

Westside New Zealand Limited
Deep Well Injection
Monitoring Programme
Annual Report
2017-2018

Technical Report 2018-80

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Executive summary

Westside New Zealand Limited (the Company) currently operates the Manutahi, Rimu, Kauri and Pohutukawa wellsites located between Hawera and Patea in South Taranaki. Each wellsite contains varying numbers of producing wells and associated production infrastructure. This report for the period July 2017 to June 2018 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) in relation to the Company's deep well injection (DWI) activities. The report details the results of the monitoring undertaken, assesses the Company's environmental performance during the period under review and the environmental effects of their DWI activities.

The Company held three resource consent for DWI activities during the review period, which included a total of 45 conditions setting out the requirements that the Company must satisfy. Only one of the consents was exercised over the period under review, Consent 7905-1 which authorised injection at the Manutahi-D wellsite.

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

The Council's monitoring programme for the year under review included an annual inspection, two injectate samples, and three groundwater samples collected for physicochemical analysis. The monitoring programme also included a significant data review component, with all injection data submitted by the company assessed for compliance on receipt.

The monitoring showed that the Company's DWI activities were being carried out in compliance with the conditions of the applicable resource consent. There is no evidence of any issues with any injection well currently in use, or the ability of the receiving formation to accept injected fluids. The results of groundwater quality monitoring undertaken show no adverse effects of the activity at monitored locations. Inspections undertaken during the monitoring year found the site being operated in a professional manner and there were no Unauthorised Incidents in relation to the Company's DWI consents.

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

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 Company over the last two years, this report shows that the Company's performance continues at a generally high level.

This report includes recommendations to be implemented during the 2018–2019 monitoring period.

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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 Westside New Zealand Limited (the Company) for deep well injection (DWI) activities. During the period under review, the Company held three resource consents for the subsurface injection of fluids by DWI. The consents authorise discharges from two separate wellsites within the Company's oil and gas fields; the Manutahi-B and Manutahi-D wellsites, located at the end of Lower Ball Road in South Taranaki. The resource consents held by the Company permit the discharge of a range of fluids by DWI, including heated water and produced water. The consents include a number of special conditions which set out specific requirements the Company must satisfy.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the DWI consents held by the Company. This is the second report to be prepared by the Council to cover the Company's DWI discharges and their effects.

Prior to November 2016 consent 7905-1 was held by Origin Energy Resources Limited (Origin) and any information covering the period prior to the 2016-2017 monitoring year can be found in previous compliance reports published by the Council covering Origin's DWI activities.

1.1.2 Structure of this report

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

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

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 Resource Management Act 1991 (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

The process of DWI involves injecting fluids deep underground into geological formations which are confined from overlying groundwater aquifers by low permeability strata. Injection wells are also designed and constructed to provide multi barrier protection against contaminant migration to groundwater systems.

The subsurface injection of fluids by DWI is often used as a method for disposing of waste fluids generated during oil and gas exploration and production activities. The greatest volume of waste fluids generated through these activities is saline water (brine) that is drawn to the surface with hydrocarbons through producing wells ('produced water'). In addition to providing a means to dispose of waste fluids, the subsurface injection of fluids by DWI is also an established oilfield technique for regulating reservoir pressure as a means of enhancing the rate of hydrocarbon recovery from a reservoir. This process, commonly referred to as water flooding, is often implemented when natural reservoir pressures become reduced due to ongoing production. Fluids can also be heated prior to injection to reduce the viscosity of the oil being produced, improving its flow toward a producing well and upward through the wellbore itself.

The DWI consents currently held by the Company authorise the injection of heated produced water, for the purpose of water flooding, to enhance oil and gas production, within the Kauri and Manutahi reservoirs.

A schematic representation of injection wells for both waste discharge and enhanced oil recovery is presented in Figure 1.

Further details regarding hydrocarbon exploration and production in Taranaki, the DWI process and its history within region can be found in previous compliance reports published by the Council (see Bibliography).

1.3 Resource consents

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

The Company held three discharge consents, summarised in the table below, covering their DWI activities during the review period. One of the three consents was exercised during the 2017-2018 monitoring year (Table 1).

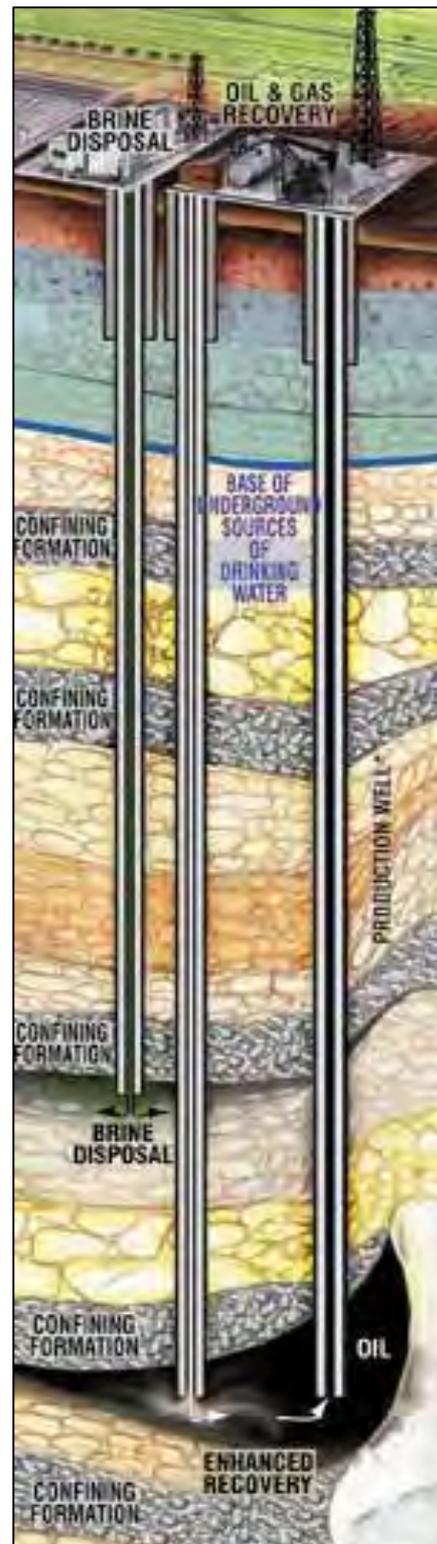


Figure 1 DWI schematic
(www.epa.gov/uic)

Table 1 Consents held by the Company during the review period

Consent number	Wellsite	Status	Injection well(s)	TRC bore id.	Formation	Issued	Expiry
7905-1	Manutahi-D	Active	D2H	GND2307	Manutahi	16/09/2011	01/06/2028
			D4HST1	GND2309			
10546-1	Manutahi-B	Not exercised	Manutahi-B2	GND3017	Manutahi	29/03/2018	01/06/2034
10575-1							

Consent **7905-1** was issued by the Council on 16 September 2011 under Section 87(e) of the RMA. It is due to expire on 1 June 2028. The consent authorises the discharge of fluids for water flooding purposes at the Manutahi-D wellsite. A water flood trial was initially carried out in September 2011, which resulted in the injection of 113 m³ of heated fluids into the Manutahi Formation. The water flooding programme commenced in August 2012. The consent was transferred to the Company on 1 November 2016.

The consent has 11 special conditions, as summarised below:

Condition 1 states that prior to exercising the consent, the consent holder shall submit an updated Injection Operation Management Plan;

Condition 2 refers to the injection well and receiving formation information requirements;

Condition 3 limits the injection pressure;

Condition 4 limits the volume of waste that can be injected;

Condition 5 requires the consent holder to adopt best practicable option;

Conditions 6 and 7 relate to the monitoring of injected wastes and provision of data;

Condition 8 requires the consent holder to notify the Council prior to the first exercising of the consent;

Condition 9 prohibits the discharge from endangering or contaminating any freshwater aquifer;

Condition 10 is a lapse clause; and

Condition 11 is a review provision.

Consent **10546-1** was issued by the Council on 29 March 2018 under Section 87(e) of the RMA. It is due to expire on 1 June 2034. The consent authorises the discharge of produced water, into the Manutahi formation, for water flooding purposes at the Manutahi-B wellsite (Figure 2).

The consent has 17 special conditions, as summarised below:

Condition 1 requires the consent holder to submit an Injection Operation Management Plan prior to exercising the consent;

Condition 2 refers to injection well and subsurface information required for submission;

Condition 3 stipulates that there shall be no injection after 1 June 2029;

Condition 4 requires the best practicable option to be adopted for fluid injection;

Condition 5 limits the injection of fluids to the Mount Messenger Formation, below 1,075 m TVD_{bgl};

Condition 6 prohibits the discharge resulting in fracturing of the geological seals confining the injection zone;

Condition 7 prohibits the discharge from resulting in any contaminants reaching any useable freshwater resources;

Condition 8 limits the type and source of fluids for discharge;

Conditions 9, 10, 11 and 12 refer to process monitoring and data submission requirements;

Conditions 13, 14 and 15 refer to local groundwater quality monitoring requirements;
Condition 16 stipulates the annual reporting requirements; and
Condition 17 is a review condition.

