

Greymouth Petroleum Limited  
Northern Sites  
Monitoring Programme  
Annual Report  
2017-2018

Technical Report 2018-55

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## Executive summary

Greymouth Petroleum Limited (GPL) operates the Turangi Production Station located on Turangi Road at Motunui, in the Parahaki catchment. The Turangi Production Station processes oil and gas from the Company's northern Taranaki operations, including the Ohanga, Onaero and Turangi group of wellsites. GPL also operate the Kowhai-A Production Station, located on Ngatimaru Road at Tikorangi. The Kowhai-A Production Station processes product from the Kowhai-A, B, C and D wellsites. This report for the period July 2017 to June 2018 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the Company's activities.

GPL holds five resource consents in relation to the Turangi and Kowhai-A production stations, which include a total of 107 conditions setting out the requirements that the Company must satisfy. The Company holds three consents to discharge stormwater and treated produced water onto land, and two consents to discharge emissions related to production activities into the air.

### **During the monitoring period Greymouth Petroleum Limited demonstrated an overall high level of environmental performance.**

The Council's monitoring programme for the year under review included five inspections of the Turangi Production Station, six inspections at the Kowhai-A Production Station, two visits to the Kowhai-D wellsite and an annual inspection of all associated wellsites. Two biomonitoring surveys of receiving waters, and two ambient air quality surveys were also undertaken in relation to the Turangi Production Station.

The monitoring showed that the production station site was well managed. All consent conditions relating to site operations and management were complied with. Biomonitoring in the receiving waters did not show any effect from discharges on the communities in the stream.

There were no adverse effects on the environment resulting from the exercise of the air discharge consent. The ambient air quality monitoring at the site showed that levels of carbon monoxide, combustible gases, PM<sub>10</sub> particulates and nitrogen oxides were all below levels of concern at the time of sampling. No offensive or objectionable odours were detected beyond the boundary during inspections and there were no complaints in relation to air emissions from the site.

During the year, the Company demonstrated a high level of both environmental performance and administrative compliance with the resource consents. There were no Unauthorised Incidents recording non-compliance in respect of this consent holder during the period under review.

For reference, in the 2017-2018 year, consent holders were found to achieve a high level of environmental performance and compliance for 76% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 20% of the consents, a good level of environmental performance and compliance was achieved.

In terms of overall environmental and compliance performance by the consent holder over the last several years, this report shows that the consent holder's performance remained at a high level in the year under review.

This report includes recommendations for the 2018-2019 year.

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# 1 Introduction

## 1.1 Compliance monitoring programme reports and the Resource Management Act 1991

### 1.1.1 Introduction

This report is for the period July 2017 to June 2018 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Greymouth Petroleum Limited (GPL). GPL operates the Turangi Production Station situated on Turangi Road at Motunui, in the Parahaki catchment. GPL also operate the Kowhai-A Production Station situated on Ngatimaru Road at Tikorangi, in the Waiau catchment.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by GPL that relate to discharges of water within the Parahaki and Waiau catchments, and the air discharge permits held by GPL to cover emissions to air from the sites.

One of the intents of the *Resource Management Act 1991* (RMA) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the Company's use of water, land and air, and is the tenth combined annual report by the Council for the Turangi Production Station and its associated sites.

### 1.1.2 Structure of this report

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

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites through annual programmes;
- the resource consents held by GPL in the Parahaki and Waiau catchments;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted at the sites.

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

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

**Section 4** presents recommendations to be implemented in the 2018-2019 monitoring year.

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

### 1.1.3 The Resource Management Act 1991 and monitoring

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

- a. the neighbourhood or the wider community around an activity, and may include cultural and social-economic effects;
- b. physical effects on the locality, including landscape, amenity and visual effects;
- c. ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;

- d. natural and physical resources having special significance (for example recreational, cultural, or aesthetic); and
- e. risks to the neighbourhood or environment.

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

#### 1.1.4 Evaluation of environmental and administrative performance

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

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

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

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

##### Environmental Performance

**High:** No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.

**Good:** Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self reports, or in response to unauthorised incident reports, but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

For example:

- High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
- Strong odour beyond boundary but no residential properties or other recipient nearby.



**Improvement required:** Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.

**Poor:** Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

### Administrative performance

**High:** The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.

**Good:** Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

**Improvement required:** Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.

**Poor:** Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

For reference, in the 2017-2018 year, consent holders were found to achieve a high level of environmental performance and compliance for 76% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 20% of the consents, a good level of environmental performance and compliance was achieved.

## 1.2 Process description

### 1.2.1 Turangi Production Station

The Turangi-A wellsite production facilities were commissioned in late 2006 following the successful drilling and testing of the Turangi-1 well. Two further production wells were drilled on the wellsite in 2008. The site was expanded to the south during the 2013-2014 year. The production facilities currently treat condensate and gas from GPL's northern Taranaki operations, including the Ohanga, Onaero and Turangi group of wellsites.

The primary facilities at the Turangi Production Station consist of:

- Wellhead shutdown systems.
- Sand catcher and heating systems.
- Inlet separator and low temperature separator.
- Methanol storage and dosing system.
- A low pressure gas compressor.
- Flare system and flare pit.
- Storage tanks (condensate, methanol, and produced water) and a condensate load-out facility.

Gas is compressed, metered and exported to the national gas network. Condensate storage is located on the wellsite and currently consists of six above ground tanks and a truck load-out facility. Condensate is pumped via pipeline to the Omata tank farm, along with up to two truckloads going to the Waihapa Production Station per day. Produced formation water is stored on the site in banded tanks prior to being pumped down the Turangi-5 well into the Mt Messenger formation for disposal.

All chemical storage is contained within bunds and isolated from the stormwater system. The stormwater drain system consists of open culverts which capture and drain general surface water run-off from the site and some surrounding farmland. Stormwater from the site passes through two sets of lined skimmer pits before discharging to land and into a tributary of the Parahaki Stream at points north and south of the access road. The separate oily water drainage system consists of a buried pipe which gathers oily water from spill containment areas (i.e. kerbed foundations and tank bunds) and directs these flows into a triple interceptor pit located near the truck loading bay. Oily water drains from the compressor house are collected in a buried fibreglass tank and are routinely pumped out into the storage tanks.



Photo 1 Turangi Production Station

### 1.2.2 Kowhai-A Production Station

The Kowhai-A Production Station is located on Ngatimaru Road at Tikorangi. The site was originally developed and drilled by Swift Energy NZ Ltd in 2006. The Kowhai-A Production Station processes (separates) product from the Kowhai A, B, C and D wellsites.



Photo 2 Kowhai-A Production Station

### 1.3 Resource consents

The Company holds five resource consents the details of which are summarised in the table below and outlined in sections 1.3.1 to 1.3.2.

Table 1 Consents held by GPL in relation to Turangi and Kowhai-A Production Stations

Site	Consent number	Purpose	Granted	Review	Expires
Turangi Production Station	6497-1	To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Turangi Road wellsite	Dec 2004	-	June 2021
	6498-1	To discharge treated stormwater and treated produced water from hydrocarbon exploration and production operations at the Turangi Production Station onto land, where it may enter into an unnamed tributary of the Parahaki Stream	Dec 2004	-	June 2021
	9674-1	To discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Turangi Production Station, onto land where it may enter an unnamed tributary of the Parahaki Stream	Sep 2013	June 2021	June 2027
Kowhai-A Production Station	6719-1	To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Kowhai-A wellsite	Nov 2005	-	June 2021

Site	Consent number	Purpose	Granted	Review	Expires
Kowhai-A Production Station	10169-1	To discharge treated stormwater from hydrocarbon exploration and production operations at the Kowhai-A wellsite onto land and into an unnamed tributary of the Waiau Stream	Jan 2016	June 2021	June 2033

### 1.3.1 Water discharge permits

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.

GPL holds water discharge permit **6498-1** for the northern section of the site, to discharge treated stormwater and treated produced water from hydrocarbon exploration and production operations at the Turangi Production Station onto land, where it may enter into an unnamed tributary of the Parahaki Stream. This permit was issued by the Council on 7 December 2004 under Section 87(e) of the RMA. On 17 March 2008 the consent was varied in relation to the method of discharging produced water and it was also transferred from Greymouth Petroleum Acquisition Company Limited to GPL. On 10 September 2013 further variations were made to allow for an increase in the size of the catchment area and alterations to the stormwater system. It is due to expire on 1 June 2021.

There are 25 special conditions attached to this consent.

Conditions 1 and 6 relate to the discharge of treated water and the perimeter drain.

Conditions 2 to 5 set out contaminant concentrations that must not be exceeded in the soil layer.

Conditions 7, 8 and 12 require records to be kept, and the provision of management and contingency plans.

Conditions 9 to 11 relate to the best practicable option, catchment area and works notifications.

Conditions 13 to 18 relate to the stormwater system design and bunding of hazardous substance storage areas.

Conditions 19 to 22 specify limits in the discharge, effects on receiving waters and no direct discharge to surface water.

Conditions 23 to 25 relate to site reinstatement, lapse and review.

GPL also holds water discharge permit **9674-1** for the southern section of the site, to discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Turangi Production Station, onto land where it may enter an unnamed tributary of the Parahaki Stream. This permit was issued by the Council on 6 September 2013 under Section 87(e) of the RMA. On 13 February 2014 variations were made to allow for an increase in the size of the catchment area and alterations to the stormwater system. It is due to expire on 1 June 2027.

There are 16 special conditions attached to this consent.

Condition 1 requires the consent holder to exercise the best practicable option to prevent or minimise effects.

Conditions 3 and 14 require notification to the Council prior to the commencement of site works, drilling and reinstatement.

Condition 4 requires maintenance of a contingency plan for spillages or accidental discharges.

Conditions 2 and 5 to 10 relate to stormwater system design, management and maintenance.

Conditions 11 to 13 place limits on constituents in the discharge and effects in the receiving waters.

Conditions 15 and 16 are lapse and review provisions.

Petrochem Limited (a subsidiary of GPL) holds water discharge permit **10169-1** to discharge treated stormwater from hydrocarbon exploration and production operations at the Kowhai-A wellsite onto land and into an unnamed tributary of the Waiau Stream. This permit replaced consent 6720-1 and was issued by the Council on 15 January 2016 under Section 87(e) of the RMA. It is due to expire on 1 June 2033.

There are 16 special conditions attached to the consent.

Condition 1 requires the consent holder to exercise the best practicable option to prevent or minimise effects.

Condition 2 places limits on the maximum stormwater catchment area.

Condition 3 requires the consent holder to notify Council prior to site works or well drilling.

Condition 4 requires contingency planning for the site.

Conditions 5 to 9 relate to the stormwater system design, management and maintenance.

Conditions 10 to 13 place limits on constituents in the discharge and effects in the receiving waters.

Condition 14 deals with site reinstatement.

Conditions 15 and 16 are lapse and review provisions.

The permits are attached to this report in Appendix I.

This summary of consent conditions may not reflect the full requirements of each condition. The consent conditions in full can be found in the resource consents which are appended to this report.

### 1.3.2 Air discharge permit

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

GPL holds air discharge permit **6497-1**, to discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Turangi Road wellsite. This permit was issued by the Council on 7 December 2004 under Section 87(e) of the RMA. On 10 September 2013 the consent was varied to allow for relocation of the flare pit. It is due to expire on 1 June 2021.

There are 27 special conditions attached to this consent.

Conditions 1 to 3 specify design and reinstatement requirements.

Conditions 4 to 7 relate to notifications.

Conditions 8 and 9 require consideration of the wind and effective separation, prior to flaring.

Conditions 10 to 12 state that no liquid or solid hydrocarbons shall be flared, and only substances from the well stream will be combusted.

Conditions 13 to 15 relate to the best practicable option and prohibit effects beyond the boundary.

Condition 16 requires vapour recovery on storage vessels.

Condition 17 specifies the maximum opacity of smoke emissions.

Conditions 18 to 20 place limits on contaminant concentrations due to air emissions.

Conditions 21 to 25 specify records to be kept and reporting requirements.

Conditions 26 and 27 are lapse and review provisions.

Petrochem Limited (a subsidiary of GPL) holds air discharge permit **6719-1** to discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Kowhai-A wellsite. This permit was issued by the Council on 1 November 2005 under Section 87(e) of the RMA. It is due to expire on 1 June 2021.

There are 23 special conditions attached to the consent.

Condition 1 required notification prior to establishment of production operations at the wellsite.

Conditions 2 to 4 relate to notifications regarding flaring.

Conditions 5 and 6 require consideration of the wind and effective separation, prior to flaring.

Conditions 7 to 9 state that no liquid or solid hydrocarbons shall be flared, and only substances from the well stream will be combusted.

Conditions 10 to 12 relate to the best practicable option and prohibit effects beyond the boundary.

Condition 13 requires vapour recovery on storage vessels.

Condition 14 specifies the maximum opacity of smoke emissions.

Conditions 15 to 17 place limits on contaminant concentrations due to air emissions.

Conditions 18 to 21 specify records to be kept and reporting requirements.

Conditions 22 and 23 are lapse and review provisions.

The permits are attached to this report in Appendix I.

This summary of consent conditions may not reflect the full requirements of each condition. The consent conditions in full can be found in the resource consents which are appended to this report.

### 1.3.3 Wellsite consents

GPL also holds consents for production activities at wellsites associated with the Turangi and Kowhai-A production stations. A summary of these consents is provided in Table 2.

**Table 2** Consents for production activities at wellsites associated with Turangi and Kowhai-A production stations

Wellsite	Consent number	Purpose	Issue date	Expiry
Epiha	7722-1	To discharge treated stormwater, produced water and surplus drilling water from hydrocarbon exploration and production operations at the Epiha wellsite onto and into land	Nov 2010	June 2027
	7725-1	To discharge emissions to air associated with production activities at the Epiha wellsite, including flaring from well workovers, and in emergency situations, and other miscellaneous activities	Nov 2010	June 2027
Kowhai-B	9203-1	To discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Kowhai-B wellsite onto and into land	Feb 2012	June 2027

Wellsite	Consent number	Purpose	Issue date	Expiry
Kowhai-B	9204-1	To discharge emissions to air associated with production activities at the Kowhai-B wellsite, including: flaring associated with emergencies and maintenance; and minor emissions from other miscellaneous activities	Feb 2012	June 2027
Kowhai-C	9474-1	To discharge emissions to air associated with hydrocarbon producing wells at the Kowhai-C wellsite	Feb 2013	June 2027
	9478-1	To discharge treated stormwater, treated produced water and surplus drilling water from hydrocarbon exploration and production operations at the Kowhai-C wellsite onto and into land where it may enter an unnamed tributary of the Waiau Stream	Feb 2013	June 2027
Kowhai-D	10293-1	To discharge emissions to air associated with hydrocarbon producing wells at the Kowhai-D wellsite	Mar 2017	June 2033
	10294-1	To discharge treated stormwater from hydrocarbon exploration and production operations at the Kowhai-D wellsite onto land and into an unnamed tributary of the Waitara River	May 2016	June 2033
Main-1	7712-1	To discharge treated stormwater from hydrocarbon exploration and production operations at the Main-1 wellsite onto and into land	Jul 2015	June 2033
	7714-1	To discharge emissions to air associated with hydrocarbon producing wells at the Main-1 wellsite	Jul 2015	June 2033
Ohanga-A	7024-1	To discharge treated stormwater and treated produced water from hydrocarbon exploration and production operations at the Ohanga-A wellsite onto and into land and into an unnamed tributary of the Onaero River	Nov 2006	June 2021
	7025-1	To discharge emissions to air from: flaring of hydrocarbons; and miscellaneous activities associated with well clean-up, well testing, and production testing, associated with up to eight wells at the Ohanga-A wellsite	Nov 2006	June 2021
Onaero	7555-1	To discharge treated stormwater, treated produced water and treated surplus drilling water from hydrocarbon exploration and production operations onto and into land in circumstances where the discharge may enter an unnamed tributary of the Onaero River at the Onaero wellsite	Dec 2009	June 2027
	7558-1	To discharge emissions to air during flaring from well workovers and in emergency situations associated with production activities at the Onaero wellsite	Dec 2009	June 2027
Turangi-B	7853-1	To discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Turangi-B wellsite onto and into land	Jun 2011	June 2027
	7854-1	To discharge emissions to air associated with production activities at the Turangi-B wellsite, including: flaring from well workovers; flaring in emergency situations; and emissions from other miscellaneous activities	Dec 2011	June 2027

Wellsite	Consent number	Purpose	Issue date	Expiry
Turangi-C	9415-1	To discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Turangi-C wellsite onto land	Feb 2013	June 2027
	9420-1	To discharge emissions to air associated with hydrocarbon producing wells at the Turangi-C wellsite	Feb 2013	June 2027
Turangi Metering Station	6807-1	To discharge emissions into the air from flaring of petroleum products in emergency situations, commissioning, and plant shutdowns, together with miscellaneous emissions at the Turangi Metering Station	Sep 2006	June 2021
	6808-1	To discharge treated stormwater from the Turangi Metering Station onto and into land in the vicinity of the Waiau Stream	Mar 2006	June 2021
Urenui-1	7532-1	To discharge treated stormwater, treated surplus drilling water and treated produced water from hydrocarbon exploration and production operations at the Urenui-1 wellsite, onto land where it may enter an unnamed tributary of the Onaero River	Aug 2013	June 2027
	9631-1	To discharge emissions to air associated with hydrocarbon producing wells at the Urenui-1 wellsite	Aug 2013	June 2027

## 1.4 Monitoring programme

### 1.4.1 Introduction

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

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

The monitoring programme for the Turangi and Kowhai-A production station sites consisted of four primary components.

### 1.4.2 Programme liaison and management

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

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



### 1.4.3 Site inspections

The Turangi Production Station and Kowhai-A Production Station were visited six times, and the Kowhai-D wellsite four times during the monitoring period. An annual inspection of all other associated wellsites was also undertaken. With regard to consents for the abstraction of or discharge to water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the Company were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

### 1.4.4 Chemical sampling

Samples of both the discharges from the site and the water quality upstream and downstream of the discharge point and mixing zone were scheduled to be sampled on two occasions during the period under review. These samples were not collected and will next be taken in the 2018-2019 year.

The Council undertook sampling of the ambient air quality outside the boundary of the Turangi Production Station. A multi-gas meter was deployed on one occasion in the vicinity of the plant, with monitoring consisting of continuous measurements of gas concentrations for the gases of interest (carbon monoxide and combustible gases). A PM<sub>10</sub> particulate monitor was deployed concurrently with the multi-gas meter. Two nitrogen oxide measuring devices were also deployed in the vicinity of the plant on one occasion during the year under review. The Company supplied data on flaring causes and flare and fuel gas volumes throughout the period.

### 1.4.5 Biomonitoring surveys

A biological survey was performed on two occasions in an unnamed tributary of the Parahaki Stream to determine whether or not the discharge of treated stormwater has had a detrimental effect upon the communities of the stream.

## 2 Results

### 2.1 Water

#### 2.1.1 Inspections

During the 2017-2018 year six inspections were carried out at the Turangi Production Station and Kowhai-A Production Station. In addition, the Kowhai-D wellsite was visited four times, along with an annual inspection of all other wellsites associated with the production stations. The following was found during the inspections:

##### 1 August 2017

Turangi Production Station: The site was neat and tidy. The skimmer pits had recently been pumped out and silt removed. No offsite discharge was observed at the time of the inspection.

No flaring, odours or smoke were noted.

##### 17 August 2017

Kowhai-D wellsite: The site was visited during rain. The site was tidy and no sheens were noted in the puddles. All chemicals on site were satisfactorily banded. The ring drains were flowing to the skimmer pits, these appeared to be working well to settle out sediment and retain hydrocarbons, with the discharge from the pits clear. The groundwater beneath the last pit at the western end was being pumped out so that works could be undertaken to repair the liner. It was noted by the inspecting officer that the discharged groundwater was causing sediment to become released and the pump was turned off while an alternate discharge point was established.

