

Shell Todd Oil Services Limited  
Deep Well Injection  
Monitoring Programme  
Annual Report  
2015-2016

Technical Report 2016-61

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## Executive summary

Shell Todd Oil Services Limited (the Company) operates a number of wellsites within the Taranaki Region, most notably the Kapuni wellsites. Each wellsite contains varying numbers of producing wells and associated production infrastructure. Two of the Kapuni wellsites, KA-9 and KA1/7/19/20, were consented for deep well injection (DWI) activities during the review period. This report for the period July 2015 to June 2016 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) in relation to the Company's DWI activities. The report details the results of the monitoring undertaken, assesses the Company's environmental performance during the period under review and the environmental effects of their DWI activities.

The Company held two resource consents during the review period, which included a total of 32 conditions setting out the requirements that the Company must satisfy. Only one of the consents was exercised during the period being reported.

**During the monitoring period Shell Todd Oil Services Limited demonstrated an overall high level of environmental performance.**

The Council's monitoring programme for the year under review included two inspections, two injectate samples, and seven 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 at monitored locations. Inspections undertaken during the monitoring year found sites being operated in a professional manner and there were no Unauthorised Incidents in relation to any of the Company's DWI consents.

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

For reference, in the 2015-2016 year, 71% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 24% demonstrated a good level of environmental performance and compliance with their consents.

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 high level.

This report includes recommendations to be implemented during the 2016-2017 monitoring period.

## Table of contents

	<b>Page</b>
1. Introduction	1
1.1 Compliance monitoring programme reports and the Resource Management Act 1991	1
1.1.1 Introduction	1
1.1.2 Structure of this report	1
1.1.3 The Resource Management Act 1991 and monitoring	1
1.1.4 Evaluation of environmental and administrative performance	2
1.2 Process description	4
1.3 Resource consents	4
1.3.1 Water abstraction permit	4
1.4 Monitoring programme	8
1.4.1 Introduction	8
1.4.2 Programme liaison and management	8
1.4.3 Site inspections	8
1.4.4 Injectate sampling	8
1.4.5 Groundwater sampling	9
1.4.6 Assessment of data submitted by the Company	11
2. Results	12
2.1 Site inspections	12
2.2 Injectate sampling	12
2.3 Groundwater sampling	13
2.4 Assessment of data submitted by the Company	14
2.5 Investigations, interventions, and incidents	17
3. Discussion	18
3.1 Discussion of site performance	18
3.2 Environmental effects of exercise of consents	18
3.3 Evaluation of performance	19
3.4 Recommendations from the 2014-2015 Annual Report	21
3.5 Alterations to monitoring programmes for 2016-2017	21
3.6 Exercise of optional review of consent	21
4. Recommendations	22
Glossary of common terms and abbreviations	23
Bibliography and references	25
Appendix I Resource consents held by Shell Todd Oil Services Limited	
Appendix II AECOM Groundwater Sampling Results	

## List of tables

<b>Table 1</b>	DWI consents held by the Company during the 2015-2016 monitoring year	5
<b>Table 2</b>	Location of groundwater monitoring sites	9
<b>Table 3</b>	Results of injectate sampling undertaken by the Council	12
<b>Table 4</b>	Results of injectate sampling undertaken by the Company (2015-2016)	13
<b>Table 5</b>	Results of groundwater sampling undertaken by the Company (2015-2016)	13
<b>Table 6</b>	Results of groundwater sampling undertaken by the Company (2015-2016)	14
<b>Table 7</b>	Summary of injection activity during the 2015-2016 monitoring year	14
<b>Table 8</b>	Summary of injection occurring under consent 1336-3 and 9970-1 (2013-2016)	15
<b>Table 9</b>	Summary of performance for consent 9970-1	19

## List of figures

<b>Figure 1</b>	DWI schematic ( <a href="http://www.epa.gov/uic">www.epa.gov/uic</a> )	4
<b>Figure 2</b>	Locations of the KA9 and KA1/7/19/20 wellsites and associated injection wells	7
<b>Figure 3</b>	Groundwater monitoring bore sites in relation to injection wells	10
<b>Figure 4</b>	Total daily injection volume KW-2 well (2015-2016)	15
<b>Figure 5</b>	Maximum daily injection pressure KW-2 well (2015-2016)	16
<b>Figure 6</b>	Total daily injection volume KW-2 well (2012-2016)	16
<b>Figure 7</b>	Maximum daily injection pressure consent KW-2 well (2012-2016)	17



# **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 2015 to June 2016 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Shell Todd Oil Services Limited (the Company) for deep well injection (DWI) activities. During the period under review the Company held two resource consents for the subsurface injection of fluids by DWI. The consents authorise discharges via the KW-2 well, located at the KA9 wellsite Lower Duthie Road, Kapuni and via the KA-01 and KA-07 wells, located at the KA1/7/19/20 wellsite, Palmer Road, Kapuni.

