance and enhancement activities [well workovers].

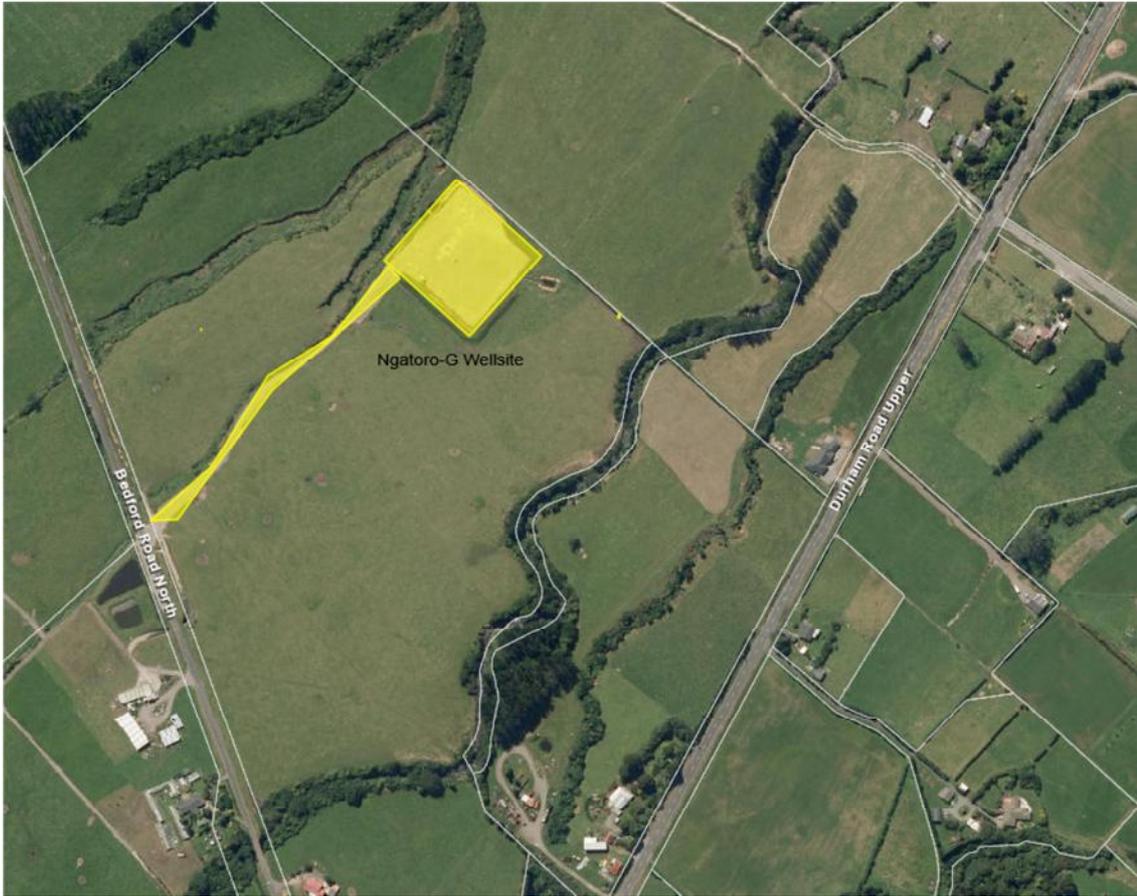


Photo 1 Aerial view showing the location of Ngatoro-G wellsite

1.3 Resource consents

1.3.1 Background

Greymouth Petroleum Limited holds 6 resource consents related to exploration activities at the Ngatoro-G wellsite site, as follows:

- Water Permit **7936-1**; granted 6 October 2011,
- Water Permit **7935-1**; granted 6 October 2011, varied 9 May 2012,
- Discharge Permit **7938-1**; granted 6 October 2011,
- Discharge permit **7937-1**; granted 6 October 2011, varied 22 June 2012,
- Discharge Permit **7934-1**; granted 6 October 2011 and
- Discharge Permit **7933-1**; granted 6 October 2011

Each of the consent applications were processed on a non-notified basis as Greymouth Petroleum Limited obtained the landowner approvals as an affected party, and the Council were satisfied that the environmental effects of the activity would be minor. The consents are discussed in further detail below.

Copies of the consents and the Council reports describing the associated activities are contained within Appendix I of this report.

1.3.2 Water abstraction permit (groundwater)

Section 14 of the Act stipulates that no person may take, use, dam or divert any water, unless the activity is expressly allowed for by resource consent or a rule in a regional plan, or it falls within some particular categories set out in Section 14.

The Council determined that the application to take groundwater fell within Rule 49 of the Regional Freshwater Plan for Taranaki (RFP) as the rate and daily volume of the groundwater abstraction might exceed that of the permitted activity (Rule 48). Rule 49 provides for groundwater abstraction as a controlled activity, subject to two conditions:

- *The abstraction shall cause not more than a 10% lowering of static water-level by interference with any adjacent bore;*
- *The abstraction shall not cause the intrusion of saltwater into any fresh water aquifer.*

Greymouth Petroleum Limited holds water permit **7936-1** to take groundwater that may be encountered as produced water during exploration and production operations at the Ngatoro-G wellsite.

Any produced water would be from reserves far below that which is used for domestic or farm purposes. In addition, there are no known groundwater abstractions within a radial distance of 1100 m from the proposed wellsite. Shallow groundwater (which does not have any saltwater content) was to be protected by casing within the bore hole. Given these factors, the abstraction would not cause the above effects.

In granting the consent it was considered that the taking of groundwater was unlikely to have any adverse effect on the environment.

The Council was satisfied that the proposed activity would meet all the standards for a controlled activity. It was therefore obliged to grant the consent but imposed conditions in respect of those matters over which it reserved control. Those matters over which the Council reserved its control were:

- Volume and rate of abstraction;
- Daily timing of abstraction;
- Effects on adjacent bores, the aquifer, river levels, wetlands and sea water intrusion;
- Fitting of equipment to regulate flows and to monitor water volumes, levels, flows and pressures;
- Payment of administrative charges;
- Monitoring and report requirements;
- Duration of consent; and
- Review of the conditions of consent and the timing and purpose of the review.

This permit was issued by the Council on 6 October 2011 under Section 87(d) of the Act. It is due to expire on 1 June 2027.

Consent conditions were imposed on Greymouth Petroleum Limited to ensure that adverse effects were avoided in the first instance. A summary of conditions can be viewed within Table 3, Section 3.3.

A copy of the permit is attached to this report in Appendix 1.

1.3.3 Surface water take

Section 14 of the Resource Management Act 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.

The taking and use of surface water falls for consideration under Rule 16 of the RFWP as a discretionary activity if the standards of Rule 15 cannot be met.

Provided the activity was to be conducted in a sensible manner, and in accordance with the recommended special conditions, then no significant effects were anticipated.

Greymouth Petroleum Limited holds water take permit **7935-1** to take water from the Ngatoronui Stream for wellsite and well drilling activities.

This permit was issued by the Taranaki Regional Council on 6 October 2011 under Section 87(e) of the Resource Management Act. A variation to the consent was issued on 9 May 2012 to reduce the maximum rate of abstraction in special condition 1 from 25 l/s to 4.5 l/s. It is due to expire on 1 June 2021.

Consent conditions were imposed on Greymouth Petroleum Limited to ensure that adverse effects are avoided in the first instance. A summary can be viewed in Table 4, Section 3.3.

A copy of the permit is attached to this report in Appendix I.

1.3.4 Water discharge permit (treated stormwater and treated produced water)

Section 15(1)(a) of the Act 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.

The Council determined that the application to discharge treated stormwater, treated produced water and surplus drill water fell within Rule 44 of the RFWP, which provides for a discharge as a discretionary activity.

The discharge of stormwater may result in contaminants (e.g. sediment, oil) entering surface water. These contaminants have the potential to smother or detrimentally affect in-stream flora and fauna. On-site management of stormwater, as discussed in 1.2 above, is necessary to avoid/remedy any adverse effects on water quality.

Greymouth Petroleum Limited holds water discharge permit **7934-1** to discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Ngatoro-G wellsite onto and into land.

Consent conditions were imposed on Greymouth Petroleum Limited to ensure that adverse effects were avoided in the first instance. A summary of conditions can be viewed in Table 7, Section 3.3.

This permit was issued by the Council on 6 October 2011 under Section 87(e) of the Act. It is due to expire on 1 June 2027.

A copy of the permit is attached to this report in Appendix I.

1.3.5 Water discharge permit (stormwater and sediment – earthworks)

Section 15(1)(a) of the Act 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.

Council considered that the application fell under Rule 27 of the RFWP as a controlled activity (which may be non-notified without written approval), subject to one standard/term/condition to be met:

- *A site erosion and sediment control management plan shall be submitted to the Taranaki Regional Council.*

Greymouth Petroleum Limited supplied a site erosion and sediment control management plan in support of the application.

The Council was satisfied that the activity would meet all the standards for a controlled activity. It was therefore obliged to grant the consent but imposed conditions in respect of those matters over which it reserved control. Those matters over which the Council reserved its control were:

- Approval of a site erosion and sediment control management plan and the matters contained therein;
- Setting of conditions relating to adverse effects on water quality and the values of the waterbody;
- Timing of works;
- Any measures necessary to reinstate the land following the completion of the activity;
- Monitoring and information requirements;
- Duration of consent;
- Review of conditions of consent and the timing and purpose of the review; and
- Payment of administrative charges and financial contributions.

Greymouth Petroleum Limited holds water discharge permit **7933-1** to discharge stormwater and sediment from earthworks during construction of the Ngatoro-Gwellsite onto and into land.

This permit was issued by the Council on 6 October 2011 under Section 87(e) of the Resource Management Act. It is due to expire on 1 June 2016.