It was noted that most areas where soil was exposed for site development have been stabilized with grass. Approved alterations and improvements have been made as the site progressed. It was noted that the sediment barriers on the access track should be repositioned and the captured sediment removed.

Flaring was occurring at the time of inspection. The flare was clean with no smoke observed. Both high pressure and low pressure separation were in place and being used. A heater was also in place and being used prior to separation.

##### 9 October 2017

Turangi Production Station: The site was found to be neat and tidy. Work had been undertaken in the ring drains, with aggregate laid to aid in silt control. Both sets of skimmer pits were clear and there was no discharge from the site. No flaring, odours or other off site effects were observed. The site was well managed.

Kowhai-A Production Station: The site was neat and tidy at the time of the inspection. Skimmer pits were clear and there was no discharge off site. No odours were noted.

##### 10 October 2017

Kowhai-D wellsite: In general the site was being maintained to a good standard, bunding was in place and the site was tidy. Recent activity at the site had caused sediment to flow to the skimmer pits and these were turbid, although not discharging. No flaring was occurring at the time of inspection.

Produced water, when flowing from the well, was being stored in a tank before being transported offsite for disposal. The tank was banded to capture any spills that may occur. No issues were noted at the time of inspection with regards to produced water.

A Diagnostic Fracture Injection Test was about to commence. The contractor had set up on site and appeared to have good management procedures in place. Chemicals on site were within appropriate bunds.

#### 11 January 2018

Turangi Production Station: The site was inspected during fine weather and no stormwater was discharging. Ring drains and bunds were secure and skimmer pits were clear of contaminants. Minimal flaring was observed with no smoke or odours noted.

Kowhai-A Production Station: The site was observed to be neat and tidy. A Tiger Drilling workover rig was present. No off site discharges were occurring at the time of the inspection.

#### 15 March 2018

Kowhai-A Production Station: The inspection found that hydraulic fracturing operations had taken place. The equipment was currently being used by another company before possibly coming back to the Kowhai-A site. Normal production operations were also taking place. During the inspection a sucker truck arrived on site to clean out some bunds and Council was also advised that the site was to be scraped in places and new metal laid. The ring drains were dry. The grasses in the ring drain were covered in fine silt. The flare pit was damp and staff advised that works were scheduled to remove sediment from the base of pit so rain water could freely drain to the ring drain. Drip trays and bunds were in use and all drums were banded. A spill kit was observed to be in place. The site was dry and a few stains were noted around the site. A sample from the second skimmer pit was collected and levels of suspended solids, pH, and chlorides all complied with consent conditions.

#### 21 March 2018

Turangi Production Station: A site inspection took place a week or so after very heavy, torrential rain, with showers prior to the inspection. All stormwater was observed to be diverted to the skimmer pits, and there was no evidence of any silt/sediment build up in the pits as a result of the rainfall experienced. The water within the skimmer pits was clean and ring drains and all bunds were clear of any contaminants. Installation of a new compressor was nearly complete. The truck load out area was clear of any hydrocarbons. No flaring was taking place and no odours or smoke were observed. The site was well-managed, neat and tidy. Everything was satisfactory.

Kowhai-A Production Station: The site was observed to be neat and tidy. There was no activity at the site at the time of the inspection, however workover and testing equipment was present on the site. The stormwater system was very clean with no discharge from the skimmer pits. No flaring, smoke or odours were noted. Everything was satisfactory.

#### 17 May 2018

Turangi Production Station: The site was inspected following some quite significant rainfall and storms over the preceding few days. In general the ring drains and silt controls had coped well with the stormwater. However, it was noted that the skimmer pits near the tanker load out area, although not discharging, contained very turbid water that may have been approaching suspended solid limits and it was recommended to staff that these levels were checked prior to pond discharge. The skimmer pits outside of the yard contained good quality water. Flaring was being undertaken as a result of a compressor shut down on the Maui pipeline at Mokau. No smoke or odours were observed. The site was neat and tidy.

Kowhai-A production Station: The site was inspected after very heavy rainfall and as a result the skimmer pits contained very turbid water, assessed to be approaching suspended solid limits. The ponds were not discharging during the inspection and staff advised that a sucker truck was scheduled to empty the ponds prior to any discharge. The ring drains and bunds had coped well with the excessive rainfall. Additional flaring was being undertaken as a result of a compressor malfunction at on the Maui pipeline at Mokau and no smoke or odours were noted as a result of this. The site was well-managed, neat and tidy.

## 29 May 2018

An annual inspection was undertaken with GPL staff of all sites in the Turangi and Kowhai fields including Urenui, Ohanga and Onaero. The inspections concentrated mainly on the stormwater systems associated with each site, including the construction and integrity of the ring drains and the ability of the drains to direct all stormwater for treatment through the skimmer pits prior to being discharged to the receiving waters.

At all sites the stormwater systems were fit for purpose; the contents of the skimmer pits were clear and there was no visual evidence to suggest that suspended solids or other contaminants would cause any non-compliance issues. Silt control measures such as silt traps, silt cloth, or sand bags were implemented where necessary and these were effective in reducing silt runoff. Some skimmer pits remained unlined and it was agreed that this would be addressed if any further exploratory drilling, workover rigs or other intensive production testing is undertaken at any of the sites.

Some historic mix-bury-cover areas were evident with no potential environmental concerns noted. Reinjection wells on a few of the sites were subject to a visual inspection and no issues were noted.

Flare pits were inspected and no well fluids or produced water was observed in these. Bunds for bulk storage areas were in place and being used. Several landscaping plantings had been undertaken on sites, and plant pests and vegetation were under control.

## 15 June 2018

Kowhai-D wellsite: The ring drains were in good working order. It was observed that concrete lined sumps had been constructed prior to the skimmer pits to help reduce sediment laden stormwater from discharging offsite. These sumps appeared to be working well as sediment was being captured. Stormwater in the skimmer pit at the northern end of the site was very clear. The south eastern skimmer pits were slightly turbid, and this may have been due to works earlier in the day during which time stormwater from the conduit trench was pumped to the ring drain/skimmer pits. The skimmer pits were not discharging at the time of inspection.

The skimmer pit linings appeared in good order with no rips or tears observed. The weight at the base of the second pit at the northern end was working well. The goose neck pipe exiting the second pond at the south eastern end is quite short would provide very little holding capacity for non-soluble products in the event of an emergency. It was recommended that this be addressed if circumstances onsite change (use of synthetic muds or oil producing wells).

It was noted that rilling and slumping on the bank adjacent to the conduit trench had occurred. Based on the location and degree of rilling, it was likely that a staff member/contractor had discharged stormwater offsite rather than into the ring drain. The consent holder was reminded to ensure that all staff and contractors were aware of the procedures around pumping out bunds/sumps etc.

### 2.1.2 Results of receiving environment monitoring

The Councils 'vegetation sweep' technique was used at three sites on 24 October 2017 and 7 February 2018 to collect macroinvertebrates from an unnamed tributary of the Parahaki Stream near the Turangi Production Station. This has provided data to assess whether discharges to nearby land had had an effect on the macroinvertebrate communities of the unnamed tributary. Samples were processed to provide number of taxa (richness), MCI, and SQMCI<sub>s</sub> scores for each site.

Taxa richness is the most robust index when determining whether a macroinvertebrate community has been exposed to toxic discharges. When exposed to toxic discharges, macroinvertebrates may die and be swept downstream or may deliberately drift downstream as an avoidance mechanism (catastrophic drift). The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution

in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI<sub>s</sub> takes into account taxa abundances as well as sensitivity to pollution. It may indicate subtle changes in communities, and therefore be the more relevant index if non-organic impacts are occurring. However, it is also influenced by the 'patchiness' of macroinvertebrates on the streambed, and as such must be considered in the context of all three metrics. Significant differences in either the MCI or the SQMCI<sub>s</sub> scores between sites may indicate the degree of adverse effects (if any) of the discharge being monitored.

During the October 2017 survey, the unnamed tributary of the Parahaki Stream recorded moderate taxa richnesses at sites 1 and 3, and high taxa richness at site 2. This taxa richness was the highest recorded to date at this site. MCI and SQMCI<sub>s</sub> scores were low, although they were similar to median and previously recorded scores for all sites respectively. MCI scores categorised all sites as having 'poor' macroinvertebrate community health, but the MCI scores were generally similar to those recorded in Taranaki lowland coastal streams. Observed differences in invertebrate metrics between sites are likely related to minor habitat variation between sites.

In the survey undertaken in February 2018, the unnamed tributary of the Parahaki Stream recorded low taxa richnesses, which were the lowest recorded to date at sites 1 and 2, and equal to the lowest recorded to date at site 3. MCI and SQMCI<sub>s</sub> scores were very low, with site 1 having 'very poor' and sites 2 and 3 having 'poor' macroinvertebrate community health. The MCI score at site 1 was the lowest recorded to date, and scores at sites 1 and 2 were significantly lower than historical medians. SQMCI<sub>s</sub> scores the lowest or equal to the lowest recorded to date at all three sites, but were not significantly different from median scores.

The results indicated that, while the biological health of this unnamed tributary of the Parahaki Stream is poor, there was no evidence that discharges from the Turangi Production Station had had any recent significant detrimental effects on the macroinvertebrate communities of the stream.

The full biomonitoring reports are attached in Appendix II.

## 2.2 Air

### 2.2.1 Inspections

Air inspections were carried out in conjunction with site inspections as discussed in Section 2.1.1 above. No issues regarding air quality were noted during the monitoring year.

### 2.2.2 Results of abstraction and discharge monitoring

#### 2.2.2.1 Carbon monoxide and combustible gases

During the monitoring year, a multi-gas meter was deployed on one occasion in the vicinity of the plant. The deployment lasted approximately 11 hours, with the instrument placed in a down-wind position at the start of the deployment. Monitoring consisted of continuous measurements of gas concentrations for the gases of interest (carbon monoxide and combustible gases). The monitoring sites used in the year under review are shown in Figure 1.

Because of the nature of the activities on the site, it was considered that the primary information of interest in respect of gases potentially emitted from the site was the average downwind concentration, rather than any instantaneous peak value. That is, the long-term exposure levels, rather than short-term maxima, are of most interest. The gas meter was therefore set up to create a data set based on recording the average concentration measured during each minute as raw data.



Figure 1 Air monitoring sites at Turangi Production Station for 2017-2018

The details of the sample run are summarised in Table 3 and the data from the sample run are presented graphically in Figure 2.

The consent covering air discharges from the Turangi Production Station has specific limits related to particular gases. Special condition 18 of consent 6497-1 sets a limit on the carbon monoxide concentration at or beyond the production station's boundary. The limit is expressed as  $10 \text{ mg/m}^3$  for an eight hour average or  $30 \text{ mg/m}^3$  for a one hour average exposure. The maximum concentration of carbon monoxide found during the monitoring run was  $3.8 \text{ mg/m}^3$  while the average concentration for the entire dataset was  $0.12 \text{ mg/m}^3$  which comply with consent conditions. This is consistent with the pattern found in previous years.

Table 3 Results of carbon monoxide and LEL monitoring at Turangi Production Station

Period (from-to)		20 to 21 March 2018 (11 hours)
Max	CO(ppm)	3.30
	LEL(%)	0.10
Mean	CO(ppm)	0.10
	LEL(%)	0.00
Min	CO(ppm)	0.00
	LEL(%)	0.00

Notes: (1) the instrument records in units of ppm. At  $25^\circ\text{C}$  and 1 atm,  $1 \text{ ppm CO} = 1.145 \text{ mg/m}^3$

(2) because the LEL of methane is equivalent to a mixture of approximately 5% methane in air, then the actual concentration of methane in air can be obtained by dividing the percentage LEL by 20.

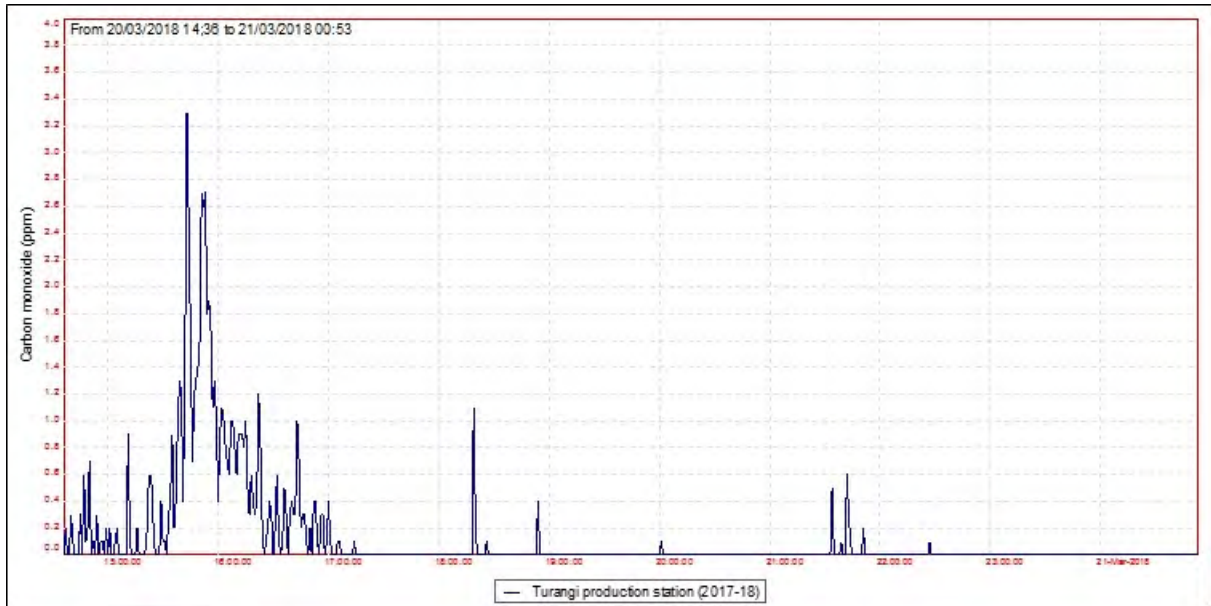


Figure 2 Ambient CO levels in the vicinity of Turangi Production Station

Lower Explosive Limit (LEL) gives the percentage of the lower explosive limit, expressed as methane that is detected in the air sampled. The sensor on the instrument reacts to gases and vapours such as acetone, benzene, butane, methane, propane, carbon monoxide, ethanol, and higher alkanes and alkenes, with varying degrees of sensitivity. The Council's Regional Air Quality Plan has a typical requirement that no discharge shall result in dangerous levels of airborne contaminants, including any risk of explosion. At no time did the level of explosive gases downwind of the Turangi Production Station reach any more than a trivial level.

### 2.2.2.2 PM<sub>10</sub> particulates

In September 2004 the Ministry for the Environment enacted National Environmental Standards (NESs) relating to certain air pollutants. The NES for PM<sub>10</sub> particulates is 50 µg/m<sup>3</sup> (24 hour average).

Particulates can be derived from many sources, including motor vehicles (particularly diesel), solid and oil-burning processes for industry and power generation, incineration and waste burning, photochemical processes, and natural sources such as pollen, abrasion, and sea spray.

PM<sub>10</sub> particles are linked to adverse health effects that arise primarily from the ability of particles of this size to penetrate the defences of the human body and enter deep into the lungs, significantly reducing the exchange of gases across the lung walls. Health effects from inhaling PM<sub>10</sub> include increased mortality and the aggravation of existing respiratory and cardiovascular conditions such as asthma and chronic pulmonary diseases.

During the reporting period, a DustTrak PM<sub>10</sub> monitor was deployed on one occasion in the vicinity of Turangi Production Station. The deployment lasted approximately 49 hours, with the instrument placed in a down-wind position at the start of the deployment. Monitoring consisted of continual measurements of PM<sub>10</sub> concentrations. The location of the DustTrak monitor during the sampling run is shown in Figure 1. The results of the sample run are presented in Figure 3 and Table 4.



Figure 3 PM<sub>10</sub> concentrations (µg/m<sup>3</sup>) at Turangi Production Station

Table 4 Daily averages of PM<sub>10</sub> results from monitoring at Turangi Production Station

	20 to 22 March 2018 (49 hours)	
24 hr. set	Day 1 (start to 24 hours)	Day 2 (24 hours to end)
Daily average	9.3 µg/m <sup>3</sup>	16.8 µg/m <sup>3</sup>
NES	50µg/m <sup>3</sup>	

During the 49 hour run, from 20 to 22 March 2018, the average recorded PM<sub>10</sub> concentration was 9.3 µg/m<sup>3</sup> for the first 24 hour period and 16.8 µg/m<sup>3</sup> for the second 24 hour period. These daily averages equate to 19% and 34%, respectively, of the 50 µg/m<sup>3</sup> value that is set by the NES. Background levels of PM<sub>10</sub> in the region have been found to be typically around 11 µg/m<sup>3</sup>.

### 2.2.2.3 Nitrogen oxides

From 2014 onwards, the Council implemented a coordinated region-wide compliance monitoring programme to measure nitrogen oxides (NO<sub>x</sub>). The programme involves deploying measuring devices at 24 NO<sub>x</sub> monitoring sites (including two sites in the vicinity of Turangi Production Station) on the same day, with retrieval three weeks later. This approach assists the Council in further evaluating the effects of local and regional emission sources and ambient air quality in the region.

The consent covering air discharges from the Turangi Production Station has specific limits related to particular gases. Special condition 19 of consent 6497-1 sets a limit on the nitrogen dioxide concentration at or beyond the production station's boundary. The limit is expressed as 200 µg/m<sup>3</sup> for a one hour average or 100 µg/m<sup>3</sup> for a 24 hour average exposure.

NO<sub>x</sub> passive adsorption discs were placed at two locations in the vicinity of the Turangi Production Station on one occasion during the year under review. The discs were left in place for a period of 21 days. The calculated one hour and 24 hour theoretical maximum NO<sub>x</sub> concentrations found at Turangi Production Station during the year under review equate to 12.2 µg/m<sup>3</sup> and 6.5 µg/m<sup>3</sup>, respectively. The results show that the ambient ground level concentration of NO<sub>x</sub> is well below the limits set out by consent 6497-1.

The full air monitoring report is attached to this report in Appendix III.



### 2.2.3 Summary of flaring volumes reported by GPL

At Turangi Production Station flaring occurred each month during the year, with the quantities of gas flared at the production station relate to things like well maintenance, equipment trips and plant servicing. The total volume flared for the reporting period was approximately 1,210,492 m<sup>3</sup>, a large increase compared with 293,043 m<sup>3</sup> flared in the previous period. The high volume of flaring from July to September 2017 was due to Turangi-3 wellsite maintenance, while the high volume in October 2017 was due to a pipeline bleed down from Urenui wellsite to clear hydrate. A summary of flaring volumes at Turangi Production Station is provided in Figure 4.

Testing activities were carried out at Kowhai-A and Kowhai-D sites during the reporting period which resulted in flaring. No flaring occurred at Kowhai B or C during the year.

The total volume of gas flared at the Kowhai-A site during the period was approximately 9,100 m<sup>3</sup>, an increase on the previous period (2,158 m<sup>3</sup>). Flaring occurred in September, November and December 2017 and February 2018 (Figure 5). The quantities flared each month varied and related to things such as maintenance and Kow-D pipeline hydrates and a shutdown at Turangi Production Station. No complaints were received from the public in relation to flaring at this site.

