

Westside New Zealand Ltd

Deep Well Injection Monitoring Programme Annual Report 2021-2022

Technical Report 2022-55



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Taranaki Regional Council
Private Bag 713
Stratford

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Westside New Zealand Ltd

Deep Well Injection
Monitoring Programme
Annual Report
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Executive summary

Westside New Zealand Ltd (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 2021 to June 2022 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.

During the monitoring period, the Company demonstrated a high level of environmental performance and high level of administrative performance.

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.

The Council's monitoring programme for the year under review included four inspections, two injectate samples and two 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 consents. 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 on local groundwater resources. Inspections undertaken during the monitoring year found sites being operated in a professional manner and there were no unauthorised incidents reported in relation to the Company's DWI consents.

For reference, in the 2021-2022 year, consent holders were found to achieve a high level of environmental performance and compliance for 88% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 10% 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 several years, this report shows that the Company's performance remains at a generally high level.

This report includes recommendations to be implemented during the 2022-2023 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 2021 to June 2022 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Westside New Zealand Ltd (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 consents permit the discharge of a range of fluids by DWI, including heated water and produced water, and include a number of special conditions which 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 sixth report to be prepared by the Council to cover the Company's DWI discharges and their effects.

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 *Resource Management Act 1991* (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 2022-2023 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' in as much as is appropriate for each activity. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with Section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the consent holders, this report also assigns a rating as to each Company's environmental and administrative performance during the period under review. The rating categories are high, good, improvement required and poor for both environmental and administrative performance. The interpretations for these ratings are found in Appendix II.

For reference, in the 2021-2022 year, consent holders were found to achieve a high level of environmental performance and compliance for 88% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 10% of the consents, a good level of environmental performance and compliance was achieved.¹

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.

¹ The Council has used these compliance grading criteria for more than 18 years. They align closely with the 4 compliance grades in the MfE Best Practice Guidelines for Compliance, Monitoring and Enforcement, 2018

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 water, including 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 holds three resource consents the details of which are summarised in Table 1 below. Summaries of the conditions attached to each permit are set out in Section 3 of this report.

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

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

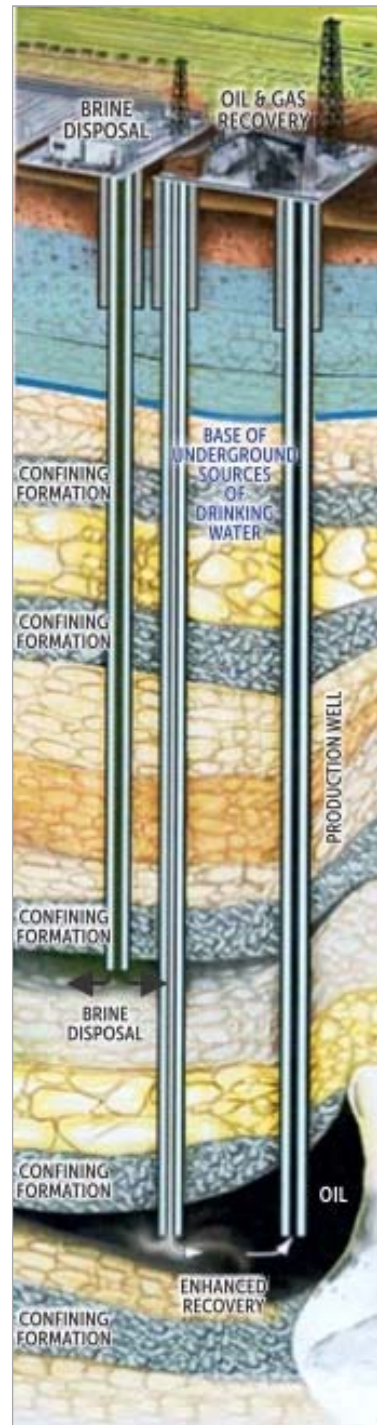


Figure 1 DWI schematic
(www.epa.gov/uic)

Table 1 Resource consents held by the Company during the 2021-2022 monitoring year

Consent number	Purpose	Granted	Review	Expires
<i>Discharges of waste to land</i>				
7905-1.1	To discharge heated water, including produced water to ground at the Manutahi-D wellsite for water flooding purposes	16 Sep 2011	Non remaining	1 June 2028
10546-1	To discharge produced water for water flooding purposes into land in the Manutahi Formation by deep well injection at the Manutahi-B wellsite	29 Mar 2018	June annually	1 Jun 2034
10575-1	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	29 Mar 2018	June annually	1 Jun 2034

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;
- 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 each 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.

In addition to the programmed DWI inspections, council officers also visited the Manutahi-D wellsite on two occasions for injectate sampling purposes.