Consent **10575-1** was issued by the Council on 29 March 2018 under Section 87(e) of the RMA. It is due to expire on 1 June 2034. The consent authorises the discharge of produced water into the Manutahi formation, in the coastal marine area, for water flooding purposes at the Manutahi-B wellsite (Figure 2).

The consent has 17 special conditions, as summarised below:

Condition 1 requires the consent holder to submit a Injection Operation Management Plan prior to exercising the consent;

Condition 2 refers to injection well and subsurface information required for submission;

Condition 3 stipulates that there shall be no injection after 1 June 2029;

Condition 4 requires the best practicable option to be adopted for fluid injection;

Condition 5 limits the injection of fluids to the Mount Messenger Formation, below 1,075 m TVDbgl;

Condition 6 prohibits the discharge resulting in fracturing of the geological seals confining the injection zone;

Condition 7 prohibits the discharge from resulting in any contaminants reaching any useable freshwater resources;

Condition 8 limits the type and source of fluids for discharge;

Conditions 9, 10, 11 and 12 refer to process monitoring and data submission requirements;

Conditions 13, 14 and 15 refer to local groundwater quality monitoring requirements;

Condition 16 stipulates the annual reporting requirements; and

Condition 17 is a review condition.

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 consent(s) which are appended to this report (Appendix I).

Figure 2 shows the location of the DWI consents held by the Company during the period under review.

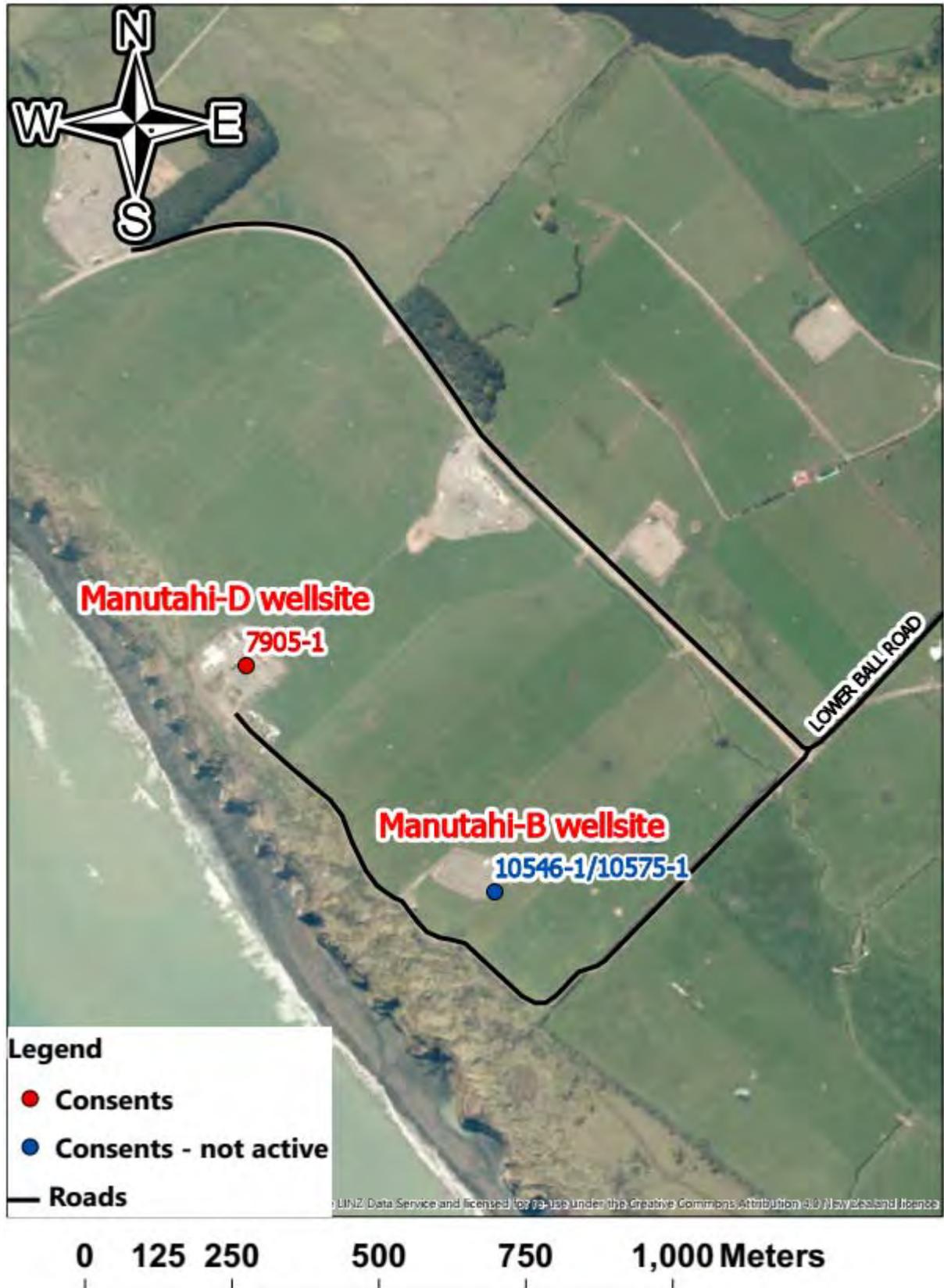


Figure 2 Location of the DWI consents held by the Company during the period under review

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 Company's DWI sites consisted of five primary components.

1.4.2 Programme liaison and management

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

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- 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 Company's Manutahi wellsites were visited once during the monitoring period. With regard to consents for DWI activities, the main points of interest are general housekeeping and any processes with potential or actual discharges, including any surface water runoff, and their receiving environments.

The inspections included undertaking a general visual assessment of the operational equipment, storage facilities and associated equipment.

An additional two visits to the Company's Manutahi-D wellsite was also undertaken by Council Officers for injectate sampling purposes, as outlined in Section 1.4.4.

1.4.4 Injectate sampling

Injectate samples were obtained for analysis in the Council's IANZ accredited laboratory on two occasions from the Manutahi-D wellsite during the monitoring period. The sampling of injectate is carried out in order to characterise the general chemical nature of the discharge and also the variation in its chemical composition across the monitoring period.

Injectate samples were collected from the bulk storage tanks at Manutahi-D, identified on-site as tank T-041 (Figure 3). The injectate samples were analysed for the following parameters:

- pH;
- conductivity;
- suspended solids;
- chlorides; and
- total petroleum hydrocarbons.

1.4.5 Groundwater sampling

Groundwater samples were also obtained on three occasions during the monitoring period. Twice from GND2372 and once from GND2824. This sampling is a continuation of the groundwater monitoring component of this programme which was initiated during the 2012-2013 monitoring period, when consent 7905-1 was held by Origin.

Details of the groundwater monitoring sites included in the monitoring programme are summarised below in Table 2. The location of the groundwater sites in relation to the wellsites being monitored is illustrated in Figure 3. GND2824 was recently installed by the Company and replaces GND2372 as the sole groundwater monitoring bore for the Manutahi B and Manutahi-D wellsites. GND2372 was removed from the programme, following burial of the bore by migrating sand dunes. The bore has now been recovered and will remain as a back-up to GND2824, which was specifically installed to enable monitoring of both wellsites.

Table 2 Location of groundwater monitoring sites

Site code	Wellsite	Distance from wellsite (m)	Screened (m)	Total depth (m)	Groundwater level (m bmp)	Aquifer	Sample method
GND2372	Manutahi-D	71	15.0-25.0	25.0	7.0	Volcanics	Bladder pump
GND2824	Manutahi-B Manutahi-D	<200 <200	19.0-25.0	25.0	18.0	Volcanics	Bladder Pump

Note: m bmp- metres below measuring point

Groundwater samples taken by the Council were either analysed in the Councils IANZ accredited laboratory or sent on behalf of the Company to Hill Laboratories Limited (Hills) and analysed for a range of parameters including the following:

- pH;
- conductivity;
- chlorides; and
- total petroleum hydrocarbons.

The parameters above are deemed sufficient to enable identification of any significant changes in groundwater quality related to DWI activities.

In addition, baseline samples have been collected from all monitored sites and analysed by Hills for general ion chemistry, BTEX and dissolved gas concentrations. These more detailed analyses will allow a more in depth assessment of variations in groundwater composition should the need arise in the future.