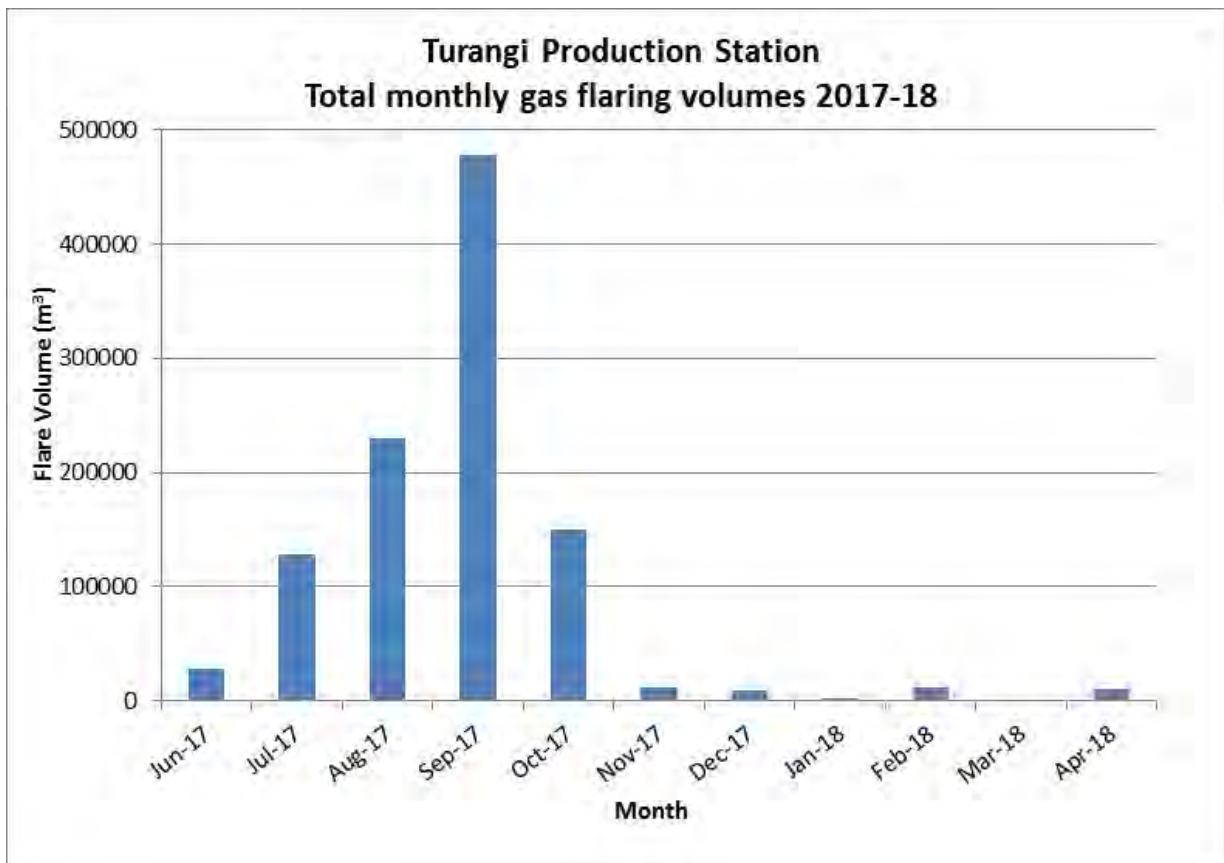


Figure 4 Summary of monthly gas flaring volumes at Turangi Production Station

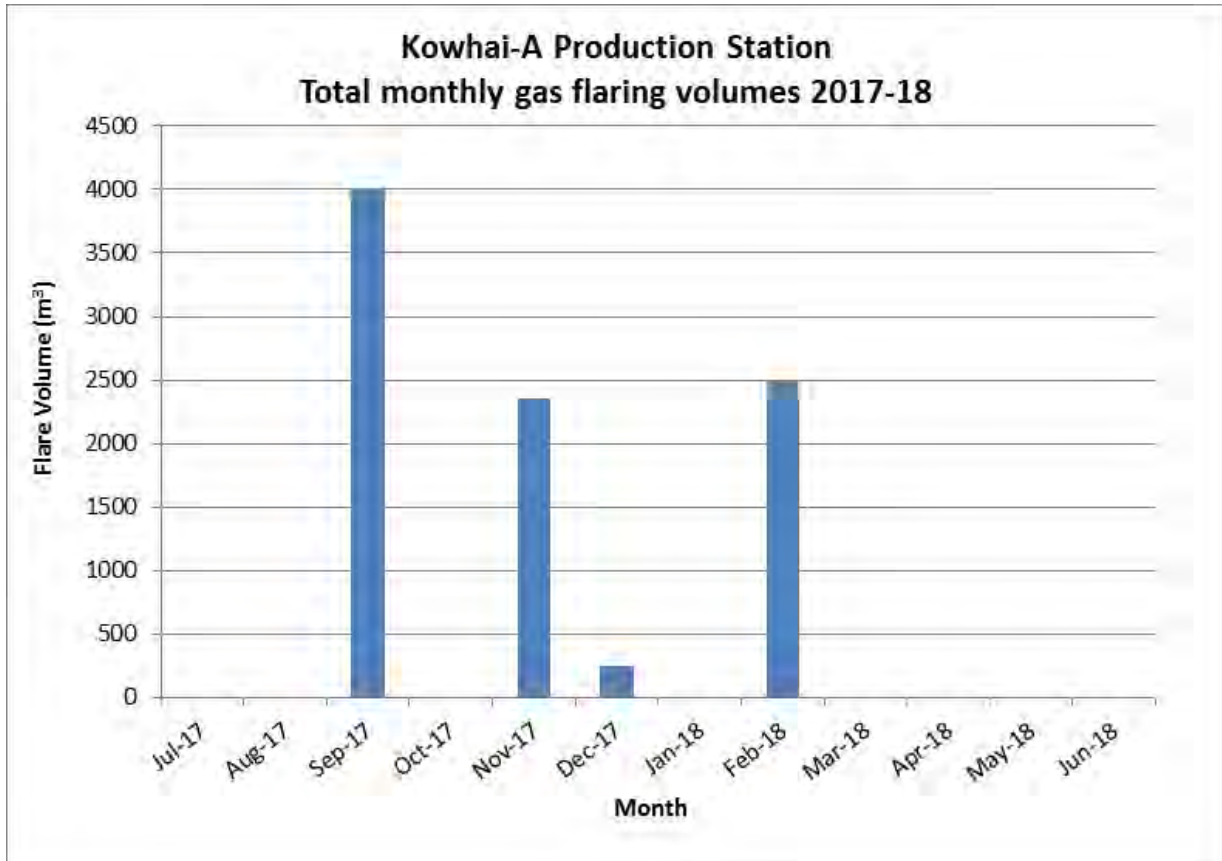


Figure 5 Summary of monthly gas flaring volumes at Kowhai-A Production Station

### 2.3 Investigations, interventions, and incidents

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

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

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

In the 2017-2018 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with the Company's conditions in resource consents or provisions in Regional Plans.

## 3 Discussion

### 3.1 Discussion of site performance

Monitoring of the Turangi and Kowhai-A production stations during the 2017-2018 year found that the sites were well managed. All consent conditions relating to site operations and management were complied with.

### 3.2 Environmental effects of exercise of consents

Site inspections found that the stormwater systems were constructed and maintained in accordance with consent conditions. Biomonitoring in the receiving waters did not show any effect from discharges on the communities in the stream.

There were no adverse effects on the environment resulting from the exercise of the air discharge consent. The ambient air quality monitoring at the site showed that levels of carbon monoxide, combustible gases, PM<sub>10</sub> particulates and nitrogen oxides were all below levels of concern at the time of sampling. No offensive or objectionable odours were detected beyond the boundary during inspections and there were no complaints in relation to air emissions from the site.

### 3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 5-9.

Table 5 Summary of performance for consent 6497-1

<b>Purpose: To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Turangi Road wellsite</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Flare pit to be lined	Inspection	Yes
2. Flaring shall occur at the designated location	Inspection	Yes
3. Temporary flare pit to be removed upon completion of the new flare pit	Inspection	Yes
4. Notification to Council one month prior to production operations	Production operations commenced early 2006	N/A
5. Notification to neighbours 24 hrs prior to flaring & record of complaints	Inspection and liaison with consent holder	Yes
6. Notification to Council 24 hrs prior to flaring	Notifications received	Yes
7. No alterations without approval	Inspection and liaison with consent holder	Yes
8. Take into account wind speed & direction when flaring	Inspection and Company records	Yes
9. Effective separation to minimise smoke	Inspection and Company records	Yes

<b>Purpose: To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Turangi Road wellsite</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
10. Notification to Council of ineffective separation	No incidents during year under review	N/A
11. No liquid or solid hydrocarbons flared	Inspection and liaison with consent holder	Yes
12. Only substances from well stream to be flared	Inspection and Company records	Yes
13. Adoption of the best practicable option	Inspection and liaison with consent holder	Yes
14. No hazardous/toxic/noxious contaminants beyond boundary	Inspection and air monitoring	Yes
15. No offensive odour or smoke beyond boundary	Inspection	Yes
16. Hydrocarbon storage vessels to have vapour recovery systems	Inspection	Yes
17. Specified opacity for smoke emissions	Air monitoring	Yes
18. Control of carbon monoxide emissions	Air monitoring	Yes
19. Control of nitrogen oxide emissions	Air monitoring	Yes
20. Control of emissions to achieve specified contaminant concentrations	Not assessed	N/A
21. Keep & maintain record of smoke emitting incidents	Inspection and annual flaring report	Yes
22. Keep & maintain flaring log	Inspection and annual flaring report	Yes
23. Monthly flaring information supplied	Information received	Yes
24. Provision of annual flaring & air emissions report during May	Received	Yes
25. Analysis of typical gas and crude oil stream	Analysis not requested	N/A
26. Lapse provision	Consent exercised	N/A
27. Optional review provision	No further option for review prior to expiry in June 2021	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>

N/A = not applicable

Table 6 Summary of performance for consent 6498-1

<b>Purpose: To discharge treated stormwater and treated produced water from hydrocarbon exploration and production operations at the Turangi Production Station onto land, where it may enter into an unnamed tributary of the Parahaki Stream</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. No observable hydrocarbon run-off to perimeter drain	Inspection	Yes
2. Soil conductivity limits	Not assessed	N/A
3. Soil sodium absorption ratio limits	Not assessed	N/A
4. Concentrations in soil not to be exceed prior to expiry/cancellation/ surrender	Consent still current	N/A
5. Hydrocarbons in soil to comply with MfE guidelines	Not assessed	N/A
6. Treated produced water discharged to land shall be within perimeter drain	All produced water re-injected	Yes
7. Records to be kept and forwarded to Council quarterly	Inspection and company records	Yes
8. Approved management plan	Received and approved	Yes
9. Adoption of the best practicable option	Inspection and liaison with consent holder	Yes
10. Maximum stormwater catchment area	Inspection and company records	Yes
11. Notification to Council 7 days prior to site works and well drilling	No significant site works or well drilling	Yes
12. Approved contingency plan	Plan up-to-date as of November 2017	Yes
13. All stormwater & produced water discharged through treatment system	Inspection	Yes
14. Consent exercised in accordance with application documentation	Inspection and liaison with consent holder	Yes
15. Design of skimmer pits to meet minimum size and hydrocarbon capture requirements	Inspection	Yes
16. Stormwater retention areas to be lined	Inspection	Yes
17. Stormwater system to be installed prior to any site works	Inspection	Yes
18. Bunding and drainage of hazardous substances	Inspection	Yes
19. Concentrations not to be exceeded in the discharge	Not assessed during period under review	Yes

<b>Purpose: To discharge treated stormwater and treated produced water from hydrocarbon exploration and production operations at the Turangi Production Station onto land, where it may enter into an unnamed tributary of the Parahaki Stream</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
20. Temperature increase of not more than 2 degrees Celsius in receiving waters	Not assessed during monitoring period	N/A
21. No effects upon surface water bodies	Inspections and biomonitoring	Yes
22. No direct discharge to surface water	Inspection	Yes
23. 48 hrs notice prior to reinstatement	Site still active	N/A
24. Lapse provision	Consent exercised	N/A
25. Optional review provision	No further option for review prior to expiry in June 2021	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>

Table 7 Summary of performance for consent 6719-1

<b>Purpose: To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Kowhai-A wellsite</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Notification to Council one month prior to production operations	Production operations commenced early 2006	N/A
2. Notification to neighbours 24 hrs prior to flaring & record of complaints	Inspection and liaison with consent holder	Yes
3. Notification to Council 24 hrs prior to flaring	Notifications received	Yes
4. No alterations without approval	Inspection and liaison with consent holder	Yes
5. Take into account wind speed & direction when flaring	Inspection and Company records	Yes
6. Effective separation to minimise smoke	Inspection and Company records	Yes
7. Notification to Council of ineffective separation	No incidents during year under review	N/A
8. No liquid or solid hydrocarbons flared	Inspection and liaison with consent holder	Yes

<b>Purpose: To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Kowhai-A wellsite</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
9. Only substances from well stream to be flared	Inspection and Company records	Yes
10. Adoption of the best practicable option	Inspection and liaison with consent holder	Yes
11. No hazardous/toxic/noxious contaminants beyond boundary	Inspection	Yes
12. No offensive odour or smoke beyond boundary	Inspection	Yes
13. Hydrocarbon storage vessels to have vapour recovery systems	Inspection	Yes
14. Specified opacity for smoke emissions	Not assessed	N/A
15. Control of carbon monoxide emissions	Not assessed	N/A
16. Control of nitrogen oxide emissions	Not assessed	N/A
17. Control of emissions to achieve specified contaminant concentrations	Not assessed	N/A
18. Keep & maintain record of smoke emitting incidents	Inspection and annual flaring report	Yes
19. Keep & maintain flaring log	Inspection and annual flaring report	Yes
20. Provision of annual flaring & air emissions report during May	Received	Yes
21. Analysis of typical gas and crude oil stream	Analysis not requested	N/A
22. Lapse provision	Consent exercised	N/A
23. Optional review provision	No further option for review prior to expiry	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>

Table 8 Summary of performance for consent 10169-1

<b>Purpose: To discharge treated stormwater from hydrocarbon exploration and production operations at the Kowhai-A wellsite onto land and into an unnamed tributary of the Waiau Stream</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Adoption of the best practicable option	Inspection and liaison with consent holder	Yes

<b>Purpose: To discharge treated stormwater from hydrocarbon exploration and production operations at the Kowhai-A wellsite onto land and into an unnamed tributary of the Waiau Stream</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
2. Maximum stormwater catchment area	Inspection and company records	Yes
3. Notification to Council five days prior to site works and well drilling	Notifications received	Yes
4. Approved contingency plan	Plan up-to-date as of December 2017	Yes
5. Design, management and maintenance of stormwater system in accordance with application	Inspection	Yes
6. All stormwater discharged through treatment system without ponding	Inspection	Yes
7. Minimum skimmer pit capacity and ability to retain hydrocarbons	Inspection and company records	Yes
8. Stormwater retention areas to be lined with a shut off valve	Inspection and company records	Yes
9. Stormwater system to be installed prior to commencing any site works	System installed	Yes
10. Concentrations not to be exceeded in the discharge	Sampling by consent holder	Yes
11. Discharge not to cause an increase of more than 0.5 pH units beyond the mixing zone	Not assessed in year under review	N/A
12. Limitation on effects beyond the mixing zone	Not assessed in year under review	N/A
13. Effects not to be caused in receiving waters	Inspections	Yes
14. 48 hrs notice prior to reinstatement	Site still active	N/A
15. Lapse provision	Consent exercised	N/A
16. Optional review provision	Next option for review in 2021	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>



Table 9 Summary of performance for consent 9674-1

<b>Purpose: To discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Turangi Production Station, onto land where it may enter an unnamed tributary of the Parahaki Stream</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Adoption of the best practicable option	Inspection and liaison with consent holder	Yes
2. Maximum stormwater catchment area	Inspection and company records	Yes
3. Notification to Council 7 days prior to site works and well drilling	No site works or well drilling during the monitoring period	Yes
4. Approved contingency plan	Plan up-to-date as of November 2017	Yes
5. Consent exercised in accordance with application documentation	Inspection and liaison with consent holder	Yes
6. All stormwater and produced water discharged through treatment system	Inspection	Yes
7. Design of skimmer pits to meet minimum size and hydrocarbon capture requirements	Inspection	Yes
8. Minimum skimmer pit storage volume	Inspection	Yes
9. Stormwater retention areas to be lined	Inspection	Yes
10. Stormwater system to be installed prior to any site works	Inspection	Yes
11. Concentrations not to be exceeded in the discharge	Not assessed	Yes
12. Temperature increase of not more than 2 degrees Celsius in receiving waters	Not assessed	Yes
13. No effects upon surface water bodies	Inspection and biomonitoring	Yes
14. 48 hrs notice prior to reinstatement	Site still active	N/A
15. Lapse provision	Consent exercised	N/A
16. Optional review provision	Next option for review in June 2021	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>

Table 10 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2009-10	6497-1	1			
	6498-1		1		
2010-11	6497-1	1			
	6498-1	1			
2011-12	6497-1	1			
	6498-1		1		
2012-14	6497-1	1			
	6498-1		1		
2014-15	6497-1	1			
	6498-1		1		
	9674-1		1		
2015-16	6497-1	1			
	6498-1	1			
	9674-1	1			
2016-17	6497-1	1			
	6498-1	1			
	9674-1	1			
Totals		12	5		

During the year, the Company demonstrated a high level of both environmental performance and administrative compliance with the resource consents as defined in Section 1.1.4. The Turangi Production Station and associated wellsites were well managed and maintained.

### 3.4 Recommendations from the 2016-2017 Annual Report

In the 2016-2017 Annual Report, it was recommended:

1. THAT in the first instance, monitoring of consented activities at Turangi Production Station and associated wellsites in the 2017-2018 year continue at the same level as in 2016-2017.
2. THAT should there be issues with environmental or administrative performance in 2017-2018, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

Recommendation one was implemented, while it was not considered necessary to perform any additional monitoring as per condition two.

### 3.5 Alterations to monitoring programmes for 2018-2019

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

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

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

It is proposed that for 2018-2019 monitoring of consented activities at the Turangi and Kowhai-A production stations and associated wellsites continue at a similar level to that of 2017-2018, with the addition of a one-off round of BTEX (benzene toluene, ethylbenzene and total xylenes) monitoring. This is in response to public concerns regarding benzene emissions from petroleum facilities, and this monitoring will be added to all petroleum industry compliance programmes in the 2018-2019 year.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the sites in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2018-2019.

## 4 Recommendations

1. THAT in the first instance, monitoring of consented activities at the Turangi and Kowhai-A production stations and associated wellsites in the 2018-2019 year continue at a similar level as in 2017-2018, with the addition of a one-off round of BTEX monitoring.
2. THAT should there be issues with environmental or administrative performance in 2017-2018, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

## Glossary of common terms and abbreviations

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

Biomonitoring	Assessing the health of the environment using aquatic organisms.
Bund	A wall around a tank to contain its contents in the case of a leak.
CO	Carbon monoxide
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
g/m <sup>2</sup> /day	grams/metre <sup>2</sup> /day.
g/m <sup>3</sup>	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
Incident Register	The Incident Register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
LEL	Lower Explosive Limit (LEL) gives the percentage of the lower explosive limit, expressed as methane, that is detected in the air sampled.
m <sup>2</sup>	Square Metres.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
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.
NO <sub>x</sub>	Nitrogen oxides
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).
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 <sub>10</sub>	Relatively fine airborne particles (less than 10 micrometre diameter, respectively).
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	<i>Resource Management Act 1991</i> and including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
UI	Unauthorised Incident.