Consent conditions were imposed on Greymouth Petroleum Limited to ensure that adverse effects are avoided in the first instance. A summary of conditions can be viewed in Table 8, Section 3.3.

A copy of the permit is attached to this report in Appendix I.

1.3.6 Air discharge permit (exploration activities)

Section 15(1)(c) of the Act 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.

The Council determined that the application to discharge emissions to air associated with the exploration activities at the Ngatoro-G wellsite fell within Rule 9 of the Regional Air Quality Plan (RAQP).

The standard/term/conditions associated with Rule 9 are as follows:

- *Flare or incinerator point is at least 300 metres from any dwelling house;*
- *The discharge to air from the flare must not last longer than 15 days cumulatively, including of testing, clean-up, and completion stages of well development or work-over, per zone to be appraised; and*
- *No material to be flared or incinerated, other than those derived from or entrained in the well steam.*

Provided the activities were conducted in accordance with the applications and in compliance with the recommended special conditions, then no significant effects were anticipated.

Greymouth Petroleum Limited holds air discharge permit **7937-1** to discharge emissions to air from hydrocarbon exploration at the Ngatoro-G wellsite.

This permit was issued by the Council on 6 October 2011 under Section 87(e) of the Act. A variation to the consent was issued on 21 June 2012 to specify the maximum cumulative flaring allowed in special condition 1 as 60 days per well instead of 15 days per zone (for up to 4 zones per well). It is due to expire on 1 June 2027.

Consent conditions were imposed on Greymouth Petroleum Limited to ensure that adverse effects are avoided in the first instance. A summary of conditions can be viewed in Table 5, Section 3.3.

A copy of the permit is attached to this report in Appendix I.

1.3.7 Air discharge permit (production activities)

Section 15(1)(c) of the Act 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.

The Council determined that the application to discharge emissions to air associated with the production activities at the Ngatoro-G wellsite fell within Rule 11 of the RAQP.

The standard/term/condition of Rule 11 states that the:

- *Flare or incinerator point is a distance equal to or greater than 300 metres from any dwelling house.*

Greymouth Petroleum Limited holds air discharge permit **7938-1** to discharge emissions to air associated with production activities at the Ngatoro-G wellsite including flaring associated with emergencies and maintenance and minor emissions from other miscellaneous activities.

This permit was issued by the Council on 6 October 2011 under Section 87(e) of the Act. It is due to expire 1 June 2027.

Consent conditions were imposed on Greymouth Petroleum Limited to ensure that adverse effects are avoided in the first instance. A summary of conditions can be viewed in Table 6, Section 3.3.

A copy of the permit is attached to this report in Appendix I.

1.4 Monitoring programme

1.4.1 Introduction

Section 35 of the Act sets out obligation/s upon the Council to: gather information, monitor, and conduct research on the exercise of resource consent 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 exploration well sites consists of seven primary components. They are:

- Programme liaison and management;
- Site inspections;
- Chemical sampling;
- Solid wastes monitoring;
- Air quality monitoring;
- Discharges to land (hydraulic fracturing and deep well injection); and
- Ecological surveys.

The monitoring programme for the Ngatoro-G wellsite focused primarily on programme liaison and management, site inspections, and discharges to land. However, all seven components are discussed below.

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, in discussion over monitoring requirements, preparation for any reviews, renewals, or new consents, advice on the Council's environmental management strategies and the content of regional plans, and consultation on associated matters.

1.4.3 Site inspections

Inspection and examination of wellsites is a fundamental and effective means of monitoring and are undertaken to ensure that good environmental practices are adhered to and resource consent special conditions complied with.

The inspections are based on internationally recognised and endorsed wellsite monitoring best-practice checklists developed by the Alberta Energy Resources Conservation Board and the USEPA, adapted for local application.

The inspections also provide an opportunity for monitoring officers to liaise with staff about on-site operations, monitoring and supervision; discuss matters of concern; and resolve any issues in a quick and informal manner.

Inspections pay special attention to the ring drains, mud sumps, treatment by skimmer pits and the final discharge point from the skimmer pit on to land and then any potential receiving waters.

During each inspection the following are checked:

- Weather;
- Flow rate of surface waters in the general vicinity;
- Flow rate of water take;
- Whether pumping of water was occurring;
- General tidiness of site;
- Site layout;
- Ring drains;
- Hazardous substance bunds;
- Treatment by skimmer pits/sedimentation pits;
- Drilling mud;
- Drill cuttings;
- Mud pit capacity and quantity contained in pit;
- Sewage treatment and disposal;
- Cementing waste disposal;
- Surface works;
- Whether flaring was in progress, and if there was a likelihood of flaring, whether the Council had been advised;
- Discharges;
- Surface waters in the vicinity for effects on colour and clarity, aquatic life and odour;
- Site records;
- General observations; and
- Odour (a marker for any hydrocarbon and hazardous chemical contamination).

1.4.4 Chemical sampling

The Council may undertake sampling of discharges from site and from sites upstream and downstream of the discharge point to ensure that resource consent special conditions are complied with.

1.4.5 Solid wastes

The Council monitors any disposal of drill cuttings on-site via mix-bury-cover to ensure compliance with resource consent conditions.

In recent times consent holders have opted to remove drilling waste from the site by contractor and dispose of it at licensed disposal areas (land farming), which are monitored separately.

1.4.6 Air quality monitoring

Air quality monitoring is carried out in association with the well testing and clean-up phase, where flaring can occur.

Assessments are made by Inspecting Officers of the Council during site inspections to ensure that operators undertake all practicable steps to mitigate any effects from flaring gas.

Inspecting Officers check that that plant equipment is working effectively, that there is the provision of liquid and solid separation, and that staff onsite have regard to wind direction and speed at the time of flaring.

The flare pit is also inspected to ensure that solid and liquid hydrocarbons are not combusted within the flare pit.

It is also a requirement that the Council and immediate land owners are notified prior to any gas being flared. This requirement was checked to ensure compliance with the conditions.

1.4.7 Ecological surveys

Ecological surveys in any nearby streams may be carried out pre and post occupation of the well site to assess whether the activities carried out on-site, and associated discharges have had any effect on ecosystems. However, as the Ngatoro-G wellsite is still being occupied, and the fact that visual inspections of the receiving water didn't show any effects from the discharges, no ecological surveys have been undertaken during this monitoring period.

2. Results

2.1 Water

2.1.1 Inspections

The Ngatoro-G wellsite, adjacent land and streams were inspected **29** times during this monitoring period.

Below is a copy of the comments that were noted on the day of each inspection.

20 October 2011

Earthworks had commenced to begin construction of the site. An access road had been formed and a layer of topsoil had been removed over an area of 90m by 100m. There were no silt/sediment controls in place. The resource consent conditions were discussed with staff members on site. They were made aware that the 200 cubic metre (approx.) settlement pond(s) needed to be installed prior to site construction, in order to capture any runoff from the exposed soil. Works were then going to be undertaken to ensure that all stormwater was directed to a settlement pond(s).

Instruction was given to ensure that all settlement ponds/skimmer pits were to be constructed prior to site construction so that all runoff from exposed earth could be directed to them. This would also ensure that resource consent conditions were being complied with at all times.

25 October 2011

Earthworks were continuing on site constructing access road and wellsite. The site was being levelled and the access road was being widened/stabilised. Hay bales had been placed within a culvert to capture silt/sediment that may have discharged from the wellsite area. The 200 cubic metre (approx.) settlement ponds had not been installed as required by condition 2 of resource consent 7933-1. The staff member present was advised to place hay bales within the stream to capture any silt/sediment that may have discharged from the exposed soil along the access road. Instruction was given to ensure that condition 2 of resource consent 7933-1 was being complied with.

14 November 2011

Construction of the wellsite was continuing. The skimmer pits had been installed and appeared to be working well. Silt cloth had been placed where required along the access road. It appeared that consent conditions were being complied with at the time of inspection.

20 April 2012

All earthworks associated with the well site construction had been completed. All exposed areas of soil had been naturally stabilised. No flaring had occurred on site up to the time of inspection, but flaring was likely to occur the following week. No water was being taken from the stream at the time of inspection. Water was being taken from the skimmer pits. No water was therefore discharging from the site. No water samples were taken. Skimmer pits, flare pits, containment pits and the need for these pits to be impermeable was discussed with the staff member on site. The staff member advised that he was looking into purchasing concrete skimmer pits.

1 May 2012

All earthworks associated with the construction of the site had been completed. Most earthworks that were exposed had been stabilised with vegetation. Runoff from any exposed areas passed through the settlement ponds (skimmer pits).

An inspection of the site found that drilling mud, drilling waste, sawdust, oil and chemicals had been discharged onto the site around the drill rig and associated equipment. Drilling operations had ceased and drilling personnel had left the site. Condition 1 requires that the consent holder adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site. This condition had not been complied with. This issue was discussed with a staff member. He advised the Investigating Officer that the site would be cleaned and scraped. The ring drains were clean. The first skimmer pit contained fine suspended solids and was 3/4 full. The second pit was half full and not discharging. The skimmer pits were not totally impermeable and some groundwater was observed to be seeping through the walls of the second pit.

No water was being taken from the Ngatoronui Stream at the time of inspection. No groundwater was being taken at the time of inspection. Emissions were being discharged to air from the flaring of gas. The flare was clean with no smoke observed. The flare pit had been repositioned and was then in the southwestern corner of the site. A staff member advised that the flare pit was impermeable. Stormwater was observed in the bottom of the pit. Taranaki Regional Council received notification that flaring may occur. A test separator was being used to separate water/oil/gas. Nearby neighbours confirmed that they received notification advising that flaring would occur.

Instruction was given to ensure that condition 1 of consent 7934-1 was complied with by removing all contaminants from the site and disposing of them appropriately.