The resource consent permits the discharge of a range of fluids by DWI, including produced water, contaminated stormwater, drilling fluids, hydraulic fracturing (HF) fluids and production sludges. The consent includes a number of special conditions which set out specific requirements the Company must satisfy.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the DWI consents held by the Company. This is the third 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 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 2016-2017 monitoring year.

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

### **1.1.3 The Resource Management Act 1991 and monitoring**

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

- (a) the neighbourhood or the wider community around an activity, and may include cultural and social-economic effects;
- (b) physical effects on the locality, including landscape, amenity and visual effects;
- (c) ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;
- (d) natural and physical resources having special significance (for example recreational, cultural, or aesthetic); and
- (e) risks to the neighbourhood or environment.

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

#### 1.1.4 Evaluation of environmental and administrative performance

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

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

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

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

##### **Environmental Performance**

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



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

For example:

- High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
  - Strong odour beyond boundary but no residential properties or other recipient nearby.
- **Improvement required:** Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.
  - **Poor:** Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

### **Administrative performance**

- **High:** The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.
- **Good:** Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.
- **Improvement required:** Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.

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

For reference, in the 2015-2016 year, 71% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 24% demonstrated a good level of environmental performance and compliance with their consents.

## 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'). The DWI consents currently held by the Company also authorise the injection of various other fluid types. The specific range of fluid types varies by consent, but include saline groundwater, well workover fluids, well drilling fluids, hydraulic fracturing fluids and hydraulic fracturing return fluids.

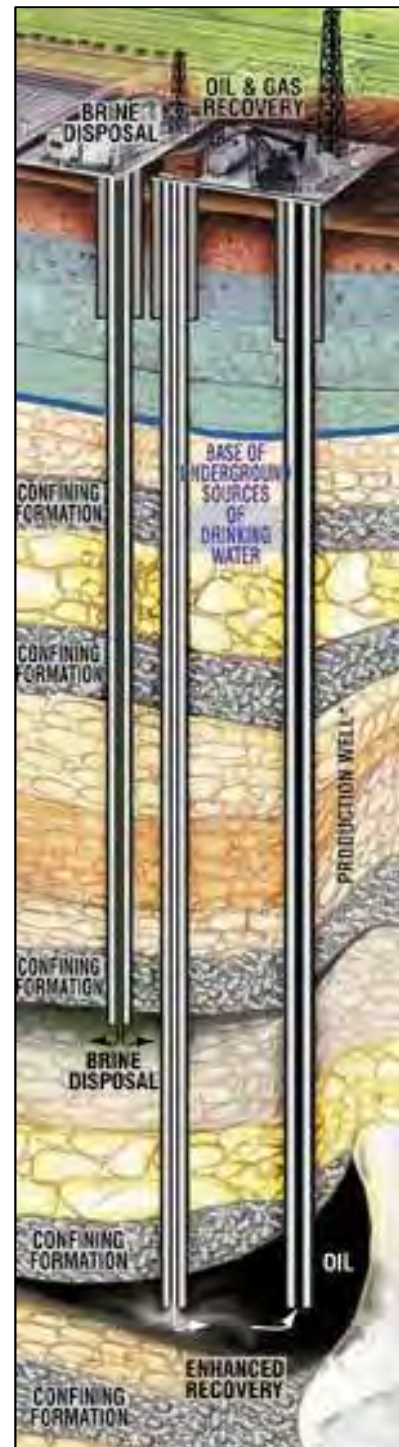
A schematic representation of injection wells for both waste discharge and enhanced oil recovery is presented in Figure 1.

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

### 1.3.1 Water abstraction permit

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



**Figure 1** DWI schematic  
([www.epa.gov/uic](http://www.epa.gov/uic))

premises onto land under any circumstances, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

The Company held two discharge consents covering their DWI activities during the review period (Table 1). Although both consents were valid during the reporting period all activities were carried out under consent 9970-1.

**Table 1** DWI consents held by the Company during the 2015-2016 monitoring year

Consent number	Wellsite	Status	Injection well(s)	TRC bore id.	Formation	Issued	Expiry
1336-3*	KA9	Not active	KW-2	GND1412	Matemateaonga	09/08/2013	01/06/2023
	KA1/7/19/20	Not active	KA-01	GND1683	Mangahewa	-	-
	KA1/7/19/20	Not active	KA-07	GND1684	Mangahewa	-	-
9970-1	KA9	Active	KW-2	GND1412	Matemateaonga	07/10/2014	01/06/2029
	KA1/7/19/20	Active	KA-01	GND1683	Mangahewa	-	-
	KA1/7/19/20	Active	KA-07	GND1684	Mangahewa	-	-

\* surrendered 20 November 2015

Consent **1336-3** was issued to the Company by the Council on 9 August 2013 under Section 87(e) of the RMA. It was due to expire on 1 June 2023 and was surrendered on 20 November 2015. The consent authorised the discharge of waste fluids by DWI at the KA-9 and KA1/7/19/20 wellsites.