1.4.6 Assessment of data submitted by the Company

A significant component of the monitoring programme is the assessment of consent holder submitted data. The Company is required to submit a wide range of data under the conditions of their DWI consents.

As required by the conditions of each consent, the Company has submitted an Injection Operation Management Plan for each active injection well. The plans are required to include the operational details of the injection activities and to identify the conditions that would trigger concerns about the integrity of the injection well, the receiving formation or overlying geological seals. The plans are also required to detail the action(s) to be taken by the consent holder if trigger conditions are reached. The Company was also required to submit well construction details, an assessment of the local geological environment, results of well integrity testing and details of the proposed monitoring plan for the injection well.

The Company is also required to maintain continuous records of injection volumes and average and maximum injection pressures, and to characterise the chemical characteristics of all waste types being discharged. This data is submitted to the Council on a monthly basis where it is assessed for compliance against the relevant consent conditions.



Figure 3 Location of monitoring sites in relation to the Company's DWI wellsites

2 Results

2.1 Inspections

The routine inspections undertaken at each active wellsite during the monitoring year, included undertaking a general visual assessment of the operational equipment, storage facilities and associated equipment. The inspecting officer concluded that the wellsites were in good condition and being well managed.

Additional inspections were also undertaken during the monitoring year, for the purpose of injectate sampling. No issues were noted by staff during these visits.

2.2 Injectate monitoring

Samples of injectate were obtained from the Company's storage tank at the Manutahi-D wellsite on 4 October 2017 and 27 April 2018. The samples were submitted to the Council's laboratory on the same day for physicochemical analysis. Injectate samples are generally a composite of waste water from the Company's wellsites, third party wellsites and other production facilities.

The results of the sample analyses are included below in Table 3. The range of results for each analyte since 2012 is also presented for comparison. The Company also undertakes additional injectate sampling, generally on a monthly basis. The results from the Company's sampling programme are presented in Table 4. The range in analyte concentrations over the period indicate that fluid composition can change significantly from month to month. If fluids are found to be acidic (<6.5 pH) they are treated, to be pH neutral prior to injection, to ensure the integrity of the well is maintained.

The concentrations of each analyte measured over the 2017-2018 period are within the expected range for injectate samples at these sites.

Table 3 Results of injectate sampling undertaken by the Council at Manutahi-D (2017-2018)

Parameter	Unit	Manutahi-D Tank T041			
		Minimum	Maximum	Tank T041	
Date		Jul-2012 to Jun 2018		04-Oct-17	27-Apr-18
Time	NZST	-	-	8:45	9:30
TRC sample number	-	-	-	TRC173434	TRC182074
pH	pH Units	6.9	8.0	7.2	7.0
Electrical conductivity	mS/m	145	2,530	2,060	2,530
Chloride	g/m ³	349	9,790	8,300	9,790
Total petroleum hydrocarbons	g/m ³	1	780	120	15

Table 4 Results of the Company's monthly injectate sampling (2017-2018)

Parameter	Unit	Manutahi-D		
		Minimum	Maximum	Mean
Date	-	Jun-2017 to May-2018		
pH	pH Units	6.4	7.3	7.0
Electrical conductivity	mS/m	232	301	262
Chloride	g/m ³	6,753	10,486	8,471
Temperature	Deg°C	16.3	25.0	21.0
Suspended solids	g/m ³	33	405	113
Salinity	TDS g/m ³	13.9	21.4	16.1
Total petroleum hydrocarbons	g/m ³	13	454	106

2.3 Groundwater sampling

Groundwater samples were obtained on two occasions during the monitoring period from GND2372 and on one occasion from GND2848.

The groundwater samples were collected following standard groundwater sampling methodologies and generally in accordance with the National Protocol for State of the Environment Groundwater sampling in New Zealand (2006). The sampling carried out at both bores was undertaken using a bladder pump, following a low flow methodology. The sample collected at GND2824 was analysed for a comprehensive suite of analytes, to provide a baseline dataset prior to injection being undertaken at the Manutahi-B wellsite.

The results of the analyses are set out below in Table 5 and Table 6.

The results show there have been no significant changes in groundwater composition at the site since monitoring commenced. This is demonstrated by the relatively narrow ranges between minimum and maximum analyte concentrations recorded. The subtle variation in analyte concentrations at the site are a result of natural seasonal fluctuation and sampling variability. All results are within the ranges expected for Taranaki groundwater.

Table 5 Results of groundwater sampling undertaken by the Council GND2372 (2013-2018)

Sample details	Units	GND2372			
		Minimum	Maximum	-	-
Date	-	Jul-2013 to Jun-2018		04-Oct-17	24-May-18
Time	NZST	-	-	11:25	12:15
TRC sample number	-	-	-	TRC173435	TRC182077
pH	pH units	7.1	7.6	7.3	7.4
Electrical conductivity	mS/m	44.8	52.5	45.7	51.2
Chloride	g/m ³	62.6	75.0	64.7	65.0
Total petroleum hydrocarbons	g/m ³	<0.5	0.7	<0.5	<0.7

Table 6 Results of baseline sampling undertaken by the Council GND2824 (2017-2018)

Sample details	Units	GND2824			
Date	-	05-Jul-18			
Time	NZST	12:00			
TRC sample number	-	TRC182805			
pH	pH units	7.3	Dissolved iron	g/m ³	0.03
Electrical conductivity	mS/m	44.4	Dissolved manganese	g/m ³	0.5
Bicarbonate	g/m ³ at 25°C	140	Dissolved mercury	g/m ³	< 0.00008
Total alkalinity	g/m ³ as CaCO ₃	115	Dissolved nickel	g/m ³	0.0013
Total hardness	g/m ³ as CaCO ₃	140	Dissolved zinc	g/m ³	0.0061
Dissolved barium	g/m ³	0.012	Methane	g/m ³	0.1
Bromide	g/m ³	0.2	Ethane	g/m ³	< 0.003
Dissolved calcium	g/m ³	32	Benzene	g/m ³	< 0.0010
Chloride	g/m ³	56	Ethylbenzene	g/m ³	< 0.0010
Dissolved magnesium	g/m ³	14.7	Ethylene	g/m ³	< 0.004
Nitrate-N	g/m ³	0.5	Toluene	g/m ³	< 0.0010
Nitrate-N + nitrite-N	g/m ³	0.5	m&p-xylene	g/m ³	< 0.002
Nitrite-N	g/m ³	0.0	o-xylene	g/m ³	< 0.0010

Sample details	Units	GND2824			
Date	-	05-Jul-18			
Time	NZST	12:00			
TRC sample number	-	TRC182805			
Dissolved potassium	g/m ³	4.1	C10 - C14	g/m ³	< 0.2
Dissolved sodium	g/m ³	35	C15 - C36	g/m ³	< 0.4
Sulphate	g/m ³	7.7	C7 - C9	g/m ³	< 0.06
Dissolved copper	g/m ³	0.0006	Total petroleum hydrocarbons	g/m ³	< 0.7

2.3.1 Provision of consent holder data

The Company provided records of their injection activities during the 2017-2018 monitoring period, including daily injection volumes, pumping duration and maximum and average injection pressures. All data, with the exception of the annual injectate quality results, was provided within the consented timeframes.

The data presented below in Table 7 to Table 9 shows that the Company conducted their injection operations within all consented injection limits during the period being reported, with the exception of some minor exceedances discussed below.

Several minor exceedances (≤ 0.2 bar) in the maximum pressure limit did occur during the monitoring period. The exceedances all occur at the moment the pump is switched on. Following the initial peak, pressures drop back down to well below the pressure limit of 50 bar. Following discussions with the company regarding the minor exceedances, an application will be made to vary consent 7905-1. Variation will result in the replacement of a number of outdated conditions, including those that limit volumes and pressure to prescriptive values. Once updated, minor exceedances like those discussed above will no longer result in a non-compliance.

The injection data is also presented graphically in Figure 4 to Figure 9 and illustrates that injection operations were generally undertaken within consented limits. The majority of fluid (73%) was discharged via the D4HST2 well during the review period. No injection was undertaken under consent 10546-1 and 10575-1.

The volume of fluid requiring disposal, and the average maximum rates it was injected were higher during the monitoring period than in previous years. The graphical data indicates these increases are a result of more sustained periods of injection than in previous years. The increased volumes and pressures are likely linked to an increase in the volume of produced fluids requiring disposal as the reservoirs mature, and the success of the water flood programme.