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

1.4.4 Injectate sampling

Injectate samples were obtained for analysis 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.

There are three wells available for the injection of fluids for the purpose of water flooding at the Company's DWI wellsites. A summary of the details for each injection well is included in Table 2 and locations are displayed in Figure 3.

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

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

Table 2 Injection well details

Wellsite	Consent	Injection well(s)	TRC bore id.	Formation
Manutahi-D	7905-1.1	D2H	GND2307	Manutahi
		D4HST1	GND2309	
Manutahi-B	10546-1 10575-1	Manutahi-B2 (upper and lower)	GND3017	Manutahi

1.4.5 Groundwater sampling

Groundwater samples in relation to the DWI monitoring programme were obtained on two occasions during the monitoring period. 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.

The programme consists of sampling one monitoring bore in the vicinity of the Manutahi-B and Manutahi-D wellsites. GND2824 is the only bore included in the monitoring programme. The bore was installed by the Company in 2018 to replace the previous monitoring bore GND2372 which, due to its close proximity to migrating sand dunes, had become buried.

Details of the groundwater monitoring site included in the current monitoring programme are summarised below in Table 3 and the location of the bore in relation to the wellsites being monitored is illustrated in Figure 3.

Groundwater samples are collected following standard groundwater sampling methodologies and generally in accordance with the National Environmental Monitoring Standards (NEMS) for discrete groundwater quality sampling (2019).

Table 3 Groundwater monitoring site details

Site code	Wellsite	Distance from wellsite (m)	Screened (m)	Total depth (m)	Groundwater level (m bmp)	Aquifer
GND2824	Manutahi-B Manutahi-D	<200 <200	19.0-25.0	25.0	18.0	Volcanics

Groundwater samples taken by the Council were sent on behalf of the Company to 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 to the routine sampling, baseline samples have been collected from monitored sites and analysed by Hills for general ion chemistry, BTEX and dissolved gas concentrations to 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 consent.

As required by the conditions of their 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.

