Origin Energy Resources New Zealand Limited Deep Well Injection Monitoring Programme Annual Report 2014-2015

Technical Report 2015-23

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Executive summary

The following Annual Report by the Taranaki Regional Council (the Council) encompasses the monitoring period 1 July 2014 to 30 June 2015. The report details the deep well injection (DWI) consents held by Origin Energy Resources New Zealand Limited (the Company) during the period under review, outlines the Company's DWI activities during this period, discusses the monitoring programme implemented by the Council and its results, and also provides an assessment of Company performance with regard to consent compliance.

During the period under review, the Company held a total of three resource consents for the injection of fluids by DWI, permitting discharges from three separate sites in the South and Central Taranaki area. The consents permit the discharge of a range of fluids, including produced water, heated water, contaminated stormwater, water based drilling fluids, and hydraulic fracturing fluids including return fluids. The consents include a number of special conditions which set out specific requirements with which the Company must comply.

During the monitoring period, Origin Energy Resources New Zealand Limited demonstrated an overall high level of environmental performance.

During the period under review, the Council carried out two routine DWI inspection visits. Inspection visits included liaising with on-site staff, identification of the active injection well(s), viewing of the injection well monitoring equipment and injection logs, and the spot sampling of the injectate. In addition to the DWI inspection visits, the Manutahi-D wellsite was visited by Council staff on one occasion in the 2014-2015 monitoring period for inspections relating to other consents held by the Company for various activities at the site.

As required by the special conditions of the DWI consents held by the Company, process monitoring data and injection records were supplied to the Council during the 2014-2015 monitoring period. In total 11,310 cubic metres of fluids were discharged under consent 7905-1. Consents 5503-1 and 6544-1 were not exercised during the 2014-2015 monitoring period. An assessment of process data provided by the consent holder and data gathered during Council inspections do not indicate any potential issues with the integrity of the injection well or the injection zone.

Groundwater monitoring carried out by the Council in the vicinity of the Manutahi-D wellsite does not indicate any contamination of shallow aquifers as a result of injection activities, further supporting the conclusion that the injection wells and injection zone remain secure.

The information gathered during inspection visits and the data supplied by the consent holder have been used in compiling this report.

The Council did not receive any complaints or register any unauthorised incidents associated with any of the Company's DWI activities during the 2014-2015 monitoring period.

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

For reference, in the 2014-2015 year, 75% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level o f environmental performance and compliance with their consents, while another 22% demonstrated a good level of environmental performance and compliance with their consents.

This report includes recommendations for the 2015-2016 year.

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

The following Annual Report covers the monitoring period 1 July 2014 to 30 June 2015. During the period under review, Origin Energy Resources New Zealand Limited (the Company) held three resource consents for the disposal of wastes by deep well injection (DWI) from three separate wellsites in the South Taranaki region. The consents held by the Company permit the discharge of a range of fluids by DWI, including produced water, heated water, contaminated stormwater, water based drilling fluids and hydraulic fracturing fluids, including return fluids. The consents include a number of special conditions which set out specific requirements with which the Company must comply.

The following report provides details of the DWI consents held by the Company during the period under review, and outlines their DWI activities during this period. The report also outlines the compliance monitoring programme implemented by the Taranaki Regional Council (the Council) with regard to these activities, discusses its results, and provides an assessment of the Company's performance with regard to consent compliance. The report concludes with recommendations regarding the future monitoring of the Company'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 compliance monitoring under the RMA and the Council's obligations and general approach to monitoring sites though annual programmes, the resource consents held by the Company/companies in the Mangaroa catchment, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted in the Company's site/catchment.

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

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

Section 4 presents recommendations to be implemented in the 2015-2016 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);
(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 consent holder/s during the period under review, this report also assigns a rating as to each Company's 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 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 2014-2015 year, 75% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level o f environmental performance and compliance with their consents, while another 22% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Process description

1.2.1 Background

The Taranaki Basin occupies an area of approximately 100,000 square kilometres and is the most explored and commercially successful hydrocarbon producing area in New Zealand. Oil and gas exploration and development has been on-going in the region for nearly 150 years. Since the first well in 1865, over 600 exploration and production wells have been drilled. While the majority of the basin is offshore, the majority of the producing wells are onshore. The geology of the basin is derived from diverse episodes of tectonic activity. The Cretaceous to Quaternary basin fill is up to 9,000 m thick in places.

The modern era of exploration began in New Zealand in 1955 when a Shell-BP-Todd consortium explored a large part of the Taranaki region. The groups first well (Kapuni-1), discovered gas-condensate in Late Eocene Kapuni Group strata, and marked the beginning of New Zealand's natural gas industry. The Kapuni Field commenced commercial production in 1970. The next major discovery was the off-shore Maui field in 1969, which was in full production by 1979. Maui is New Zealand's largest hydrocarbon field to date. Many smaller fields were discovered between 1979 and 1999, including the McKee, Mangahewa, Ngatoro, Kaimiro and Rimu fields. More recent discoveries include the Pohokura gas field in 2001.

Overall, the Taranaki Basin remains relatively under-explored compared to many comparable rift complex basins of its size and potential.

1.2.2 Deep well injection (DWI)

DWI is often utilised as liquid waste disposal technology and provides an alternative to the surface disposal of such material. The DWI process utilises specially designed injection wells to pump liquid waste into deep geological formations, hydrocarbon reservoirs or confined saline aquifers. The receiving formations generally contain water that is too saline to be of any potential use. Impermeable geological seals overlying the injection intervals restrict any potential vertical migration of injected wastes into shallow freshwater aquifers.

A typical injection well consists of concentric casing, cemented into the surrounding rock, which extend into permeable saline formations, at depths far below the base of potentially useable freshwater aquifers. Waste is then injected into the receiving formation by pressure generated by surface pumps. International standards (adopted in the Taranaki Region) for the construction of disposal wells emphasise the

importance of surface casing extending to depths below the base of the freshwater zones and that it is cemented back to surface. The standards also highlight the requirement for internal casing strings to be cemented back up the hole to seal off and isolate the disposal interval from the overlying freshwater zones, providing a multi-barrier approach to the protection of freshwater resources. As part of the resource consent application procedure for DWI activities, applicants are required to submit information that details both the design and construction specifications of the injection well(s) and illustrates well integrity and the isolation of the well bore from surrounding formations.

In Taranaki, contaminants disposed of by DWI are generally limited to produced water, saline groundwater, contaminated stormwater, waste drilling fluids, HF fluids, and production sludges. The Council has approved, on specific occasions, the discharge of small volumes of other specified contaminants by DWI. Any application to discharge waste material not specifically licenced by the relevant resource consent is assessed by the Council on a case by case basis. The Council will assess the composition of the waste for consistency with those specifically approved for disposal. In some cases, a new consent may be required.

Produced water makes up the greatest volume of waste fluids generated by oil and gas exploration and production activities. Produced water is water that is present in a hydrocarbon bearing reservoir, brought to the surface as crude oil or natural gas is extracted from it. The composition of this produced fluid is dependent on whether crude oil or natural gas is being produced and generally includes a mixture of either liquid or gaseous hydrocarbons, formation water, dissolved or suspended solids, produced solids such as sand or silt, and injected fluids and additives that may have been placed in the formation as a result of exploration, hydraulic fracturing, and/or production activities. Produced waters may contain, in addition to salts, hydrocarbon residues and free oil, and traces of process additives including anti-scaling agents, anti-corrosion agents and biocides. Proportionally, higher quantities of water are produced from a hydrocarbon field as more oil or gas is extracted and the productive life of the field diminishes. The volume of produced water requiring disposal is therefore expected to increase as many producing fields approach the end of their lives, and as more fields are discovered and developed.

Produced water and drilling fluid wastes are typically highly saline and contain hydrocarbon residues and system additives. Without treatment to an acceptable standard, the surface disposal of large volumes of produced water is not a suitable disposal option, particularly where the discharge can enter surface or groundwater systems. The salts and other contaminants contained within the discharge can adversely affect soil or freshwater biological systems and the quality of water resources used for supply purposes. Although there are methods to treat produced waters to a suitable standard for surface disposal, such as gas/steam stripping, biological and chemical adsorption, and activated carbon, they are generally not practical or economically viable. The injection of produced waters into deep geological formations by DWI is presently the most cost-effective option for the disposal of this type of waste, and more importantly, is an environmentally sound disposal option.

Produced waters have been disposed of by DWI in Taranaki since the development of the Kapuni Field in 1970. The collection, handling, treatment and disposal of produced water from a producing field are major undertakings and, if not appropriately

managed, can have lasting adverse environmental effects. However, under appropriate geological and operational conditions, the disposal of produced waters by DWI should have no more than negligible environmental effects.

The injection of fluids into hydrocarbon bearing reservoirs is also an established oilfield technique for regulating reservoir pressure and/or as a means of enhancing the rate of oil recovery from a reservoir. This process is often referred to as water flooding. Water flooding is a secondary recovery process that is often implemented when natural reservoir pressures decline due to the removal of reservoir fluids during production. The injection of produced fluids back into the reservoir can increase reservoir pressure and stimulate production by driving reserves toward a production well. In certain cases, injected water is heated and injected through a well annulus to reduce oil viscosity, improving oil deliverability through the wellbore. Typically, either produced waters or freshwater, or a combination of the two, are used for water flooding.