4 May 2012

Notification was received from a staff member that the site had been scraped and cleaned. A site inspection was carried out with the staff member present. It was observed that the area around the rig that contained drilling mud/sawdust/oil stains during the last inspection had been cleaned. The staff member advised that further scraping would take place once the rig had been removed from site. The skimmer pits were assessed and impermeability of pits (flare/skimmer etc.) was discussed. The discharge pipe from the flare pit to the ring drain had been capped. All was satisfactory at the time of inspection.

25 May 2012

The well was shut in at the time of inspection. No flaring of gas or taking of groundwater was occurring at the time of inspection. The rig and associated equipment were still on site.

Works had begun to construct a second well (cellar). Taranaki Regional Council was not notified of these works as required by condition 3 of resource consent 7934-1. The disturbed earth was being dumped outside of the ring drain near an unnamed tributary. No silt controls were in place at the time of inspection.

It was observed that the bulk fuel (diesel) tank had been placed next to the ring drain and hydrocarbon had spilt into the ring drain as a result.

It appeared that hydrocarbon had discharged from the drip trap (that was full and contained hydrocarbon). Photos and a sample were taken. It was unlikely that the amount of hydrocarbon in the ring drain would have had any adverse effect on the environment as it would have been contained on the surface of the first skimmer pit and would not have discharged off site. However, Taranaki Regional Council believed that the best practicable option was not adopted to prevent the discharge of contaminants onto the site.

A water sample was also taken from the second skimmer pit to confirm that condition 6 of resource consent 7934-1 was being complied with.

Instruction was given to remove the hydrocarbon from the ring drain and take appropriate steps to ensure that no further hydrocarbon could enter the ring drain. (Note: A staff member advised Taranaki Regional Council at 11:10am that the diesel had been removed from the ringdrain).

14 June 2012

No drilling was occurring at the time of inspection. Recent operations had focused on cementing a section of the well before continuing to drill to total depth. No flaring had occurred recently as gas was being burned inside a container. No surface water had been taken. The skimmer pits were nearly empty and not discharging. No groundwater had been encountered. The site was tidy.

18 June 2012

Drilling had continued. No groundwater had been taken from the well. Stormwater in the skimmer pits had been used onsite. The skimmer pits were not discharging at the time of inspection. Gas flowing from the first well being incinerated inside a chamber. No flaring of gases was occurring at the time of inspection. Water was being trucked onto site as the water pump needed repairing.

It was noted that some sections of the ring drain had become degraded over time and did not appear to be impermeable.

Instruction was given to ensure that the ringdrain was impermeable so that any contaminant that discharged onto the site would travel to the skimmer pits where they could be contained and recovered.

2 July 2012

Drilling of well 15 was complete. The rig had been set aside as works were undertaken to set the site up for drilling well 16. The cellar for well 16 has been constructed. The site was also being scraped, with waste material being removed off site and disposed of at Remediation's landfarm at Uruti. Works had begun to reform the ring drain. A plastic drain had been laid along a section of the drain and was working very well. Further works had yet to be completed. Stormwater in the ring drain appeared clear. The skimmer pits were full and discharging off site. An upstream, discharge and downstream sample were taken to ensure compliance with special condition 5 of resource consent No.7934-1. No flaring was occurring and no water was being taken from the stream.

13 July 2012

The rig had been set up over well 16, however the crew was off site at the time of inspection and drilling had not commenced. The site was tidy and all drilling chemicals had been removed from the site. The ring drain was mostly dry. The

section of ring drain that required attention had been mended and looked to be working well. The first skimmer pit was full and the second skimmer pit was empty. Silt cloth had been placed around a section of the ring drain to stop silt/sediment from reaching the stream. No water was being taken from the stream. No produced water had been encountered. Flaring had occurred onsite and was stopped that morning. Gas was then being burned in the flare chamber and no smoke was observed. The flare pit was dry with no sign of hydrocarbons in the pit. Neighbours had been informed that flaring may take place.

27 July 2012

The site and the activities being carried out was the same as the previous visit (no drilling and testing continuing). Gas was being burned inside the flare chamber and there was no external flare. Stormwater/springwater flowing off site was clear. No effect was observed downstream of the discharge point and the site was tidy.

29 August 2012

No drilling activity was occurring at the time of inspection. Well testing was taking place with gas from both wells being flared. The flare chamber was in use, as was the flare pit. The flare was burning clean with no smoke visible at the time of inspection. Water was not being taken from the stream. The skimmer pits were near full but were not discharging. The water appeared "clean" with low concentrations of suspended solids. No samples were taken at time of inspection. There was no change in the appearance of the stream, downstream of the discharge point. A staff member confirmed that a flare log was being maintained.

13 September 2012

Drilling operations had commenced on well 2 following a long break. A sample of stormwater was taken from the second skimmer pit for analysis. Two issues were raised with a staff member whilst on site. It was observed that machinery that had drilling mud on it was being cleaned with a water blaster. The waste water discharged directly onto the ground and flowed into the ring drain. Also, a hose associated with the Halliburton operation had been disconnected and wastewater and a synthetic product were being discharged onto the ground and into the ring drain. A brown and grey scum/foam was observed in the ring drain and also in the first skimmer pit. The staff member advised Taranaki Regional Council's Investigating Officer that sawdust would be laid and a sucker truck would be used to remove the scum/foam from the ring drain. The staff member advised that a drill cuttings tank was available for Halliburton to dispose of wastewater. Gas was being burned inside the flare chamber and no smoke was observed.

20 September 2012

The site was dry and tidy. No flaring was occurring via the flare pit. Gas was being burned within the flare chamber, with only a heat haze visible. Stormwater was not discharging from site. Water was being pumped from the second skimmer pit and reused onsite. Water was also being taken from the stream. Staff onsite could not confirm whether conditions of consent 7935-1 (surface water take) were being complied with. A copy of the consent was taken and left onsite for reference.

24 September 2012

No discharges from site were occurring at the time of inspection. No effects were observed as a result of previous discharges from the site.

It was observed that some discharges/spills had occurred around the rig from disconnected hoses, water blasting equipment and from leaks in machinery. Some of these discharges had entered the ring drain.

Instruction was given to ensure that processes were in place to contain and prevent discharges escaping to the ring drain (and wider site in general) in order to ensure consent conditions were complied with and so that any potential discharges could be observed and contained more easily.

5 October 2012

Drilling had continued. The water based mud was being replaced with synthetic based muds in order to complete the well. Taranaki Regional Council's monitoring officer was advised of a hydrocarbon spill from Halliburton equipment. No effects were visible in the ring drain or in the skimmer pit. Water from the second skimmer pit was being pumped onto the site and reused. Small spills were observed around the site and in most cases, measures had been taken to mitigate any further spread of the material.

9 October 2012

Drilling of well 2 was complete. Heavy rain had fallen over the previous 24 hours and the site was wet. The ring drains and skimmer pits contained stormwater laden with suspended solids/sediment. The discharge from the skimmer pit was only slightly discoloured and no change in clarity was observed in the stream, once the discharge had entered it. No smoke was observed from the flare chamber as a result of flaring. No water was being taken from the stream at the time of inspection.

17 October 2012

Drilling had been completed and well testing may take place in the near future. All drilling muds had been disposed of off site and the rig had been cleaned. No stormwater was discharging from the site because water from the second skimmer pit had been reused on site. Well testing of well 15 was continuing. Smoke was not observed at the time of inspection.

16 November 2012

Drilling had been completed and the rig had been dismantled. Maintenance was being carried out on the rig. The ring drains appeared discoloured, as did the first skimmer pit. Half of the site had been scraped and new fill put down, which may have been leaching suspended solids. Also, water blasters were being used on the site to clean the rig and this may have been contributing to the discolouration in the ring drain. The second skimmer pit was not discharging. Water samples were taken for analysis. No flaring was occurring as maintenance of pipes etc. was being carried out.

27 November 2012

No drilling was occurring at the time of inspection. The rig had been dismantled and work had taken place on site, carrying out maintenance. It was observed that the site was very dry, following a period of fine weather. It was clear that numerous areas of the site had been stained from the drilling operation and from the recent maintenance works. The ring drain was also stained. An open bag containing an unknown product had leached into the ring drain. It appeared that no drip trays/mats were used during the period of maintenance. Council's Investigating Officer spoke to a staff member from Greymouth Petroleum Limited and it was agreed that the site would be cleaned up that day and the remaining

stained/contaminated areas cleaned when the rig was moved on, or about the 17 Dec 2012. No further enforcement action was taken at that stage. The skimmer pits were not discharging from the site. The Greymouth staff member advised that three recent water samples taken from the skimmer pit showed that chloride levels had been within consent limits.

10 January 2013

A stormwater sample from the second skimmer pit was taken for analysis. Testing operations were continuing onsite. The site was tidy and no stormwater was discharging.

25 January 2013

A stormwater sample was collected for analysis to confirm that resource consent conditions would have been complied with, should a discharge from the site have occurred. Stormwater was not discharging from the site at the time of inspection.

7 February 2013 at 10:56

The site was dry and tidy. The skimmer pits had recently been re-lined with black plastic and were empty at the time of inspection. It was observed that base oil had spilled onto the ground below the bulk storage tank. A staff member (HSE Greymouth) advised that the area would be monitored and the remaining oil in the bund removed when the well was complete. The Greymouth staff member was advised to keep the area around the mud tanks and chemical hopper tidy. It was noted that a small amount of mud and chemical had spilt onto the ground. The staff member was advised that this could have caused elevated levels of suspended solids and chloride if it continued.

7 February 2013 at 14:27

A stormwater sample was collected for analysis to ensure that resource consent conditions would have been complied with should discharge from site have occurred.

1 March 2013

The site was dry, clean and tidy. There was no activity on site at this time. Testing had stopped and wire lining was about to begin. Skimmer pits were not discharging at the time of the visit. The pits had a large numbers of frogs and tadpoles in them. There was no sign of any recent spill or contamination on the site. Visual inspection only was undertaken on this visit. No samples were taken.