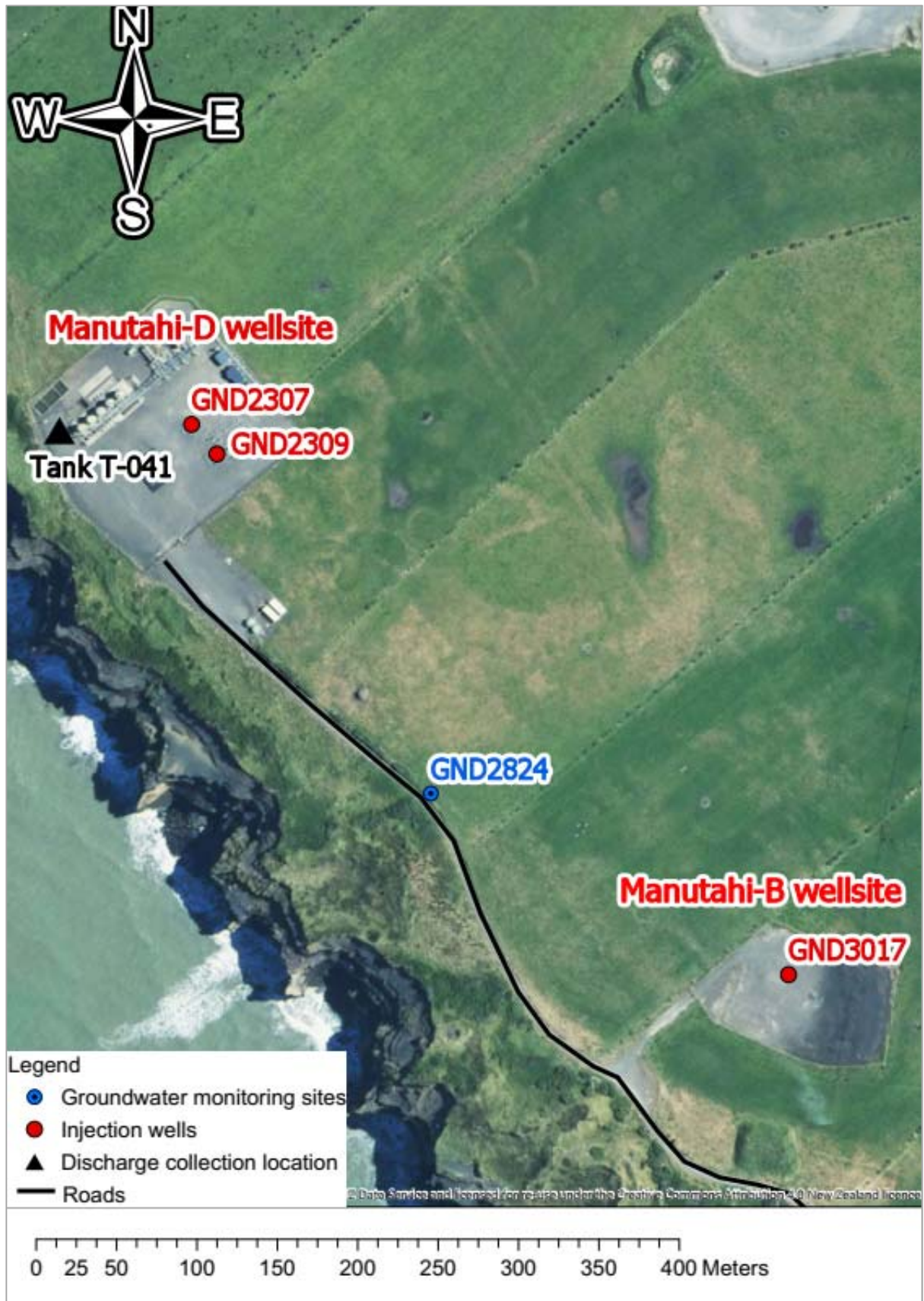


Figure 3 Location of monitoring sites in relation to the Company's DWI wellsites

2 Results

2.1 Inspections

The routine inspections undertaken at each active wellsite on 21 September 2021 included undertaking a general visual assessment of the operational equipment, storage facilities and associated equipment.

Both wellsites were found to be tidy and clean with minimal activity occurring. 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 on 27 November 2021 and 13 May 2022. The samples were sent to Hills on the same day for physicochemical analysis. Injectate samples are generally a composite of produced water from the Manutahi and Kauri oil and gas fields.

The results of the sample analyses undertaken by the Council are included below in Table 4. The range of results for each analyte since 2012 is also presented for comparison.

The Company is also required by consent conditions to undertake additional injectate sampling on each waste stream arriving on site for discharge. A summary of the results from the Company's sampling programme are presented in Table 5. The range in analyte concentrations reported indicate that fluid composition can change significantly from month to month. The concentrations of each analyte measured over the 2021-2022 period are within the typical range for injectate samples at these sites.

Table 4 Results of injectate sampling undertaken by the Council

Parameter	Unit	Minimum	Maximum	TRC213773	TRC226453
Date	-	1-Jul-12 to 30-Jun-22		17-Nov-21	13-May-22
Time	NZST	-	-	10:38	10:10
pH	pH	4.7	8.0	5.5	6.9
Electrical conductivity	mS/m	160	3,090	1,837	2,890
Chloride	g/m ³	349	14,300	6,100	10,800
Total petroleum hydrocarbons	g/m ³	1	780	24	6

Table 5 Results of injectate sampling undertaken by the Company (2021-2022)

Parameter	Unit	Minimum	Maximum
Date	-	01-Jun-21 to 30-May-22	
pH	pH Unit	6.2	7.3
Temperature	Deg°C	19.0	21.3
Electrical conductivity	mS/m	4,200	14,900
Chloride	g/m ³	5,946	10,404
Salinity	-	10.1	18.7
Suspended solids	g/m ³	17	30
Total petroleum hydrocarbons	g/m ³	8	1,440

2.3 Groundwater sampling

Groundwater samples were obtained from GND2824 on two occasions during the monitoring period.

The results of the analyses carried out during the monitoring period compared to historical concentrations reported at GND2824 and the previous monitoring site GND2372 are set out below in Table 6.

The results show there have been no significant changes in groundwater composition in the vicinity of either monitored wellsite since monitoring commenced. The subtle variation in analyte concentrations at each site and between each site are a result of natural seasonal fluctuation and sampling variability.

Table 6 Results of Manutahi B and Manutahi D wellsite sampling at GND2372 and GND2824

Bore id.	-	GND2372		GND2824			
Parameter	Unit	Min	Max	Min	Max	TRC213772	TRC226452
Date	-	01-Jul-13 to 30-Jun-18		01-Jul-18 to 30 Jun- 22		18-Nov-21	13-May-22
Time	NZST	-	-	-	-	8:45	11:00
pH	pH unit	7.1	7.6	6.8	7.3	6.9	6.9
Electrical conductivity	µS/cm	495	525	444	547	535	536
Chloride	g/m ³	63	75	56	90	89	89
Total petroleum hydrocarbons	g/m ³	<0.5	0.7	<0.7	<0.7	<0.7	<0.7

2.4 Provision of consent holder data

The Company provided records of their injection activities during the 2021-2022 monitoring period, including daily injection volumes and maximum and average injection pressures. Data was provided within the consented timeframes.