Regional councils are responsible for monitoring environmental effects from hydrocarbon exploration and development activities under the RMA. Sections 15 and 30 of the RMA give regional councils the responsibility for regulating the discharge of contaminants into the environment. The discharge of contaminants onto or into land that may result in water contamination may not take place unless expressly allowed by a rule in a regional plan, resource consent or other relevant regulations. The control of DWI activities through the resource consenting process and subsequent compliance monitoring is an appropriate regulatory regime. In the Taranaki region, the discharge of contaminants by DWI requires resource consent from the Council. The activity falls under Rule 51 of the Regional Freshwater Plan for Taranaki and is classified as a discretionary activity. The application may be non-notified if no parties are deemed to be adversely affected by the proposed activity.

At the time of writing, there were a total of 19 current resource consents for DWI in Taranaki. However, several resource consents have been issued for relatively short-term activities during exploration phase drilling, and several others have not been, and may never be exercised.

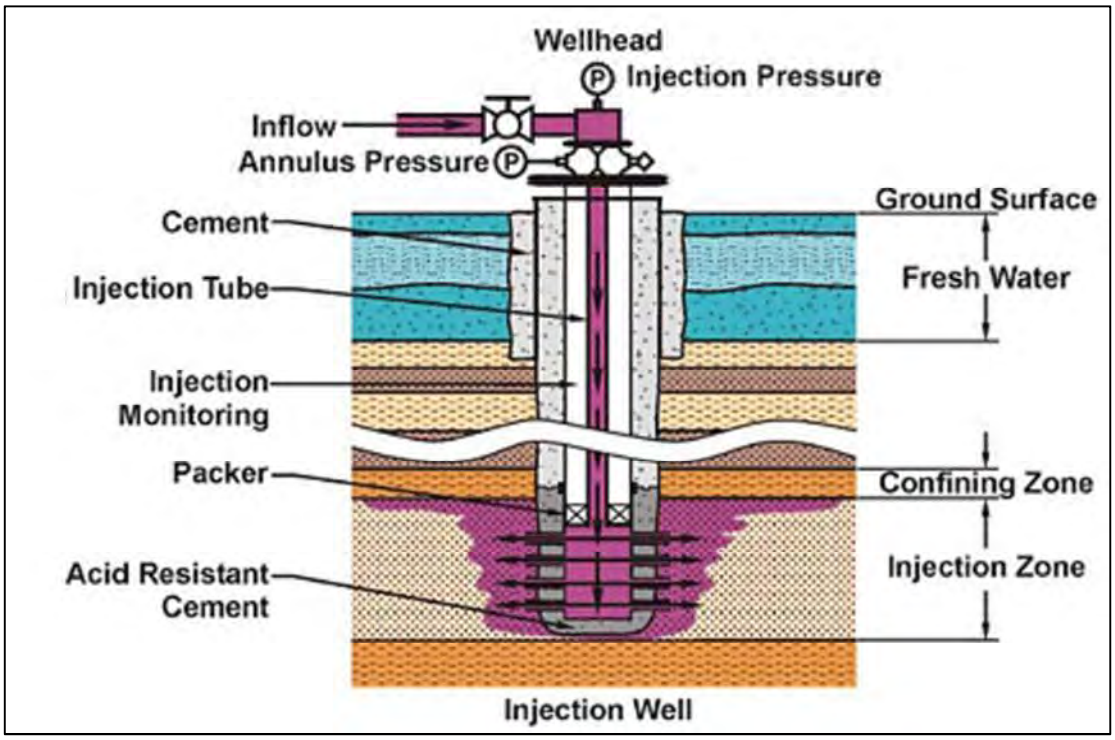

Figure 1 DWI schematic representative of Taranaki sites[1]

1.2.3 Manutahi-D wellsite DWI process

The Manutahi D wellsite was established in 2004 and is located off the end of Lower Ball Road, 21 km southeast of Hawera. Three horizontal wells were drilled into the oil bearing Manutahi sands in 2011.

Fuel gas is piped from Kauri A to provide energy for the gas fired Tri Ethylene Glycol [TEG] heater unit. Heat transfer around the site is via a hot TEG recirculation piping system. Injection water, power fluid and separation tanks are heated by this system. An injection water storage facility is located at Kauri F, the nearest wellsite to Manutahi D, to accept bore water and treated production water transferred via road tankers from Kupe.

Hot water is injected down two of the wells (injectors) to: provide heat energy into the reservoir; replace void space; and flush oil through to the producer well. Oil and water separation takes place on site. Hydrocarbon liquids are pumped to RPS via pipeline. Produced water is retained on site for reinjection via the hot water system.

1.3 Potential environmental effects of exercising a DWI consent

The most significant potential adverse environmental effect arising as a result of fluid injection is the contamination of freshwater aquifers during or following the discharge. Potential pathways for contamination of a freshwater aquifer can be created by the rupture of geological seals confining the injection zone, or failure of the grout seal in either the injection well or any other well that penetrates the disposal interval. There is also potential for fluids to be forced upward from the

[1] https://upstrm.wordpress.com/tag/injection-wells/

injection zone through transmissive faults or fractures in the geological formations overlying the injection zone. Faults or fractures may have formed naturally prior to injection, or may be created by the waste dissolving the rocks of the confining zone. Artificial fractures may also be created by injecting wastewater at excessive pressures or by thermal processes.

There is also the potential for shallow groundwater to be contaminated by surface activities associated with DWI operations, particularly the handling, storage and transport of waste fluids. In all cases, the risk of contamination by spillage or unintended discharge of fluids being managed can be adequately mitigated by ensuring wastes are stored and transported in appropriately constructed and tested storage vessels and pipelines.

In each of the scenarios outlined above, the potential risk can be adequately mitigated by appropriate assessment, design, operation and monitoring of DWI activities. Appropriately engineered technology, regional and local geologic characterisation, and site specific modelling are typically combined at the planning stage of an injection well to ensure that fluids discharged by DWI will be contained within the intended disposal interval. The assessment of resource consent applications and setting of appropriate conditions address these issues.

1.4 Resource consents

The protection of groundwater quality is of primary concern to the Council when processing resource consent applications for DWI activities. Section 15(1)(b) of the RMA stipulates that no person may discharge any contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant originated as a result of natural processes from that contaminant) entering water, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or national regulations.

Table 1 lists the consents held by the Company during the period under review, the wellsites to which the consents relate and the injection wells in use at each site. All of the resource consents were issued by the Council under Section 87(e) of the RMA.

Table 1 Summary of DWI consents held by the Company during the 2014-2015 period

Consent Number	Wellsite	Injection Well(s)	Formation
5503-1*	Rimu-A	*none identified*	*none identified*
6544-1*	Kupe Production Station	*none identified*	*none identified*
7905-1	Manutahi-D	D-2H, D-3H and D-4H ST2	Manutahi

* The consent issued for this activity requires details of proposed injection well(s) to be submitted prior to commencement of any injection. No injection activities have commenced at this site and hence details of the intended injection well(s) have not been submitted to the Council.

A summary of each consent held by the Company for DWI activities during the 2014-2015 monitoring period is included below.

Resource Consent: 5503-1
"To discharge waste drilling fluids from hydrocarbon exploration operations by deepwell injection into the Matemateaonga Formation at the Rimu-A wellsite"

Background:
Consent 5503-1, which permits the discharge of waste fluids by DWI at the Rimu-A wellsite, Old South Road, Mokoia, was originally granted to Swift on 23 June 1999.

On 29 September 2000, an application was received to change the consent conditions by removing the reference to the discharge volume. A revised consent was granted on 25 October 2000. On 5 December 2002, a further application was received to extend the lapse period for the consent. A revised consent was granted on 9 January 2003.

Consent 5503 was transferred to Origin Energy Resources New Zealand (SPV2) Ltd. on 11 April 2008 and to the current consent holder, Origin Energy Resources New Zealand (Rimu) Ltd., on 1 December 2008.

The Council waived its option to review this consent in June 2004 and June 2010 as the consent conditions were deemed adequate to deal with the potential effects of the activity. The consent is due to expire on 1 June 2016.

The current consent has five special conditions, as summarised below:

- Special conditions 1 and 3 refer to the Company's process monitoring and data submission requirements;
- Special condition 2 prohibits the discharge from endangering or contaminating any freshwater aquifer;
- Special condition 4 is a review provision; and
- Special condition 5 is a lapse clause.

It is noted that there is no record of consent 5503-1 having been exercised to date and therefore no well has been designated for disposal at the site. Therefore, on 31 March 2014, this consent lapsed, as per condition 5 in the consent.

Resource Consent: 6544-1
"To discharge produced water from hydrocarbon production operations by deepwell injection at the Kupe Production Station site"

Background:
Consent 6544, which permits the discharge of waste fluids by DWI at the Kupe Production Station, Inaha, Manaia, was granted to Origin Energy New Zealand (Kupe) Ltd, on 21 June 2005. The consent was varied in June 2010 to extend the lapse date of the consent until 30 June 2015. The consent provides for reviews in June 2017, June 2023, June 2029 and June 2034 and is due to expire on 1 June 2039.