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

## Bibliography and references

- Taranaki Regional Council (2018): *Greymouth Petroleum Limited Turangi Production Station Monitoring Programme Annual Report 2016-2017*. Technical Report 2017-55
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- Taranaki Regional Council (2014): *Greymouth Petroleum Limited Turangi Production Station Monitoring Programme Biennial Report 2012-2014*. Technical Report 2014-33
- Taranaki Regional Council (2013): *Greymouth Petroleum Limited Turangi-A Wellsite Monitoring Programme Annual Report 2011-2012*. Technical Report 2012-73
- Taranaki Regional Council (2011): *Greymouth Petroleum Limited Turangi-A Wellsite Monitoring Programme Annual Report 2010-2011*. Technical Report 2011-20
- Taranaki Regional Council (2010): *Greymouth Petroleum Limited Turangi-A Wellsite Monitoring Programme Annual Report 2009-2010*. Technical Report 2010-47
- Taranaki Regional Council (2009): *Greymouth Petroleum Limited Turangi-A Wellsite Monitoring Programme Annual Report 2008-2009*. Technical Report 2009-37
- Taranaki Regional Council (2008): *Greymouth Petroleum Limited Turangi-A Wellsite Monitoring Programme Annual Report 2007-2008*. Technical Report 2008-91





# Appendix I

## Resource consents held by Greymouth Petroleum Limited and Petrochem Limited

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



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

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

Decision Date (Change): 10 September 2013

Commencement Date (Change): 10 September 2013 (Granted: 7 December 2004)

**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 Turangi Road wellsite

Expiry Date: 1 June 2021

Review Date(s): June 2015

Site Location: Turangi Production Station, Turangi Road, Motunui  
(Property owner: BA & JM McKenzie)

Legal Description: Sec 21 Blk VI Waitara SD (Discharge source & site)

Grid Reference (NZTM) 1713792E-5681411N (temporary flare pit)  
1713756E-5681440N

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

### **General conditions**

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

### **Special conditions**

#### **Information and notification**

1. Flaring shall only occur over a pit, or similar containment area, lined with impermeable material that prevents any liquid from leaking through its base or sidewalls and discharging to land.
2. Flaring shall only occur within 20 metres of the location defined by NZTM:
  - 1713792E-5681411N (temporary flare pit); and
  - 1713756E-5681440N.
3. The temporary flare pit shall be removed and site reinstated following the completion of the permanent flare pit.
4. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least one month prior to the establishment of production operations at the Turangi Road wellsite.
5. At least 24 hours prior to any flaring, other than in emergencies, the consent holder shall undertake all practicable measures to notify residents within 1000 metres of the site 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/or complaints received.
6. The consent holder shall, whenever practicable, 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, as far as practicable, be no less than 24 hours prior to such flaring being commenced.

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7. No alteration shall be made to plant equipment or processes which may substantially alter the nature or quantity of flare emissions or other site emissions, including but not limited to the recovery of produced gas, other than as notified in this consent application, without prior consultation with the Chief Executive, Taranaki Regional Council, and the consent holder shall obtain any necessary approvals under the Resource Management Act 1991.

### **Emissions from the site**

8. Other than for the maintenance of a pilot flare flame, the consent holder shall have regard to the prevailing and predicted wind speed and direction at the time of initiation of any episode of flaring or other combustion of hydrocarbons.
9. All gas being flared, at any time must first be treated by effective liquid and solid separation and recovery, as far as is practicable, to ensure that smoke emission during flaring is minimised.
10. If separation cannot be implemented and/or maintained at any time while there is a flow from the well, whether natural or induced, then the consent holder shall notify the Chief Executive, Taranaki Regional Council, and shall in any case re-establish liquid and solid separation and recovery within three hours.
11. Subject to special conditions 9 and 10, no liquid or solid hydrocarbons shall be combusted through the gas flare system other than in an emergency.
12. Only substances originating from the well stream and treated as outlined by conditions 9, 10, 11 & 13 are to be combusted within the flare pit.
13. 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 or any other emissions to air from the Turangi Road wellsite. Any adoption of the best practicable option as outlined in this special condition shall be to the satisfaction of the Chief Executive, Taranaki Regional Council.
14. The consent holder shall not discharge any contaminant to air authorised by this consent at a rate or a quantity such that the contaminant, whether alone or in combination with other contaminants, is or is liable to be hazardous or toxic or noxious at or beyond the boundary of the wellsite, or beyond 100 metres of the flare, whichever distance is greater.
15. There shall not be any offensive odour or smoke, as determined by an enforcement officer of the Taranaki Regional Council, beyond the boundary of the wellsite or beyond 100 metres of the flare, whichever distance is greater, arising from the exercise of this consent.
16. All hydrocarbon storage vessels shall be fitted with vapour recovery systems.
17. The opacity of any smoke emissions shall not exceed a level of 1 as measured on the Ringelmann Scale for more than four minutes cumulative duration in any 60-minute period.
18. The consent holder shall control all emissions of carbon monoxide to the atmosphere from the flare, whether alone or in conjunction with any other emissions from the

wellsite, in order that the maximum ground level concentration of carbon monoxide arising from the exercise of this consent measured under ambient conditions does not exceed 10 mg/m<sup>3</sup> (eight-hour average exposure), or 30 mg/m<sup>3</sup> one-hour average exposure) at or beyond the boundary of the wellsite or beyond 100 metres from the flare, whichever distance is greater.

19. The consent holder shall control all emissions of nitrogen oxides to the atmosphere from the flare, whether alone or in conjunction with any other emissions from the wellsite, in order that 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 (24-hour average exposure), or 200 micrograms per cubic metre (1-hour average exposure) at or beyond the boundary of the wellsite, or beyond 100 metres from the flare, whichever distance is greater.
20. 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, whether alone or in conjunction with any emissions from the flare, in order that the maximum ground level concentration for any particular contaminant arising from the exercise of this consent measured at or beyond the boundary of the wellsite or beyond 100 metres from the flare, whichever distance is greater, is not increased above background levels:
  - a) by more than 1/30<sup>th</sup> 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).

### **Recording and reporting information**

21. The consent holder shall keep and make available to the Chief Executive, Taranaki Regional Council, upon request, a record of all smoke-emitting incidents noting time, duration and cause.
22. The consent holder shall keep and maintain a log of all continuous flaring incidents longer than five minutes, and any intermittent flaring lasting for an aggregate of ten minutes or longer in any 120-minute period. Such a log shall contain the date, the start and finish times, the quantity and type of material flared, and the reason for flaring. This log shall be made available to the Chief Executive, Taranaki Regional Council, upon request, and summarised annually in the report required under condition 20.
23. The consent holder shall supply to the Taranaki Regional Council each month a copy of flaring information comprising: the type and amount of material flared (including any gas used to maintain a pilot flame), the date this was flared, the reason why flaring was undertaken, and an indication of whether smoke was produced from such flaring events.
24. The consent holder shall provide to the Taranaki Regional Council during May of each year, for the duration of this consent, a report:
  - i) detailing any energy efficiency measures implemented on the site;

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- ii) detailing smoke emissions as required under condition 21;
  - iii) detailing any measures to reduce smoke emissions;
  - iv) detailing any measures to reduce flaring;
  - v) addressing any other issue relevant to the minimisation or mitigation of emissions from the flare;
  - vi) detailing any complaints received and any measures undertaken to address complaints; and
  - vii) reviewing all options and technological advances relevant to the reduction or mitigation of any discharge to air from the site, how these might be applicable and/or implemented at the site, and the benefits and costs of these advances.
25. The consent holder shall make available to the Chief Executive, Taranaki Regional Council, upon request, an analysis of a typical gas and crude oil stream from the field, covering sulphur compound content and the content of carbon compounds of structure C<sub>6</sub> or higher number of compounds.

### Lapse and Review

26. This consent shall lapse on the expiry of 16 years after the date of first issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
27. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 10 September 2013

For and on behalf of  
Taranaki Regional Council

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**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): 10 September 2013

Commencement Date  
(Change): 10 September 2013 (Granted: 7 December 2004)

**Conditions of Consent**

Consent Granted: To discharge treated stormwater and treated produced water from hydrocarbon exploration and production operations at the Turangi Production Station onto land, where it may enter into an unnamed tributary of the Parahaki Stream

Expiry Date: 1 June 2021

Review Date(s): June 2015

Site Location: Turangi Production Station, Turangi Road, Motunui  
(Property owner: BA & JM McKenzie)

Legal Description: Sec 21 Blk VI Waitara SD (Discharge source & site)

Grid Reference (NZTM) 1713982E-5681378N

Catchment: Parahaki

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

### General conditions

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

### Special Conditions

1. The consent holder shall ensure that the discharge of treated produced water to land does not result in an observable Hydrocarbon run-off into the perimeter drain.
2. The conductivity of the soil layer containing the discharge shall be maintained at less than  $400 \text{ mSm}^{-1}$ , or alternatively, if the background soil conductivity exceeds  $400 \text{ mSm}^{-1}$ , the application of waste shall not increase the soil conductivity by more than  $100 \text{ mSm}^{-1}$  over the background concentrations established prior to the exercise of this consent.
3. The sodium absorption ratio (SAR) of the soil layer containing the discharge shall be maintained at less than 18.0, or alternatively if the background soil SAR exceeds 18.0, the application of waste shall not increase the SAR by more than 1.0 over the background concentrations established prior to the exercise of this consent.
4. Prior to the expiry, cancellation, or surrender of this consent soil parameters shall not exceed the following limits: conductivity,  $290 \text{ mSm}^{-1}$ ; total dissolved salts,  $2500 \text{ gm}^{-3}$ ; sodium,  $460 \text{ gm}^{-3}$ ; and chloride,  $700 \text{ gm}^{-3}$ .
5. At all times the levels of hydrocarbons in the soil within the discharge area shall comply with the guideline values for sandy soil type in the surface layer set out in Tables 4.12 and 4.15 of the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Ministry for the Environment, 1999), appended to this consent.
6. Any discharge of treated produced water directly to land shall occur within the area enclosed by the perimeter drain

7. The consent holder shall keep records of the following:
  - a) The results of analysis of a monthly representative sample of the composition of the treated produced water, which is being or will be discharged on the site (including pH level, electro-conductivity, Salinity, and concentration of total hydrocarbons)
  - b) volumes of treated produced water discharged directly to land
  - c) dates and times of commencement and completion of discharge events
  - d) sampling, analysis and results of monitoring undertaken by the consent holderand shall forward these records to the Chief Executive, Taranaki Regional Council, on a quarterly basis, or as requested by the Council.
8. Prior to the exercise of this consent, the consent holder shall provide, to the written satisfaction of the Chief Executive, Taranaki Regional Council, a management plan to confirm that the activity will be conducted to comply with all of the conditions of this consent. The management plan shall be reviewed annually and shall include as a minimum:
  - a. sampling regime
  - b. a representative analysis of the quality of soil within the proposed discharge area;
  - c. procedures for notification to Council of disposal activities;
  - d. contingency procedures;
  - e. site reinstatement and monitoring; and
  - f. control of site access.
9. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects of the discharge on the environment.
10. The maximum stormwater catchment area shall be no more than 1.8 hectares.
11. 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.
12. Prior to the exercise of this consent, the consent holder shall provide for the written approval of the Chief Executive, Taranaki Regional Council, site specific details relating to contingency planning for the wellsite.
13. All discharges from the site, including from any containment pit or hydrocarbon combustion facility (e.g. flare pit, thermal oxidiser), shall flow to a perimeter drain and skimmer pit. Perimeter drains shall be designed, including by having a positive grade and low permeability, to ensure that runoff flows directly to a skimmer pit without ponding.

14. Subject the other conditions of this consent the design, management and maintenance of the stormwater system shall be undertaken in accordance with the information submitted in support of the consent application 7570, and in particular:
- Drawing 12364-02, Sheet 1, prepared by BTW Company Limited and dated June 2013;
  - Drawing 12364-02, Sheet 5, prepared by BTW Company Limited and dated June 2013; and
  - Stormwater design report for Turangi Production Station, prepared by BTW Company Limited, referenced 12364-8/2013 and dated 14 August 2013.
15. Skimmer pits shall have a combined capacity of no less than 340 m<sup>3</sup>, and be designed to retain any hydrocarbons that enter them.
16. All skimmer pits and any other stormwater retention areas shall be lined with an impervious material to prevent seepage through the bed and sidewalls, and all skimmer pits shall have a valve that can be shut off to prevent any discharge from the site.
17. Perimeter drains and skimmer pits necessary to comply with the conditions of this consent shall be installed before any site works commences. Site works includes the introduction of a drilling rig, drilling equipment or any other associated equipment or facilities to the site for any purpose other than for the construction of the site.
18. Any above ground hazardous substances storage areas shall be bunded with drainage to sumps, or other appropriate recovery systems, and not to the stormwater catchment.
19. The following concentrations shall not be exceeded in the discharge from the perimeter drain through the interceptor pit:

<b>Component</b>	<b>Concentration</b>
pH (range)	6.5 - 8.5
suspended solids	100 gm <sup>-3</sup>
total recoverable hydrocarbons (infrared spectroscopic technique)	15 gm <sup>-3</sup>
chloride	50 gm <sup>-3</sup>

This condition shall apply prior to the entry of the treated stormwater and produced water either onto and into land, or into surface water, at a designated sampling point approved by the Chief Executive, Taranaki Regional Council.

20. After allowing for reasonable mixing, within a mixing zone extending seven times the width of the water body downstream of a designated discharge point, the discharge shall not give rise to an increase in temperature of more than 2 degrees Celsius.

## Consent 6498-1

21. After allowing for reasonable mixing, within a mixing zone extending seven times the width of the water body downstream of a designated discharge point, the discharge shall not give rise to any of the following effects in the receiving waters:
  - a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
  - b) any conspicuous change in the colour or visual clarity;
  - c) any emission of objectionable odour;
  - d) the rendering of fresh water unsuitable for consumption by farm animals;
  - e) any significant adverse effects on aquatic life.
22. The discharge onto and into land shall occur a minimum of 20 metres from any surface water body. Discharge shall be onto and into land and there shall be no direct discharge to surface water.
23. The Chief Executive, Taranaki Regional Council, shall be advised in writing at least 48 hours prior to the reinstatement of the site and the reinstatement shall be carried out so as to minimise effects on stormwater quality.
24. This consent shall lapse on the expiry of five years after the date of first issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
25. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 10 September 2013

For and on behalf of  
Taranaki Regional Council

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**Director-Resource Management**

## Appendix 1

Tables 4.12 and 4.15 of the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand [Ministry for the Environment, 1999].

**Table 4.12 Tier 1 soil acceptance criteria *Agricultural use* <sup>(1,3,6)</sup> ALL PATHWAYS (all values mg/kg)**

Soil Type/ Contaminant	Depth of contamination		
	Surface (<1m)	1m - 4m	> 4m
<b>SAND</b>			
MAHs			
Benzene	1.1 <sup>(v)</sup>	1.9 <sup>(7,v)</sup>	2.4 <sup>(7,v)</sup>
Toluene	(68) <sup>(4,v)</sup>	(94) <sup>(4,m)</sup>	(230) <sup>(4,v)</sup>
Ethylbenzene	(53) <sup>(4,v)</sup>	(92) <sup>(4,7,v)</sup>	(120) <sup>(4,v)</sup>
Xylenes	(48) <sup>(4,v)</sup>	(130) <sup>(4,7,v)</sup>	(180) <sup>(4,v)</sup>
PAHs			
Naphthalene	7.2 <sup>(p)</sup>	70 <sup>(v)</sup>	80 <sup>(v)</sup>
Non-carc. (Pyrene)	(160) <sup>(4,p)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>
Benzo(a)pyrene eq. <sup>(5)</sup>	0.027 <sup>(p)</sup>	(25) <sup>(4,m)</sup>	NA <sup>(2)</sup>
<b>SANDY SILT</b>			
MAHs			
Benzene	1.1 <sup>(v)</sup>	1.9 <sup>(v)</sup>	2.4 <sup>(v)</sup>
Toluene	(82) <sup>(4,v)</sup>	(170) <sup>(4,v)</sup>	(240) <sup>(4,v)</sup>
Ethylbenzene	(59) <sup>(4,v)</sup>	(92) <sup>(4,v)</sup>	(140) <sup>(4,v)</sup>
Xylenes	(59) <sup>(4,v)</sup>	(130) <sup>(4,v)</sup>	(180) <sup>(4,v)</sup>
PAHs			
Naphthalene	7.2 <sup>(p)</sup>	83 <sup>(v)</sup>	(130) <sup>(4,v)</sup>
Non-carc. (Pyrene)	(160) <sup>(4,p)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>
Benzo(a)pyrene eq. <sup>(5)</sup>	0.027 <sup>(p)</sup>	(25) <sup>(4,m)</sup>	NA <sup>(2)</sup>
<b>SILTY CLAY</b>			
MAHs			
Benzene	1.7 <sup>(v)</sup>	4.6 <sup>(v)</sup>	12 <sup>(v)</sup>
Toluene	(210) <sup>(4,v)</sup>	(950) <sup>(4,v)</sup>	(3,000) <sup>(4,v)</sup>
Ethylbenzene	(110) <sup>(4,v)</sup>	(800) <sup>(4,v)</sup>	(2,800) <sup>(4,v)</sup>
Xylenes	(160) <sup>(4,v)</sup>	(710) <sup>(4,v)</sup>	(2,200) <sup>(4,v)</sup>
PAHs			
Naphthalene	7.2 <sup>(p)</sup>	(330) <sup>(4,v)</sup>	(1,100) <sup>(4,v)</sup>
Non-carc. (Pyrene)	(160) <sup>(4,p)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>
Benzo(a)pyrene eq. <sup>(5)</sup>	0.027 <sup>(p)</sup>	(25) <sup>(4,m)</sup>	NA <sup>(2)</sup>

## NOTES:

1. Based on protection of human health. Refer to Table 4.20 for protection of groundwater. Site-specific consideration of aesthetic and ecological impacts is required.
2. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.
3. Surface soil acceptance criteria are based on the lower value of volatilisation criteria (Table 4.16), other pathway criteria (Table 4.18) and criteria for the protection of maintenance workers (Table 4.19). Criteria for soils at 1 m are based on the lower value of those arising from volatilisation and maintenance criteria. Criteria for soils at 4 m are based on volatilisation only.
4. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.
5. Risk associated with mixture of carcinogenic PAHs assessed by comparison with criteria based on benzo(a)pyrene equivalent concentration. Refer to Section 4.4.3 for details of the calculation of Benzo(a)pyrene equivalent concentrations.
6. The following notes indicate the limiting pathway for each criterion: v - Volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation
7. Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil type. Therefore, the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.