26 March 2013

There was little activity recently on site; however the GPL workover rig was in the process of being set up. Ring drains were clean and tidy. Skimmer pits were not discharging at the time of inspection. Samples were taken from the second skimmer pit to ensure that discharge would have complied with consent conditions should a discharge have occurred.

26 April 2013

A small amount of activity was on occurring site. The work-over rig was on site; however the well work-over had not yet begun. Pipelines were being laid to the site and were beginning to enter the site. Skimmer pits were discharging at the time of the inspection and samples had been taken from the discharge to ensure that consent conditions were being complied with.

Rainwater was collecting in the large trench being dug, in order to lay the pipelines to the site. This water was then being pumped out and discharged onto land next to the site. The Investigating Officer had asked that the trench be bunded to ensure that the only water being pumped from the trench was that which had been collected off site. This would have prevented any site run off entering the pipe trench and then being pumped off site, as all site stormwater must be discharged via the ring drain/skimmer pit system.

21 June 2013

Site inspection found that there was minimal activity on site at the time, however work-over of a well on site was planned for the following weeks. Site inspection found that some earthworks had recently taken place on site near the flare pit. The site was found to be clean and tidy. All wells were shut in at the time and there was no sign of recent flaring activities on site. Flare pit was clean and tidy and had some water in its base.

Ring drains were in place and appeared to be working well. Skimmer pits were full and discharging at the time of the inspection. Discharge appeared to be clear visually.

Samples were taken of discharge, upstream and downstream.

2.1.2 Results of abstraction and discharge monitoring

During the period under review, stormwater was observed discharging from the skimmer pits on one occasion. The discharge sample was collected and chemical analysis of the stormwater discharge was carried for that occasion.

Results (see Tables 1 and Table 2) found that the concentrations of chloride, hydrocarbon and suspended solid were within the discharge limits set by Condition 8 of Resource Consent 7595-1. However on 16 November 2012 the chloride level in one of two samples collected would not have complied with consent conditions had a discharge occurred.

All sewage was directed for treatment through a septic tank system and removed by contractor to a licensed disposal facility. Cementing wastes were contained and disposed of offsite. Water was abstracted from the Ngatoronui, as permitted by Resource Consent 7935-1. Inspections of the stormwater discharge found it to be mostly clear. No odours were found to be associated with the discharge.

Table 1 Results of water samples taken from the skimmer pit on seven occasions during the monitoring period

Parameters	Consent limit	16 November 2012	16 November 2012	10 January 2013	25 January 2013	25 January 2013	27 March 2013	26 April 2013
Chloride (g/m ³)	50	56.3	37.2	10.0	36.4	8.2	8.4	8.6
Conductivity	-	25.6	16.6	6.5	16.1	6.0	5.3	7.1
pH	6-9	7.0	8.2	7.1	-	-	6.9	7.0
Suspended solids (g/m ³)	100	100	8	4	12	5	11	17
Temperature (°C)	-	16.8	16.3	17.6	-	-	-	-

Parameters	Consent limit	16 November 2012	16 November 2012	10 January 2013	25 January 2013	25 January 2013	27 March 2013	26 April 2013
Hydrocarbon (g/m ³)	15	3.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Turbidity (NTU)	-	-	-	12	3.6	3.8	16	17

The skimmer pits were not discharging on most occasions when samples were collected.

Table 2 Results of water sample taken from the skimmer pit as well as upstream and downstream samples collected 21 June 2013

Parameters	Consent limit	Discharge	Upstream	Downstream
Chloride (g/m ³)	50	9.4	10.0	9.4
Conductivity	-	8.3	9.3	9.3
pH	6-9	6.9	7.0	7.0
Suspended solids (g/m ³)	100	30	6	8
Temperature (°C)	-	-	-	-
Hydrocarbon (g/m ³)	15	<0.5	<0.5	<0.5
Turbidity (NTU)	-	31	5.4	6.5

The results of the discharge and its effects upon the receiving waters from the site on 21 June 2013 was found to be within consent limits set out in resource consent 7935-1.

2.1.3 Results of receiving environment monitoring

The authorised discharges offsite were onto land from the skimmer pits. It is considered that the discharge was unlikely to reach a surface water body due to the small catchment area of the site.

The receiving surface water body was visually inspected in conjunction with site inspections. No effects were observed and the stream appeared clear with no visual change in colour or clarity. There was also no odour, oil, grease films, scum, foam or suspended solids observed in the stream during the monitoring period.

2.2 Air

2.2.1 Inspections

Air quality monitoring inspections were carried out in conjunction with general compliance monitoring inspections. See Section 2.1.1 above for comments concerning site inspections.

2.2.2 Results of discharge monitoring

Ngatoro-G wellsite notified the Council of its intention to test the well and flare gas intermittently between 31 July 2012 and 20 September 2012. During inspections of the site the Inspecting Officer found there were no offensive or objectionable odours, smoke or dust associated with activities at Ngatoro-G wellsite. The Taranaki Regional Council received no complaints regarding smoke from flaring at the Ngatoro-G wellsite.

It appeared that Greymouth Petroleum Limited took all practicable steps to mitigate any effects of smoke, which included ensuring that plant equipment was working effectively and having regard to wind direction and speed. In regard to the smoke issue noted above no offensive or objectionable smoke or odours were observed by Inspecting Officers.

The flare pit was inspected during most inspections to ensure that solid and liquid hydrocarbons were not combusted within the flare pit. There was no evidence to suggest that solid and liquid hydrocarbons were being combusted through the gas flare system.

From observations during site inspections, including the inspection of the flare log maintained by Greymouth Petroleum Limited, it appeared that special conditions relating to the control of emissions to air from the flaring of hydrocarbons were complied with.

2.2.3 Results of receiving environment monitoring

No chemical monitoring of air quality was undertaken during the testing phase of the Ngatoro-G wellsite as the controls implemented by Greymouth Petroleum Limited did not give rise to any concerns with regard to air quality, and Inspections found no offensive or objectionable odours, smoke or dust that were associated with activities at the site.

2.2.4 Other ambient monitoring

No other ambient air sampling was undertaken, as the controls implemented by Greymouth Petroleum Limited did not give rise to any concerns with regard to air quality.

2.2.5 Land status

The well site was constructed on a flat rural dairy farming area. Relatively minor earthworks were required to construct the site. The land had not been reinstated at the time of the last inspection on 21 June 2013 as the well was still currently producing, and the site is still in use.

2.3 Contingency plan

Greymouth Petroleum Limited has provided a general contingency plan, as required by Condition 4 of recourse consent 7934-1 with site specific maps which cover all onshore sites that they operate. The contingency plan has been reviewed and approved by officers of the Council.

2.4 Investigations, interventions and incidents

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 Unauthorised Incident Register (UIR) includes events where the company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

Incidents may be alleged to be associated with a particular site. If there is 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).

During the period under review, there was 1 incident recorded by the Inspecting Officer during an inspection. On 1 May 2012, the Inspecting Officer found that resource consent conditions were not being complied with at the Ngatoro-G wellsite at Bedford Road, Inglewood. As a result an abatement notice was issued.

Any minor actual or potential non-compliance with consent conditions were addressed during site inspections. Greymouth Petroleum Limited staff would quickly take steps to ensure that requests made by Council Inspecting Officers were adhered to without delay.

3. Discussion

3.1 Discussion of consent exercise

Of the 6 resource consent relating to the Ngatoro-G wellsite, consents 7936-1 (take groundwater), consents 7935-1 (take surface water) 7937-1 (air discharge associated with exploration), 7938-1 (air discharge associated with production) 7934-1 (to discharge treated stormwater and produced water), 7933-1 (to discharge stormwater and sediment from earthworks during construction), were exercised and actively monitored.

3.2 Environmental effects of exercise of consents

Stormwater

The discharge of stormwater from earthworks has the potential for sediment and other contaminants to enter surface water where it may detrimentally affect in-stream flora and fauna. To mitigate these effects, Greymouth Petroleum Limited established perimeter drains during the construction of the wellsite, and care was taken to ensure runoff from disturbed areas was directed into the drains or directed through adequate silt control structures.

Once the well was constructed, attention was given to controlling stormwater that ran off the wellsite and the associated plant and equipment.

Adverse effects on surface water quality can occur if contaminated water escapes through the stormwater system. Interceptor pits are designed to trap sediment and hydrocarbons through gravity separation. Any water that is unsuitable for release via the interceptor pits was directed to the drilling sumps, or removed for off-site disposal.

Greymouth Petroleum Limited also undertook the following mitigation measures in order to minimize off-site adverse effects:

- All stormwater was directed via perimeter drains to the skimmer pits for treatment prior to discharge;
- Additional bunding was constructed around the bulk fuel tank, chemical storage area, and other areas where runoff from areas containing contaminants could occur;
- Regular inspections of the interceptor pits occurred; and
- Maintenance and repairs were carried out if required.

Interceptor pits do not discharge directly to surface water, instead they discharge onto and into land where the discharge usually soaks into the soil before reaching any surface water. However, if high rainfall had resulted in the discharge reaching the surface water, significant dilution would have occurred.

There are numerous on-site procedures included in drilling and health and safety documentation that are aimed at preventing spills on-site, and further procedures that address clean-up to remedy a spill situation before adverse environmental effects have the opportunity to occur (e.g. bunding of chemicals and bulk fuel).

Groundwater

Small amounts of groundwater may have been encountered as produced water during operations at the wellsite. It was anticipated that the abstraction of groundwater would not impact on any groundwater resource and that the groundwater would not be affected as it would be protected by the well casing.

Flaring

The environmental effects from flaring have been evaluated in monitoring reports prepared by the Council in relation to the flaring emissions from specific wells in the region.