The current consent has nine special conditions, as summarised below:

- Special condition 1 states how the activity must be undertaken;
- Special condition 2 refers to best practicable option;
- Special conditions 3, 5 and 7 refer to the Company's process monitoring and data submission requirements;
- Special condition 4 prohibits the discharge from endangering or contaminating any freshwater aquifer;

- Special condition 6 requires injection pressure to remain below that required to fracture the injection interval;
- Special condition 8 is a lapse clause; and
- Special condition 9 is a review provision.

It is noted that there is no record of consent 6544-1 having been exercised to date and therefore no well has been designated for disposal at the site. On 24 June 2015 the Company was granted a lapse extension for the consent. The consent provides for reviews in June 2017, June 2023, June 2029 and June 2034 and is due to expire in June 2039.

Resource Consent: 7905-1
"To discharge heated water, including produced water to ground at the Manutahi-D wellsite for water flooding purposes"

Background:
Consent 7905 permits the discharge of fluids for water flooding purposes at the Manutahi-D wellsite, Lower Ball Road, Kakaramea (Photo 3). The consent was granted to Origin Energy New Zealand (Rimu) Ltd., on 16 September 2011. A waterflood trial was carried out in September 2011, which resulted in the injection of 113 m^3 of heated fluids into the Manutahi Formation. The water flooding programme commenced in August 2012.

The current consent has 11 special conditions, as summarised below:

- Special condition 1 states that prior to exercising the consent, the consent holder shall submit an updated "Injection Operation Management Plan";
- Special condition 2 refers to the injection well and receiving formation information requirements;
- Special condition 3 limits the injection pressure;
- Special condition 4 limits the volume of waste that can be injected;
- Special condition 5 requires the consent holder to adopt best practicable option;
- Special conditions 6 and 7 relate to the monitoring of injected wastes and provision of data;
- Special condition 8 requires the consent holder to notify the Council prior to the first exercising of the consent;
- Special condition 9 prohibits the discharge from endangering or contaminating any freshwater aquifer;
- Special condition 10 is a lapse clause; and
- Special condition 11 is a review provision.

Consent 7905-1 provides for reviews in June 2016 and June 2022 and is due to expire in June 2028.

Photo 1 Manutahi-D wellsite and disposal wells D-2H and D-4H ST2 (7905-1)

Figure 2 shows the location of the DWI consents held by the Company during the period under review. A copy of the consent exercised during the 2014-15 monitoring period is attached in Appendix I.

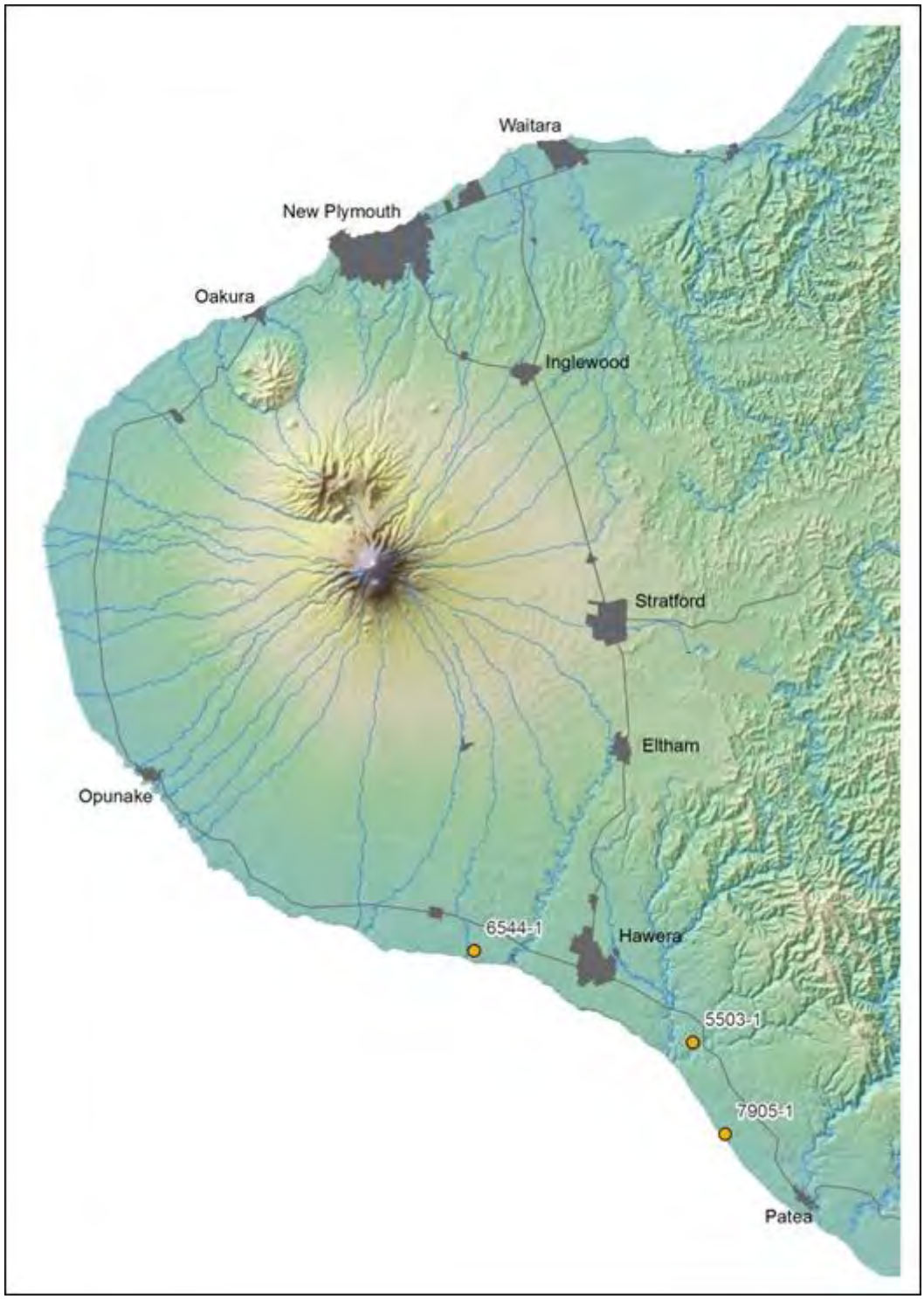

Figure 2 Resource consents for DWI held by the Company during the period under review

1.5 Monitoring programme

1.5.1 Introduction

Section 35 of the RMA sets obligations upon the Council to gather information, monitor, and conduct research on the effects arising from consented activities within the Taranaki region and report upon these.

To perform its statutory obligations, the Council may be required to take 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 implemented by the Council in relation to the Company's DWI activities consisted of four main components:

- Programme design, liaison and management;
- Site inspections and injectate sampling;
- Assessment of data submitted by the consent holder; and
- Groundwater quality monitoring.

Each component of the monitoring programme is discussed in further detail below.

1.5.2 Programme liaison and management

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

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

1.5.3 Site inspections

The monitoring programme provides for physical inspections to be undertaken at all active DWI sites operated by the Company. The inspections include an examination of the injection wellhead, viewing the monitoring equipment and the spot sampling of the injectate for laboratory analysis. 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. Samples of the injectate were collected from the injection line linking the produced water tanks to the disposal wells.

The injectate samples collected were submitted to Council's IANZ[2] accredited laboratory for the following analyses:

- pH;
- Suspended solids concentration;
- temperature;
- salinity;
- Chlorides; and
- Total petroleum hydrocarbons.

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[2] All tests reported herein have been performed in accordance with the Council laboratory's scope of accreditation.

Table 2 Location of sample points for Manutahi-D wellsite

Consent	Wellsite	Injection well	Site code	Sample point
7905-1	Manutahi-D	D-2H, D-4H ST2	GND2307	Tank 041

1.5.4 Consent holder data submission requirements

The resource consents held by the Company for DWI include conditions which require the Company to submit injection data and supporting information to the Council within specified timeframes. The injection data submitted by the consent holder forms the basis for assessing consent compliance. The major information requirements are as follows:

1. Information on the disposal well and injection zone

The conditions of the resource consents exercised by the Company required them to submit management plans for the operation of each injection well(s). The plans were 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 information requested is required to demonstrate that the exercise of the consent will not contaminate or endanger any actual or potentially useable freshwater aquifers.

2. Discharge records

For each well used for DWI during the period under review, the consent holder was required to provide discharge records. Specific data requirements included the following:

- Injection volumes;
- Injection pressures;
- Injection rate; and
- Analytical results for injectate samples.

Monthly injection discharge data was not provided to the Council at the end of each month between the months of December 2014 and May 2015 as specified in special condition 6 of Consent 7905-1. Monthly injection data for December 2014 to May 2015 was provided to the Council in June 2015.

Not all of the analytes listed in special condition 7 of consent 7905-1 were tested for by the Company at various points throughout the monitoring period. Furthermore, injectate sampling was not carried out monthly as per special condition 7. The action taken by the Council in light of this is described in section 2.4.

3. Annual reporting

The Company was required to submit annual written reports to the Council providing a summary of all injection data gathered over the previous 1 July to 30 June period. Annual reports also require the Company to detail how compliance has been achieved with the special conditions of consents exercised during the monitoring period. The Company's annual written report for the 2014-2015 period was received by the Council on 13 July 2015.

1.5.5 Groundwater quality monitoring

A programme of groundwater monitoring in the vicinity of the Company's active injection sites was initiated during the 2012-2013 period and was continued in the 2013-2014 and 2014-2015 periods. The programme provides for biannual sampling of groundwater from selected groundwater abstraction sites during each monitoring year.