**Table 4.12 (CONTINUED)**  
**Tier 1 soil acceptance criteria *Agricultural use* <sup>(1,3,6)</sup> ALL PATHWAYS**  
**(all values mg/kg)**

Soil Type/ Contaminant	Depth of contamination		
	Surface (<1m)	1m - 4m	> 4m
<b>CLAY</b>			
MAHs			
Benzene	2.7 <sup>(v)</sup>	8.8 <sup>(v)</sup>	(26) <sup>(4,v)</sup>
Toluene	(320) <sup>(4,v)</sup>	(2,400) <sup>(4,v)</sup>	(8,500) <sup>(4,v)</sup>
Ethylbenzene	(160) <sup>(4,v)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>
Xylenes	(250) <sup>(4,v)</sup>	(1,800) <sup>(4,v)</sup>	(6,500) <sup>(4,v)</sup>
PAHs			
Naphthalene	7.2 <sup>(p)</sup>	(360) <sup>(4,v)</sup>	(1,200) <sup>(4,v)</sup>
Non-carc. (Pyrene)	(160) <sup>(4,p)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>
Benzo(a)pyrene eq. <sup>(5)</sup>	0.027 <sup>(d)</sup>	(25) <sup>(4,m)</sup>	NA <sup>(2)</sup>
<b>PUMICE</b>			
MAHs			
Benzene	1.2 <sup>(v)</sup>	2.4 <sup>(v)</sup>	3.1 <sup>(v)</sup>
Toluene	(73) <sup>(4,v)</sup>	(240) <sup>(4,v)</sup>	(350) <sup>(4,v)</sup>
Ethylbenzene	(48) <sup>(4,v)</sup>	(140) <sup>(4,v)</sup>	(220) <sup>(4,v)</sup>
Xylenes	(53) <sup>(4,v)</sup>	(180) <sup>(4,v)</sup>	(260) <sup>(4,v)</sup>
PAHs			
Naphthalene	7.2 <sup>(p)</sup>	140 <sup>(v)</sup>	(220) <sup>(4,v)</sup>
Non-carc. (Pyrene)	(160) <sup>(4,p)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>
Benzo(a)pyrene eq. <sup>(5)</sup>	0.027 <sup>(d)</sup>	(25) <sup>(4,m)</sup>	NA <sup>(2)</sup>
<b>PEATS AND HIGHLY ORGANIC SOILS</b>			
MAHs			
Benzene	5.7 <sup>(v)</sup>	10 <sup>(v)</sup>	13 <sup>(v)</sup>
Toluene	(2,500) <sup>(4,v)</sup>	(2,900) <sup>(4,v)</sup>	(3,800) <sup>(4,v)</sup>
Ethylbenzene	(2,200) <sup>(4,v)</sup>	(2,500) <sup>(4,v)</sup>	(3,200) <sup>(4,v)</sup>
Xylenes	(1,700) <sup>(4,v)</sup>	(2,000) <sup>(4,v)</sup>	(2,600) <sup>(4,v)</sup>
PAHs			
Naphthalene	7.2 <sup>(p)</sup>	(2,700) <sup>(4,v)</sup>	(3,500) <sup>(4,v)</sup>
Non-carc. (Pyrene)	(160) <sup>(4,p)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>
Benzo(a)pyrene eq. <sup>(5)</sup>	0.027 <sup>(d)</sup>	(25) <sup>(4,m)</sup>	NA <sup>(2)</sup>

## NOTES:

1. Based on protection of human health. Refer to Table 4.20 for protection of groundwater. Site-specific consideration of aesthetic and ecological impacts is required.
2. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.
3. Surface soil acceptance criteria are based on the lower value of volatilisation criteria (Table 4.16), other pathway criteria (Table 4.18) and criteria for the protection of maintenance workers (Table 4.19). Criteria for soils at 1 m are based on the lower value of those arising from volatilisation and maintenance criteria. Criteria for soils at 4 m are based on volatilisation only.
4. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.
5. Risk associated with mixture of carcinogenic PAHs assessed by comparison with criteria based on benzo(a)pyrene equivalent concentration. Refer to Section 4.4.3 for details of the calculation of Benzo(a)pyrene equivalent concentrations.
6. The following notes indicate the limiting pathway for each criterion: v - Volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation

**Table 4.15 Tier 1 soil acceptance criteria for TPH<sup>(1,3,5,6)</sup> Agricultural use ALL PATHWAYS**  
(all values in mg/kg)

Soil Type/ Contaminant	Depth of contamination		
	Surface (<1m)	1m - 4m	> 4m
<b>SAND</b> C <sub>7</sub> -C <sub>9</sub> <sup>(4)</sup> C <sub>10</sub> -C <sub>14</sub> C <sub>15</sub> -C <sub>36</sub>	120 <sup>(m)</sup> 58 <sup>(x)</sup> (4,000) <sup>(7,x)</sup>	120 <sup>(m)</sup> (560) <sup>(7,x)</sup> NA <sup>(2)</sup>	(3,800) <sup>(7,8,v)</sup> (650) <sup>(7,x)</sup> NA <sup>(2)</sup>
<b>SANDY SILT</b> C <sub>7</sub> -C <sub>9</sub> <sup>(4)</sup> C <sub>10</sub> -C <sub>14</sub> C <sub>15</sub> -C <sub>36</sub>	(500) <sup>(7,m)</sup> 58 <sup>(x)</sup> (4,000) <sup>(7,x)</sup>	(500) <sup>(7,m)</sup> (670) <sup>(7,x)</sup> NA <sup>(2)</sup>	(3,800) <sup>(7,v)</sup> (4,900) <sup>(7,v)</sup> NA <sup>(2)</sup>
<b>SILTY CLAY</b> C <sub>7</sub> -C <sub>9</sub> <sup>(4)</sup> C <sub>10</sub> -C <sub>14</sub> C <sub>15</sub> -C <sub>36</sub>	(2,700) <sup>(7,v)</sup> 58 <sup>(x)</sup> (4,000) <sup>(7,x)</sup>	(7,300) <sup>(7,v)</sup> (2,700) <sup>(7,x)</sup> NA <sup>(2)</sup>	(19,000) <sup>(7,v)</sup> (8,900) <sup>(7,x)</sup> NA <sup>(2)</sup>
<b>CLAY</b> C <sub>7</sub> -C <sub>9</sub> <sup>(4)</sup> C <sub>10</sub> -C <sub>14</sub> C <sub>15</sub> -C <sub>36</sub>	(15,000) <sup>(7,v)</sup> 58 <sup>(x)</sup> (4,000) <sup>(7,x)</sup>	NA <sup>(2)</sup> (2,900) <sup>(7,x)</sup> NA <sup>(2)</sup>	NA <sup>(2)</sup> (9,700) <sup>(7,x)</sup> NA <sup>(2)</sup>
<b>PUMICE</b> C <sub>7</sub> -C <sub>9</sub> <sup>(4)</sup> C <sub>10</sub> -C <sub>14</sub> C <sub>15</sub> -C <sub>36</sub>	(810) <sup>(7,m)</sup> 58 <sup>(x)</sup> (4,000) <sup>(7,x)</sup>	(810) <sup>(7,m)</sup> (1,100) <sup>(7,x)</sup> NA <sup>(2)</sup>	(4,800) <sup>(7,v)</sup> (1,800) <sup>(7,x)</sup> NA <sup>(2)</sup>
<b>PEATS AND HIGHLY ORGANIC SOILS</b> C <sub>7</sub> -C <sub>9</sub> <sup>(4)</sup> C <sub>10</sub> -C <sub>14</sub> C <sub>15</sub> -C <sub>36</sub>	(6,700) <sup>(7,m)</sup> 58 <sup>(x)</sup> (4,000) <sup>(7,x)</sup>	(6,700) <sup>(7,m)</sup> NA <sup>(2)</sup> NA <sup>(2)</sup>	NA <sup>(2)</sup> NA <sup>(2)</sup> NA <sup>(2)</sup>

## NOTES:

- Criteria for C10 - C14 and C15 - C36 are based on consideration of aliphatic component of TPH measurement and consideration of TPH as a surrogate measure for PAH, consideration of PAHs completed by extrapolation of PAH content of diesel and PAH criteria (refer Table 4.10)
- NA indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix. Some aesthetic impact may be noted.
- Based on protection of human health only. Site specific consideration of aesthetic and ecological impact is required.
- Based on health effects associated with aliphatic component only. Separate consideration of the health effects associated with the aromatic component (i.e. BTEX) is required.
- Soil acceptance criteria are based on the lower value of criteria based on volatilisation (Table 4.16), other pathways (Table 4.18), criteria for the protection of maintenance workers (Table 4.19) and TPH criteria developed as surrogates for PAHs (Table 4.22). Surface soils criteria are based on all three pathways, criteria for soils at 1 m are based on volatilisation and maintenance workers, and criteria for soils at 4 m are based on volatilisation only. PAH surrogate considerations apply at all depths.
- The following notes indicate the limiting pathway for each criterion: v - Volatilisation, s - Soil Ingestion d - Dermal, p - Produce, m - Maintenance/Excavation, x - PAH surrogate
- Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.
- Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil type. Therefore, the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.



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

Name of  
Consent Holder: Petrochem Limited  
P O Box 1394  
Shortland Street  
AUCKLAND

Consent Granted  
Date: 1 November 2005

**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 Kowhai-A wellsite at or about (NZTM)  
1710907E-5676255N

Expiry Date: 1 June 2021

Review Date(s): June 2009, June 2021

Site Location: Kowhai-A wellsite, Ngatimaru Road, Tikorangi, Waitara  
[Property owner: BJ & RN Jupp]

Legal Description: Pt Sec 44 Tikorangi Dist Blks IX & X Waitara SD

### **General conditions**

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

### **Special conditions**

#### **Information and notification**

1. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least one month prior to the establishment of production operations at the Kowhai-A wellsite.
2. At least 24 hours prior to any flaring, other than in emergencies, the consent holder shall undertake all practicable measures to notify residents within 1000 metres of the site 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/or complaints received.
3. The consent holder shall, whenever practicable, 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, as far as practicable, be no less than 24 hours prior to such flaring being commenced.
4. No alteration shall be made to plant equipment or processes which may substantially alter the nature or quantity of flare emissions or other site emissions, including but not limited to the recovery of produced gas, other than as notified in this consent application, without prior consultation with the Chief Executive, Taranaki Regional Council, and the consent holder shall obtain any necessary approvals under the Resource Management Act 1991.

**Emissions from the site**

5. Other than for the maintenance of a pilot flare flame, the consent holder shall have regard to the prevailing and predicted wind speed and direction at the time of initiation of any episode of flaring or other combustion of hydrocarbons.
6. All gas being flared, at any time must first be treated by effective liquid and solid separation and recovery, as far as is practicable, to ensure that smoke emission during flaring is minimised.
7. If separation cannot be implemented and/or maintained at any time while there is a flow from the well, whether natural or induced, then the consent holder shall notify the Chief Executive, Taranaki Regional Council, and shall in any case re-establish liquid and solid separation and recovery within three hours.
8. Subject to special conditions 6 and 7, no liquid or solid hydrocarbons shall be combusted through the gas flare system other than in an emergency.
9. Only substances originating from the well stream and treated as outlined by conditions 6, 7, 8, and 10 shall be combusted within the flare pit.
10. 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 or any other emissions to air from the Kowhai-A wellsite. Any adoption of the best practicable option as outlined in this special condition shall be to the satisfaction of the Chief Executive, Taranaki Regional Council.
11. The consent holder shall not discharge any contaminant to air authorised by this consent at a rate or a quantity such that the contaminant, whether alone or in combination with other contaminants, is or is liable to be hazardous or toxic or noxious at or beyond the boundary of the wellsite, or beyond 100 metres of the flare, whichever distance is greater.
12. There shall not be any offensive odour or smoke, as determined by an enforcement officer of the Taranaki Regional Council, beyond the boundary of the wellsite or beyond 100 metres of the flare, whichever distance is greater, arising from the exercise of this consent.
13. All hydrocarbon storage vessels shall be fitted with vapour recovery systems.
14. The opacity of any smoke emissions shall not exceed a level of 1 as measured on the Ringelmann Scale for more than four minutes cumulative duration in any 60-minute period.
15. The consent holder shall control all emissions of carbon monoxide to the atmosphere from the flare, whether alone or in conjunction with any other emissions from the wellsite, in order that the maximum ground level concentration of carbon monoxide arising from the exercise of this consent measured under ambient conditions does not exceed 10 mg/m<sup>3</sup> [eight-hour average exposure], or 30 mg/m<sup>3</sup> one-hour average exposure] at or beyond the boundary of the wellsite or beyond 100 metres from the flare, whichever distance is greater.

## Consent 6719-1

16. The consent holder shall control all emissions of nitrogen oxides to the atmosphere from the flare, whether alone or in conjunction with any other emissions from the wellsite, in order that the maximum ground level concentration of nitrogen dioxide arising from the exercise of this consent measured under ambient conditions does not exceed 100 mg/m<sup>3</sup> [24-hour average exposure], or 200 mg/m<sup>3</sup> [1-hour average exposure] at or beyond the boundary of the wellsite, or beyond 100 metres from the flare, whichever distance is greater.
17. 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, whether alone or in conjunction with any emissions from the flare, in order that the maximum ground level concentration for any particular contaminant arising from the exercise of this consent measured at or beyond the boundary of the wellsite or beyond 100 metres from the flare, whichever distance is greater, is not increased above background levels:
  - a) by more than 1/30<sup>th</sup> 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].

### Recording and reporting information

18. The consent holder shall keep and make available to the Chief Executive, Taranaki Regional Council, upon request, a record of all smoke-emitting incidents noting time, duration and cause.
19. The consent holder shall keep and maintain a log of all continuous flaring incidents longer than five minutes, and any intermittent flaring lasting for an aggregate of ten minutes or longer in any 120-minute period. Such a log shall contain the date, the start and finish times, the quantity and type of material flared, and the reason for flaring. This log shall be made available to the Chief Executive, Taranaki Regional Council, upon request, and summarised annually in the report required under condition 20.
20. The consent holder shall provide to the Taranaki Regional Council during May of each year, for the duration of this consent, a report:
  - i. detailing any energy efficiency measures implemented on the site;
  - ii. detailing smoke emissions as required under condition 18;
  - iii. detailing any measures to reduce smoke emissions;
  - iv. detailing any measures to reduce flaring;
  - v. addressing any other issue relevant to the minimisation or mitigation of emissions from the flare;
  - vi. detailing any complaints received and any measures undertaken to address complaints; and

## Consent 6719-1

- vii. reviewing all options and technological advances relevant to the reduction or mitigation of any discharge to air from the site, how these might be applicable and/or implemented at the site, and the benefits and costs of these advances.
21. The consent holder shall make available to the Chief Executive, Taranaki Regional Council, upon request, an analysis of a typical gas and crude oil stream from the field, covering sulphur compound content and the content of carbon compounds of structure C<sub>6</sub> or higher number of compounds.

### **Lapse and Review**

22. This consent shall lapse on the expiry of 16 years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
23. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 22 July 2008

For and on behalf of  
Taranaki Regional Council

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**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: Petrochem Limited  
P O Box 1394  
Shortland Street  
AUCKLAND

Consent Granted  
Date: 26 October 2005

**Conditions of Consent**

Consent Granted: To discharge treated stormwater and treated production water from hydrocarbon exploration and production operations at the Kowhai-A wellsite onto and into land in the vicinity of an unnamed tributary of the Waiau Stream at or about (NZTM) 1710907E-5676255N

Expiry Date: 1 June 2021

Review Date(s): June 2009, June 2015

Site Location: Kowhai-A wellsite, Ngatimaru Road, Tikorangi, Waitara  
[Property owners: BJ & RN Jupp]

Legal Description: Pt Sec 44 Tikorangi Dist Blks IX & X Waitara SD

Catchment: Waiau

**General conditions**

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

**Special conditions**

- 1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects of the discharge.
- 2. The maximum stormwater catchment area shall be no more than 12,000 m<sup>2</sup>.
- 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.
- 4. Prior to the exercise of this consent, the consent holder shall provide for the written approval of the Chief Executive, Taranaki Regional Council, site specific details relating to contingency planning for the wellsite.
- 5. All stormwater and produced water to be discharged under this permit shall be directed for treatment through the stormwater treatment system for discharge in accordance with the special conditions of this consent.
- 6. The design, management and maintenance of the stormwater system shall be generally undertaken in accordance with the information submitted in support of consent application 3963.
- 7. Any above ground hazardous substances storage areas shall be bunded with drainage to sumps, or other appropriate recovery systems, and not to the stormwater catchment.
- 8. The following concentrations shall not be exceeded in the discharge:

<b>Component</b>	<b>Concentration</b>
pH (range)	6.5 - 8.5
suspended solids	100 gm <sup>-3</sup>
total recoverable hydrocarbons [infrared spectroscopic technique]	15 gm <sup>-3</sup>
chloride	50 gm <sup>-3</sup>



## Consent 6720-1

This condition shall apply prior to the entry of the treated stormwater and produced water either onto and into land, or into surface water, at a designated sampling point approved by the Chief Executive, Taranaki Regional Council.

9. After allowing for reasonable mixing, within a mixing zone extending seven times the width of the water body downstream of a designated discharge point, the discharge shall not give rise to an increase in temperature of more than 2 degrees Celsius.
10. After allowing for reasonable mixing, within a mixing zone extending seven times the width of the water body downstream of a designated discharge point, the discharge shall not give rise to any of the following effects in the receiving waters:
  - a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
  - b) any conspicuous change in the colour or visual clarity;
  - c) any emission of objectionable odour;
  - d) the rendering of fresh water unsuitable for consumption by farm animals;
  - e) any significant adverse effects on aquatic life.
11. The discharge onto and into land shall occur a minimum of 30 metres from any surface water body. Discharge shall be onto and into land and there shall be no direct discharge to surface water.
12. The Chief Executive, Taranaki Regional Council, shall be advised in writing at least 48 hours prior to the reinstatement of the site and the reinstatement shall be carried out so as to minimise effects on stormwater quality.
13. This consent shall lapse on the expiry of five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
14. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 22 July 2008

For and on behalf of  
Taranaki Regional Council

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**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): 13 February 2014

Commencement Date  
(Change): 13 February 2014 (Granted: 6 September 2013)

**Conditions of Consent**

Consent Granted: To discharge treated stormwater and produced water from hydrocarbon exploration and production operations at the Turangi Production Station, onto land where it may enter an unnamed tributary of the Parahaki Stream

Expiry Date: 1 June 2027

Review Date(s): June 2015, June 2021

Site Location: Turangi Production Station, Turangi Road, Motunui  
(Property owner: Ducal Products Limited)

Legal Description: Sec 21 & Lot 1 DP 19476 Blk VI Waitara SD  
(Discharge source & site)

Grid Reference (NZTM) 1713988E-5681344N

Catchment: Parahaki

*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 1991.

### Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any 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 1.8 Ha.
3. At least 5 working days prior, the consent holder shall advise the Chief Executive, Taranaki Regional Council of the date of each of the following events:
  - a) commencement of any site works (site works includes the introduction of a drilling rig, drilling equipment or any other associated equipment or facilities to the site for any purpose other than for the construction of the site);
  - b) commencement of any well drilling operation; and
  - c) recommencement of any site works or drilling operations following a period of inactivity exceeding 30 days.

If any of these events is rescheduled or delayed, the consent holder shall immediately provide further notice advising of the new date.

Any advice given in accordance with this condition shall include the consent number and the wellsite name and be emailed to [worknotification@trc.govt.nz](mailto:worknotification@trc.govt.nz).

4. The consent holder shall maintain a contingency plan that 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 certified by the Chief Executive, Taranaki Regional Council prior to discharging from the site, and after any change to the Plan.
5. Subject the other conditions of this consent the design, management and maintenance of the stormwater system shall be undertaken in accordance with the information submitted in support of the consent application 9674 and in particular, the following drawings prepared by BTW Company Limited:
  - a) Drawing 12364-103-GIS, Sheet 1 and dated March 2013;
  - b) Drawing 12364-02, Sheet 1, Revision 2 and dated December 2013;
  - c) Drawing 12364-02, Sheet 2, Revision 3 and dated December 2013;
  - d) Drawing 12364-02, Sheet 3, Revision 2 and dated December 2013;
  - e) Drawing 12364-02, Sheet 4, Revision 3 and dated December 2013;
  - f) Drawing 12364-02, Sheet 5, Revision 3 and dated December 2013;
  - g) Drawing 12364-02, Sheet 6, Revision 3 and dated December 2013;
  - h) Stormwater design report for Turangi-A Production Station, referenced 12364-8/2013, Revision 2 and dated December 2013.