The Council has previously undertaken field studies at two wells (one gas, and the other producing oil and heavier condensates); together with dispersion modelling at a third site¹. More recently two studies have focused on field investigations and modelling of emissions from flares involving fracturing fluids.²

In brief, the previous studies found that measurements of carbon monoxide, carbon dioxide, and methane concentrations to be safe at all points downwind, including within 50 m of the flare pit. Measurements of suspended particulate matter found concentrations typical of background levels, and measurements of PM₁₀ found compliance with national standards even in close proximity to the flare. Beyond 120 m from the flare pit, concentrations of polycyclic aromatic hydrocarbons (PAH) approached background levels, as did levels of dioxins beyond 250 m from the flare.

In summary, the studies established that under combustion conditions of high volume flaring of gases with some light entrained liquids etc., atmospheric concentrations of all contaminants had reduced by a distance of 250 m downwind to become essentially typical of or less than elsewhere in the Taranaki environment (e.g. urban areas). These levels are well below any concentrations at which there is any basis for concern over potential health effects.

The measures to be undertaken by Greymouth Petroleum Limited to avoid or mitigate actual or potential adverse environmental impacts on air quality included:

- The use of a test separator to separate solids and fluids from the gas during all well clean-ups, and workover activities where necessary, thus reducing emissions to air. In particular, this would reduce the potential for heavy smoke incidents associated with elevated PAH and dioxin emissions;
- Records of flaring events are kept by Greymouth Petroleum Limited and provided to the Council;
- Use of an flare chamber, which gave better control of combustion conditions and have less potential for smoke and odour.

¹ Taranaki Regional Council, *Fletcher Challenge Energy Taranaki Ltd, Mangaheva 2 Gas Well Air Quality Monitoring Programme Report 1997 – 98*, August 1998.

² Taranaki Regional Council: *Atmospheric Dispersion Modelling of Discharges to Air from the Flaring of Fracturing Fluid*, Backshall, March 2013; and *Investigation of air quality arising from flaring of fracturing fluids -emissions and ambient air quality*, Technical Report 2012– 03, Taranaki Regional Council May 2012.

- Every endeavor was made by Greymouth Petroleum Limited to minimise the total volume of gas flared while ensuring that adequate flow and pressure data was gathered to inform their investment decision; and
- Every endeavor was made by Greymouth Petroleum Limited to minimise smoke emissions from the flare.

Odour and dust

Suppression of dust with water was to be implemented if it was apparent that dust may be travelling in such a direction to adversely affect off-site parties. Odour may stem from the product, flare, or some of the chemicals used on-site. Care was taken to minimize the potential for odour emissions (e.g. by keeping containers sealed, and ensuring the flare burnt cleanly).

Hazardous substances

The use and storage of hazardous substances on-site has the potential to contaminate surface water and soils in the event of a spill. In the unlikely event of a serious spill or fire, the storage of flammable materials could have resulted in air, soil and water contamination.

Greymouth Petroleum Limited was required to implement the following mitigation measures:

- All potentially hazardous material were used and stored in accordance with the relevant Hazardous Substances and New Organisms regulations;
- All areas containing hazardous chemicals were bunded;
- Ignition sources were not permitted on any site;
- Sufficient separation of chemicals from the flare pit were maintained for safety reasons;
- In the unlikely event of a spill escaping from bunded areas, the site perimeter drain and interceptor pit system was implemented to provide secondary containment on-site; and
- A spill contingency plan was prepared that sets out emergency response procedures to be followed in the event of a spill.
- Scraping of the wellsite surface to remove any minor spillage residues

Summary

There were no environmental effects observed to water, land or air as a result of the exploration drilling and fracturing during the monitoring period. An incident of minor spillage on the site was remediated promptly and without residual efforts. There were no unauthorised discharges to water or the air observed from the Ngatoro-G wellsite.

3.3 Evaluation of performance

A tabular summary of Greymouth Petroleum Limited's compliance record for the period under review is set out in Tables 3- 8.

Table 3 Summary of performance for Consent 7936-1 to take groundwater that may be encountered during exploration and production operations at Ngatoro-G wellsite

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. The abstraction must not cause more than a 10% lowering of static water level by interference with any adjacent bore	Complaints	Yes – no complaints were received
2. The abstraction does not cause the intrusion of salt water into any freshwater aquifer	Water sampling adjacent bores pre/post drilling	Yes
3. A well log to 1,000 m must be submitted to the Council	Well log to 1,000 m submitted	Yes
4. Consent shall lapse if not implemented by date specified	Notification received and confirmed by inspection	N/A
5. Notice of Council to review consent	Notice of intention /not served	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High

Table 4 Summary of performance for Consent 7935-1 to take and use water from the Ngatoronui Stream for hydrocarbon exploration activities at the Ngatoro-G wellsite

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Maximum volume of water to be abstracted	Inspection of Company records	Yes
2. Maintain abstraction records	Inspection of Company records	Yes
3. Best practicable option to avoid, remedy or mitigate any adverse effects	Visually inspecting site, procedures & processes	Yes
4. Properly screen the intake structure	Inspecting the intake screen	Yes
5. Consent lapse	N/A	N/A
6. Review, amend, delete or add to conditions of consent	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High

Table 5 Summary of performance for Consent 7937-1 to discharge emissions to air from flaring of hydrocarbon exploration.

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Limit on the maximum cumulative number of days of flaring from each well	Inspection of records	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
2. 24hrs notice of flaring to the Council for initial flare of each zone	Notification received 24hrs prior to flaring	Yes
3. 24hrs notice of flaring to the residents for initial flare of each zone	Notification received 24hrs prior to flaring	Yes
4. Liquid and solid separation to occur before flaring to minimise smoke emissions	Inspection of flare pit and flare	Yes
5. No liquid or solid hydrocarbons are to be combusted in the flare pit	Inspection of flare pit and flare	Yes
6. Best practicable option adopted	Visually inspecting site, procedures & processes	Yes
7. No offensive odour or smoke beyond boundary	Assessment by investigating officer	Yes
8. Control of carbon monoxide	Inspections confirming chemical analysis not required	
9. Control of nitrogen	Inspections confirming chemical analysis not required	N/A
10. Control of other emissions	Inspections	N/A
11. Analysis of typical gas and crude oil stream from field to be made available to the Council	Available upon request	N/A
12. Log all flaring including time, duration, zone and volumes flared	Inspection of Company records	Yes
13. Consent shall lapse if not implemented by date specified	Exercise of consent confirmed by inspection	Yes
14. Notice of Council to review consent	No provision for review during period	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High

Table 6 Summary of performance for Consent 7938-1 to discharge emissions to air during flaring from well workovers and emergency situations associated with production activities at the Ngatoro-G wellsite

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. 24hrs notice of flaring to the Council when flaring is longer than 5 minutes in duration	Notification received 24hrs prior to flaring	Yes
2. 24hr notice of flaring to all residents within 300 m of the wellsite	Residents confirm 24hr notice provided	Yes
3. Liquid and solid separation to occur before flaring to minimise smoke emissions	Inspection of flare pit and flare	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
4. Only gaseous hydrocarbons originating from the site shall be combusted within the flare pit.	Inspection of flare pit and flare	Yes
5. Best practicable option adopted	Visually inspecting site, procedures & processes	Yes
6. No offensive odour or smoke beyond boundary	Assessment by investigating officer	Yes
7. All storage tanks to have vapour recovery systems fitted.	Visual inspection of site	Yes
8. Control of carbon monoxide	Chemical analysis of emissions	Yes
9. Control of nitrogen	Chemical analysis of emissions	Yes
10. Control of other emissions	Chemical analysis of emissions	Yes
11. Analysis of typical gas and condensate stream from field to be made available to the Council	Available upon request	Yes
12. Log all flare events longer than 5 minutes (10 minutes aggregate or longer than 120 minutes) including time, duration, zone and reason for flare	Available upon request	Yes
13. Consent shall lapse if not implemented by date specified	Notification of flaring received	Yes
14. Notice of Council to review consent	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High

Table 7 Summary of performance for Consent 7934-1 to discharge treated stormwater, and produced water from hydrocarbon exploration and production operations at the Ngatoro-G wellsite onto and into land and into an unnamed tributary of the Ngatoronui stream

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Consent holder to adopt best practicable option at all times	Visually inspecting site, procedures & processes	Yes
2. Stormwater discharge shall be collected from a catchment area of no more than 1 ha.	Inspection of site and records	Yes
3. 7 days written notice prior to site works and drilling	Notification received	Yes
4. Maintain a contingency plan	Contingency plan received and approved	Yes
5. All discharges to be directed for treatment through skimmer pit. Stormwater pits to be impermeable	Visual inspection of stormwater system	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
6. Discharge of chloride shall not exceed 50 ppm	Sampling of discharge	Yes
7. 48 hours notice of reinstatement	Notification received	Yes
8. Consent shall lapse if not implemented by date specified	Exercise of consent confirmed by inspection	N/A – consent exercised
9. Notice of Council to review consent	No provision for review during period	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High

Table 8 Summary of performance for Consent 7933-1 to discharge stormwater and sediment from earthworks during construction of the Ngatoro-G wellsite onto and into land

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Consent holder to adopt best practicable option at all times	Visually inspecting site, procedures & processes	Yes
2. All runoff shall pass through settlement ponds or traps with a minimum capacity of 100 m ³	Site erosion and sediment control plan submitted	Yes
3. Condition 2 will not apply when site is stabilised	Visual inspection	Yes
4. All earth worked areas shall be stabilised as soon as practicable	Visual inspection	Yes
5. 7 days written notice prior to site earthworks	Notification received	Yes
Overall assessment of consent compliance and environmental performance in respect of this consent		High

During the monitoring period, Greymouth Petroleum Limited demonstrated a good level of environmental performance and compliance with the resource consents. The incident that occurred in respect of resource consent 7934-1 has been discussed in Section 2.5. The site was generally neat, tidy, and well maintained.