In order to select suitable sampling sites for inclusion in the monitoring programme, surveys of water abstraction sites within a 1 km radius of the Manutahi-D wellsite were carried out. Initially, a desktop review of data held by the Council was conducted, including a search of the Council groundwater sites database. The desktop review indicated that the Council held records of a limited number of groundwater abstractions in the area of investigation.

Following the desktop review, a field survey was undertaken to confirm the location of known abstraction sites, to assess their suitability for sampling, and to identify any additional groundwater abstraction sites that may not have been registered with the Council.

There was no groundwater monitoring site identified for the Manutahi-D wellsite during the 2012-2013 survey. However, on 2 November 2013, a groundwater monitoring well (GND2372) was drilled for the purpose of monitoring shallow groundwater in relation to DWI activities at the wellsite. The criteria used in assessing the suitability of a site for inclusion in the monitoring programme is the proximity of the site to the injection well in use, the depth to which the bore has been drilled, its construction of specification, and its susceptibility to contamination by surface runoff.

Details of the sites selected for inclusion in the monitoring programme are listed below in Table 3.

Table 3 Details of groundwater sampling sites

Site Code	Classification	Distance from injection wellhead (m)	Casing depth (m)	Total depth (m)	High static water level (m)	Aquifer	Comment
GND2372	Bore	71	15	24	7	Volcanics	Downgradient of Manutahi-D wellsite

2. Results

2.1 Site inspections and injectate sampling

During the period under review, the Council carried out two routine DWI inspections at the Company's active DWI sites. In addition, one separate inspection was carried out by Council staff in relation to various activities at these sites during the 2014-2015 monitoring year.

Routine DWI inspections included undertaking a general visual assessment of the operational equipment, storage facilities and associated equipment. No operational issues were identified during the inspections and all equipment appeared in good condition. Company personnel were able to assist by detailing the status of injection equipment, outlining the injection operations being carried out by the Company at that time, and also providing real-time monitoring data on request.

As part of the monitoring programme, spot samples of the injectate were obtained from active injection sites during inspection visits. No sampling of injectate was carried out at the Manutahi-D wellsite during the October DWI inspection as no injection was taking place at the wellsite at that time. A sample was obtained from the wellsite on 20 April 2015. The injectate sample was submitted to the Council's IANZ accredited laboratory for physicochemical analysis. The results of the analysis are included below in Table 4. The concentrations of each analyte are within the expected range for produced water samples.

Table 4 Results of injectate sampling undertaken by the Council (2014-2015)

Parameter	Unit	Site GND2307
		20/4/15
Time	NZST	10:15
TRC sample number	-	TRC151492
pH	pH units	8.0
Conductivity @ 20°C	mS/m @ 20^0C	1,780
Alkalinity	g/m^3 $CaCO_3$	579
Chloride	g/m^3	5,790
Total petroleum hydrocarbons	g/m^3	56

2.2 Assessment of data provided by the consent holder

The Company provided a record of injection data for the 2014-2015 monitoring period, including the injection volumes, rates and pressure data.

Table 5 outlines the Company's injection activities during the period under review. The injection data provided by the Company is summarised in Table 6.

Table 5 Summary of volumes of waste discharged by DWI (2014-2015)

Consent	Wellsite	Injection wells	Total volume discharged (m^3) 01/07/13 – 30/06/14	Discharge period		TRC well ID
				From	To	
7905-1	Manutahi-D	D-2H	3,927	28/10/14	30/06/15	GND2307
		D-4H ST2	7,383	25/10/14	30/06/15	GND2309
		Total	11,310	25/10/14	30/6/15	-

Table 6 Summary of the rate and pressure of the waste discharged by DWI (2014-2015)

	7905-1 – D-2H injection well		
	Volume injected (m^3)	Injection pressure (bar)	Injection Rate (m^3/day)
Total	3,926	-	-
Daily Maximum	75	38	75
Daily Average	15	17	15
	7905-1 – D-4H ST2 injection well		
	Volume injected (m^3)	Injection pressure (bar)	Injection Rate (m^3/day)
Total	7,383	-	-
Daily Maximum	133	39	133
Daily Average	29	17	29

The injection volume and pressure data provided by the Company for injection carried out under consent 9545-1 in D-2H is presented graphically in Figures 3 and 4 and D-4H ST2 in Figures 5 and 6.

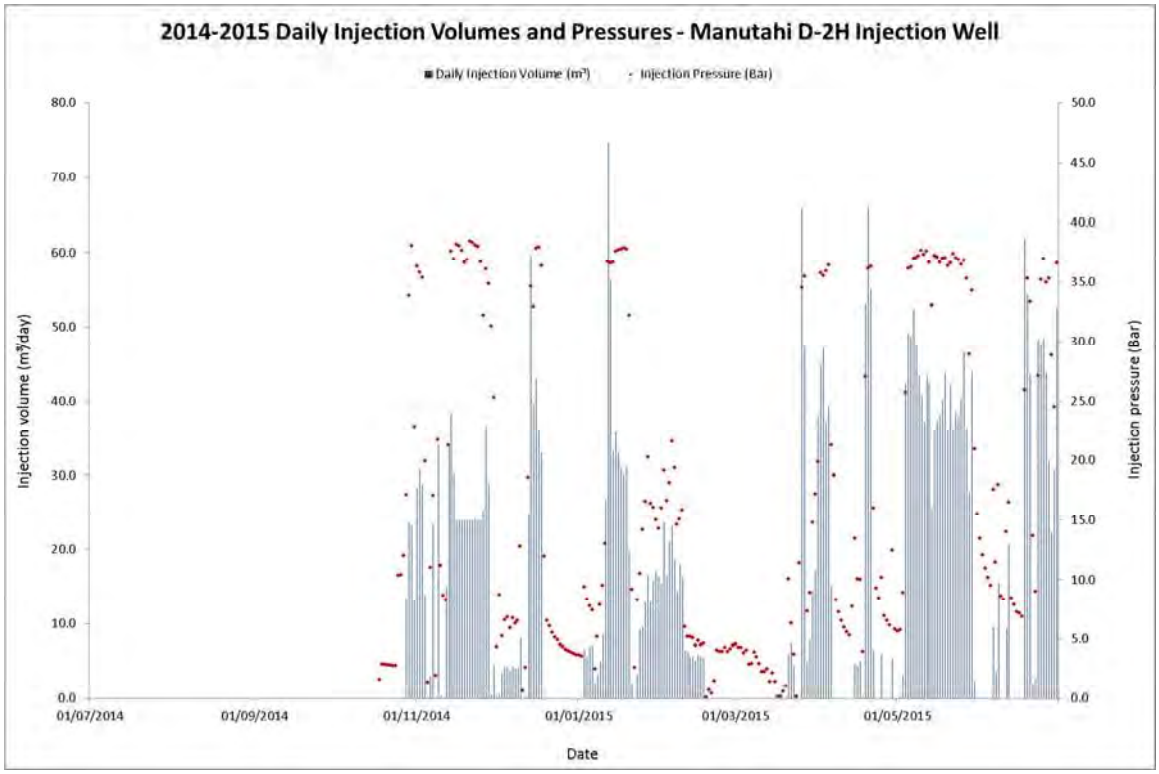

Figure 3 2014-2015 daily injection volumes and pressure –Manutahi D-2H injection well (7905-1)

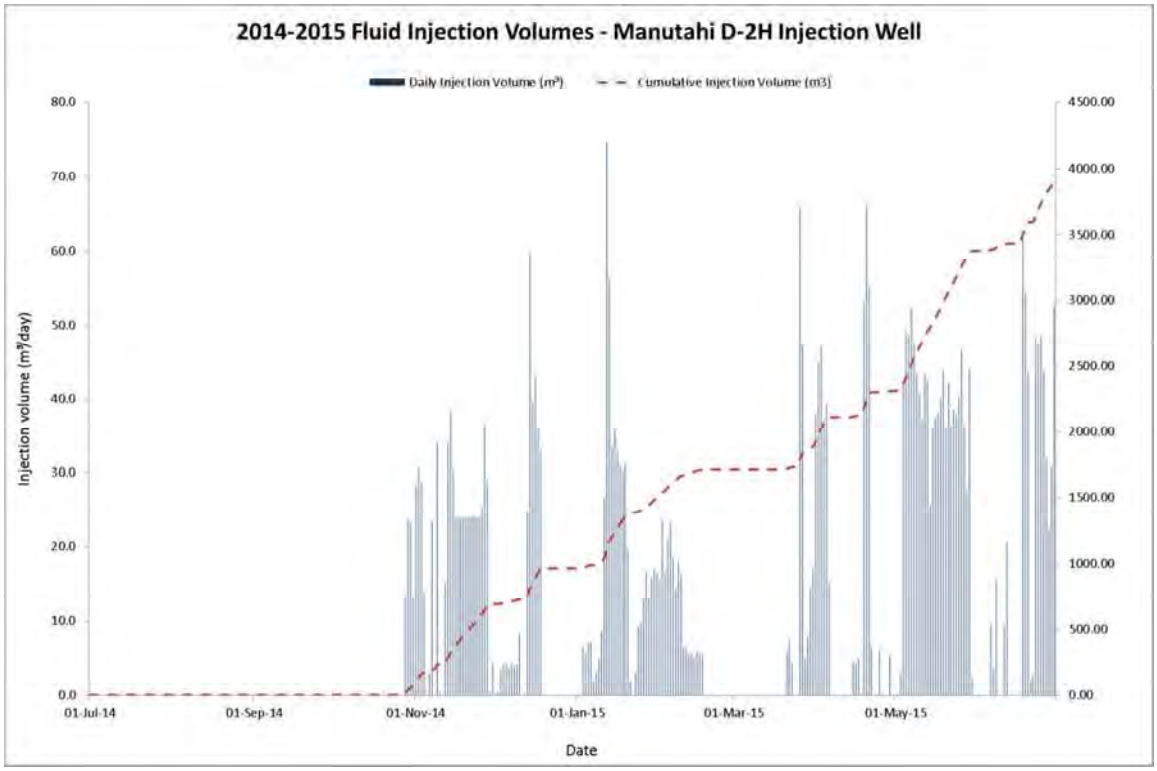

Figure 4 2014-2015 fluid injection volumes – Manutahi D-2H injection well (7905-1)