## Consent 9674-1.1

6. All discharges from the site, including from any containment pit or hydrocarbon combustion facility (e.g. flare pit, thermal oxidiser), shall flow to a perimeter drain and skimmer pit. Perimeter drains shall be designed, including by having a positive grade and low permeability, to ensure that runoff flows directly to a skimmer pit without ponding.
7. Skimmer pits shall have a combined capacity of no less than 370 m<sup>3</sup>, and be designed to retain any hydrocarbons that enter them.
8. Skimmer pits shall have a combined capacity of no less than 370 m<sup>3</sup> including a 'dead storage' of no less than 106 m<sup>3</sup>, and be designed to retain any hydrocarbons that enter them.
9. All skimmer pits and any other stormwater retention areas shall be lined with an impervious material to prevent seepage through the bed and sidewalls, and all skimmer pits shall have a valve that can be shut off to prevent any discharge from the site.
10. Perimeter drains and skimmer pits necessary to comply with the conditions of this consent shall be installed before any site works commences. Site works includes the introduction of a drilling rig, drilling equipment or any other associated equipment or facilities to the site for any purpose other than for the construction of the site.
11. Constituents in the discharge shall meet the standards shown in the following table.

<b>Constituent</b>	<b>Standard</b>
pH	Within the range 6.0 to 9.0
suspended solids	Concentration not greater than 100 gm-3
total recoverable hydrocarbons	Concentration not greater than 15 gm-3 [as determined by infrared spectroscopic technique]
chloride	Concentration not greater than 50 gm-3

12. After allowing for a mixing zone of 25 metres, the discharge shall not give rise to an increase in the temperature of the receiving waters of more than 2 degrees Celsius.
13. After allowing for a mixing zone of 25 metres, the discharge shall not give rise to any of the following effects in the receiving water:
  - a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
  - b) any conspicuous change in the colour or visual clarity;
  - c) any emission of objectionable odour;
  - d) the rendering of fresh water unsuitable for consumption by farm animals;
  - e) any significant adverse effects on aquatic life.
14. 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](mailto:worknotification@trc.govt.nz).

Consent 9674-1.1

15. This consent shall lapse on 30 September 2018, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
16. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 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 13 February 2014

For and on behalf of  
Taranaki Regional Council

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A D McLay  
**Director-Resource Management**

## Appendix II

### Biomonitoring reports





To Job Manager, Callum MacKenzie  
From Technical Officer, Katie Blakemore  
Document 1892124  
Report No KB031  
Date 23 February 2018

## Biomonitoring of an unnamed tributary of the Parahaki Stream in relation to the Turangi Production Station, Greymouth Petroleum Ltd, October 2017

### Introduction

This was the first of two biomonitoring surveys scheduled in the 2017-2018 monitoring year for the Turangi Production Station of Greymouth Petroleum. The Production Station discharges stormwater and treated production water to land where they may enter the Parahaki Stream. The Taranaki Regional Council has undertaken eight previous surveys at the site in relation to petrochemical activities, four in relation to the Turangi-A wellsite and four surveys in relation to the Turangi Production Station. This macroinvertebrate survey was performed at the Turangi Production Station to determine whether discharges to land have had a detrimental effect on macroinvertebrate communities of an unnamed tributary of the Parahaki Stream.

### Methods

The survey was undertaken on 24 October 2017 at three established sites (Table 1, Figure 1). Site 1 was the control site, while site 2 was the primary impact site and site 3 was the secondary impact site.

Table 1 Biomonitoring sites in an unnamed tributary of the Parahaki Stream in relation to Turangi Production Station

Site number	Site code	Grid reference (NZTM)	Location	Altitude (masl)
1	PRH000020	E1714011 N5681332	Upstream of Turangi Production Station discharge	40
2	PRH000022	E1713999 N5681410	25m downstream of Turangi Production Station discharge	40
3	PRH000024	E1714012 N5681446	100m downstream of Turangi Production Station discharge	40

A combination of 'vegetation sweep' sampling and 'kick-sampling' was used to collect streambed macroinvertebrates in the unnamed tributary of the Parahaki Stream. The 'kick-sampling' and 'vegetation sweep' techniques are very similar to Protocol C1 (hard-bottomed, semi-quantitative) and C2 (soft-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

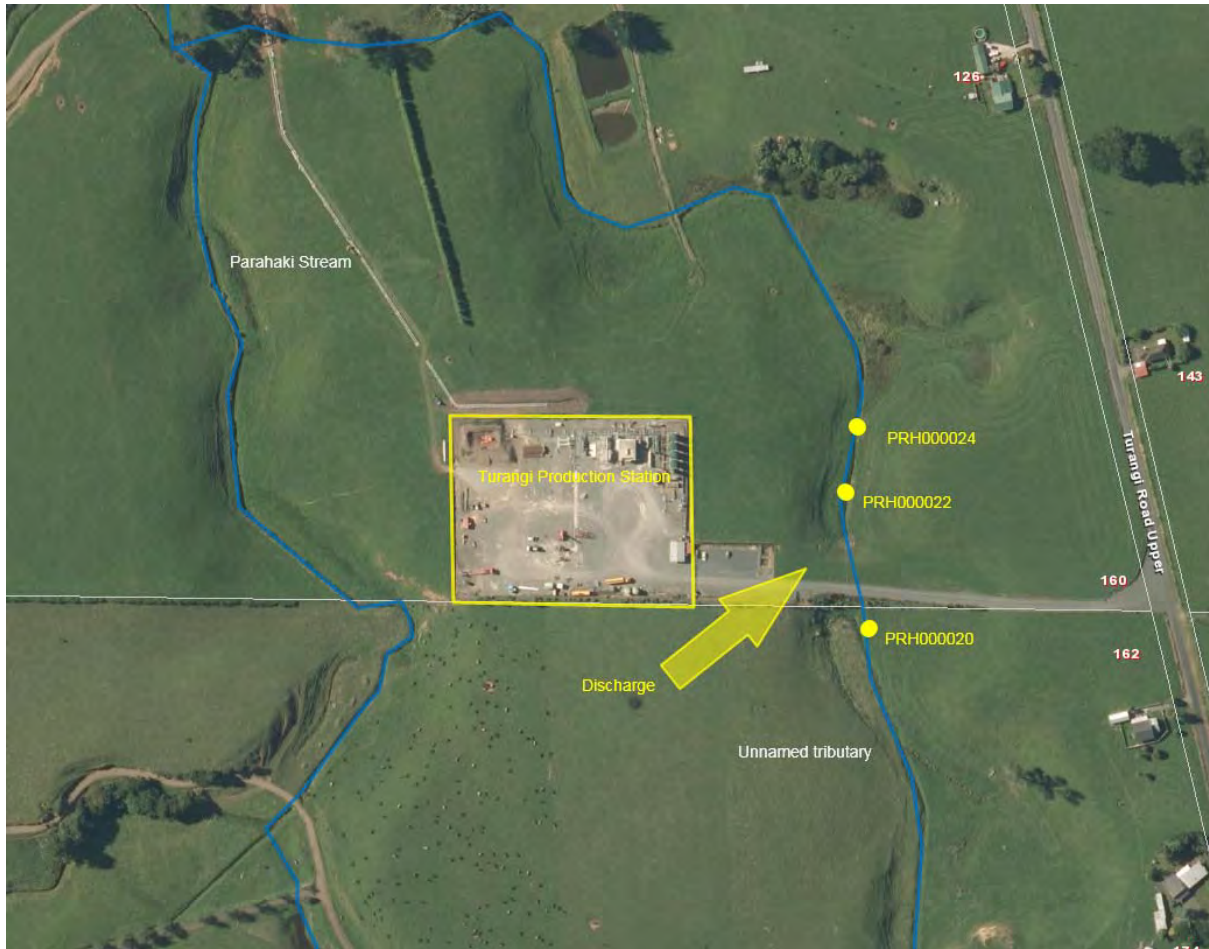


Figure 1 Biomonitoring sites in an unnamed tributary of the Parahaki Stream in relation to the Turangi Production Station

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001). Macroinvertebrate taxa found in each sample were recorded based on the abundance categories in Table 2.

Table 2 Macroinvertebrate abundance categories

Abundance category	Number of individuals
R (rare)	1-4
C (common)	5-19
A (abundant)	20-99
VA (very abundant)	100-499
XA (extremely abundant)	>499

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. By averaging the scores obtained from a list of taxa taken from one site and multiplying by a scaling factor of 20, a Macroinvertebrate Community Index (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. More 'sensitive' communities inhabit less polluted waterways. A difference of 11 or more

MCI units is considered significantly different (Stark 1998). A gradation of biological water quality conditions based upon MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985; Boothroyd and Stark, 2000) (Table 3).

**Table 3** Macroinvertebrate community health based on MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000)

Grading	MCI
Excellent	>140
Very Good	120-140
Good	100-119
Fair	80-99
Poor	60-79
Very Poor	<60

A semi-quantitative MCI value (SQMCIs) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCIs is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower.

## Results

The survey was carried out ten days following a fresh of 3x median flow and 11 days following a fresh of 7x median flow. At the time of the survey, all three sites had a clear and uncoloured moderate flow, which was slow at sites 1 and 3, and very slow/still at site 2. The water temperature at the three sites ranged between 16.2 – 16.9°C at the time of this survey.

Macrophytes were present on the streambed at all three sites, while moss, leaves or wood was absent from the streambed at all three sites. Periphyton mats were absent at all three sites, while filamentous periphyton was patchy at site 1 and absent at sites 2 and 3. Overhanging vegetation and undercut banks were present at all three sites, providing partial shading of the streambed at all three sites.

At all three sites, substrate comprised hard clay, silt, sand and wood/root, fine and coarse gravels, with cobbles also present at site 3. A silt coating was present at all three sites, and gravels and cobbles were embedded in silt and sand at all three sites.

## Macroinvertebrate communities

Eight previous surveys have been undertaken at these sites in relation to petrochemical activities, four in relation to the Turangi-1 wellsite (two in 2005, one in 2014 and one in 2017), as well as four previous surveys in relation to the Turangi Production Station (spring 2015, summer 2016 and summer 2017 and autumn 2017). Data from these surveys is summarised in Table 4 for comparative purposes. The results of the current survey are provided in Table 5 and are also summarised in Table 4 together with the past results.

Table 4 Summary of previously recorded number of taxa, MCI values and SQMCI<sub>s</sub> values together with results from the October 2017 survey

Site	Number of previous surveys	Numbers of taxa			MCI values			SQMCI <sub>s</sub> values		
		Median	Range	Current Survey	Median	Range	Current Survey	Median	Range	Current Survey
1	8	15	9-25	20	66	58-78	65	1.4	1.1-2.6	1.3
2	8	17	14-25	27	73	59-79	73	1.7	1.1-2.5	2.0
3	8	19	9-21	18	67	55-75	70	1.3	1.1-3.3	2.1

Table 5 Macroinvertebrate fauna of an unnamed tributary of the Parahaki Stream in relation to the Turangi Production Station, sampled on 24 October 2017

Taxa List	Site Number		MCI score	1	2	3	
	Site Code	Sample Number		PRH000020	PRH000022	PRH000024	
				FWB17302	FWB17303	FWB17304	
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>		3	R	R	R	
NEMERTEA	Nemertea		3	-	R	-	
NEMATODA	Nematoda		3	R	R	-	
ANNELIDA (WORMS)	Oligochaeta		1	XA	VA	VA	
HIRUDINEA (LEECHES)	Hirudinea		3	R	-	-	
MOLLUSCA	Lymnaeidae		3	C	R	R	
	<i>Physa</i>		3	C	C	R	
	<i>Potamopyrgus</i>		4	R	A	A	
CRUSTACEA	Ostracoda		1	VA	VA	VA	
	Talitridae		5	-	R	R	
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>		7	-	C	C	
ODONATA (DRAGONFLIES)	<i>Xanthocnemis</i>		4	C	C	-	
HEMIPTERA (BUGS)	<i>Microvelia</i>		3	-	C	-	
COLEOPTERA (BEETLES)	Dytiscidae		5	R	C	R	
	Hydrophilidae		5	R	R	-	
	TRICHOPTERA (CADDISFLIES)	<i>Hydrobiosis</i>		5	-	-	C
	<i>Polypsectropus</i>		6	A	C	R	
	<i>Psilochorema</i>		6	-	R	C	
	<i>Oxyethira</i>		2	C	A	C	
	<i>Triplectides</i>		5	-	R	-	
DIPTERA (TRUE FLIES)	<i>Zelandotipula</i>		6	R	R	-	
	<i>Chironomus</i>		1	VA	C	C	
	<i>Corynoneura</i>		3	C	R	R	
	Orthocladiinae		2	VA	A	A	
	<i>Polypedilum</i>		3	R	A	A	
	Tanytarsini		3	-	R	-	
	<i>Paradixa</i>		4	R	C	-	
	<i>Austrosimulium</i>		3	R	A	VA	
ACARINA (MITES)	Acarina		5	-	R	-	
No of taxa				20	27	18	
MCI				65	73	70	
SQMCI <sub>s</sub>				1.3	2.0	2.1	
EPT (taxa)				1	4	4	
%EPT (taxa)				5	15	22	
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa			

R = Rare    C = Common    A = Abundant    VA = Very Abundant    XA = Extremely Abundant

## Site 1-upstream of Production Station discharge

A moderate taxa richness of 20 taxa was recorded by this survey (Table 5, Figure 2). This is six taxa more than that recorded in the previous survey, and five taxa more than the median richness for this site (15 taxa; Table 4, Figure 2). The macroinvertebrate community at the time of the current survey was characterised by four 'tolerant' taxa [seed shrimp (*Ostracoda*), midge larvae (*Chironomus* and *Orthoclaadiinae*) and worm (*Oligochaeta*)] and one 'moderately sensitive' taxon [caddisfly (*Polyplectropus*)].

A MCI score of 65 units was recorded (Table 5, Figure 2), categorising the site as having 'poor' macroinvertebrate community health (Table 3). This score is not significantly different to either (Stark 1998) the median score for this site (median MCI score 66 units; Table 4, Figure 2), or the previously recorded score of 70 units. A very low SQMCI<sub>s</sub> score of 1.3 units was recorded (Table 5). This is not significantly different (Stark 1998) to either the previously recorded score of 1.2 units or to the median score for this site (1.4 units; Table 4).

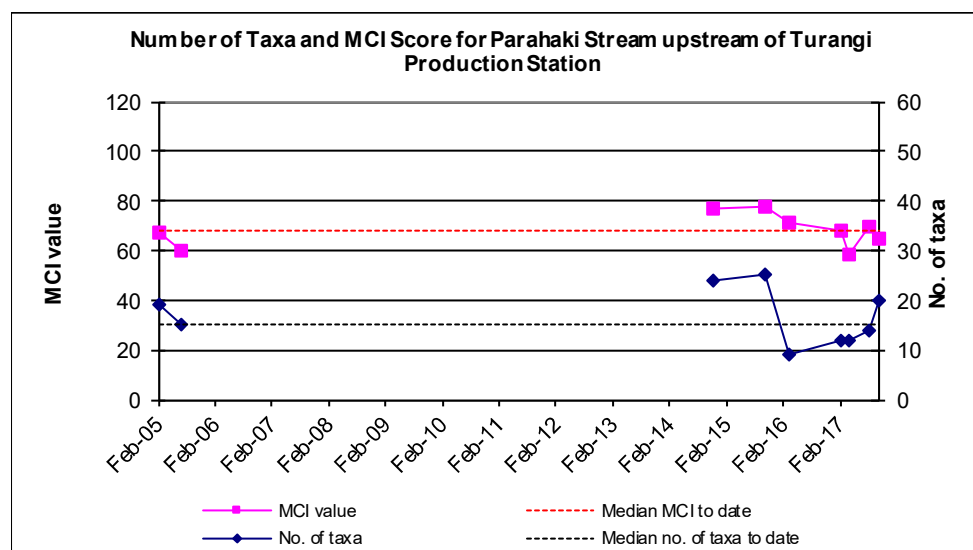


Figure 2 Taxa richness and MCI scores recorded to date at site 1, upstream of Turangi Production Station

## Site 2-25m downstream of Production Station discharge

A high taxa richness of 27 units was recorded (Table 5, Figure 3). This is a substantial 13 taxa more than the previously recorded richness of 14 taxa and ten taxa more than the median taxa richness for this site (17 taxa; Table 4, Figure 3). It is also two taxa more than the highest previously recorded taxa richness at this site (Table 4, Figure 3). The macroinvertebrate community at the time of the current survey was characterised by seven 'tolerant' taxa [seed shrimp (*Ostracoda*), worm (*Oligochaeta*), axehead caddis (*Oxyethira*), midge larvae (*Orthoclaadiinae* and *Polypedilum*), sandfly (*Austrosimulium*) and mud snail (*Potamopyrgus*)].

The recorded MCI score of 73 units (Table 5, Figure 3) categorised the site as having 'poor' macroinvertebrate community health (Table 3). This score is insignificantly lower (Stark 1998) to the previously recorded score of 74 units and is equal to the median score for this site (73 units; Table 4, Figure 3). A SQMCI<sub>s</sub> score of 2.0 units was recorded, insignificantly higher (Stark 1998) the median score for this site (1.7 units, Table 4), and the previously recorded score of 2.1 units.

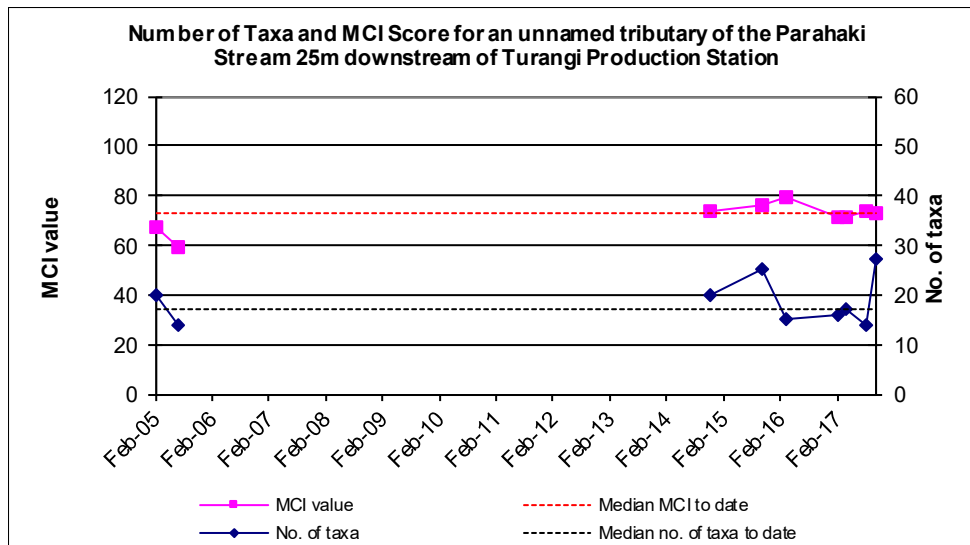


Figure 3 Taxa richness and MCI scores to date at site 2, 25m downstream of Production Station discharges

### Site 3-100m downstream of Production Station discharge

A moderate taxa richness of 18 taxa was recorded at this site (Table 5, Figure 4). This is one taxon more than the previously recorded richness of 17 taxa and equal to the median richness for this site (18 taxa; Table 4, Figure 4). The macroinvertebrate community at the time of the current survey was characterised by six 'tolerant' taxa [seed shrimp (*Ostracoda*), sandfly larvae (*Austrosimulium*), midge larvae (*Orthocladiinae* and *Polypedilum*), mud snail (*Potamopyrgus*) and worm (*Oligochaeta*)].