Table 7 provides an overview of the Company's injection activities across all consents during the monitoring period. The total volume of fluid injected by the Company over the monitoring period was greater than that recorded last year (Table 8). During the monitoring period injection was undertaken via the Manutahi-B2 lower at the Manutahi-B wellsite. The Manutahi-B2 well is a dual completion well that consists of two independent well casings that run to depth side by side, with the upper formation well (B2 upper) terminating at a shallower depth than the lower formation well (B2 lower). Although both wells receive injectate via the same headworks the data collected for the Manutahi-B2 well is presented for each completion separately.

During the monitoring period no injection was undertaken via the Manutahi B2 upper at the Manutahi-B wellsite or the Manutahi D2H and Manutahi D4HST2 wells at the Manutahi-D wellsite (Table 7).

Table 7 Summary of injection activity during the 2021-2022 monitoring year

Consent	Wellsite	Injection wells	Total volume discharged (m ³) 01-Jul-21 – 30-Jun-22	Discharge period		TRC well ID
				From	To	
7905-1	Manutahi-D	D2H	0.0	No discharge		GND2307
		D4HST2	0.0	No discharge		GND2309
10546-1	Manutahi-B	B2 upper	0.0	No discharge		GND3017
10575-1		B2 lower	5,813.50	01-Jul-21	30-Jun-22	
Total			5,813.50	-	-	-

Table 8 Summary of the Company's historical injection activity by year

Period	Total volume discharged (m ³)
2021-2022	5,814
2020-2021	2,964
2019-2020	24,956
2018-2019	25,254
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)

2.4.1 Summary of injection at the Manutahi-D wellsite (consent 7905-1.1)

Table 9 provides a summary of the historical activities undertaken at the Manutahi-D wellsite since 2012. The data shows that the volume of fluid discharged via the wellsite decreased significantly in comparison to previous years.

The historical injection data for the Manutahi-D wells is also presented graphically in Figure 4. Injection at the wellsite is undertaken primarily to enhance production within the formation (water flooding) and therefore the volumes injected are dictated by the requirements of the production network with more fluid injected when pressures decline. There was no injection at the Manutahi-D wellsite during the monitoring period and both wells are currently shut-in. Injection was not required as a result of an overall decrease in activity across the Company's oil and gas fields.

Table 9 Summary of injection activity under Consent 7905-1.1 2012-2022

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 (bar)	Avg. injection pressure D4HST2 (bar)
2021-2022	0	0	-	-	-
2020-2021	2,49	1.8	36	9	9
2019-2020	17,404	160	50	28	29
2018-2019	6,646	146	53	14	23
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

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 (bar)	Avg. injection pressure D4HST2 (bar)
2012-2013	23,677	144	41	21	17