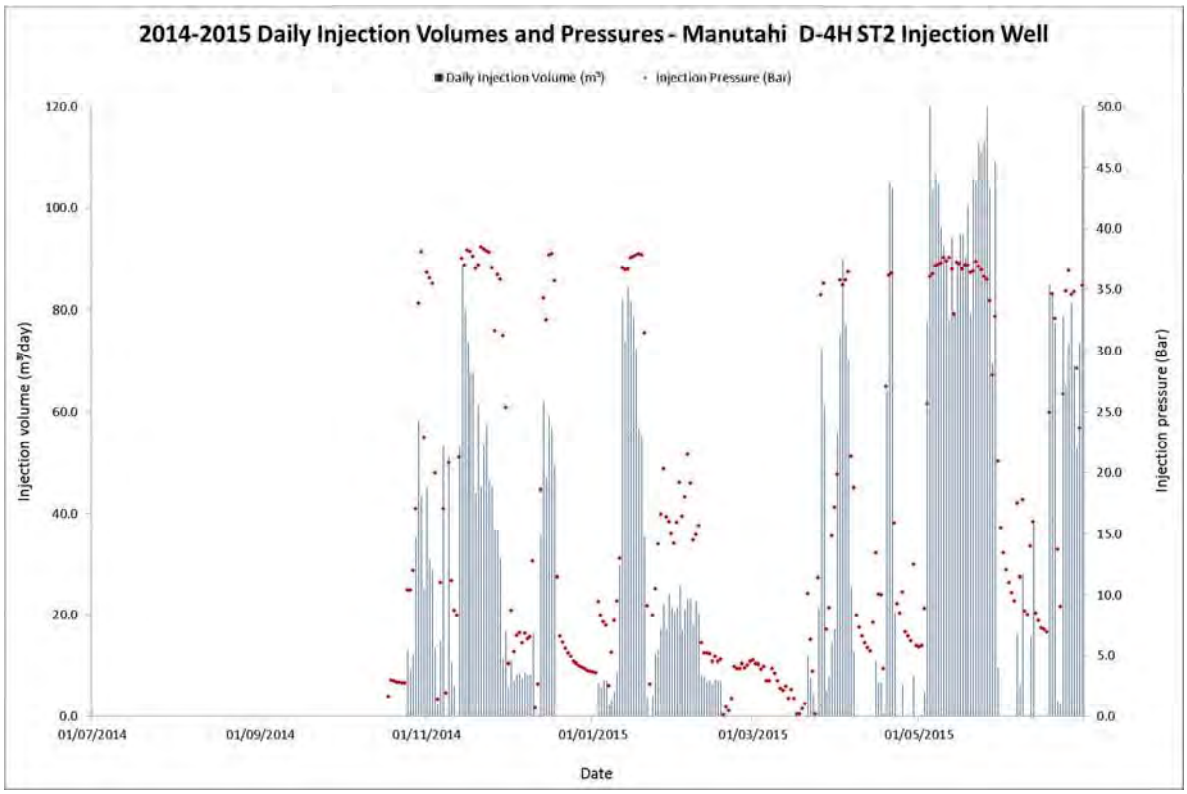

Figure 5 2014-2015 daily injection volumes and pressure –Manutahi D-4H ST2 injection well (7905-1)

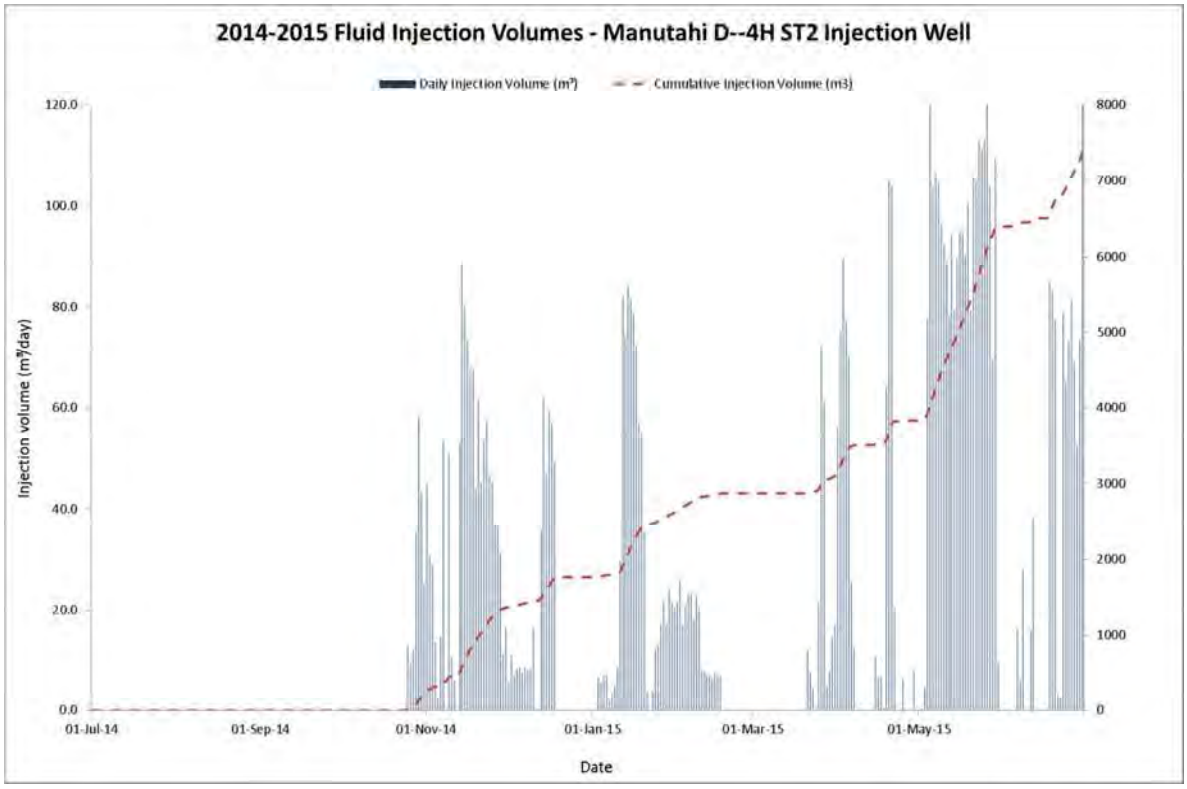

Figure 6 2014-2015 fluid injection volumes – Manutahi D-4H ST2 injection well (7905-1)

The injection volume and pressure data provided by the Company for injection carried out via the Manutahi D-2H and Manutahi D-4H ST2 wells between August 2012 and June 2015 is presented graphically in Figure 7 and Figure 8, respectively. The total annual injection volumes for the Manutahi D-2H and Manutahi D-4H ST2 wells for the 2012-13 to 2014-15 monitoring periods are shown in Figure 9 and Figure 10, respectively.

In addition to the Council's injectate sampling (Section 2.1), the Company also provided analytical results for samples of produced water injected via the Manutahi D-2H and Manutahi D-4H ST2 wells. As presented in Table 7, the maximum and mean values associated with the results of these analyses illustrate the variability in the composition of injectate across the monitoring period. The composition of the injectate varies depending on the origin and volume of fluids transferred from each individual source at the time of injection.