Table 7 Summary of injection activity during the 2017-2018 monitoring year

Consent	Wellsite	Injection wells	Total volume discharged (m ³) 01-Jul-17 – 30-Jun-18	Discharge period		TRC well ID
				From	To	
7905-1	Manutahi-D	D2H	8,455.77	01-Jul-17	30-Jun-18	GND2307
		D4HST2	22,712.17	01-Jul-17	30-Jun-18	GND2309
10546-1	Manutahi-B	Manutahi-B2	-	Not exercised	Not exercised	GND3017
10575-1						
Total			31,167.94	-	-	-

Table 8 Summary of historical injection volumes 2009-2018 under Consent 7905-1

Period*	Total volume discharged (m ³)
2017-2018	31,168
2016-2017	12,164
2015-2016	19,276
2014-2015	11,310
2013-2014	20,827
2012-2013	23,677
2009-2012	113 (water flood trial)

Note *Prior to November 2016 consent 7905-1 was held by Origin.

Table 9 Summary of the injection activity under consent 7905-1 (2012-2018)

Deep well injection undertaken at Manutahi-D wellsite				
Year	Annual volume (m ³)	Max. injection volume* (m ³ /day)	Max. injection pressure (bar)	Avg. injection pressure D2H/D4HST2 (bar)
Consent limits	-	318	50	-
2017-2018	31,168	177	50	33/38
2016-2017	12,164	116	45	26/26
2015-2016	19,276	198	39	23/22
2014-2015	11,310	133	39	17/17
2013-2014	20,827	146	40	31/31
2012-2013	23,677	144	41	21/17

Note* The maximum injection rate is the same as maximum injection volume at this site as rate is reported in volumes per day

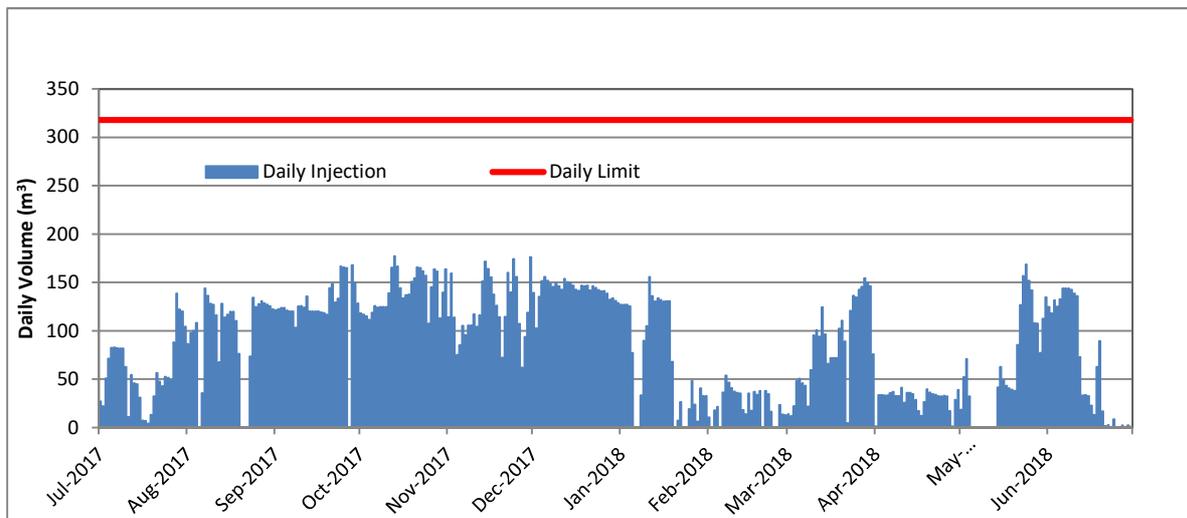


Figure 4 Daily injection volume consent 7905-1 (2017-2018)

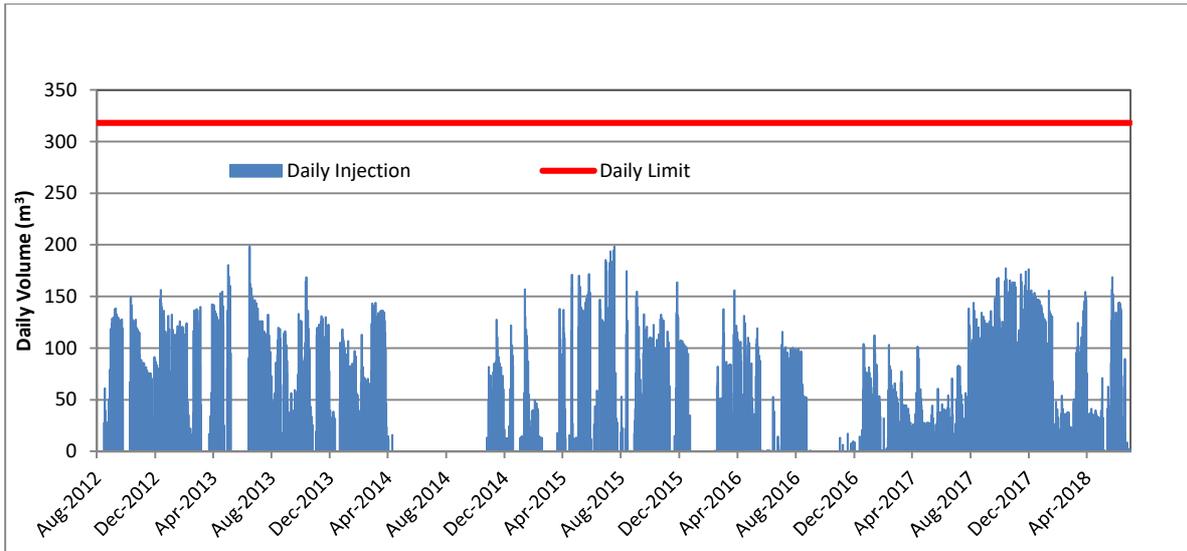


Figure 5 Daily cumulative injection volume consent 7905-1 (2012-2018)

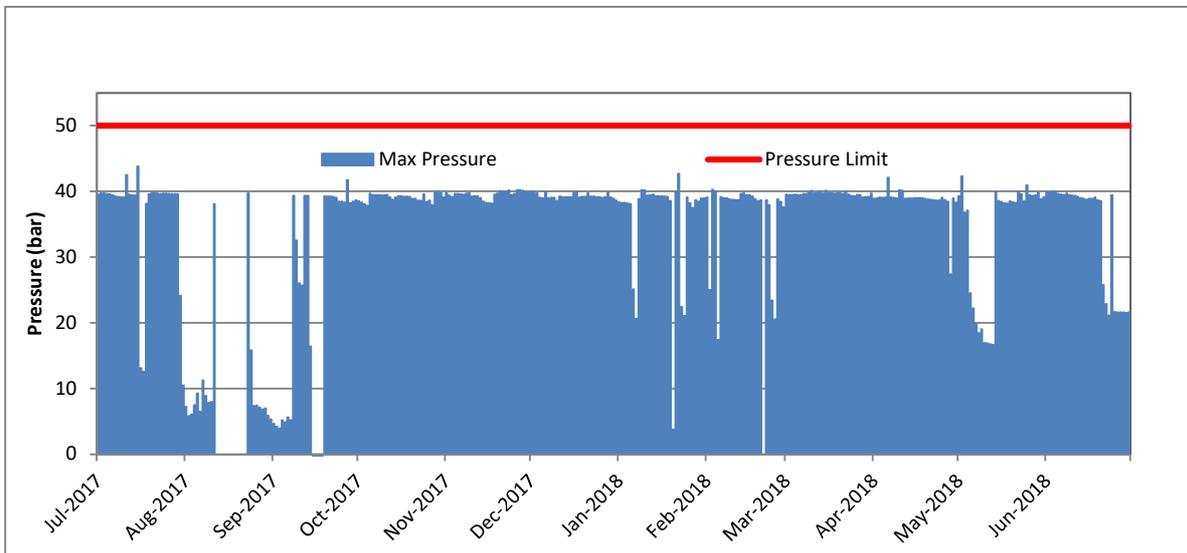


Figure 6 Daily maximum injection pressure consent (D2H well) 7905-1 (2012-2018)