Note * Consent conditions were updated 18 December 2018 and limits were removed

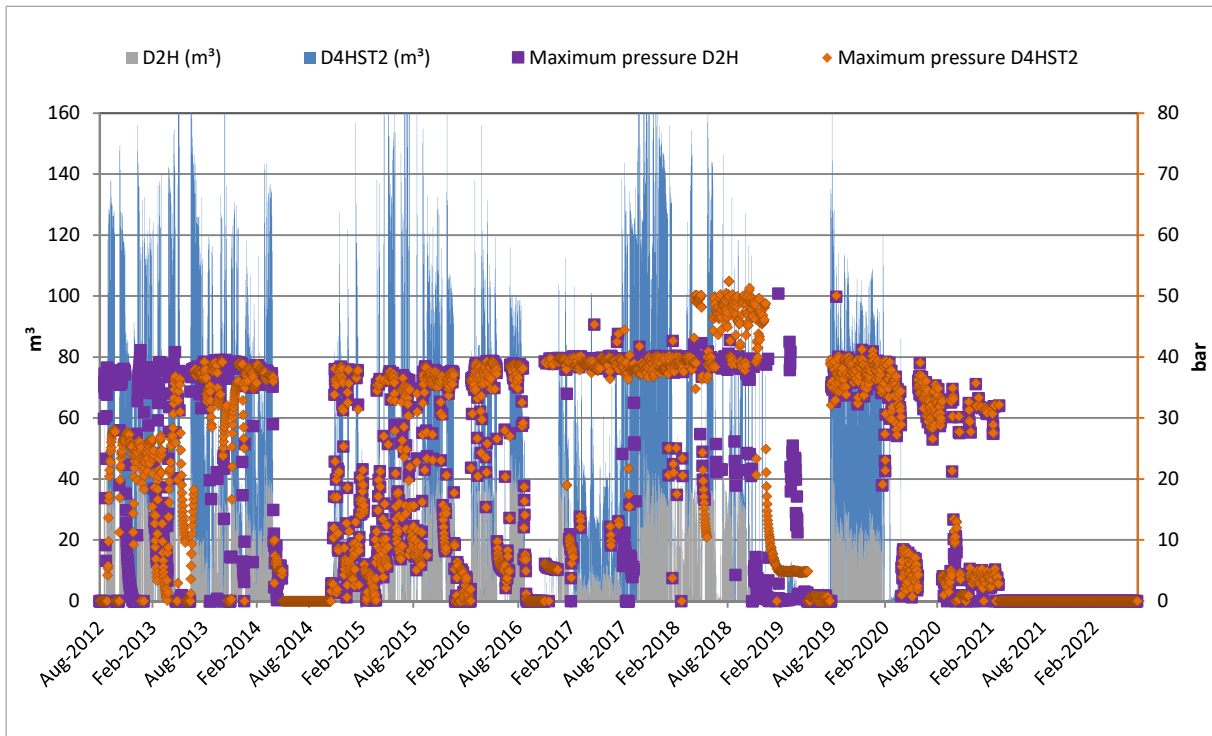


Figure 4 Manutahi-D cumulative daily injection volumes and maximum pressures (2012-2022)

2.4.2 Summary of injection at the Manutahi-B wellsite (consent 10546-1/10575-1)

Table 10 provides a summary of the historical activities undertaken at the Manutahi-B wellsite since 2018. The data shows that the volume of fluid discharged via the wellsite has decreased significantly in the last two years.

The injection data for the Manutahi-B wellsite is also presented graphically in Figure 5, Figure 6 and Figure 7. There was no injection via the Manutahi-B upper. Figure 5 has been included to show the fluctuating pressures recorded at the wellhead.

As all three of the Company's injection wells are utilised to maintain pressures within the formation pressures will fluctuate in response to both abstraction and injection across the field.

The Manutahi-B2 lower pressures corresponded to volumes injected with pressures increasing during periods of injection and declining when injection ceases (Figure 6). The low injection volumes at the Manutahi-B wellsite are a result of an overall decrease in the activity across the Company's oil and gas fields (Figure 7).

Table 10 Summary of injection activity under Consents 10546-1/10575-1

Deep well injection undertaken at Manutahi-B wellsite					
Year	Annual volume (m ³)	Max. injection volume (m ³ /day)	Max. injection pressure (bar)	Avg. injection pressure B2 upper (bar)	Avg. injection pressure B2 lower (bar)
2021-2022	5,814	93	60	19	18
2020-2021	2,962	73	55	19	10
2019-2020	7,551	161	52	12	12
2018-2019	18,609	172	154	17	29

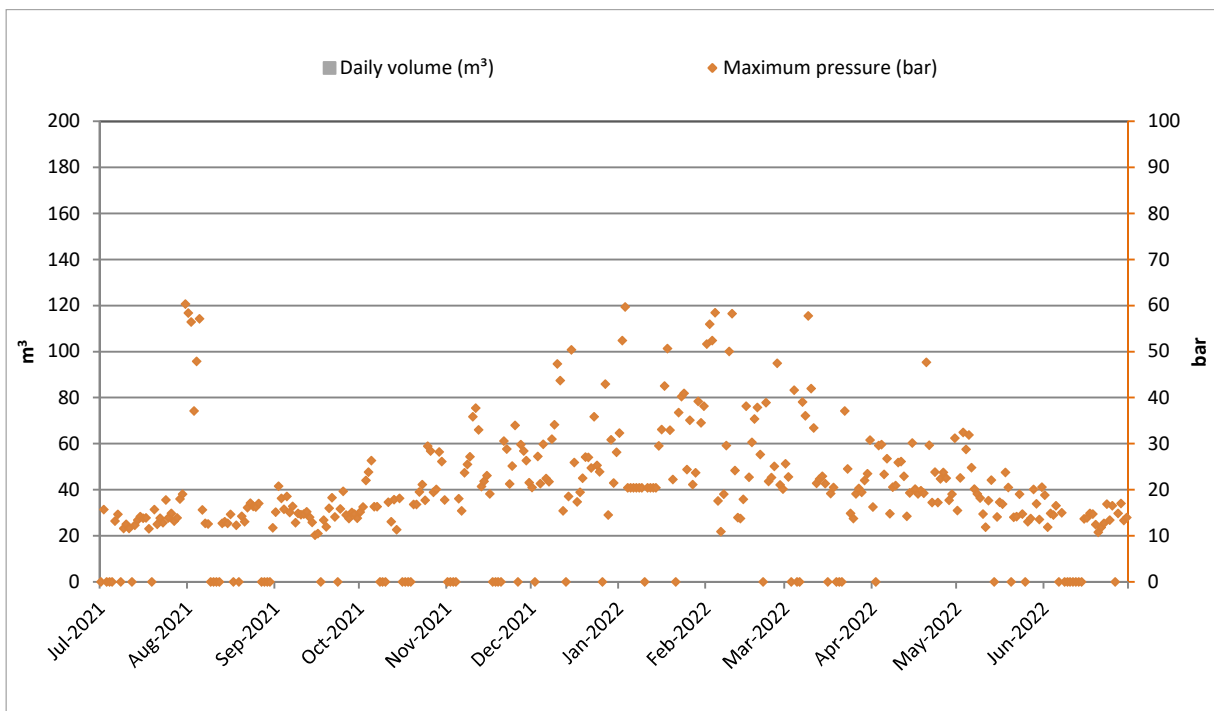


Figure 5 Manutahi-B upper daily maximum injection pressure (2021-2022)