Table 7 Range of contaminants in injectate sampled in 2014-2015

Parameter	Unit	Number of samples	Maximum value	Minimum value	Mean value
Temperature	^{0}C	2	25	19.4	22.2
pH	pH units	4	8.1	7.0	7.5
Conductivity	uS/cm	3	18,050	10,340	15,393
Salinity	g/m^3	3	10.5	5.8	8.9
Chloride	g/m^3	3	12,514	4,736	7,760
Suspended solids	g/m^3	3	68	15	36.5
Total petroleum hydrocarbons	ppm	4	56.5	<1.0	21.6

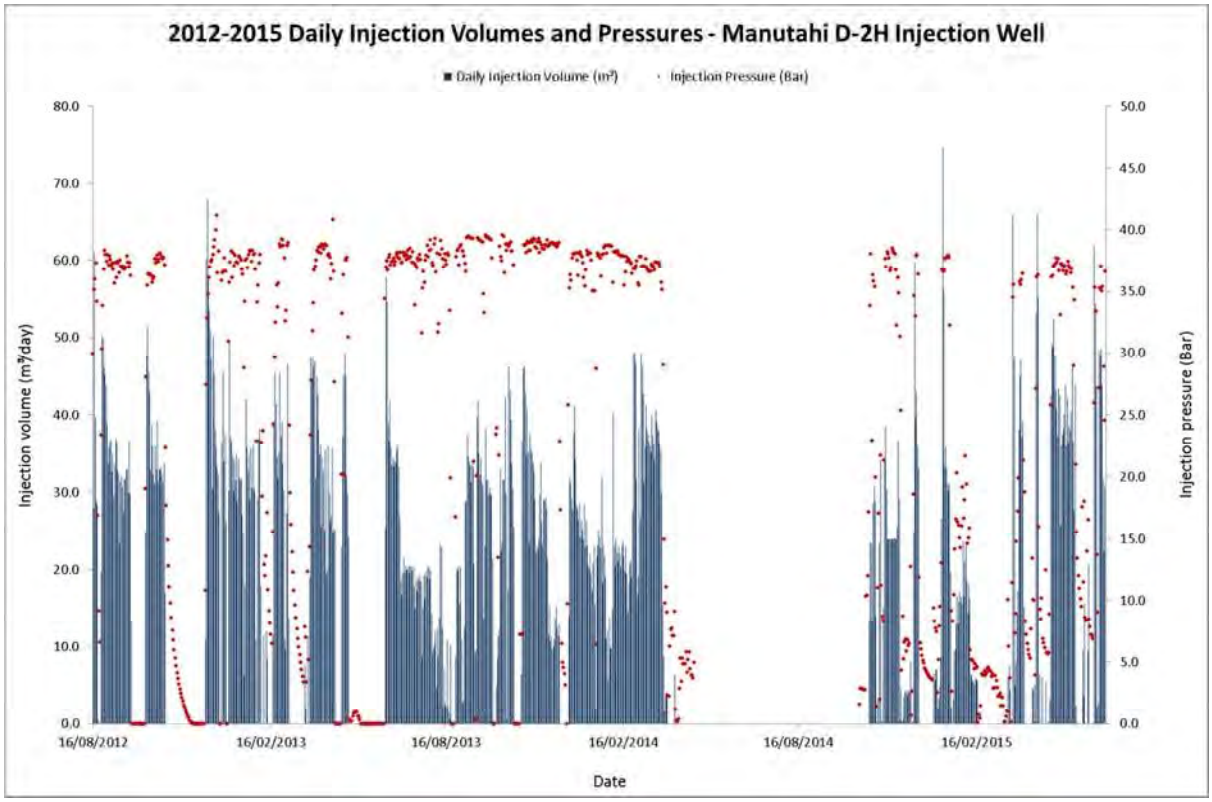

Figure 7 2012-2015 daily injection volumes and pressure –Manutahi D-2H injection well (7905-1)

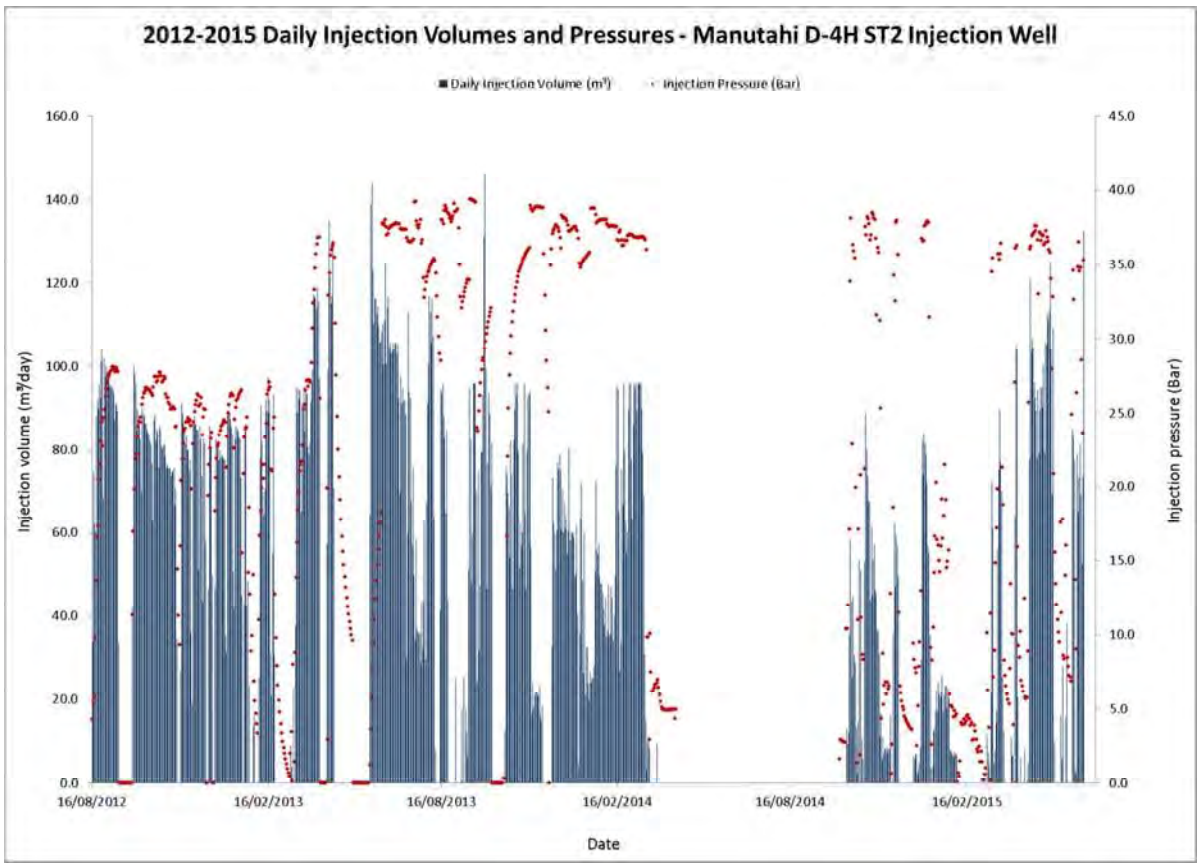

Figure 8 2012-2015 daily injection volumes and pressure –Manutahi D-2H injection well (7905-1)

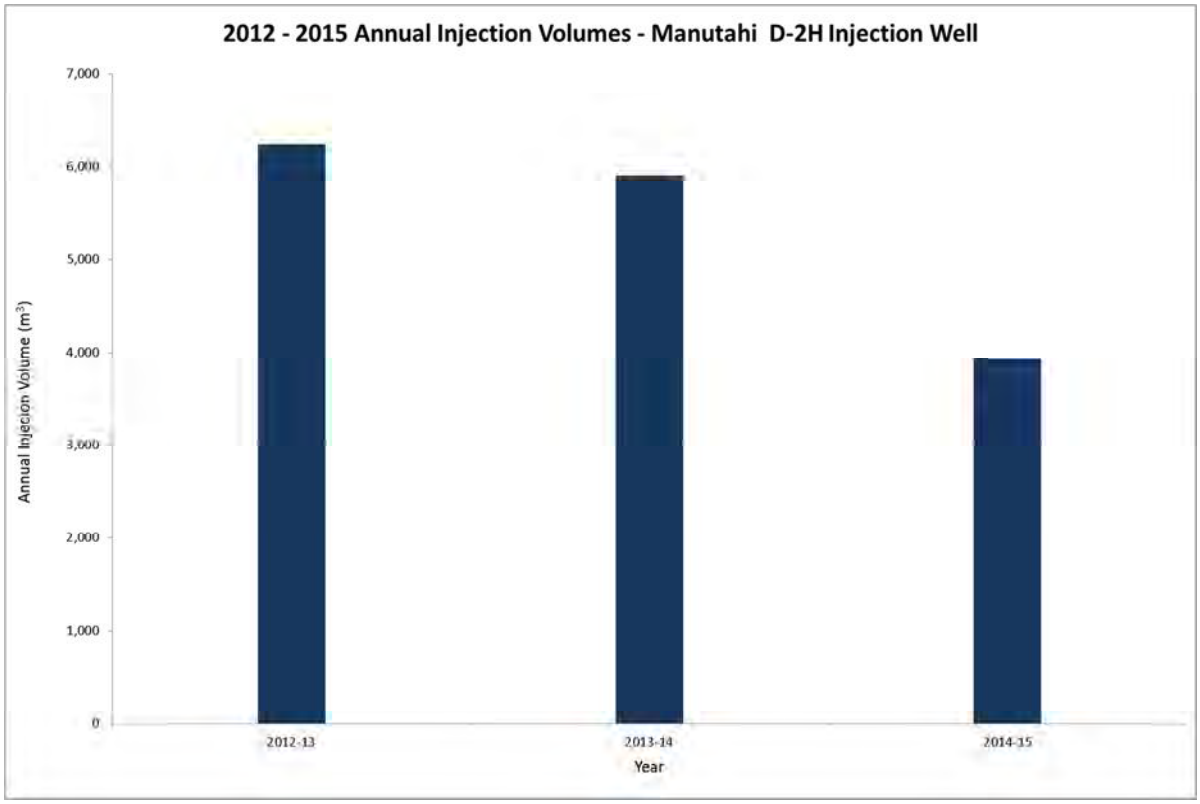

Figure 9 2012-2015 Annual injection volumes –Manutahi D-2H injection well (7905-1)