3.4 Exercise of optional review of consents

Each resource consent includes a condition which allows the Council to review the consent, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of the resource consent, which were not foreseen at the time the application was considered or which it was not appropriate to deal with at the time. The next provisions for review are in June 2015.

Based on the results of monitoring during the period under review, it is considered that there are no grounds that require a review to be pursued. A recommendation to this effect is presented in section 4.

3.5 Change to any future monitoring programmes

In designing and implementing the monitoring programmes for air and water discharges and water abstractions at well sites in the region, the Council takes into account the extent of information made available by previous and other authorities, its relevance under the Act, the obligations of the Act in terms of monitoring emissions/discharges and effects, and of subsequently reporting to the regional community, the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of well site processes within Taranaki.

The Council has routinely monitored well site activities for more than 20 years in the region. This work has included in the order of hundreds of water samples and bio-monitoring surveys in the vicinity of well sites, and has demonstrated robustly that a monitoring regime based on frequent and comprehensive inspections is rigorous and thorough, in terms of identifying any adverse effects from well site and associated activities. Accordingly the Council had for a time not routinely required the imposition of additional targeted physicochemical and biological monitoring unless a site-specific precautionary approach indicated this would be warranted for certainty and clarity around site effects.

However, the Council has also noted a desire by some community members for a heightened level of information feedback and certainty around the results and outcomes of monitoring at well sites to occur or has occurred. Notwithstanding the long track record of a demonstrable suitability of an inspection-based monitoring programme, the Council has therefore moved to extend the previous regime, to make the sampling and extensive analysis of treated stormwater discharge and bio-monitoring of surface water ecosystems, an integral part of the basic monitoring programme for such activities.

The monitoring of future consented activities at Ngatoro-G wellsite shall be extended to include an ecological survey.

A recommendation to this effect is present in section 4 of this report.

4. Recommendations

1. THAT this report be forwarded to the Company, and to any interested parties upon request;
2. THAT the Company be asked to inform the Council of the intention to either drill, test or undertake reinstatement;
3. THAT the monitoring of future consented activities at Ngatoro-G wellsite be extended to include an ecological survey;
4. THAT, subject to the findings of monitoring of any further activities at the Ngatoro-G wellsite consents shall not be reviewed in 2015;

Glossary of common terms and abbreviations

The following abbreviations and terms may have been used within this report:

Al*	aluminium.
As*	arsenic
Biomonitoring	assessing the health of the environment using aquatic organisms
BOD	biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate
BODF	biochemical oxygen demand of a filtered sample
Bund	a wall around a tank to contain its contents in the case of a leak
CBOD	carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate
Cfu	colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample
COD	chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
Condy	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
<i>E.coli</i>	<i>Escherichia coli</i> , an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample
Ent	Enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample
F	Fluoride
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
Fresh g/m ³	elevated flow in a stream, such as after heavy rainfall grammes per cubic metre, and equivalent to milligrammes 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

l/s	litres per second
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
mS/m	millisiemens per metre
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.
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
PM ₁₀	relatively fine airborne particles (less than 10 micrometre diameter)
Resource consent	refer Section 87 of the RMA. Resource consent include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15)
RMA	Resource Management Act 1991 and subsequent amendments
SS	suspended solids,
Temp	temperature, measured in °C (degrees Celsius)
Turb	turbidity, expressed in NTU
UI	Unauthorised Incident
UIR	Unauthorised 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
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

Appendix I

Resource consents



CHIEF EXECUTIVE
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Please quote our file number
on all correspondence

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

Name of
Consent Holder: Greymouth Petroleum Limited
P O Box 3394
NEW PLYMOUTH 4341

Decision Date: 6 October 2011

Commencement
Date: 6 October 2011

Conditions of Consent

Consent Granted: To discharge stormwater and sediment onto and into land associated with earthworks during the construction of the Ngatoro-G wellsite at or about (NZTM) 1703136E-5659535N

Expiry Date: 1 June 2016

Site Location: Ngatoro-G wellsite, Bedford Road, Inglewood
[Property owner: RJ & GW Moffitt]

Legal Description: Lot 2 DP 333320 [Discharge source & site]

Catchment: Waitara

Tributary: Manganui
Ngatoro
Ngatoronui

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

General condition

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

Special conditions

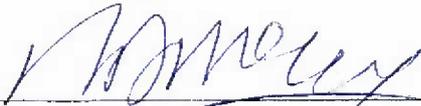
1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site.
2. If any area of soil is exposed, all run off from that area shall pass through settlement ponds or sediment traps with a minimum total capacity of:
 - a) 100 cubic metres for every hectare of exposed soil between 1 November to 30 April; and
 - b) 200 cubic metres for every hectare of exposed soil between 1 May to 31 October;unless other sediment control measures that achieve an equivalent standard are agreed to by the Chief Executive of the Taranaki Regional Council.
3. The obligation described in condition 2 above shall cease to apply, and accordingly the erosion and sediment control measures can be removed, in respect of any particular site or area of any site, only when the site is stabilised.

Note: For the purpose of conditions 3 and 4 "stabilised" in relation to any site or area means inherently resistant to erosion or rendered resistant, such as by using rock or by the application of basecourse, colluvium, grassing, mulch, or another method to the reasonable satisfaction of the Chief Executive, Taranaki Regional Council and as specified in the Taranaki Regional Council's Guidelines for Earthworks in the Taranaki Region, 2006. Where seeding or grassing is used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once, on reasonable visual inspection by an officer of the Taranaki Regional Council, an 80% vegetative cover has been established.

4. All earthworked areas shall be stabilised vegetatively or otherwise as soon as is practicable immediately following completion of soil disturbance activities.
5. At least 7 working days prior to the commencement of earthworks the consent holder shall notify the Taranaki Regional Council of the proposed start date for the earthworks. Notification shall include the consent number and a brief description of the activity consented and shall be emailed to worknotification@trc.govt.nz.

Signed at Stratford on 6 October 2011

For and on behalf of
Taranaki Regional Council



Director-Resource Management



Discharge Permit
Pursuant to the Resource Management Act 1991
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Taranaki Regional Council

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Please quote our file number
on all correspondence

Name of
Consent Holder: Greymouth Petroleum Limited
P O Box 3394
NEW PLYMOUTH 4341

Decision Date: 6 October 2011

Commencement
Date: 6 October 2011

Conditions of Consent

Consent Granted: To discharge treated stormwater and produced water onto
and into land from hydrocarbon exploration and production
operations at the Ngatoro-G wellsite at or about (NZTM)
1703112E-5659563N

Expiry Date: 1 June 2027

Review Date(s): June 2015, June 2021

Site Location: Ngatoro-G wellsite, Bedford Road, Inglewood
[Property owner: RJ & GW Moffitt]

Legal Description: Lot 2 DP 333320 [Discharge source & site]

Catchment: Waitara

Tributary: Manganui
Ngatoro
Ngatoronui

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

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

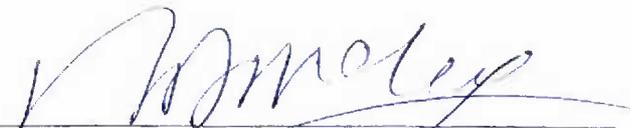
Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site.
2. Stormwater discharged shall be collected from a catchment area of no more than 1 ha.
3. The Chief Executive, Taranaki Regional Council, shall be advised in writing at least 7 days prior to any site works commencing, and again in writing at least 7 days prior to any well drilling operation commencing. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.
4. The consent holder shall maintain a contingency plan that, to the satisfaction of the Chief Executive, Taranaki Regional Council, details measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not authorised by this consent and measures to avoid, remedy or mitigate the environmental effects of such a spillage or discharge. The contingency plan shall be provided to the Council prior to discharging from the site.
5. All stormwater and produced water [with a maximum chloride concentration of 50 ppm] shall be directed for treatment through the stormwater treatment system before being discharged.
6. There shall be no discharge of produced water with a chloride concentration greater than 50 ppm.
7. The consent holder shall advise the Chief Executive, Taranaki Regional Council, in writing at least 48 hours prior to the reinstatement of the site and the reinstatement shall be carried out so as to minimise adverse effects on stormwater quality. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.
8. This consent shall lapse on 31 December 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.

9. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2015 and/or June 2021, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 6 October 2011

For and on behalf of
Taranaki Regional Council



Director-Resource Management



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

CHIEF EXECUTIVE
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Please quote our file number
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Name of
Consent Holder: Greymouth Petroleum Limited
P O Box 3394
NEW PLYMOUTH 4341

Decision Date: 6 October 2011

Commencement
Date: 6 October 2011

Conditions of Consent

Consent Granted: To take water from the Ngatoronui Stream and an unnamed tributary of the Ngatoronui Stream for wellsite and well drilling during hydrocarbon exploration and production activities at the Ngatoro-G wellsite at or about (NZTM) 1703282E-5659432N and 1703115E-5659582N

Expiry Date: 1 June 2021

Review Date(s): June 2015

Site Location: Ngatoro-G wellsite, Bedford Road, Inglewood
[Property owner: RJ & GW Moffitt]

Legal Description: Lot 2 DP 333320 [Site of take]

Catchment: Waitara

Tributary: Manganui
Ngatoro
Ngatoronui

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*
www.trc.govt.nz

General condition

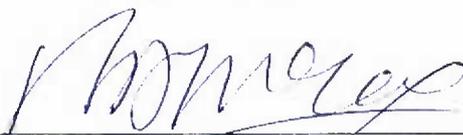
- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance to section 36 of the Resource Management Act.