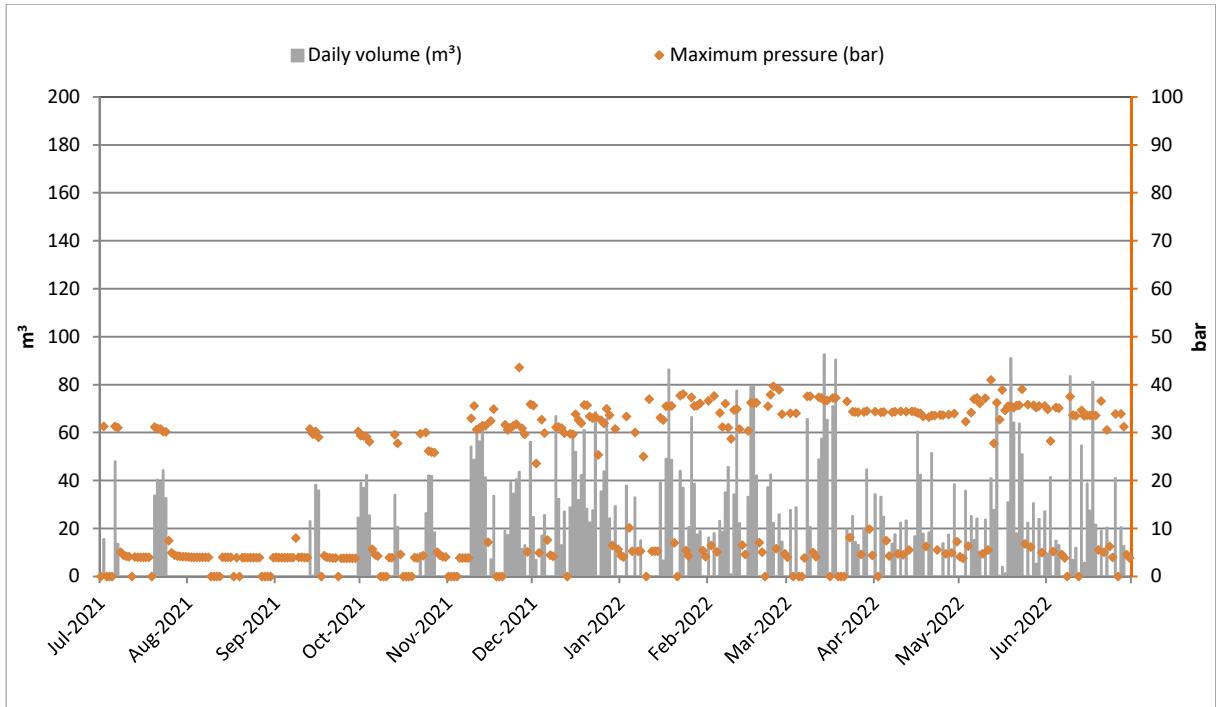


Figure 6 Manutahi-B lower daily injection and maximum pressure (2021-2022)