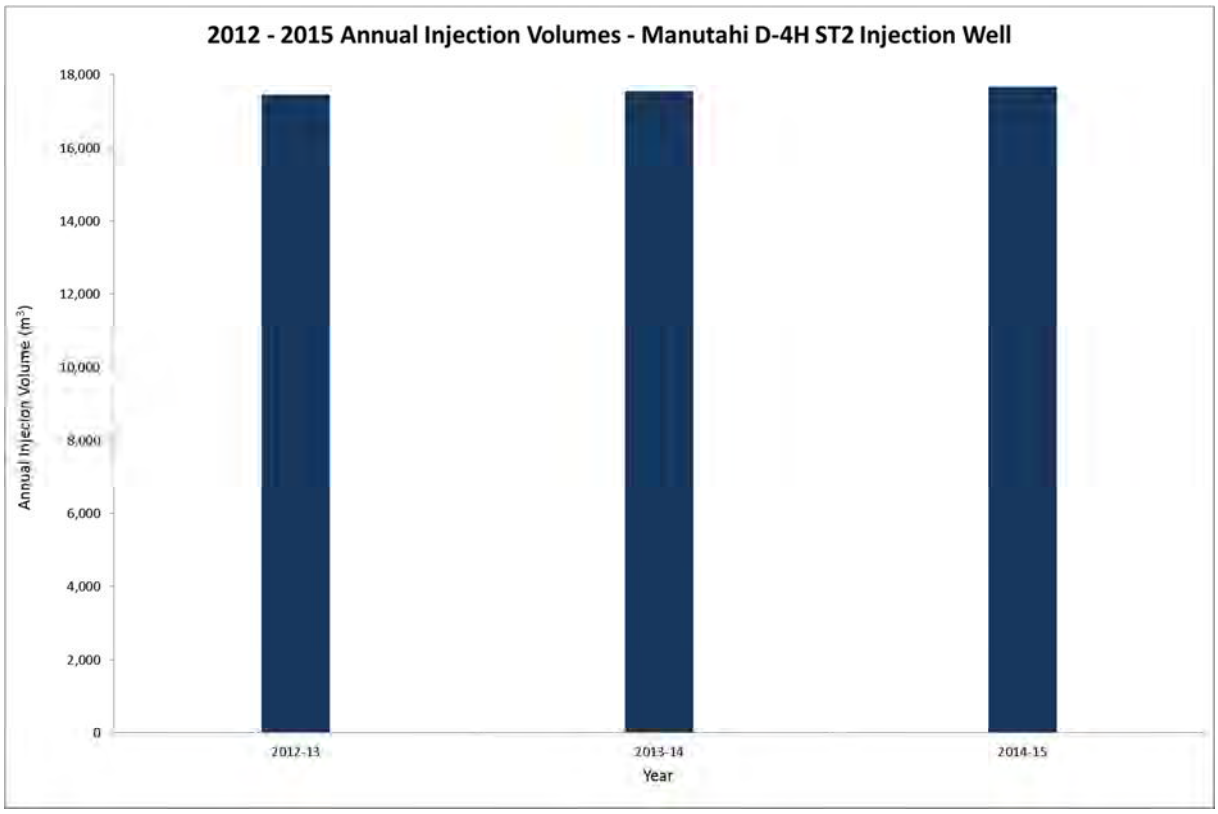

Figure 10 2012-2015 Annual injection volumes –Manutahi D-4H ST2 injection well (7905-1)

2.3 Groundwater Quality Monitoring

As part of the groundwater monitoring programme implemented in the vicinity of the Manutahi-D wellsite, groundwater samples were obtained from GND2372 on 6 October 2014 and 20 April 2015. The samples collected were analysed in the Council's IANZ accredited laboratory. Samples were analysed for a basic range of parameters, sufficient to characterise local groundwater quality, and to assess for potential contamination due to injection activities. The results of the analyses preformed on the samples collected are outlined in Table 8. Trace levels of hydrocarbons were detected during the October 2014 sampling of GND2372. The level of hydrocarbons found was well within the percentage error of the laboratory test for hydrocarbons. No hydrocarbons were detected during the April 2015 sampling event from the same well. It is not suspected that the hydrocarbons detected were caused by injected fluids migrating to freshwater aquifers.

Table 8 Results of groundwater sampling undertaken by the Council (2014-2015)

Sample details	Units	GND2372	
TRC sample number	-	TRC1411383	TRC151491
Sample date	-	6/10/2014	20/4/2015
Sample time	NZST	10:57	11:36
Analyte	Units		
Static water level	m	20.8	20.8
Temperature	ºC	15.3	16.1
pH	pH Units	7.1	7.2
Conductivity (EC)	mS/m@20ºC	46.9	47.8
Chloride	g/m^3	63.1	62.8
Total hydrocarbons	g/m^3	0.7	<0.5

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 consent holder. 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 courses 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 (IR) 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 2014-2015 period, the Council was 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. On 24 July 2015, a 14 day letter was sent to the Company due to an inadequate supply of data during the 2014-15 monitoring period. Injection pressure, maximum daily volume and total volume injected data for December 2014 to May 2015 was provided to the Council in June 2015, instead of on a monthly basis as per special condition 6 in consent 7905-1. In addition, some parameters were missing for injectate samples carried out by the Company, and sampling was not carried out on a monthly basis between January and May 2015, as per special condition 7 in consent 7905-1. The reasons for the non compliance provided by the Company were as follows;

- A plant shutdown in 2014 led to reporting requirements to the Council being overlooked once the plant started injection again;
- The plant was only producing for a total of 28 days between January and April 2015. The laboratory technician visited the site on days the plant was not injecting, resulting in no samples being taken over these months;
- Knowledge of the consent requirements had not been communicated adequately with the laboratory technician;
- No checks were carried out by the Environmental Advisor to ensure information was being sent over the December to May period.

Sampling procedures have been reviewed by the Company and procedures are now in place to ensure that an injection water sample is taken every month. The requirement to send monthly injection data to the Council has now been included on the production data co-ordinator's month end checklist. The Council is happy with the actions taken by the Company to avoid non-compliance issues in the future and as long as the Company continues to comply with the special conditions of their consent and other requirements contained in the Regional Plans, no further action will be taken.

3. Discussion

During the period under review, the Company exercised one resource consent, 7905-1, for the injection of fluids by DWI. This consent authorised the discharge of various forms of fluid into the Mateamateaonga Formation, via the Manutahi D-2H and Manutahi D-4H ST2 wells. Produced water from the Company's producing fields was the main source of fluid for injection.

Consent 7905-1 permits the discharge of heated water, including produced water to ground at the Manutahi-D wellsite. The Company injects the water for enhanced oil recovery purposes within its Manutahi Field. Injection was carried out under the consent between 25 October 2014 and 30 June 2015. No injection took place between 1 July 2014 and 24 October 2014 due to a well shut in. The injection was via two separate wells, Manutahi D-2H and D-4H ST2. The Manutahi D-2H and Manutahi D-4H ST2 wells discharge into a confined oil reservoir within the Manutahi Formation. Injection via Manutahi D-2H occurs between 1,114.3 -1,114.9 m TVD (below ground level), and injection via Manutahi D-4H ST2 occurs between 1,112.8 -1,125.5 m TVD (below ground level). During the period under review, a total of 11,310 m^3 was injected under consent 7905-1. A total of 3,927 m^3 was injected via the D-2H well, at an average of 15 m^3/day, and 7,383 m^3 was injected via the D-4H ST2 well, at an average of 29 m^3/day. The maximum injection pressure reached within the D-2H and D-4H ST2 wells were 38 bar and 39 bar, respectively.

Special condition 4 of consent 7905-1 specifies a maximum daily injection volume of 318 m^3. Based on the data provided by the Company, the highest volume of daily injection occurred on 30 June 2015, when 133 m^3 was injected via the D-4H ST2 well. Special condition 3 requires that the maximum injection pressure is to remain below 50 bar. Based on the data provided by the Company, the maximum injection pressure reached was 39 bar (D-4H ST2 well). Both the maximum daily discharge volume and maximum injection pressure were within the consented limits.

Daily injection volumes and pressures over the 2012-2013 to 2014-2015 monitoring periods show that injection pressures in both Manutahi D-2H and Manutahi D-4H ST2 only increase when large volumes of fluid are being injected. When lower volumes are being injected, the pressure decreases accordingly, indicating that capacity remains within the formation for further injection. Annual injection volume data shows that the volumes of fluid injected via the Manutahi D-2H well has decreased over the last three years. Annual injection volumes decreased from 6,239 m^3 in 2012-2013 to 3,926 m^3 in 2014-2015 monitoring periods. Volumes of fluid injected via the Manutahi D-2H ST2 well has remained realatively consistent over the last three years. Annual injection volumes increased from 17,438 m^3 in 2012-2013 to 17,652 m^3 in 2014-2015 monitoring periods.

For each of the wells used for DWI during the monitoring period, the consent holder has provided sufficient information regarding well construction and the injection zone to satisfy the relevant consent and monitoring programme information requirements. However, if deemed necessary, the Council may request further information from the consent holder that illustrates that the wells being used for the injection and the receiving formation remain secure.