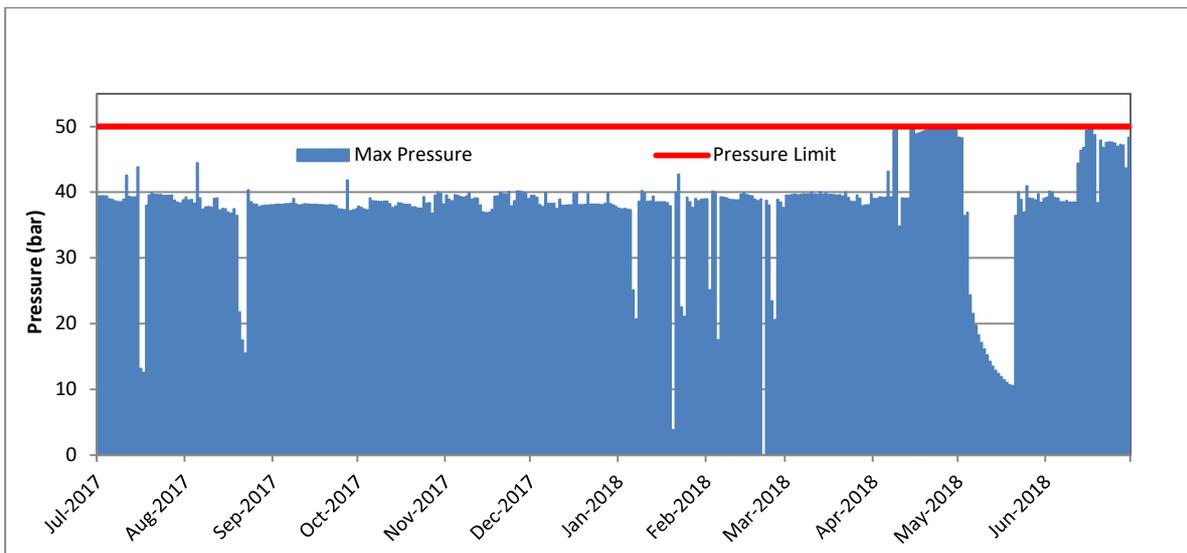


Figure 7 Daily maximum injection pressure (D4HST2 well) 7905-1 (2012-2018)

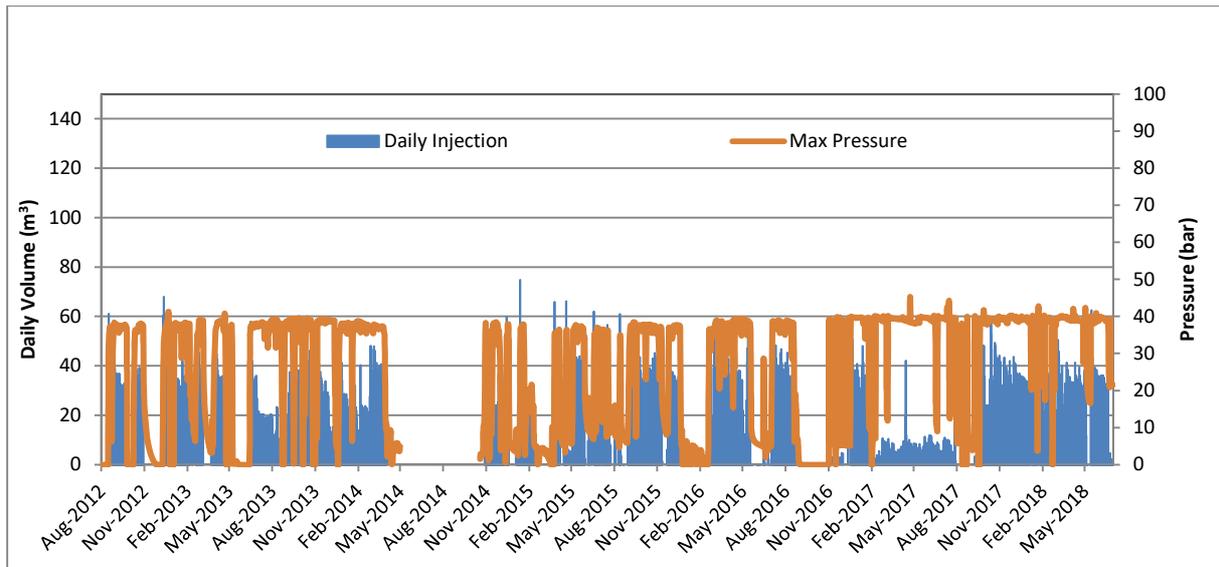


Figure 8 Daily volume and maximum injection pressure (D2H well) 7905-1 (2012-2018)

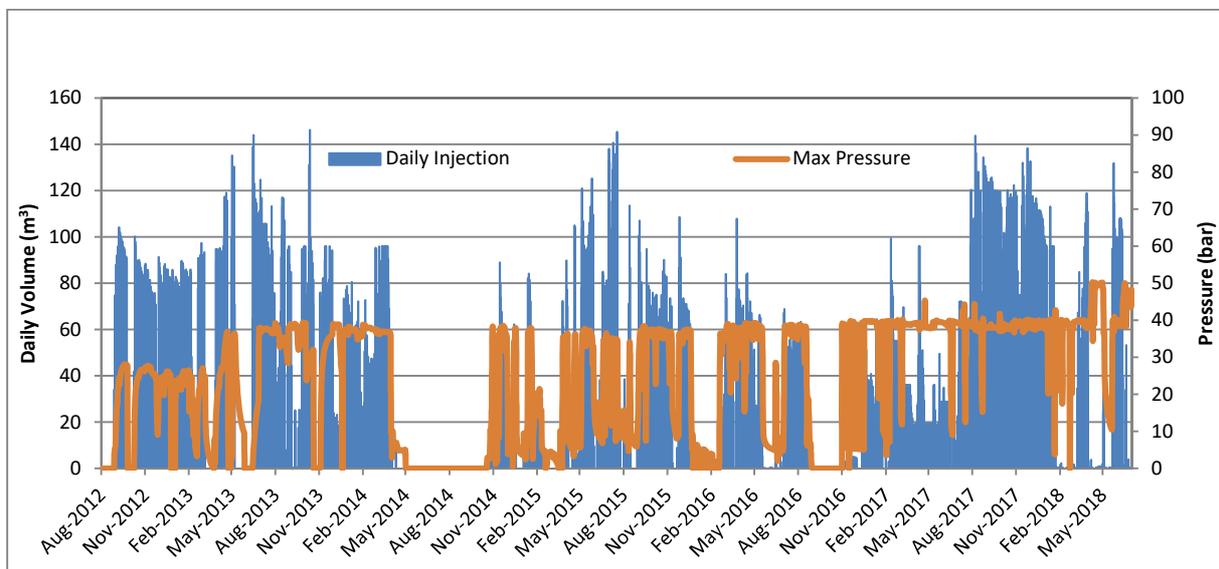


Figure 9 Daily volume and maximum injection pressure (D4HST well) 7905-1 (2012-2018)

2.4 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.

During the monitoring period some minor non-compliances in pressure were recorded. The non-compliances were not considered significant and after discussions with the consent holder, an application to vary the consent will be made. No further actions were deemed necessary.

3 Discussion

3.1 Discussion of site performance

During the period under review, the Company exercised one resource consent for the injection of fluids by DWI (7905-1). The consent authorises the injection of heated fluids into the Manutahi Formation. Injection into the Formation is via the D2H and D4HST2 injection wells. Consents 10456-1 and 10575-1 to enable DWI at the Manutahi-B wellsite were granted during the review period and are yet to be exercised.

The injection wells are fitted with engineering controls and in built safety systems to protect against any process or subsurface related failures. In the event of any sudden pressure losses or increases, safety systems isolate the well and shut down the injectate pumping system. It should also be noted that maximum pressure that can be generated by the injectate pumps is well below the safe operating pressures of the wellhead, casing and tubing.

The operation of the injection well is monitored by Company staff, with automated systems recording the injection data required under the conditions of their consent. Throughout the monitoring period, with the exception of the annual injectate sampling results, data was submitted to the Council at the specified frequency.

A review of the 2017-2018 injection data provided by the Company shows that:

- 31,167.94 m³ of fluid was injected under consent 7905-1;
- The majority (22,712.17 m³) of fluid was injected via the D4HST2 injection well;
- The remaining 8,455.77 m³ was discharged via the D2H well;
- The maximum daily volume injected was 177.23 m³, which occurred on 13 October 2017; and
- The maximum injection pressure of 50.2 bar was recorded on 15 April 2018 in the D4HST2 injection well.

Both the daily injection volumes and maximum injection pressures recorded were within the respective limits of 318 m³/day and 50 bar, with some minor exceptions, where pressure were recorded up to 50.2 bar at the moment the pump engaged.

An assessment of the historical injection data record of consent 7905-1 (2012-2018) shows annual volumes fluctuate from year to year. As the site is used for water flooding purposes, injection is undertaken in response to the requirements of the programme, designed to enhance production within the oil and gas reservoirs.

Routine inspections of the Company's Manutahi-D wellsite conducted during the period under review found the site to be in good condition and being well managed. The Council was not required to enter any incidents in relation to the exercising of the Company's DWI consents during the review period, nor were any complaints received from the public in relation to these consents.

3.2 Environmental effects of exercise of consents

To date, no adverse environmental effects have been recorded by the Council in relation to any DWI consent exercised by the Company.