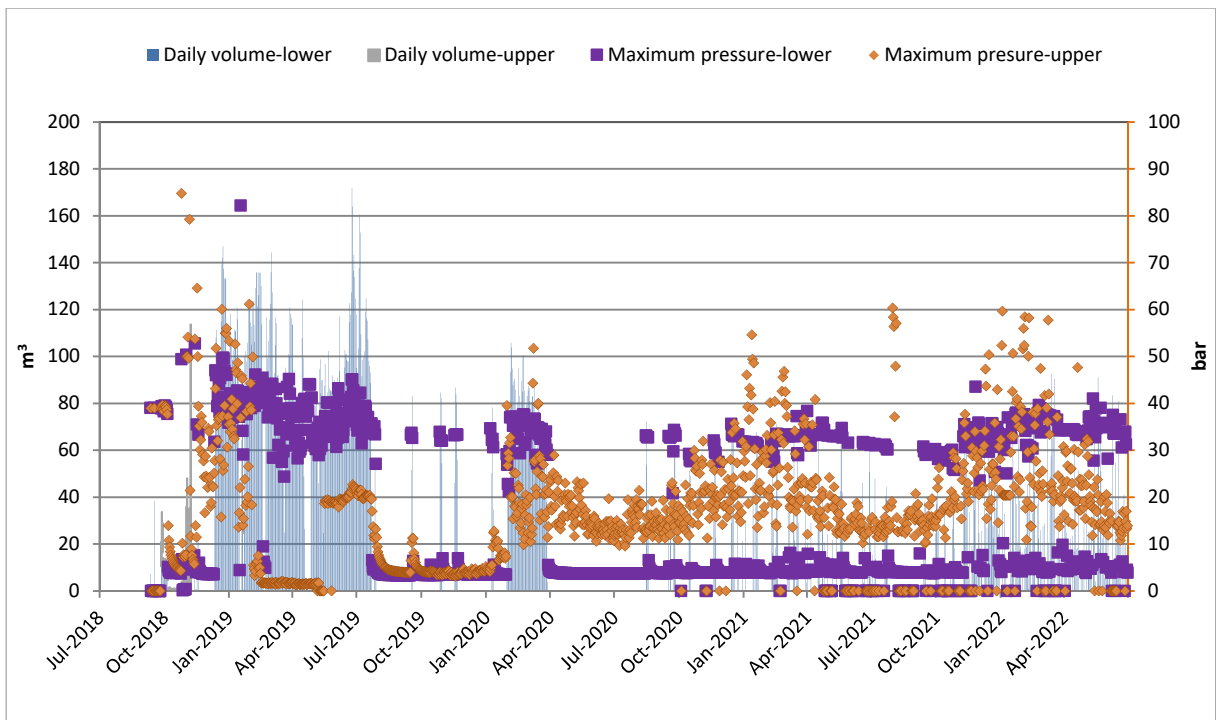


Figure 7 Manutahi-B cumulative daily injection volumes and maximum pressures (2018-2022)

2.5 Incidents, investigations, and interventions

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

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

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

In the 2021-2022 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with the Company's conditions in resource consents or provisions in Regional Plans.

3 Discussion

3.1 Discussion of site performance

During the period under review, the Company held three resource consents for the injection of fluids by DWI. Consent 7905-1.1 authorises the injection of heated fluids into the Manutahi Formation at the Manutahi-D wellsite. Injection into the Formation is via the D2H and D4HST2 injection wells. Consents 10456-1 and 10575-1 authorise the injection of produced fluids into the Manutahi Formation at the Manutahi-B wellsite. Injection into the Formation is via the Manutahi-B2 well.

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 the 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 Company's injectate sampling results, data was submitted to the Council at the specified frequency. The data shows that injection was carried out in compliance with consent conditions.

An assessment of the historical injection data record at the Manutahi-D and Manutahi-B wellsites indicates that injection volumes fluctuate from year to year in response to the requirements of the water flood programme. During the year being reported a lower volume of injection occurred due to a significant reduction in production. All injection during the 2021-2022 monitoring year occurred via the Manutahi-B2 well at the Manutahi-B wellsite. There was no injection at the Manutahi-D wellsite.

Routine inspections of the Company's Manutahi-D and Manutahi-B wellsites conducted during the period under review found the sites to be in good condition and being well managed, no issues were noted by the inspecting officer in relation to DWI activities. 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

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 two samples being taken from one monitoring site in the vicinity of the Company's active injection wells. The results of the monitoring carried out show that the groundwater composition at the 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.

Compliance with the conditions of the Company's DWI consents exercised during the 2021-2022 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 11-13. An evaluation of the environmental performance in relation to the DWI activities at the Manutahi DWI wellsites since 2009 is presented in Table 14.

Table 11 Summary of performance for Consent 7905-1.1

Purpose: To discharge heated water, including produced water to ground at the Manutahi-D wellsite for water flooding purposes		
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 2023.	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 1,000 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.	Yes
8. Limits the type and source of discharge.	Receipt and assessment of injection data.	Yes
9. Maintain records and undertake analysis to characterise each type of waste arriving on-site for discharge.	Receipt and assessment of injection data.	Yes
10. Maintain full records of injection data.	Receipt and assessment of injection data.	Yes

Purpose: To discharge heated water, including produced water to ground at the Manutahi-D wellsite for water flooding purposes		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
11. If the analysis required by condition 9c is not carried out in an 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.	Yes
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.	Yes
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.	Yes
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.	Yes
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.	Yes

Purpose: To discharge heated water, including produced water to ground at the Manutahi-D wellsite for water flooding purposes		
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.	Not assessed - Report completed prior to submission due date
17. Consent 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		High

N/A = not applicable

Table 12 Summary of performance for Consent 10546-1

Purpose: To discharge produced water for water flooding purposes into land in the Manutahi Formation by deep 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.	Yes