Special conditions

1. The volume of water taken shall not exceed 100 cubic metres per day and at a rate not exceeding 25 litres per second over a maximum period of 60 days.
2. The consent holder shall maintain a record of the abstraction including date, rate, pumping hours and daily volume abstracted and supply these records to the Chief Executive, Taranaki Regional Council, no later than 31 July of each year, or earlier upon request.
3. The consent holder shall take all reasonable steps to avoid, remedy or mitigate any adverse effect on the environment arising from the exercise of this consent, including, but not limited to, the efficient and conservative use of water.
4. The consent holder shall ensure that the intake structure is appropriately screened to avoid the entrainment of fish.
5. This consent shall lapse on 31 December 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.
6. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2015 for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 6 October 2011

For and on behalf of
Taranaki Regional Council



Director-Resource Management

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

Name of Consent Holder: Greymouth Petroleum Limited
P O Box 3394
NEW PLYMOUTH 4341

Decision Date (Change): 9 May 2012

Commencement Date (Change): 9 May 2012 (Granted: 6 October 2011)

Conditions of Consent

Consent Granted: To take water from the Ngatoronui Stream and an unnamed tributary of the Ngatoronui Stream for wellsite and well drilling during hydrocarbon exploration and production activities at the Ngatoro-G wellsite at or about (NZTM) 1703282E-5659432N and 1703115E-5659582N

Expiry Date: 1 June 2021

Review Date(s): June 2015

Site Location: Ngatoro-G wellsite, Bedford Road, Inglewood
(Property owner: RJ & GW Moffitt)

Legal Description: Lot 2 DP 333320 (Site of take)

Catchment: Waitara

Tributary: Manganui
Ngatoro
Ngatoronui

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

General condition

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

Special conditions

1. The volume of water taken shall not exceed 100 cubic metres per day and at a rate not exceeding 4.5 litres per second over a maximum period of 60 days.
2. The consent holder shall maintain a record of the abstraction including date, rate, pumping hours and daily volume abstracted and supply these records to the Chief Executive, Taranaki Regional Council, no later than 31 July of each year, or earlier upon request.
3. The consent holder shall take all reasonable steps to avoid, remedy or mitigate any adverse effect on the environment arising from the exercise of this consent, including, but not limited to, the efficient and conservative use of water.
4. The consent holder shall ensure that the intake structure is appropriately screened to avoid the entrainment of fish.
5. This consent shall lapse on 31 December 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.
6. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2015 for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 9 May 2012

For and on behalf of
Taranaki Regional Council

Director-Resource Management



Water Permit
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Please quote our file number
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Name of
Consent Holder: Greymouth Petroleum Limited
P O Box 3394
NEW PLYMOUTH 4341

Decision Date: 6 October 2011

Commencement
Date: 6 October 2011

Conditions of Consent

Consent Granted: To take groundwater that may be encountered during hydrocarbon exploration and production operations at the Ngatoro-G wellsite at or about (NZTM) 1703136E-5659535N

Expiry Date: 1 June 2027

Review Date(s): June 2015, June 2021

Site Location: Ngatoro-G wellsite, Bedford Road, Inglewood
[Property owner: RJ & GW Moffitt]

Legal Description: Lot 2 DP 333320 [Site of take]

Catchment: Waitara

Tributary: Manganui
Ngatoro
Ngatoronui

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*
www.trc.govt.nz

General condition

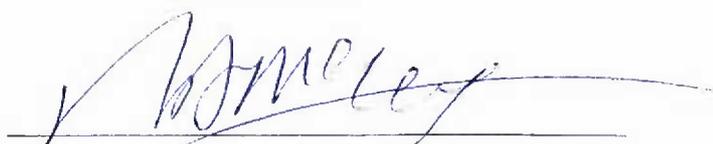
- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance to section 36 of the Resource Management Act.

Special conditions

1. The consent holder shall ensure the abstraction does not cause more than a 10% lowering of static water-level by interference with any adjacent bore.
2. The consent holder shall ensure the abstraction does not cause the intrusion of salt water into any freshwater aquifer.
3. The consent holder shall submit a summary well log to a depth of 1000 metres, within three months of the completion of drilling. The report shall:
 - a) provide a log to show the true vertical depth to all geological formation tops intersected within the freshwater zone;
 - b) identify the true vertical depth to, and thickness of, any freshwater aquifers intersected by the well;
 - c) identify the true vertical depth to the freshwater- saline water interface in the well.
4. This consent shall lapse on 31 December 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.
5. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2015 and/or June 2021, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 6 October 2011

For and on behalf of
Taranaki Regional Council



Director-Resource Management



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

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Please quote our file number
on all correspondence

Name of
Consent Holder: Greymouth Petroleum Limited
P O Box 3394
NEW PLYMOUTH 4341

Decision Date: 6 October 2011

Commencement
Date: 6 October 2011

Conditions of Consent

Consent Granted: To discharge emissions to air from flaring of hydrocarbons and miscellaneous emissions associated with drill stem testing, well clean-up, well testing and production testing at the Ngatoro-G wellsite at or about (NZTM) 1703210E-5659498N

Expiry Date: 1 June 2027

Review Date(s): June 2015, June 2021

Site Location: Ngatoro-G wellsite, Bedford Road, Inglewood
[Property owner: RJ & GW Moffitt]

Legal Description: Lot 2 DP 333320 [Discharge source & site]

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*
www.trc.govt.nz

General condition

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

Special conditions

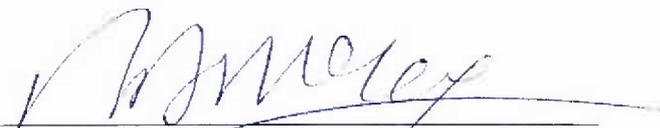
1. Flaring shall not occur on more than 15 days, cumulatively, per zone for each well [with a maximum of 4 zones per well], for up to eight wells.
2. The consent holder shall notify the Chief Executive, Taranaki Regional Council, at least 24 hours before the initial flaring of each zone being commenced. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.
3. At least 24 hours before any flaring, other than in emergencies, the consent holder shall provide notification to all residents within 300 metres of the wellsite of the commencement of flaring. The consent holder shall include in the notification a 24-hour contact telephone number for a representative of the consent holder, and shall keep and make available to the Chief Executive, Taranaki Regional Council, a record of all queries and complaints received in respect of any flaring activity.
4. To the greatest extent possible, all gas that is flared must first be treated by effective liquid and solid separation and recovery.
5. Only gaseous hydrocarbons originating from the well stream shall be combusted within the flare pit.
6. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or potential effect on the environment arising from any emission to air from the flare, including, but not limited to, having regard to the prevailing and predicted wind speed and direction at the time of initiation of, and throughout, any episode of flaring so as to minimise offsite effects [other than for the maintenance of a pilot flare flame].
7. The discharge shall not cause any objectionable or offensive odour or smoke at or beyond the boundary of the property where the wellsite is located.

8. The consent holder shall control all emissions of carbon monoxide to the atmosphere from the flare so that, whether alone or in conjunction with any other emissions from the wellsite, the maximum ground level concentration of carbon monoxide arising from the exercise of this consent measured under ambient conditions does not exceed 10 milligrams per cubic metre [mg/m^3] [eight-hour average exposure], or $30 \text{ mg}/\text{m}^3$ [one-hour average exposure] at or beyond the boundary of the property where the wellsite is located.
9. The consent holder shall control all emissions of nitrogen oxides to the atmosphere from the flare, so that whether alone or in conjunction with any other emissions from the wellsite, the maximum ground level concentration of nitrogen dioxide arising from the exercise of this consent measured under ambient conditions does not exceed 100 micrograms per cubic metre [$\mu\text{g}/\text{m}^3$] [24-hour average exposure], or $200 \mu\text{g}/\text{m}^3$ [1-hour average exposure] at or beyond the boundary of the property where the wellsite is located.
10. The consent holder shall control emissions to the atmosphere from the wellsite and flare of contaminants other than carbon dioxide, carbon monoxide, and nitrogen oxides, so that whether alone or in conjunction with any emissions from the flare, the maximum ground level concentration for any particular contaminant arising from the exercise of this consent measured at or beyond the boundary of the property where the wellsite is located, is not increased above background levels:
 - a) by more than $1/30^{\text{th}}$ of the relevant Occupational Threshold Value-Time Weighted Average, or by more than the Short Term Exposure Limit at any time [all terms as defined in Workplace Exposure Standards, 2002, Department of Labour]; or
 - b) if no Short Term Exposure Limit is set, by more than three times the Time Weighted Average at any time [all terms as defined in Workplace Exposure Standards, 2002, Department of Labour].
11. The consent holder shall make available to the Chief Executive, Taranaki Regional Council, upon request, an analysis of a typical gas and condensate stream from the field, covering sulphur compound content and the content of carbon compounds of structure C_6 or higher number of compounds.
12. The consent holder shall record and make available to the Chief Executive, Taranaki Regional Council, a 'flaring log' that includes:
 - a) the date, time and duration of all flaring episodes;
 - b) the zone from which flaring occurred;
 - c) the volume of substances flared;
 - d) whether there was smoke at any time during the flaring episode and if there was, the time, duration and cause of each 'smoke event'.
13. This consent shall lapse on 31 December 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.

14. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2015 and/or June 2021, for any of the following purposes:
- a) dealing with any **significant** adverse effect on the environment arising from the exercise of the consent which was not foreseen at the time the application was considered or which it was not appropriate to deal with at the time; and/or
 - b) requiring the consent holder to adopt specific practices in order to achieve the best practicable option to remove or reduce any adverse effect on the environment caused by the discharge; and/or
 - c) to alter, add or delete limits on mass discharge quantities or discharge or ambient concentrations of any contaminant.