During the 2014-2015 period, consent holder performance was assessed on compliance with consent conditions, with a particular emphasis on record keeping requirements and information provision, and the analysis of the information and data provided. Compliance with the conditions of the DWI consents exercised during the 2014-2015 year is summarised below in Section 4.1.

The consent holder is required to ensure that the discharge does not result in any contamination of any actual or potential useable freshwater aquifer. Compliance with this condition is based on the assessment of consent holder submitted data, and the sampling and analysis of local groundwater abstractions. There is no evidence to suggest that the injection of fluids by DWI at either of the Company's active injection sites has resulted in the vertical migration of contaminants outside of the intended injection interval. During the period under review, a groundwater sampling site was identified in the vicinity of the Manutahi-D wellsite and sampled. The results of the analyses carried out do not indicate any form of contamination of local groundwater due to injection activities at the Manutahi-D wellsite.

No complaints were received from the public with regard to any of the Company's DWI activities during the period under review, and no incidents were recorded by the Council.

3.1 Evaluation of performance

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

Table 9 Summary of Company performance with regard to consent 7905-1

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. 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	Yes
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	No*
7. Provision of records of chemical analysis of discharge .	Receipt of discharge analytical results	No**
8. Notification provision.	Received five working days prior to consent exercise	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?
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 consent compliance and administrative performance in respect of this consent		Good

N/A = not applicable

*Records were not provided to the Council at the end of each month, but were received by the end of the monitoring period.

**Discharge was not sampled each month, and when sampled, some analytes were not tested for.

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

3.2 Recommendations from the 2013-2014 Annual Report

In the 2013-2014 Annual Report, it was recommended:

1. THAT the range of monitoring carried out during the 2013-2014 period in relation to the Company's DWI activities be continued during the 2014-2015 monitoring period.

   The recommendation was implemented in the 2014-2015 period.

2. THAT sampling of shallow groundwater in the vicinity of active injection wells be carried out on a biannual basis.

   The recommendation was implemented in the 2014-2015 period.

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

There was no review of any DWI consent held by the Company during the 2014-2015 period as it was deemed that the conditions of each consent were adequate to deal with the potential adverse effects of the activity.

3.3 Alterations to monitoring programmes for 2015-2016

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account the extent of information made available by previous authorities, its relevance under the RMA, its obligations to monitor emissions/discharges and effects under the RMA, and report 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 emitting to the atmosphere/discharging to the environment.

It is proposed that the range of monitoring carried out in the 2014-2015 period be continued in the 2015-2016 period.

3.4 Exercise of optional review of consent

The next optional review date for consent 7905-1 is provided for in June 2016.

The Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent. A review may be required 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.

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

4. Recommendations

1. That discharge records are provided to the Council at the end of each month, as per special condition 6 in Consent 7905-1.

2. That all analytes listed in special condition 7 of consent 7905-1 are tested for each month that discharge is occurring at the Manutahi-D wellsite.

3. THAT the range of monitoring carried out during the 2014-2015 period in relation to the Company's DWI activities be continued during the 2015-2016 monitoring period.

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

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.
Bcf	Billion cubic feet.
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 earths 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.
Freshwater-saline-water interface	The depth in a well at which fresh water becomes saline. The interface may be a gradational or sharp transition, depending on geology. The FW-SW transition is demonstrated by down-hole geophysical logging.
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 ("fraccing").
Injectate	Fluid disposed of by deep well injection.
IR	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.
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.
mbgl	Metres below ground level.
m^3	Cubic metre.

Packer	A down hole device used to isolate the annulus from the production conduit, enabling controlled production, injection or treatment.
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.
Power fluid	Pressurised fluids used to transmit and control energy into oil/gas wells. Cheal power fluid is a heated combination of fresh and produced water.
ppt	Parts per thousand.
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).
The Act	Resource Management Act 1991 and subsequent amendments.
TRC	Taranaki Regional Council (the Council).
TVDSS	True vertical depth sub sea. Given as metres below sea level.
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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Appendix I

DWI consent exercised in 2014-2015 period

Discharge Permit

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

Name of Consent Holder:	Origin Energy Resources NZ [Rimu] Limited Private Bag 2022 NEW PLYMOUTH
Change To Conditions Date:	8 December 2008 [Granted: 23 June 1999]

Conditions of Consent

Consent Granted:	To discharge waste drilling fluids from hydrocarbon exploration operations by deepwell injection into the Matemateaonga Formation at the Rimu-A wellsite at or about (NZTM) 1717352E-5611071N
Expiry Date:	1 June 2016
Review Date(s):	June 2010
Site Location:	Rimu-A wellsite, Old South Road, Mokoia [Property owner: M & P Hawken & Tongahoe Farm Limited]
Legal Description:	Lots 4 & 5 DP 9677 Blk XIV Hawera SD
Catchment:	Manawapou

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

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

Conditions 1 to 4 [unchanged]

1. That prior to the exercise of this consent, the consent holder shall submit to the Taranaki Regional Council a log of the well, to the satisfaction of the Chief Executive, to demonstrate the conditions of consent can be met.

2. That the consent holder shall ensure that injection will not contaminate or endanger any actual or potential usable freshwater aquifer.

3. That the consent holder shall keep records of amounts of drilling fluids injected, including injection pressure and rate, and shall make the records available to the Taranaki Regional Council upon request.

4. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 2004 and/or June 2010, 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 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.

Condition 5 [new]

5. This consent shall lapse on 31 March 2014 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.

Signed at Stratford on 8 December 2008

For and on behalf of
Taranaki Regional Council

_____

Director-Resource Management

Discharge Permit

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

Name of Consent Holder:	Origin Energy Resources (Kupe) Limited Private Bag 2202 New Plymouth 4342
Decision Date (Change):	24 June 2015
Commencement Date (Change):	24 June 2015 (Granted Date: 21 June 2005)

Conditions of Consent

Consent Granted:	To discharge produced water from hydrocarbon production operations by deepwell injection at the Kupe Production Station site
Expiry Date:	1 June 2039
Review Date(s):	June 2017, June 2023, June 2029, June 2034
Site Location:	Kupe Production Station, west of Inaha Road, east of Kapuni Road (being a paper road) and south of Siggs Road (being a paper road), Inaha, Manaia
Legal Description:	Secs 55, 56 Pt Secs 53, 54 Sbdn 1 of Pt Sec 53 Sbdn 1 of Pt Sec 54 DP 2201 Blk VII Waimate SD Sec 17 Blk VII I Waimate SD
Grid Reference (NZTM)	1699750E-5618461N
Catchment:	Kapuni

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

General conditions

a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.

b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.

c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:

i) the administration, monitoring and supervision of this consent; and
ii) charges authorised by regulations.

Special conditions

1. The exercise of this consent shall be undertaken in general accordance with the documentation submitted in support of application 3514. In the case of any contradiction between the documentation submitted in support of application 3514 and the conditions of this consent, the conditions of this consent shall prevail.

2. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.

3. Prior to the exercise of this consent for each individual well to be used for deepwell injection, the consent holder shall submit, to the written satisfaction of the Chief Executive, Taranaki Regional Council, a log of the injection well, and an injection well operation management plan, to demonstrate that special condition 4 of this consent can be met. The report shall:

a) identify the injection zone, including a validated bore log and geophysical log;
b) detail the results of fluid sampled from the injection zone, and the proposed wastes to be injected for maximum and mean concentrations for pH, suspended solids, total dissolved solids, salinity, chlorides, and total hydrocarbons;
c) demonstrate the integrity of well casing; and
d) outline design and operational procedure to isolate the zone.

4. The consent holder shall ensure that injection will not contaminate or endanger any actual or potential useable freshwater aquifer.

5. The consent holder shall keep daily records of the nature and amounts of all material injected, including injection pressure and rate, and mean concentrations of pH, suspended solids, total dissolved solids, salinity, chlorides, and total hydrocarbons. The consent holder shall make the records available to the Taranaki Regional Council on a 3 monthly basis, and when there has been a significant pressure change event.

6. The consent holder shall inject fluids at pressures below the pressure that would be required to fracture the injection formation.

7. The consent holder shall provide to the Taranaki Regional Council during the month of May of each year, for the duration of the consent, a written report on all matters required under special conditions 3, 4, 5, and 6 above.

8. This consent shall lapse on 30 June 2020, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

9. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2011 and/or June 2017 and/or June 2023 and/or June 2029 and/or June 2034, 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 24 June 2015

For and on behalf of
Taranaki Regional Council

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B G Chamberlain
Chief Executive

Discharge Permit

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

Name of Consent Holder:	Origin Energy Resources NZ [Rimu] Limited Sustainability Manager Private Bag 2022 NEW PLYMOUTH 4342
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 at or about (NZTM) 1719971E-5603672N
Expiry Date:	1 June 2028
Review Date(s):	June 2016, June 2022
Site Location:	Manutahi-D wellsite, Lower Ball Road, Kakaramea [Property Owner: NA Schrider & PW Campbell]
Legal Description:	Lot 5 DP 14553 Blk I Carlyle SD [Discharge source & site]
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 to section 36 of the Resource Management Act

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.

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.

Signed at Stratford on 16 September 2011

For and on behalf of
Taranaki Regional Council

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Director – Resource Management