The groundwater monitoring component of this programme continued during the period under review, with three samples being taken from two monitoring sites in the vicinity of the Company's active injection wells. The results of the monitoring carried out show that the groundwater composition at each site has remained stable since the commencement of monitoring. Some very minor fluctuations in analyte concentrations are attributable to seasonal variations in water composition and standard sampling variability. There is no

evidence to suggest that injection activities undertaken by the Company during the review period have had any adverse effect on local groundwater quality.

All results are within the ranges expected for shallow Taranaki groundwater and indicate that there has been no contamination by DWI fluids.

Compliance with the conditions of the Company's DWI consents exercised during the 2017-2018 monitoring period is summarised below in Section 3.3.

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 10 to Table 12 and an evaluation of the Company's environmental performance in relation to their DWI activities since 2009 is presented in Table 13.

Table 10 Summary of performance for consent 7905-1

Purpose: To discharge produced water, contaminated stormwater, water based drilling fluids and hydraulic fracturing fluids, including return fluids, by deep well injection into the Matemateaonga Formation		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Consent holder must submit an Injection Operation Management Plan	Receipt of satisfactory Injection Operation Management plan	Yes
2. Provision of well and injection zone information	Receipt of satisfactory information	Yes
3. Injection pressure must not exceed 50 Bar (721 PSI)	Assessment of consent holder records	Some minor exceedances
4. Daily volume of fluid injected must not exceed 318 m ³	Assessment of consent holder records	Yes
5. The consent holder shall at all times adopt the best practicable option	Assessment of consent holder records and site inspection notices	Yes
6. Provision of records for discharge volumes, rates, and pressures	Receipt of well discharge data	Yes
7. Provision of records of chemical analysis of discharge	Receipt of discharge analytical results	Provided late
8. Notification provision	Received five working days prior to consent exercise	Yes
9. No contamination of freshwater aquifers	Assessment of consent holder records	Yes
10. Lapse clause	Receive notice of exercise of consent	Yes
11. Review provision	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		Good

Table 11 Summary of performance for consent 10456-1

Purpose: To discharge produced water for water flooding purposes into land in the Manutahi Formation by dep well injection at the Manutahi-B wellsite		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Before exercising the consent the consent holder shall submit an "Injection Operation Management Plan."	Receipt of satisfactory Injection Operation Management Plan.	Yes
2. Injection well, geological and operational data submission requirements. This information can be included in the "Injection Operation Management Plan."	Receipt of satisfactory information.	Yes
3. No injection permitted after 1 June 2029.	Assessment of injection records and site inspection notices.	N/A
4. The consent holder shall at all times adopt the best practicable option.	Assessment of consent holder records and site inspection notices.	Yes
5. The injection of fluids shall be confined to the Manutahi Formation, deeper than 1,075 metres true vertical depth.	Review of "Water Flooding Operation Management Plan," well construction log and injection data.	Yes
6. The injection of fluids shall not fracture any overlying geological seal.	Review and analysis of injection data.	N/A
7. The consent holder shall ensure that the exercise of this consent does not result in contaminants reaching any useable fresh water (groundwater or surface water).	Assessment of injection records and results of groundwater sampling and analysis programme.	N/A
8. Limits the type and source of discharge	Receipt and assessment of injection data.	N/A
9. Maintain records and undertake analysis to characterise each type of waste arriving on-site for discharge.	Receipt and assessment of injection data.	N/A
10. Maintain full records of injection data.	Receipt and assessment of injection data.	N/A

Purpose: To discharge produced water for water flooding purposes into land in the Manutahi Formation by dep well injection at the Manutahi-B wellsite		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
11. If the analysis required by condition 9c is not carried out in a accredited laboratory sampling shall be undertaken in accordance with a certified Quality Assurance Plan.	Sampling undertaken by the Council, and submitted to an accredited laboratory.	N/A
12. The data required by conditions 9 & 10 above, for each calendar month, is required to be submitted by the 28th day of the following month.	Receipt of satisfactory data by the date specified.	N/A
13. The consent holder shall undertake a programme of sampling and testing (the 'Monitoring Programme') that monitors the effects of the exercise of this consent on fresh water resources.	Monitoring Programme submitted to the Chief Executive, Taranaki Regional Council, for certification.	N/A
14. All groundwater samples taken for monitoring purposes shall be taken in accordance with recognised field procedures and analysed for: <ul style="list-style-type: none"> • pH • conductivity • chloride; and • total petroleum hydrocarbons 	Implementation of Groundwater Monitoring Programme and assessment of results.	N/A
15. All groundwater sampling and analysis shall be undertaken in accordance with a Sampling and Analysis Plan, which shall be submitted to the Chief Executive, Taranaki Regional Council for review and certification before the first sampling is undertaken.	Receipt of Sampling and Analysis Plan prior to first round of sampling being undertaken.	N/A

Purpose: To discharge produced water for water flooding purposes into land in the Manutahi Formation by dep well injection at the Manutahi-B wellsite		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
16. The consent holder shall provide to the Council, before 31 August each year, a summary of all data collected and a report detailing compliance with consent conditions over the previous 1 July to 30 June period.	Receipt of satisfactory report by 31 August each year.	N/A
17. Consent review provision.	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Not exercised
Overall assessment of administrative performance in respect of this consent		Not exercised

Table 12 Summary of performance for consent 10575-1

Purpose: To discharge produced water for water flooding purposes into land in the Manutahi Formation in the coastal marine area by dep well injection at the Manutahi-B wellsite		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Before exercising the consent the consent holder shall submit an "Injection Operation Management Plan."	Receipt of satisfactory Injection Operation Management Plan.	Yes
2. Injection well, geological and operational data submission requirements. This information can be included in the "Injection Operation Management Plan."	Receipt of satisfactory information.	Yes
3. No injection permitted after 1 June 2029.	Assessment of injection records and site inspection notices.	N/A
4. The consent holder shall at all times adopt the best practicable option.	Assessment of consent holder records and site inspection notices.	Yes
5. The injection of fluids shall be confined to the Manutahi Formation, deeper than 1,075 metres true vertical depth.	Review of "Water Flooding Operation Management Plan," well construction log and injection data.	Yes
6. The injection of fluids shall not fracture any overlying geological seal.	Review and analysis of injection data.	N/A

Purpose: To discharge produced water for water flooding purposes into land in the Manutahi Formation in the coastal marine area by dep well injection at the Manutahi-B wellsite		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
7. The consent holder shall ensure that the exercise of this consent does not result in contaminants reaching any useable fresh water (groundwater or surface water).	Assessment of injection records and results of groundwater sampling and analysis programme.	N/A
8. Limits the type and source of discharge	Receipt and assessment of injection data.	N/A
9. Maintain records and undertake analysis to characterise each type of waste arriving on-site for discharge.	Receipt and assessment of injection data.	N/A
10. Maintain full records of injection data.	Receipt and assessment of injection data.	N/A
11. If the analysis required by condition 9c is not carried out in a accredited laboratory sampling shall be undertaken in accordance with a certified Quality Assurance Plan.	Sampling undertaken by the Council, and submitted to an accredited laboratory.	N/A
12. The data required by conditions 9 & 10 above, for each calendar month, is required to be submitted by the 28th day of the following month.	Receipt of satisfactory data by the date specified.	N/A
13. The consent holder shall undertake a programme of sampling and testing (the 'Monitoring Programme') that monitors the effects of the exercise of this consent on fresh water resources.	Monitoring Programme submitted to the Chief Executive, Taranaki Regional Council, for certification.	N/A
14. All groundwater samples taken for monitoring purposes shall be taken in accordance with recognised field procedures and analysed for: <ul style="list-style-type: none"> • pH • conductivity • chloride; and • total petroleum hydrocarbons 	Implementation of Groundwater Monitoring Programme and assessment of results.	N/A

Purpose: To discharge produced water for water flooding purposes into land in the Manutahi Formation in the coastal marine area by dep well injection at the Manutahi-B wellsite		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
15. All groundwater sampling and analysis shall be undertaken in accordance with a Sampling and Analysis Plan, which shall be submitted to the Chief Executive, Taranaki Regional Council for review and certification before the first sampling is undertaken.	Receipt of Sampling and Analysis Plan prior to first round of sampling being undertaken.	N/A
16. The consent holder shall provide to the Council, before 31 August each year, a summary of all data collected and a report detailing compliance with consent conditions over the previous 1 July to 30 June period.	Receipt of satisfactory report by 31 August each year.	N/A
17. Consent review provision.	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Not exercised
Overall assessment of administrative performance in respect of this consent		Not exercised

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

Table 13 Evaluation of environmental performance over time

Year	Consent number	High	Good	Improvement required	Poor
2016-2017	7905-1	1			
2015-2016*	7905-1	1			
2014-2015*	7905-1	1			
2013-2014*	7905-1	1			
2012-2013*	7905-1	1			
Totals		5			

Note-* consent held by origin

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 in the 2017-2018 year continues at the same level as in the 2016-2017 monitoring period.