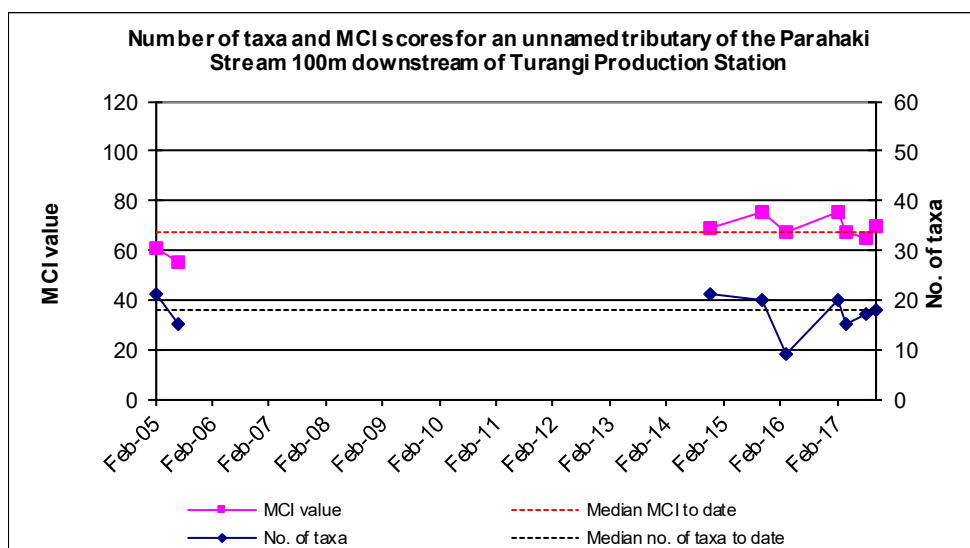


Figure 4 Taxa richness and MCI scores to date at site 3, 100m downstream of Turangi Production Station discharges

A MCI score of 70 units was recorded (Table 5, Figure 4), characterising the site as having 'poor' macroinvertebrate community health (Table 3). This is insignificantly higher (Stark 1998) than the previously recorded score of 65 units and the median score for this site (67 units; Table 4, Figure 4). A SQMCI<sub>s</sub> score of 2.1 units was recorded. This score is insignificantly higher (Stark 1998) than both the score of 1.5 units recorded by the previous survey and the median score for this site (1.3 units; Table 4).

## Discussion and conclusions

The Councils 'kick-sampling' and 'vegetation sweep' techniques were used at three sites to collect macroinvertebrates from an unnamed tributary of the Parahaki Stream for the spring survey at the Turangi Production Station. This has provided data to assess whether discharges to nearby land had had any effect on the macroinvertebrate communities of the unnamed tributary. Samples were processed to provide number of taxa (richness), MCI, and SQMCI<sub>5</sub> scores for each site.

Taxa richness is the most robust index when determining whether a macroinvertebrate community has been exposed to toxic discharges. When exposed to toxic discharges, macroinvertebrates may die and be swept downstream or may deliberately drift downstream as an avoidance mechanism (catastrophic drift). The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI<sub>5</sub> takes into account taxa abundances as well as sensitivity to pollution. It may indicate subtle changes in communities, and therefore be the more relevant index if non-organic impacts are occurring. However, it is also influenced by the 'patchiness' of macroinvertebrates on the streambed, and as such must be considered in the context of all three metrics. Significant differences in either the MCI or the SQMCI<sub>5</sub> scores between sites may indicate the degree of adverse effects (if any) of the discharge being monitored.

MCI scores categorised all three sites as having 'poor' macroinvertebrate community health. All sites recorded MCI scores which were not significantly different from historical medians or from the scores recorded in the previous survey. The MCI scores recorded in the current survey were typical of those recorded in lowland coastal streams in the Taranaki region (TRC 2016). SQMCI<sub>5</sub> scores were very low, but were similar to median scores and to those recorded in the preceding survey for each site respectively. SQMCI<sub>5</sub> scores were generally lower than is typical for lowland coastal streams in the Taranaki region (TRC 2016), reflecting the high proportion of tolerant taxa found at these sites.

Moderate taxa richnesses were recorded at sites 1 and 3, and a high taxa richness was recorded at site 2. Richnesses were higher than richnesses recorded in the preceding survey at all sites, with a substantial increase recorded at site 2. The richnesses were similar to median scores at sites 1 and 3, and these were typical of those recorded for lowland coastal streams in the Taranaki region (TRC 2016). Site 2 recorded its highest richness to date, which was also substantially higher than is typical of lowland coastal streams in the Taranaki region (TRC 2016). The high taxa richness at site 2 included a high proportion of taxa typically associated with macrophyte beds and slow flowing waters, and may have been due to the slower flow at this site compared to sites 1 and 2, allowing the colonisation of some taxa which are often associated with very slow moving rivers or ponds. Approximately 30% of the taxa found at this site were categorised as 'moderately sensitive'.

Taken together, the moderate to high taxa richnesses, low MCI and SQMCI<sub>5</sub> scores and high proportions of tolerant taxa found indicate that the macroinvertebrate communities of this small stream were influenced primarily by habitat conditions at the three sites, with observed differences resulting from minor variation in habitat between sites. All invertebrate metrics recorded in this survey, with the exception of the high taxa richness at site 2, were similar to those recorded in the preceding survey. Further, the MCI and SQMCI<sub>5</sub> scores were lowest at site 1, the upstream 'control' site which is upstream of all discharges from the Turangi Production Station. It is also worth noting that this high taxa richness was found at the 'primary impact' site, which would be the site where any impacts caused by discharges from the Turangi Production Station are most likely to be observed. Overall, these results provide no evidence that discharges of stormwater and treated production water have had any recent significant detrimental effects on the macroinvertebrate communities of this unnamed tributary of the Parahaki Stream.

## Summary

A macroinvertebrate survey was carried out at three sites in an unnamed tributary of the Parahaki Stream near the Turangi Production Station, to determine if discharges from the Production Station had detrimental effects on the stream macroinvertebrate communities.

The unnamed tributary of the Parahaki Stream recorded moderate taxa richnesses at sites 1 and 3, and high taxa richness at site 2. This taxa richness was the highest recorded to date at this site. MCI and SQMCI<sub>s</sub> scores were low, although they were similar to median and previously recorded scores for all sites respectively. MCI scores categorised all sites as having 'poor' macroinvertebrate community health, but the MCI scores were generally similar to those recorded in Taranaki lowland coastal stream, Observed differences in invertebrate metrics between sites are likely related to minor habitat variation between sites. Overall, the results of this survey provide no evidence that discharges from the Turangi Production Station have had any recent significant detrimental impacts on the stream macroinvertebrate communities.



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To Job Manager, Callum MacKenzie  
From Technical Officer, Katie Blakemore  
Document 1892124  
Report No KB039  
Date 11 April 2018

## Biomonitoring of an unnamed tributary of the Parahaki Stream in relation to the Turangi Production Station, Greymouth Petroleum Ltd, February 2018

### Introduction

This was the second of two biomonitoring surveys scheduled in the 2017-2018 monitoring year for the Turangi Production Station of Greymouth Petroleum. The Production Station discharges stormwater and treated production water to land where they may enter the Parahaki Stream. The Taranaki Regional Council has undertaken nine previous surveys at the site in relation to petrochemical activities, four in relation to the Turangi-A wellsite and five surveys in relation to the Turangi Production Station. This macroinvertebrate survey was performed at the Turangi Production Station to determine whether discharges to land have had a detrimental effect on macroinvertebrate communities of an unnamed tributary of the Parahaki Stream.

### Methods

The survey was undertaken on 7 February 2018 at three established sites (Table 1, Figure 1). Site 1 was the control site, while site 2 was the primary impact site and site 3 was the secondary impact site.

Table 1 Biomonitoring sites in an unnamed tributary of the Parahaki Stream in relation to Turangi Production Station

Site number	Site code	Grid reference (NZTM)	Location	Altitude (masl)
1	PRH000020	E1714011 N5681332	Upstream of Turangi Production Station discharge	40
2	PRH000022	E1713999 N5681410	25m downstream of Turangi Production Station discharge	40
3	PRH000024	E1714012 N5681446	100m downstream of Turangi Production Station discharge	40

A combination of 'vegetation sweep' sampling and 'kick-sampling' was used to collect streambed macroinvertebrates in the unnamed tributary of the Parahaki Stream. The 'kick-sampling' and 'vegetation sweep' techniques are very similar to Protocol C1 (hard-bottomed, semi-quantitative) and C2 (soft-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

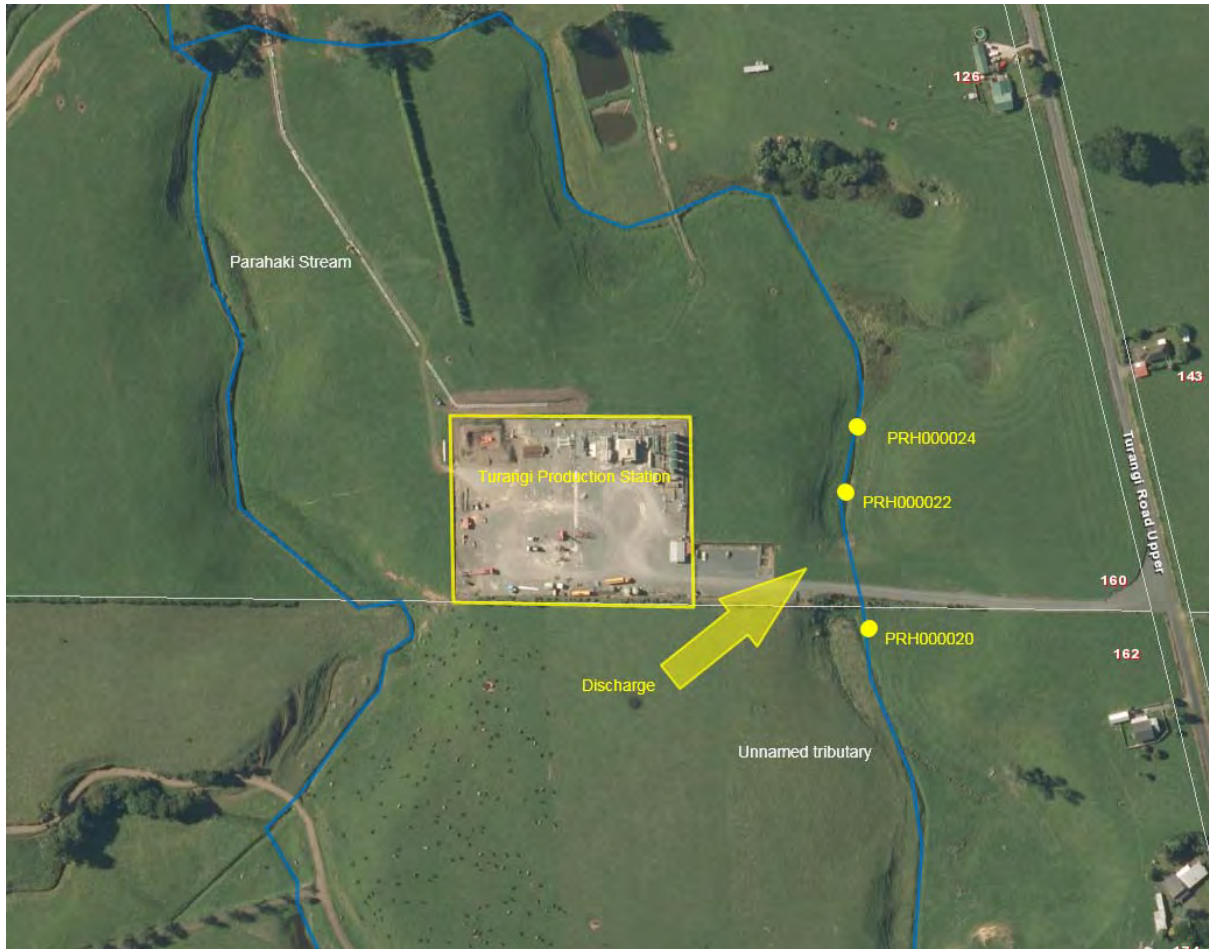


Figure 1 Biomonitoring sites in an unnamed tributary of the Parahaki Stream in relation to the Turangi Production Station

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001). Macroinvertebrate taxa found in each sample were recorded based on the abundance categories in Table 2.

Table 2 Macroinvertebrate abundance categories

Abundance category	Number of individuals
R (rare)	1-4
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Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. By averaging the scores obtained from a list of taxa taken from one site and multiplying by a scaling factor of 20, a Macroinvertebrate Community Index (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. More 'sensitive' communities inhabit less polluted waterways. A difference of 11 or more

MCI units is considered significantly different (Stark 1998). A gradation of biological water quality conditions based upon MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985; Boothroyd and Stark, 2000) (Table 3).

**Table 3** Macroinvertebrate community health based on MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000)

Grading	MCI
Excellent	>140
Very Good	120-140
Good	100-119
Fair	80-99
Poor	60-79
Very Poor	<60

A semi-quantitative MCI value (SQMCIs) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCIs is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower.

## Results

The survey was carried out 33 days following a fresh of 3x median flow and 119 days following a fresh of 7x median flow. At the time of the survey, all three sites had a cloudy, brown, very low flow, which was very slow/still. The water temperature at the three sites ranged between 16.4-17.6 °C at the time of this survey.

Macrophytes were present on the streambed at sites 1 and 2 and on the stream margins at site 3, while moss, leaves or wood was absent from the streambed at all three sites. Periphyton mats were absent at all three sites, while filamentous periphyton was patchy at site 1 and absent at sites 2 and 3. Overhanging vegetation and undercut banks were present at all three sites, providing partial shading of the streambed at all three sites.

At all three sites, substrate comprised hard clay, silt, sand and wood/root, fine and coarse gravels, with cobbles also present at site 2. A silt coating was present at all three sites.

## Macroinvertebrate communities

Nine previous surveys have been undertaken at these sites in relation to petrochemical activities, four in relation to the Turangi-1 wellsite (two in 2005, one in 2014 and one in 2017), as well as five previous surveys in relation to the Turangi Production Station (spring 2015, summer 2016, summer 2017, autumn 2017 and spring 2017). Data from these surveys is summarised in Table 4 for comparative purposes. The results of the current survey are provided in Table 5 and are also summarised in Table 4 together with the past results.

Table 4 Summary of previously recorded number of taxa, MCI values and SQMCI<sub>s</sub> values together with results from the February 2018 survey

Site	Number of previous surveys	Numbers of taxa			MCI values			SQMCI <sub>s</sub> values		
		Median	Range	Current Survey	Median	Range	Current Survey	Median	Range	Current Survey
1	9	15	9-25	6	68	58-78	47	1.4	1.1-2.6	1.0
2	9	17	14-27	10	73	59-79	64	1.7	1.1-2.5	1.1
3	9	18	9-21	9	67	55-75	64	1.3	1.1-3.3	1.1

Table 5 Macroinvertebrate fauna of an unnamed tributary of the Parahaki Stream in relation to the Turangi Production Station, sampled on 7 February 2018

Taxa List	Site Number	MCI score	1	2	3
	Site Code		PRH000020	PRH000022	PRH000024
	Sample Number		FWB18030	FWB18031	FWB18032
COELENTERATA	Coelenterata	3	-	C	C
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	R	-	-
ANNELIDA (WORMS)	Oligochaeta	1	A	VA	C
MOLLUSCA	<i>Physa</i>	3	R	R	R
	<i>Potamopyrgus</i>	4	-	C	R
CRUSTACEA	Ostracoda	1	XA	XA	XA
HEMIPTERA (BUGS)	<i>Microvelia</i>	3	-	R	-
COLEOPTERA (BEETLES)	Hydrophilidae	5	C	-	R
TRICHOPTERA (CADDISFLIES)	<i>Polypectropus</i>	6	-	C	R
	<i>Triplectides</i>	5	-	R	R
DIPTERA (TRUE FLIES)	<i>Chironomus</i>	1	C	VA	A
	Tanypodinae	5	-	R	-
No of taxa			6	10	9
MCI			47	64	64
SQMCI <sub>s</sub>			1.0	1.1	1.1
EPT (taxa)			0	2	2
%EPT (taxa)			0	20	22
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa	

R = Rare    C = Common    A = Abundant    VA = Very Abundant    XA = Extremely Abundant

## Site 1-upstream of Production Station discharge

A very low taxa richness of six taxa was recorded by this survey (Table 5, Figure 2). This is a substantial fourteen taxa less than that recorded in the previous survey, and nine taxa less than the median richness for this site (15 taxa; Table 4, Figure 2). This is the lowest taxa richness recorded to date at this site (Figure 2). The macroinvertebrate community at the time of the current survey was characterised by two 'tolerant' taxa [seed shrimp (*Ostracoda*) and worm (*Oligochaeta*)].

A MCI score of 47 units was recorded (Table 5, Figure 2), categorising the site as having 'very poor' macroinvertebrate community health (Table 3). This score is significantly lower (Stark 1998) than the median score for this site (median MCI score 68 units; Table 4, Figure 2) and the previously recorded score of 67 units. A very low SQMCI<sub>s</sub> score of 1.0 units was recorded, which is in fact the lowest SQMCI<sub>s</sub> score possible (Table 5). This is not significantly different (Stark 1998) to either the previously recorded score of 1.3 units or to the median score for this site (1.4 units; Table 4). Both the MCI and SQMCI<sub>s</sub> scores are the lowest recorded to date at this site.

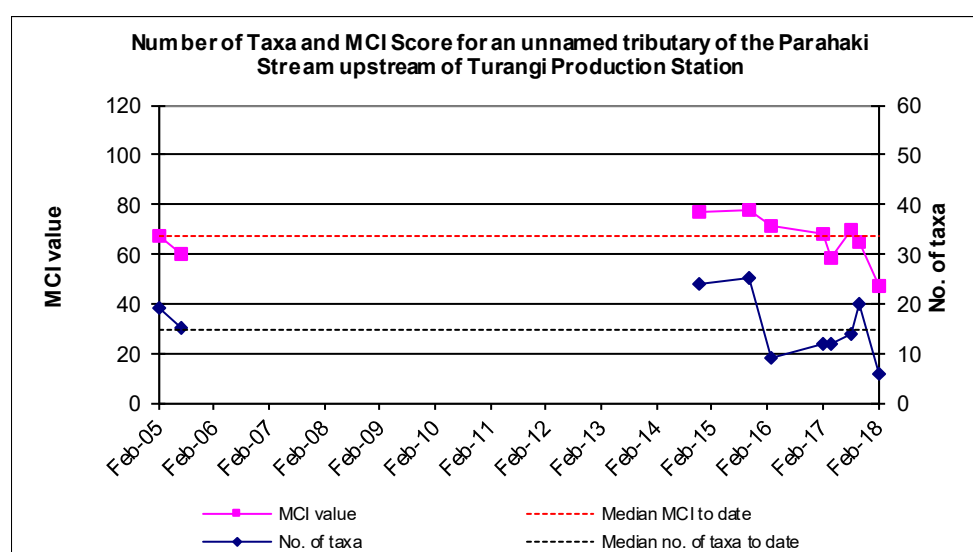


Figure 2 Taxa richness and MCI scores to date at site 1, upstream of Turangi Production Station discharges

## Site 2-25m downstream of Production Station discharge

A low taxa richness of ten taxa was recorded (Table 5, Figure 3). This is a substantial seventeen taxa less than the previously recorded richness of 27 taxa and seven taxa less than the median taxa richness for this site (17 taxa; Table 4, Figure 3). It is the lowest taxa richness recorded to date at this site, by four taxa (Table 4, Figure 3). The macroinvertebrate community at the time of the current survey was characterised by three 'tolerant' taxa [seed shrimp (*Ostracoda*), worm (*Oligochaeta*) and midge larvae (*Chironomus*)].