Purpose: To discharge produced water for water flooding purposes into land in the Manutahi Formation by deep 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.	Yes
8. Limits the type and source of discharge.	Receipt and assessment of injection data.	Yes
9. Maintain records and undertake analysis to characterise each type of waste arriving on-site for discharge.	Receipt and assessment of injection data.	Yes
10. Maintain full records of injection data.	Receipt and assessment of injection data.	Yes
11. If the analysis required by condition 9c is not carried out in an 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.	Yes
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.	Yes
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.	Yes
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.	Yes

Purpose: To discharge produced water for water flooding purposes into land in the Manutahi Formation by deep 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.	Yes
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.	Not assessed - Report completed prior to submission due date
17. Consent 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		High

Table 13 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 deep 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

Purpose: 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		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
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.	Yes
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.	Yes
8. Limits the type and source of discharge.	Receipt and assessment of injection data.	Yes
9. Maintain records and undertake analysis to characterise each type of waste arriving on-site for discharge.	Receipt and assessment of injection data.	Yes
10. Maintain full records of injection data.	Receipt and assessment of injection data.	Yes
11. If the analysis required by condition 9c is not carried out in an 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.	Yes
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.	Yes
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.	Yes

Purpose: 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		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
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.	Yes
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.	Yes
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.	Not assessed - Report completed prior to submission due date
17. Consent 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		High

Table 14 Evaluation of environmental performance over time

Year	Consent number	High	Good	Improvement required	Poor
2021-2022	7905-1.1	1	-	-	-
	10456-1/10575-1	1	-	-	-
2020-2021	7905-1.1	1	-	-	-
	10456-1/10575-1	1	-	-	-

Year	Consent number	High	Good	Improvement required	Poor
2019-2020	7905-1.1	1	-	-	-
	10456-1/10575-1	1	-	-	-
2018-2019	7905-1.1	1	-	-	-
	10456-1/10575-1	1	-	-	-
2017-2018	7905-1.1	1	-	-	-
	10456-1/10575-1	Not exercised			
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	-	12	-	-	-

Note-* consent held by Origin Energy Resources Ltd

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

3.4 Recommendations from the 2020-2021 Annual Report

In the 2020-2021 Annual Report, it was recommended:

1. THAT in the first instance, monitoring of consented activities in the 2021-2022 year continue at the same level as in 2020-2021.
2. THAT should there be issues with environmental or administrative performance in 2021-2022, 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 2022, as set out in the respective consent conditions not be exercised.

The recommendations above were implemented during the period under review.

3.5 Alterations to monitoring programmes for 2022-2023

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 2021-2022 period be continued during the 2022-2023 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 2022-2023.

3.6 Exercise of optional review of consent

Resource consents 10456-1, 10575-1 provide for an optional review in June 2023. Condition 17 of the consents allow the Council to review the 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'.

Based on the results of monitoring in the year under review, and in previous years as set out in earlier annual compliance monitoring reports, it is considered that there are no grounds that require a review to be pursued or grounds to exercise the review option on any of the consents.

4 Recommendations

1. THAT in the first instance, monitoring of consented activities in the 2022-2023 year continue at the same level as in 2021-2022.
2. THAT should there be issues with environmental or administrative performance in 2022-2023, 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 2023, 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.
Bar	Measurement of pressure.
BTEX	Benzene, toluene, ethylbenzene and xylene
BPO	Best practicable option.
Conductivity	A measure of the level of dissolved salts in a sample. Usually measured at 25°C and expressed as microsiemens per centimetre ($\mu\text{S}/\text{cm}$) 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.
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.
$\mu\text{S}/\text{cm}$	Microsiemens per centimetre
mS/m	Millisiemens per metre.
m TVD	Metres true vertical depth.
m^3	Cubic metre.
N/A	Not applicable.
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.

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.
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).
RMA	Resource Management Act 1991 and including all subsequent amendments.
SS	Suspended solids.
TDS	Total dissolved solids in a solution.
Temp	Temperature, measured in °C (degrees Celsius).
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.

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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)

Water abstraction permits

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

Water discharge permits

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

Air discharge permits

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

Discharges of wastes to land

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

Land use permits

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

Coastal permits

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

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

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

Decision Date 18 December 2018

Commencement Date 18 December 2018 (Granted 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) 1719970E-5603670N

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. There shall be no injection of any fluids after 1 June 2023.
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 1,000 metres true vertical depth subsea.
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.
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)

Consent 7905-1.1

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.
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.

Consent 7905-1.1

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.

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 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.

Signed at Stratford on 18 September 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:

- (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 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:
- (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 10546-1.0

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

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

Appendix II

Categories used to evaluate environmental and administrative performance

Categories used to evaluate environmental and administrative performance

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

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

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

Environmental Performance

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

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

For example:

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

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

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

Administrative performance

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

Good: Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively

adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

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

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