Signed at Stratford on 6 October 2011

For and on behalf of
Taranaki Regional Council



Director-Resource Management

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

Name of
Consent Holder: Greymouth Petroleum Limited
P O Box 3394
NEW PLYMOUTH 4341

Decision Date
(Change): 22 June 2012

Commencement
Date (Change): 22 June 2012 (Granted: 6 October 2011)

Conditions of Consent

Consent Granted: To discharge emissions to air from flaring of hydrocarbons and miscellaneous emissions associated with drill stem testing, well clean-up, well testing and production testing at the Ngatoro-G wellsite at or about (NZTM) 1703210E-5659498N

Expiry Date: 1 June 2027

Review Date(s): June 2015, June 2021

Site Location: Ngatoro-G wellsite, Bedford Road, Inglewood
(Property owner: RJ & GW Moffitt)

Legal Description: Lot 2 DP 333320 (Discharge source & site)

*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. Flaring shall not occur on more than 60 days cumulatively for each well for up to eight wells.
2. The consent holder shall notify the Chief Executive, Taranaki Regional Council, at least 24 hours before the initial flaring of each zone being commenced. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.
3. At least 24 hours before any flaring, other than in emergencies, the consent holder shall provide notification to all residents within 300 metres of the wellsite of the commencement of flaring. The consent holder shall include in the notification a 24-hour contact telephone number for a representative of the consent holder, and shall keep and make available to the Chief Executive, Taranaki Regional Council, a record of all queries and complaints received in respect of any flaring activity.
4. To the greatest extent possible, all gas that is flared must first be treated by effective liquid and solid separation and recovery.
5. Only gaseous hydrocarbons originating from the well stream shall be combusted within the flare pit.
6. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or potential effect on the environment arising from any emission to air from the flare, including, but not limited to, having regard to the prevailing and predicted wind speed and direction at the time of initiation of, and throughout, any episode of flaring so as to minimise offsite effects (other than for the maintenance of a pilot flare flame).
7. The discharge shall not cause any objectionable or offensive odour or smoke at or beyond the boundary of the property where the wellsite is located.
8. The consent holder shall control all emissions of carbon monoxide to the atmosphere from the flare so that, whether alone or in conjunction with any other emissions from the wellsite, the maximum ground level concentration of carbon monoxide arising from the exercise of this consent measured under ambient conditions does not exceed 10 milligrams per cubic metre (mg/m³) (eight-hour average exposure), or 30 mg/m³ one-hour average exposure) at or beyond the boundary of the property where the wellsite is located.

Consent 7937-1

9. The consent holder shall control all emissions of nitrogen oxides to the atmosphere from the flare, so that whether alone or in conjunction with any other emissions from the wellsite, the maximum ground level concentration of nitrogen dioxide arising from the exercise of this consent measured under ambient conditions does not exceed 100 micrograms per cubic metre ($\mu\text{g}/\text{m}^3$) (24-hour average exposure), or 200 $\mu\text{g}/\text{m}^3$ (1-hour average exposure) at or beyond the boundary of the property where the wellsite is located.
10. The consent holder shall control emissions to the atmosphere from the wellsite and flare of contaminants other than carbon dioxide, carbon monoxide, and nitrogen oxides, so that whether alone or in conjunction with any emissions from the flare, the maximum ground level concentration for any particular contaminant arising from the exercise of this consent measured at or beyond the boundary of the property where the wellsite is located, is not increased above background levels:
 - a) by more than 1/30th of the relevant Occupational Threshold Value-Time Weighted Average, or by more than the Short Term Exposure Limit at any time (all terms as defined in Workplace Exposure Standards, 2002, Department of Labour); or
 - b) if no Short Term Exposure Limit is set, by more than three times the Time Weighted Average at any time (all terms as defined in Workplace Exposure Standards, 2002, Department of Labour).
11. The consent holder shall make available to the Chief Executive, Taranaki Regional Council, upon request, an analysis of a typical gas and condensate stream from the field, covering sulphur compound content and the content of carbon compounds of structure C₆ or higher number of compounds.
12. The consent holder shall record and make available to the Chief Executive, Taranaki Regional Council, a 'flaring log' that includes:
 - a) the date, time and duration of all flaring episodes;
 - b) the zone from which flaring occurred;
 - c) the volume of substances flared;
 - d) whether there was smoke at any time during the flaring episode and if there was, the time, duration and cause of each 'smoke event'.
13. This consent shall lapse on 31 December 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.

Consent 7937-1

14. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2015 and/or June 2021, for any of the following purposes:
- a) dealing with any significant adverse effect on the environment arising from the exercise of the consent which was not foreseen at the time the application was considered or which it was not appropriate to deal with at the time; and/or
 - b) requiring the consent holder to adopt specific practices in order to achieve the best practicable option to remove or reduce any adverse effect on the environment caused by the discharge; and/or
 - c) to alter, add or delete limits on mass discharge quantities or discharge or ambient concentrations of any contaminant.

Signed at Stratford on 22 June 2012

For and on behalf of
Taranaki Regional Council

Director-Resource Management



CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE: 06-765 7127
FAX: 06-765 5097
www.trc.govt.nz

Please quote our file number
on all correspondence

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

Name of
Consent Holder: Greymouth Petroleum Limited
P O Box 3394
NEW PLYMOUTH 4341

Decision Date: 6 October 2011

Commencement
Date: 6 October 2011

Conditions of Consent

Consent Granted: To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Ngatoro-G wellsite at or about (NZTM) 1703210E-5659498N

Expiry Date: 1 June 2027

Review Date(s): June 2015, June 2021

Site Location: Ngatoro-G wellsite, Bedford Road, Inglewood
[Property owner: RJ & GW Moffitt]

Legal Description: Lot 2 DP 333320 [Discharge source & site]

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*
www.trc.govt.nz

General condition

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

Special conditions

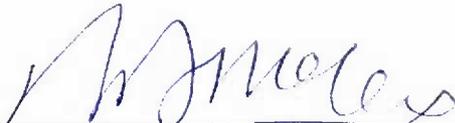
1. Other than in emergencies, the consent holder shall notify the Chief Executive, Taranaki Regional Council, whenever the continuous flaring of hydrocarbons [other than purge gas] is expected to occur for more than five minutes in duration. Notification shall be no less than 24 hours before the flaring commences. Notification shall include the consent number and be emailed to worknotification@trc.govt.nz.
2. At least 24 hours before any flaring, other than in emergencies, the consent holder shall provide notification to all residents within 300 metres of the wellsite of the commencement of flaring. The consent holder shall include in the notification a 24-hour contact telephone number for a representative of the consent holder, and shall keep and make available to the Chief Executive, Taranaki Regional Council, a record of all queries and complaints received in respect of any flaring activity.
3. To the greatest extent possible, all gas that is flared must first be treated by effective liquid and solid separation and recovery.
4. Only gaseous hydrocarbons originating from the well stream shall be combusted within the flare pit.
5. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or potential effect on the environment arising from any emission to air from the flare, including, but not limited to, having regard to the prevailing and predicted wind speed and direction at the time of initiation of, and throughout, any episode of flaring so as to minimise offsite effects [other than for the maintenance of a pilot flare flame].
6. The discharge shall not cause any objectionable or offensive odour or smoke at or beyond the boundary of the property where the wellsite is located.
7. All permanent tanks used as hydrocarbon storage vessels, shall be fitted with vapour recovery systems.

8. The consent holder shall control all emissions of carbon monoxide to the atmosphere from the flare so that, whether alone or in conjunction with any other emissions from the wellsite, the maximum ground level concentration of carbon monoxide arising from the exercise of this consent measured under ambient conditions does not exceed 10 milligrams per cubic metre [mg/m^3] [eight-hour average exposure], or 30 mg/m^3 one-hour average exposure] at or beyond the boundary of the property where the wellsite is located.
9. The consent holder shall control all emissions of nitrogen oxides to the atmosphere from the flare so that, whether alone or in conjunction with any other emissions from the wellsite, the maximum ground level concentration of nitrogen dioxide arising from the exercise of this consent measured under ambient conditions does not exceed 100 micrograms per cubic metre [$\mu\text{g}/\text{m}^3$] [24-hour average exposure], or 200 $\mu\text{g}/\text{m}^3$ [1-hour average exposure] at or beyond the boundary of the of the property where the wellsite is located.
10. The consent holder shall control emissions to the atmosphere from the wellsite and flare of contaminants other than carbon dioxide, carbon monoxide, and nitrogen oxides so that, whether alone or in conjunction with any emissions from the flare, the maximum ground level concentration for any particular contaminant arising from the exercise of this consent measured at or beyond the boundary of the property where the wellsite is located, is not increased above background levels:
 - a) by more than 1/30th of the relevant Occupational Threshold Value-Time Weighted Average, or by more than the Short Term Exposure Limit at any time [all terms as defined in Workplace Exposure Standards, 2002, Department of Labour]; or
 - b) if no Short Term Exposure Limit is set, by more than three times the Time Weighted Average at any time [all terms as defined in Workplace Exposure Standards, 2002, Department of Labour].
11. The consent holder shall make available to the Chief Executive, Taranaki Regional Council, upon request, an analysis of a typical gas and condensate stream from the field, covering sulphur compound content and the content of carbon compounds of structure C₆ or higher number of compounds.
12. The consent holder shall record and make available to the Chief Executive, Taranaki Regional Council, a 'flaring log' that includes:
 - a) the date, time and duration of all flaring episodes;
 - b) the zone from which flaring occurred;
 - c) the volume of substances flared;
 - d) whether there was smoke at any time during the flaring episode and if there was, the time, duration and cause of each 'smoke event'.

13. This consent shall lapse on 31 December 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.
14. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2015 and/or June 2021, for any of the following purposes:
 - a) dealing with any significant adverse effect on the environment arising from the exercise of the consent which was not foreseen at the time the application was considered or which it was not appropriate to deal with at the time; and/or
 - b) requiring the consent holder to adopt specific practices in order to achieve the best practicable option to remove or reduce any adverse effect on the environment caused by the discharge; and/or
 - c) to alter, add or delete limits on mass discharge quantities or discharge or ambient concentrations of any contaminant.

Signed at Stratford on 6 October 2011

For and on behalf of
Taranaki Regional Council


~~Director~~ Resource Management