The recorded MCI score of 64 units (Table 5, Figure 2) categorised the site as having 'poor' macroinvertebrate community health (Table 3). This score is significantly lower (Stark 1998) than the previously recorded score of 73 units and the median score for this site (73 units; Table 4, Figure 3). A SQMCI<sub>s</sub> score of 1.1 units was recorded, insignificantly lower (Stark 1998) the median score for this site (1.7 units, Table 4), and significantly lower than the previously recorded score of 2.0 units. This SQMCI<sub>s</sub> score is equal to the lowest recorded score at this site to date.

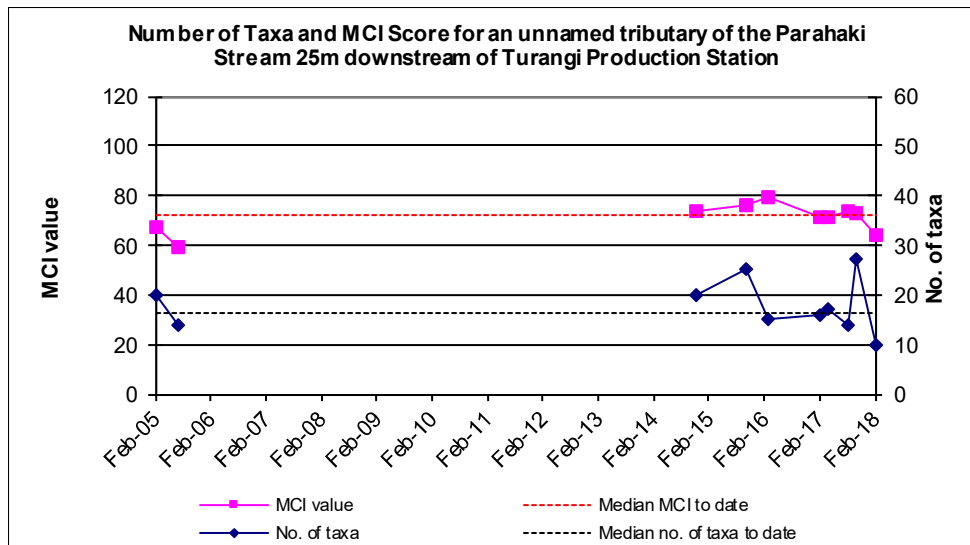


Figure 3 Taxa richness and MCI scores to date at site 2, 25m downstream of Turangi Production Station discharges

### Site 3-100m downstream of Production Station discharge

A low taxa richness of nine taxa was recorded at this site (Table 5, Figure 4). This is nine taxa less than the previously recorded richness of 18 taxa and the median richness for this site (18 taxa; Table 4, Figure 4). It is equal to the lowest taxa richness recorded to date at this site. The macroinvertebrate community at the time of the current survey was characterised by two 'tolerant' taxa [midge larvae (*Chironomus*) and worm (Oligochaeta)].

A MCI score of 64 units was recorded (Table 5, Figure 4), characterising the site as having 'poor' macroinvertebrate community health (Table 3). This is insignificantly lower (Stark 1998) than the previously recorded score of 70 units and the median score for this site (67 units; Table 4, Figure 4). A SQMCI<sub>s</sub> score of 1.1 units was recorded, insignificantly lower (Stark 1998) the median score for this site (1.7 units, Table 4), and significantly lower than the previously recorded score of 2.1 units. This SQMCI<sub>s</sub> score is equal to the lowest recorded score at this site to date.



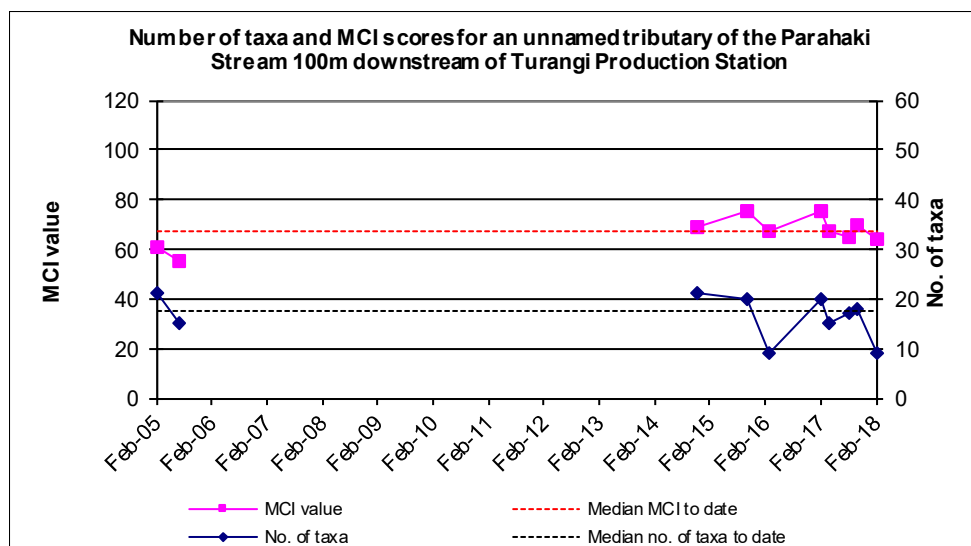


Figure 4 Taxa richness and MCI scores to date at site 3, 100m downstream of Turangi Production Station discharges

## Discussion and conclusions

The Councils 'kick-sampling' and 'vegetation sweep' techniques were used at three sites to collect macroinvertebrates from an unnamed tributary of the Parahaki Stream for the summer survey at the Turangi Production Station. This has provided data to assess whether discharges to nearby land had had any affect on the macroinvertebrate communities of the unnamed tributary. Samples were processed to provide number of taxa (richness), MCI, and SQMCI<sub>s</sub> scores for each site.

Taxa richness is the most robust index when determining whether a macroinvertebrate community has been exposed to toxic discharges. When exposed to toxic discharges, macroinvertebrates may die and be swept downstream or may deliberately drift downstream as an avoidance mechanism (catastrophic drift). The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI<sub>s</sub> takes into account taxa abundances as well as sensitivity to pollution. It may indicate subtle changes in communities, and therefore be the more relevant index if non-organic impacts are occurring. However, it is also influenced by the 'patchiness' of macroinvertebrates on the streambed, and as such must be considered in the context of all three metrics. Significant differences in either the MCI or the SQMCI<sub>s</sub> scores between sites may indicate the degree of adverse effects (if any) of the discharge being monitored.

Taxa richnesses were low at all three sites, and were the lowest recorded to date or equal to the lowest recorded to date for all three sites. The richnesses at all three sites decreased substantially from the previous survey. The macroinvertebrate communities at the three sites had a high proportion of tolerant taxa found (83%, 70% and 67% at the three sites respectively). All of the characteristic taxa at the three sites had the lowest possible tolerance value (ostracod seed shrimps, oligochaete worms and *Chironomus* midges, tolerance value 1). With one exception, the taxa found in this survey are typically associated with macrophyte beds and slow flowing waters.

MCI scores categorised site 1 as having 'very poor' macroinvertebrate community health and sites 2 and 3 as having 'poor' macroinvertebrate community health. The recorded MCI scores were lower than the preceding scores and historical medians at all sites, but this difference was significant only for site 1. Site 1 also recorded the lowest MCI score to date at this site. SQMCI<sub>s</sub> scores were extremely low, but were not significantly different from median scores for each site respectively. The scores at sites 2 and 3 were significantly lower than the preceding survey. The score at site 1 was not a significant decrease from the

preceding survey, but was the lowest possible SQMCI<sub>s</sub> score of 1.0 units. The SQMCI<sub>s</sub> score at site 1 was the lowest recorded to date, while at sites 2 and 3 the score was equal to the lowest recorded score to date. Both MCI and SQMCI<sub>s</sub> scores were lower than is typical for lowland coastal streams in the Taranaki region (TRC 2016), reflecting the high proportion and numerical dominance of tolerant taxa in the current survey.

This survey was undertaken during a period of low flow conditions, with very low and very slow/still flows recorded at all sites. Under low flow conditions, organisms are more likely to experience extremes of variables such as water temperature, conductivity and dissolved oxygen levels. There is also less dilution of any discharges that may occur. Therefore organisms which cannot tolerate these conditions may die or deliberately drift downstream to avoid the unfavourable conditions (catastrophic drift), thus reducing taxa richness. The low flow conditions also reduce the area of habitat available, directly impacting the organisms present.

When the taxa richness, MCI scores, SQMCI<sub>s</sub> scores and macroinvertebrate community composition are considered together, the macroinvertebrate community health indicated is very poor, and worse than could be expected for similar streams. A general decrease in community health has been observed since the preceding survey at all three sites. This may be attributed in part to the low flow conditions at the time of the survey, although it is possible that activities upstream of the production station may also have impacted on the macroinvertebrate communities recorded in the current survey. It is also noteworthy that site 1, the upstream 'control' site, recorded the lowest results for all three macroinvertebrate indices, and that all three metrics were the lowest recorded to date at this site. Given that the lowest results were recorded upstream of the Production Station discharges, it is likely that the poor results can be attributed to agricultural impacts, and exacerbated by the low flow conditions at the time of the survey. This survey provides no evidence that discharges of stormwater and treated production water from the Turangi Production Station have had any recent significant detrimental effects on the macroinvertebrate communities of this unnamed tributary of the Parahaki Stream.

## Summary

A macroinvertebrate survey was carried out at three sites in an unnamed tributary of the Parahaki Stream near the Turangi Production Station, to determine if discharges from the Production Station had detrimental effects on the stream macroinvertebrate communities.

The unnamed tributary of the Parahaki Stream recorded low taxa richnesses, which were the lowest recorded to date at sites 1 and 2, and equal to the lowest recorded to date at site 3. MCI and SQMCI<sub>s</sub> scores were very low, with site 1 having 'very poor' and sites 2 and 3 having 'poor' macroinvertebrate community health. The MCI score at site 1 was the lowest recorded to date, and scores at sites 1 and 2 were significantly lower than historical medians. SQMCI<sub>s</sub> scores the lowest or equal to the lowest recorded to date at all three sites, but were not significantly different from median scores. The observed results indicate that while the biological health of this unnamed tributary of the Parahaki Stream is poor, there is no evidence that discharges from the Turangi Production Station have had any recent significant detrimental effects on the macroinvertebrate communities of this stream.

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## Appendix III

### Air monitoring report



**To** Job Manager, Callum MacKenzie  
**From** Environmental Scientist - Air Quality, Brian Cheyne  
**Document** 2102062  
**Date** August 13, 2018

## Ambient Gas (PM10, NO<sub>x</sub>, CO and LEL) Monitoring at Turangi Production Stations during 2017-2018 monitoring year

### Introduction

In January and March 2018 as part of the compliance monitoring programme for the Turangi production station, a survey of ambient air quality sampling was carried out by the Taranaki Regional Council (the Council) in the vicinity of the plant. The main objectives were to measure:

- The concentrations of PM10 using a portable data logging TSI 'DustTrak';
- To measure the concentrations of the nitrogen oxides (NO<sub>x</sub>) using a passive sampling method, that gives a result for average exposure;
- And to measure carbon monoxide (CO) using a portable multi gas meter that provides instantaneous data throughout the monitoring period.

The findings of this study are presented in this memorandum, together with the locations of the monitoring sites which are provided in Figure 1.

### Carbon monoxide (CO) and Lower explosive limit (LEL)

During the monitoring year, a multi-gas meter was deployed on one occasion in the vicinity of the plant. The deployment lasted approximately 11 hours, with the instrument placed in a down-wind position at the start of the deployment. Monitoring consisted of continuous measurements of gas concentrations for the gases of interest (carbon monoxide and combustible gases).

Because of the nature of the activities on the site, it was considered that the primary information of interest in respect of gases potentially emitted from the site was the average downwind concentration, rather than any instantaneous peak value. That is, the long-term exposure levels, rather than short-term maxima, are of most interest. The gas meter was therefore set up to create a data set based on recording the average concentration measured during each minute as raw data.



Figure 1 Air monitoring sites at Turangi production station (2017-2018)

The details of the sample run are summarised in Table 1 and the data from the sample run are presented graphically in Figure 2.

The consents covering air discharges from the Turangi production station have specific limits related to particular gases. Special condition 18 of consent 6497-1 set a limit on the carbon monoxide concentration at or beyond the production station's boundary. The limit is expressed as  $10 \text{ mg/m}^3$  for an eight hour average or  $30 \text{ mg/m}^3$  for a one hour average exposure. The maximum concentration of carbon monoxide found during the monitoring run was  $3.8 \text{ mg/m}^3$  with average concentration for the entire dataset was only  $0.12 \text{ mg/m}^3$  which comply with consent conditions. This is in line with the pattern found in previous years.

Table 1 Results of carbon monoxide and LEL monitoring at Turangi production station

Period (from-to)		20/03/2018 14:36 to 21/03/2018 00:53
Max	CO(ppm)	3.30
	LEL(%)	0.10
Mean	CO(ppm)	0.10
	LEL(%)	0.00
Min	CO(ppm)	0.00
	LEL(%)	0.00

- Note:
- (1) the instrument records in units of ppm. At  $25^\circ\text{C}$ , 1 atm.  
 $1\text{ppm CO} = 1.145 \text{ mg/m}^3$
  - (2) See text for explanation of LEL. Because the LEL of methane is equivalent to a mixture of approximately 5% methane in air, then the actual concentration of methane in air can be obtained by dividing the percentage LEL by 20.

LEL gives the percentage of the lower explosive limit, expressed as methane that is detected in the air sampled. The sensor on the instrument reacts to gases and vapours such as acetone, benzene, butane, methane, propane, carbon monoxide, ethanol, and higher alkanes and alkenes, with varying degrees of



sensitivity. The Council's Regional Air Quality Plan has a typical requirement that no discharge shall result in dangerous levels of airborne contaminants, including any risk of explosion. At no time did the level of explosive gases downwind of the Turangi production station reach any more than a trivial level.

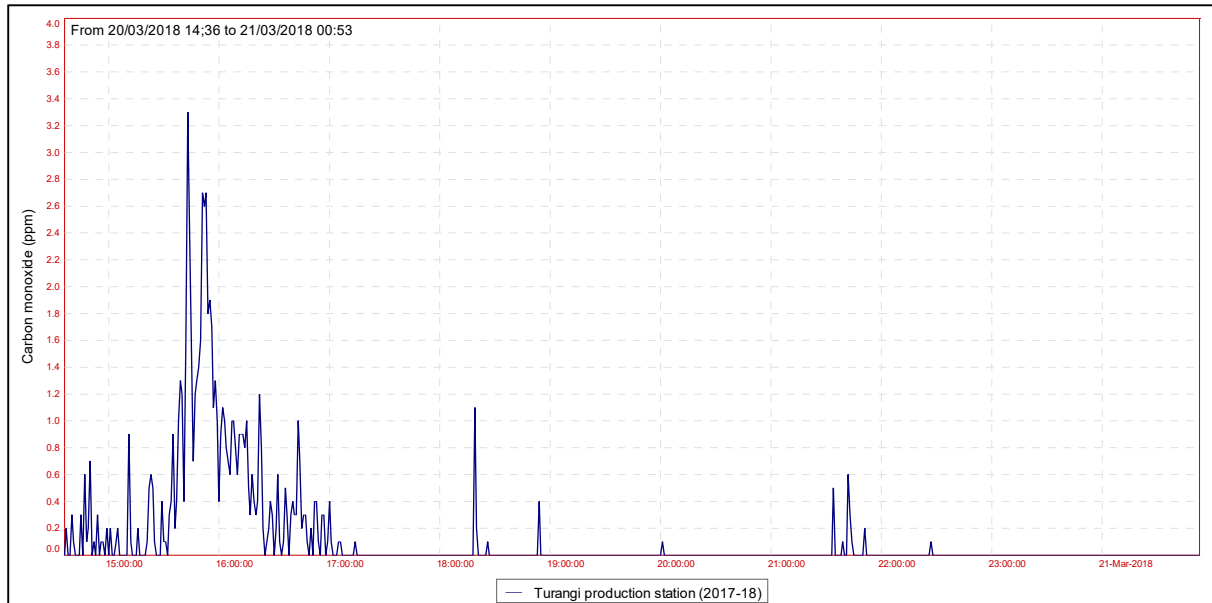


Figure 2 Graph of ambient CO levels in the vicinity of the Turangi Production Station (2016-17)

## PM10

In September 2004 the Ministry for the Environment made public National Environmental Standards (NESs) relating to certain air pollutants. The NES for PM10 is  $50 \mu\text{g}/\text{m}^3$  (24-hour average).

Particulates can be derived from many sources, including motor vehicles (particularly diesel), solid and oil-burning processes for industry and power generation, incineration and waste burning, photochemical processes, and natural sources such as pollen, abrasion, and sea spray.

PM10 particles are linked to adverse health effects that arise primarily from the ability of particles of this size to penetrate the defences of the human body and enter deep into the lungs significantly reducing the exchange of gases across the lung walls. Health effects from inhaling PM10 include increased mortality and the aggravation of existing respiratory and cardiovascular conditions such as asthma and chronic pulmonary diseases.

During the reporting period, a "DustTrak" PM10 monitor was deployed on one occasion in the vicinity of the Turangi production station. The deployment lasted approximately 49 hours, with the instrument placed in a down-wind position at the start of the deployment. Monitoring consisted of continual measurements of PM10 concentrations. The location of the "DustTrak" monitor during the sampling run is shown in Figure 1.

The details of the sample run are presented in Figure 3 and Table 2.



Figure 2 PM10 concentrations ( $\mu\text{g}/\text{m}^3$ ) at the Turangi production station (2017-18)

Table 1 Daily mean of PM10 results during two days' monitoring at Turangi production station

	(49 hours) (20-22/03/2018)	
24 hr. set	Day 1	Day 2
Daily average	9.3 $\mu\text{g}/\text{m}^3$	16.8 $\mu\text{g}/\text{m}^3$
NES	50 $\mu\text{g}/\text{m}^3$	

During the 49-hour run, from 20<sup>th</sup> of March to 22<sup>nd</sup> of March 2018, the average recorded PM<sub>10</sub> concentration for the first 24 hour period was 9.3 $\mu\text{g}/\text{m}^3$  and 16.8 $\mu\text{g}/\text{m}^3$  for the second 24 hour period. These daily means equate to 19% and 34%, respectively, of the 50  $\mu\text{g}/\text{m}^3$  value that is set by the National Environmental Standard.

Background levels of PM<sub>10</sub> in the region have been found to be typically around 11 $\mu\text{g}/\text{m}^3$ .

## Nitrogen oxides (NOx)

From 2014 onwards, the Council has implemented a coordinated region-wide compliance monitoring programme to measure NOx. The programme involves deploying all measuring devices at 24 NOx monitoring sites (including two sites in the vicinity of the Turangi production station) on the same day, with retrieval three weeks later. This approach assists the Council in further evaluating the effects of local and regional emission sources and ambient air quality in the region.

The complete report covering region-wide NOx monitoring is attached in the Appendix to this memorandum (TRC #2089257).

The consents covering air discharges from the Turangi production station have specific limits related to particular gases. Special condition 19 of consent 6497-1 set a limit on the nitrogen dioxide concentration at or beyond the production station's boundary. The limit is expressed as 100  $\mu\text{g}/\text{m}^3$  for a 24 hour average or 200  $\mu\text{g}/\text{m}^3$  for a one hour average exposure.

NOx passive adsorption discs were placed at two locations in the vicinity of the Turangi production station on one occasion during the year under review. The discs were left in place for a period of 21 days.

The calculated 1-hour and 24-hour theoretical maximum NO<sub>x</sub> concentrations found at the Turangi production station during the year under review equates to 12.2 µg/m<sup>3</sup> and 6.5 µg/m<sup>3</sup> respectively. The results show that the ambient ground level concentration of NO<sub>x</sub> is well below the limits set out by consent 6497-1.