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.
3. THAT there is no requirement at this time for a consent review to be pursued or grounds to exercise the review options.

The recommendations above were implemented during the period under review

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 the range of monitoring carried out during the 2017-2018 period be continued during the 2018-2019 monitoring period. Recommendations to this effect are included in Section 4 of this report.

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

3.6 Exercise of optional review of consent

Resource consent 10546-1 and 10575-1 provide for an optional review in June 2019. Condition 17 allows the Council to review each consent, if there are grounds that "the conditions are not adequate to deal with any adverse effects on the environment arising from the exercise of the resource consent, which were either not foreseen at the time the application was considered or which was not appropriate to deal with at the time". These consents have not yet been exercised and therefore it is considered that there are no grounds that require a review to be pursued or grounds to exercise the review option.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities in the 2018-2019 year continue at the same level as in 2017-2018.
2. THAT should there be issues with environmental or administrative performance in 2018-2019, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.
3. THAT the option for a review of resource consents in June 2019, as set out in the respective consent conditions not be exercised.

Glossary of common terms and abbreviations

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

Aquifer (freshwater)	A formation, or group or part of a formation that contains sufficient saturated permeable media to yield exploitable quantities of fresh water.
BPO	Best practicable option
Conductivity	A measure of the level of dissolved salts in a sample. Usually measured at 20°C and expressed as millisiemens per metre (mS/m) or as Total Dissolved Solids (g/m ³).
Confining layer	A geological layer or rock unit that is impermeable to fluids.
Deep well injection (DWI)	Injection of fluids at depth for disposal or enhanced recovery.
Fracture gradient	A measure of how the pressure required to fracture rock in the earth's crust changes with depth. It is usually measured in units of "pounds per square inch per foot" (psi/ft) and varies with the type of rock and the strain of the rock.
g/m ³	Grams per cubic metre. A measure of concentration which is equivalent to milligrams per litre (mg/L), or parts per million (ppm).
Hydraulic fracturing (HF)	The process of increasing reservoir permeability by injecting fluids at pressures sufficient to fracture rock within the reservoir ("fracking").
Injectate	Fluid disposed of by deep well injection.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
IR	Unauthorised Incident Register – contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m bgl	Metres below ground level.
m bmp	Metres below measuring point.
mS/m	Millisiemens per metre.
m TVD	Metres true vertical depth
m ³	Cubic metre.

pH	Numerical system for measuring acidity in solutions, with 7 as neutral. Values lower than 7 are acidic and higher than 7 are 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.
Produced water	Water associated with oil and gas reservoirs that is produced along with the oil and gas. Typically highly saline with salt concentrations similar to seawater and containing low levels of hydrocarbons.
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).
UI	Unauthorised Incident.
Water flooding	A method of thermal recovery in which hot water is injected into a reservoir through specially distributed injection wells. Hot water flooding reduces the viscosity of the crude oil, allowing it to move more easily toward production wells.

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

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- Taranaki Regional Council (2011): Origin Energy Resources New Zealand Limited Deep Well Injection Monitoring Programme Triennial Report 2009-2012. Technical Report 2011-85.

Appendix I

Resource consents held by Westside New Zealand Ltd

(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: Westside New Zealand Limited
Level 17
300 Queen Street
Brisbane QLD 4000
AUSTRALIA

Decision Date: 16 September 2011

Commencement Date: 16 September 2011

Conditions of Consent

Consent Granted: To discharge heated water, including produced water to ground at the Manutahi-D wellsite for water flooding purposes

Expiry Date: 1 June 2028

Review Date(s): June 2022

Site Location: Manutahi-D wellsite, Lower Ball Road, Kakaramea
(Property Owner: NA Schrider & PW Campbell)

Grid Reference (NZTM) 1719971E-5603672N

Catchment: Mangaroa

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

General condition

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

Special conditions

1. Before this consent is exercised, except for an initial injection trial of up to 64 cubic metres of produced water per well, the consent holder shall submit an updated "Injection Operation Management Plan" which includes the details of this waterflooding pilot project and identifies the conditions that would trigger concerns about the integrity of the well, or the injection zone, and the action to be taken by the consent holder if trigger conditions are reached.
2. Before this consent is exercised the consent holder shall provide to the Chief Executive of the Taranaki Regional Council:
 - a) Subsurface construction details, including design of the exterior surface casing, the intermediate protective casing, and the innermost casing, tubing, and packer;
 - b) A log of the well, or a representative nearby well, from 0.0 mbgl to 1000 mbgl; clearly showing the freshwater/brine water interface zone;
 - c) Annular pressure; pressure testing which demonstrates well integrity [MIT];
 - d) Receiving Formation fracture pressure and geological seal fracture pressure;
 - e) A chemical analysis of the formation-water;
 - f) Cementing details.
3. The injection pressure at the wellhead shall not exceed a maximum injection pressure of 721 PSI [50 Bars].
4. The volume of liquid re-injected shall not exceed 318 cubic metres per day.
5. 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; in particular, ensuring that the injection material is contained within the injection zone.
6. The consent holder shall keep daily records of:
 - a) maximum injection pressure;
 - b) maximum and average rate of injection; and
 - c) volume of fluid injected;

during operation of the well. These records shall be provided to the Taranaki Regional Council at the end of each month.

Consent 7905-1

7. The consent holder shall measure and record the following constituents of the discharge each month:
 - a) pH;
 - b) suspended solids concentration;
 - c) temperature;
 - d) salinity;
 - e) chloride concentration; and
 - f) total hydrocarbon concentration.

The consent holder shall provide to Taranaki Regional Council, during the month of May of every year, a summary of all records collected in accordance with this condition.

8. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 5 working days prior to the first exercise of this consent, except for an initial injection trial of up to 64 cubic metres of produced water per well. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.
9. The consent holder shall ensure that the exercise of this consent not contaminate or put at risk actual or potential usable freshwater aquifer.
10. This consent shall lapse on the 30 September 2016, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(b) of the Resource Management Act 1991.
11. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2016 and/or June 2022, 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 1 November 2016

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

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

Name of
Consent Holder: Westside New Zealand Limited
 PO Box 550
 Hawera 4640

Decision Date: 29 March 2018

Commencement Date: 29 March 2018

Conditions of Consent

Consent Granted: To discharge produced water for water flooding purposes
 into land in the Manutahi Formation in the coastal marine
 area by deep well injection at the Manutahi-B wellsite

Expiry Date: 1 June 2034

Review Date(s): June annually

Site Location: Manutahi-B wellsite, Lower Ball Road, Kakaramea
 (Property owner: N & M Schrider)

Grid Reference (NZTM) 1720287E-5603378N

Catchment: Mangaroa

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

General condition

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

Special conditions

1. Before exercising the consent, the consent holder shall submit an "Injection Operation Management Plan." The plan shall include the operational details of the injection activities and identify the conditions that would trigger concerns about the integrity of the injection well, the receiving formation or overlying geological seals. The plan shall also detail the action(s) to be taken by the consent holder if trigger conditions are reached.
2. Before exercising the consent, the consent holder shall provide to the Chief Executive, Taranaki Regional Council:
 - (a) a geological assessment of the environment in which the well is located, including the injection zone, the geological seals confining the injection zone and any associated faulting;
 - (b) details of the injection well design and its structural integrity;
 - (c) an assessment of the suitability of the injection well for the proposed activity;
 - (d) details of how the integrity of the injection well will be monitored and maintained;
 - (e) confirmation of the depth to which fresh water resources, as defined in condition 7, are encountered below the site; and
 - (f) a chemical assessment of the receiving formation water which confirms its Total Dissolved Solids (TDS) concentration, and also demonstrates that the mixing of formation and injection fluids will not result in any adverse effects on the receiving formation or the injection well.

(Note: The information required by condition 2 may be included within the "Injection Operation Management Plan" required by condition 1.)

3. There shall be no injection of any fluids after 1 June 2029.
4. 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.
5. The injection of fluids shall be confined to the Manutahi Formation, and be injected at a minimum depth of 1,075 metres true vertical depth below ground level.
6. The consent holder shall ensure that the discharge authorised by this consent does not result in the fracturing of the geological seals confining the injection zone.

Consent 10575-1.0

7. The consent holder shall ensure that the exercise of this consent does not result in contaminants reaching any useable fresh water (groundwater or surface water). Useable fresh groundwater is defined as any groundwater having a TDS concentration of less than 1,000 mg/L.

8. Only produced water from the Manutahi Field and the Kauri Field may be discharged.

(Note: This means any compatible produced water contained within the formations covered by the Manutahi, Kauri and Rimu hydrocarbon permits)

9. For each waste stream arriving on site for discharge, the consent holder shall characterise the fluids by recording the following information:

- (a) type of fluid (as listed in condition 8);
- (b) source of fluid (site name and company);
- (c) an analysis of a representative sample of the fluid for:
 - (i) pH;
 - (ii) conductivity;
 - (iii) suspended solids concentration;
 - (iv) temperature;
 - (v) salinity;
 - (vi) chloride concentration; and
 - (vii) total hydrocarbon concentration.

The analysis required by condition 9(c) above is not necessary if a sample of the same type of fluid, from the same source, has been taken, analysed and provided to the Chief Executive, Taranaki Regional Council within the previous 6 months.

10. Once the consent is exercised, the consent holder shall keep daily records of the:

- (a) injection hours;
- (b) volume of fluid discharged; and
- (c) maximum and average injection pressure.

11. If the analysis required by condition 9(c) above is not carried out in an International Accreditation New Zealand (IANZ) accredited laboratory, it shall be undertaken in accordance with a "Quality Assurance (QA) Plan" that has been certified by the Chief Executive, Taranaki Regional Council, as meeting the requirements of condition 9. The Council may also, at its discretion, carry out an audit of the consent holder's sampling and analysis regime to assess adherence to the QA plan.

12. The information required by conditions 9 and 10 above, for each calendar month, shall be provided to the Chief Executive, Taranaki Regional Council before the 28th day of the following month.

Consent 10575-1.0

13. The consent holder shall undertake a programme of sampling and testing that monitors the effects of the exercise of this consent on fresh water resources within an Area of Review (AoR) to assess compliance with condition 7 (the 'Monitoring Programme'). The Monitoring Programme shall be submitted to the Chief Executive, Taranaki Regional Council, for certification before exercising the consent, and shall include:
- (a) the location of sampling sites;
 - (b) well/bore construction details; and
 - (c) sampling frequency.

The AoR shall extend 1,000 metres from the point of injection. It is a requirement that at least one suitable monitoring bore be located within 500 metres of the well head. If no suitable existing bores are available, it will be necessary for the Monitoring Programme to include installation of, and sampling from, a suitable bore. The bore would be of a depth, location and design determined after consultation with the Chief Executive, Taranaki Regional Council and installed in accordance with NZS 4411:2001.

14. All groundwater samples taken for monitoring purposes shall be taken in accordance with recognised field procedures and analysed for:
- (a) pH;
 - (b) conductivity;
 - (c) chloride; and
 - (d) total petroleum hydrocarbons.

Note: The samples required, under conditions 13 and 14, could be taken and analysed by the Council or other contracted party on behalf of the consent holder.

15. All groundwater sampling and analysis shall be undertaken in accordance with a *Sampling and Analysis Plan*, which shall be submitted to the Chief Executive, Taranaki Regional Council for review and certification before the first sampling is undertaken. This Plan shall specify the use of standard protocols recognised to constitute good professional practice including quality control and assurance. An IANZ accredited laboratory shall be used for all sample analysis. Results shall be provided to the Chief Executive, Taranaki Regional Council within 30 days of sampling and shall include supporting quality control and assurance information.

Note: The Sampling and Analysis Plan may be combined with the Monitoring Programme required by condition 13.

16. The consent holder shall provide to the Chief Executive, Taranaki Regional Council, before 31 August each year, a summary of all data collected and a report detailing compliance with consent conditions over the previous 1 July to 30 June period. Based on the data provided, the report shall also provide:
- a) an assessment of injection well performance;
 - b) an assessment of the on-going integrity and isolation of the wellbore;
 - c) an assessment of the on-going integrity and isolation of the receiving formation; and
 - d) an updated injection modeling report, demonstrating the ability of the receiving formation to continue to accept additional waste fluids and an estimation of remaining storage capacity.

Consent 10575-1.0

17. 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 annually, 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 29 March 2018

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

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

Name of
Consent Holder: Westside New Zealand Limited
PO Box 550
Hawera 4640

Decision Date: 29 March 2018

Commencement Date: 29 March 2018

Conditions of Consent

Consent Granted: To discharge produced water for water flooding purposes into land in the Manutahi Formation by deep well injection at the Manutahi-B wellsite

Expiry Date: 1 June 2034

Review Date(s): June annually

Site Location: Manutahi-B wellsite, Lower Ball Road, Kakaramea
(Property owner: N & M Schrider)

Grid Reference (NZTM) 1720287E-5603378N

Catchment: Mangaroa

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

General condition

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

Special conditions

1. Before exercising the consent, the consent holder shall submit an "Injection Operation Management Plan." The plan shall include the operational details of the injection activities and identify the conditions that would trigger concerns about the integrity of the injection well, the receiving formation or overlying geological seals. The plan shall also detail the action(s) to be taken by the consent holder if trigger conditions are reached.
2. Before exercising the consent, the consent holder shall provide to the Chief Executive, Taranaki Regional Council:
 - (a) a geological assessment of the environment in which the well is located, including the injection zone, the geological seals confining the injection zone and any associated faulting;
 - (b) details of the injection well design and its structural integrity;
 - (c) an assessment of the suitability of the injection well for the proposed activity;
 - (d) details of how the integrity of the injection well will be monitored and maintained;
 - (e) confirmation of the depth to which fresh water resources, as defined in condition 7, are encountered below the site; and
 - (f) a chemical assessment of the receiving formation water which confirms its Total Dissolved Solids (TDS) concentration, and also demonstrates that the mixing of formation and injection fluids will not result in any adverse effects on the receiving formation or the injection well.

(Note: The information required by condition 2 may be included within the "Injection Operation Management Plan" required by condition 1.)

3. There shall be no injection of any fluids after 1 June 2029.
4. 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.
5. The injection of fluids shall be confined to the Manutahi Formation, and be injected at a minimum depth of 1,075 metres true vertical depth below ground level.
6. The consent holder shall ensure that the discharge authorised by this consent does not result in the fracturing of the geological seals confining the injection zone.

Consent 10546-1.0

7. The consent holder shall ensure that the exercise of this consent does not result in contaminants reaching any useable fresh water (groundwater or surface water). Useable fresh groundwater is defined as any groundwater having a TDS concentration of less than 1,000 mg/L.

8. Only produced water from the Manutahi Field and the Kauri Field may be discharged.

(Note: This means any compatible produced water contained within the formations covered by the Manutahi, Kauri and Rimu hydrocarbon permits)

9. For each waste stream arriving on site for discharge, the consent holder shall characterise the fluids by recording the following information:

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 - (v) salinity;
 - (vi) chloride concentration; and
 - (vii) total hydrocarbon concentration.

The analysis required by condition 9(c) above is not necessary if a sample of the same type of fluid, from the same source, has been taken, analysed and provided to the Chief Executive, Taranaki Regional Council within the previous 6 months.

10. Once the consent is exercised, the consent holder shall keep daily records of the:

- (a) injection hours;
- (b) volume of fluid discharged; and
- (c) maximum and average injection pressure.

11. If the analysis required by condition 9(c) above is not carried out in an International Accreditation New Zealand (IANZ) accredited laboratory, it shall be undertaken in accordance with a "Quality Assurance (QA) Plan" that has been certified by the Chief Executive, Taranaki Regional Council, as meeting the requirements of condition 9. The Council may also, at its discretion, carry out an audit of the consent holder's sampling and analysis regime to assess adherence to the QA plan.

12. The information required by conditions 9 and 10 above, for each calendar month, shall be provided to the Chief Executive, Taranaki Regional Council before the 28th day of the following month.

Consent 10546-1.0

13. The consent holder shall undertake a programme of sampling and testing that monitors the effects of the exercise of this consent on fresh water resources within an Area of Review (AoR) to assess compliance with condition 7 (the 'Monitoring Programme'). The Monitoring Programme shall be submitted to the Chief Executive, Taranaki Regional Council, for certification before exercising the consent, and shall include:
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Note: The Sampling and Analysis Plan may be combined with the Monitoring Programme required by condition 13.

16. The consent holder shall provide to the Chief Executive, Taranaki Regional Council, before 31 August each year, a summary of all data collected and a report detailing compliance with consent conditions over the previous 1 July to 30 June period. Based on the data provided, the report shall also provide:
- a) an assessment of injection well performance;
 - b) an assessment of the on-going integrity and isolation of the wellbore;
 - c) an assessment of the on-going integrity and isolation of the receiving formation; and
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Consent 10546-1.0

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Signed at Stratford on 29 March 2018

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management