The consent had eleven special conditions, as summarised below:

- Condition 1 requires the best practicable option to be adopted for the discharge;
- Conditions 2, 3, 5, 6 and 8 refer to information and data submission requirements;
- Condition 4 prohibits the discharge from endangering or contaminating any freshwater aquifer;
- Condition 7 limits injection pressures to those which do not fracture the stratigraphic seals of the injection zone;
- Condition 9 details the consent lapse and expiry dates;
- Condition 10 contains review provisions; and
- Condition 11 allows for the introduction of new chemicals to the produced water system, provided they can reasonably be expected to be used in petrochemical well maintenance and development, and they will not have environmental effects that are more adverse than current chemicals in use.

Consent 1336-3 was surrendered on 20 November 2015

Consent **9970-1** was issued to the Company by the Council on 7 October 2014 under Section 87(e) of the RMA. It is due to expire on 1 June 2029. The consent authorises the discharge of waste fluids by DWI at the KA-9 and KA1/7/19/20 wellsites. The company applied for consent 9970-1 because consent 1336-3 required the Company to seek prior approval from the Council for any additives being used in the injection fluid that were not listed in the original application. Consent 9970-1 is less prescriptive and covers a wider range of additives.

The consent has 21 special conditions, as summarised below:

- Condition 1 sets a maximum daily injection volume of 2,000 m<sup>3</sup>/day;
- Condition 2 requires to consent holder to submit an “Injection Operation Management Plan” by 1 January 2015;
- Condition 3 requires the consent holder to submit well completion information;
- Condition 4 requires that no injection be made after 1 June 2024;
- Condition 5 requires to BPO requirements;
- Condition 6 sets a minimum injection depth of 1,200 mbgl;
- Condition 7 requires the consent holder to submit an “Injection Operation Management Plan” prior to utilising either contingency back up wells;
- Condition 8 prohibits the discharge from resulting in the fracturing of the geological seals confining the injection zone;
- Condition 9 prohibits the discharge from endangering or contaminating any freshwater aquifer;
- Condition 10 limits the type of fluid that may be discharged;
- Condition 11 lists other fluids that may be discharged subject to a number of conditions;
- Conditions 12, 13, 14 and 15 refer to process monitoring and data submission requirements;
- Conditions 16, 17 and 18 relate to the requirement for the consent holder to implement a groundwater monitoring programme;
- Condition 19 requires an annual report summarising data collected and compliance with consent conditions to be provided before 31 August each year;
- Condition 20 is a lapse clause; and
- Condition 21 is a review provision.

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

Copies of both consents are attached to this report in Appendix I.



**Figure 2** Locations of the KA9 and KA1/7/19/20 wellsites and associated injection wells

## **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 active DWI sites consisted of five primary components.

### **1.4.2 Programme liaison and management**

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

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- in discussion over monitoring requirements;
- preparation for any reviews;
- renewals;
- new consents;
- 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 KA9 and KA1/7/19/20 wellsites were inspected once by Council Officer's during the monitoring period. With regard to consents for the abstraction of or discharge to water, the main points of interest are plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focus on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the Company are also identified and accessed, so that performance in respect of operation, internal monitoring, and supervision can be reviewed by the Council. The neighbourhood is surveyed for environmental effects.

An additional two visits to the Company's Kapuni Production Station were undertaken by Council Officer's for injectate sampling purposes as outlined in Section 1.4.4.

### **1.4.4 Injectate sampling**

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

Injectate samples were collected from the bulk storage tank at the Kapuni Production Station, identified on-site as tank T604.

The injectate samples were analysed for the following parameters:

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

#### 1.4.5 Groundwater sampling

The Company contracted AECOM Consulting Services New Zealand Limited (AECOM) to carry out the sampling on their behalf during the 2015-2016 monitoring period, as it has done for the previous monitoring periods. AECOM obtained samples of groundwater from four existing groundwater monitoring sites on two separate occasions. Details of the sites sampled by AECOM are included in Table 2. The locations of the groundwater monitoring sites in relation to the injection well being monitored are illustrated in Figure 3.

**Table 2** Location of groundwater monitoring sites

AECOM reference	Site code	Type	Distance from wellsite (m)	Screened/open depth (m)	Total depth (m)	High static water level (m)	Aquifer	Sample type
Site 1	GND1143	Bore	948	40	65	18	Volcanics	Tap
Site 2	GND1701	Bore	2,971	92	337	NR*	Matemateaonga	Tap
Site 3	GND2369	Bore	4,643	280	448	NR*	Matemateaonga	Tap
Site 4	GND1659	Bore	4,020	123	432	6	Matemateaonga	

NR\* Not Recorded: Design of the bore prevents static water level from being measured from the ground surface

Groundwater samples were sent by AECOM to Hill Laboratories Limited (Hills) and analysed for the following range of chemical parameters:

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

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

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



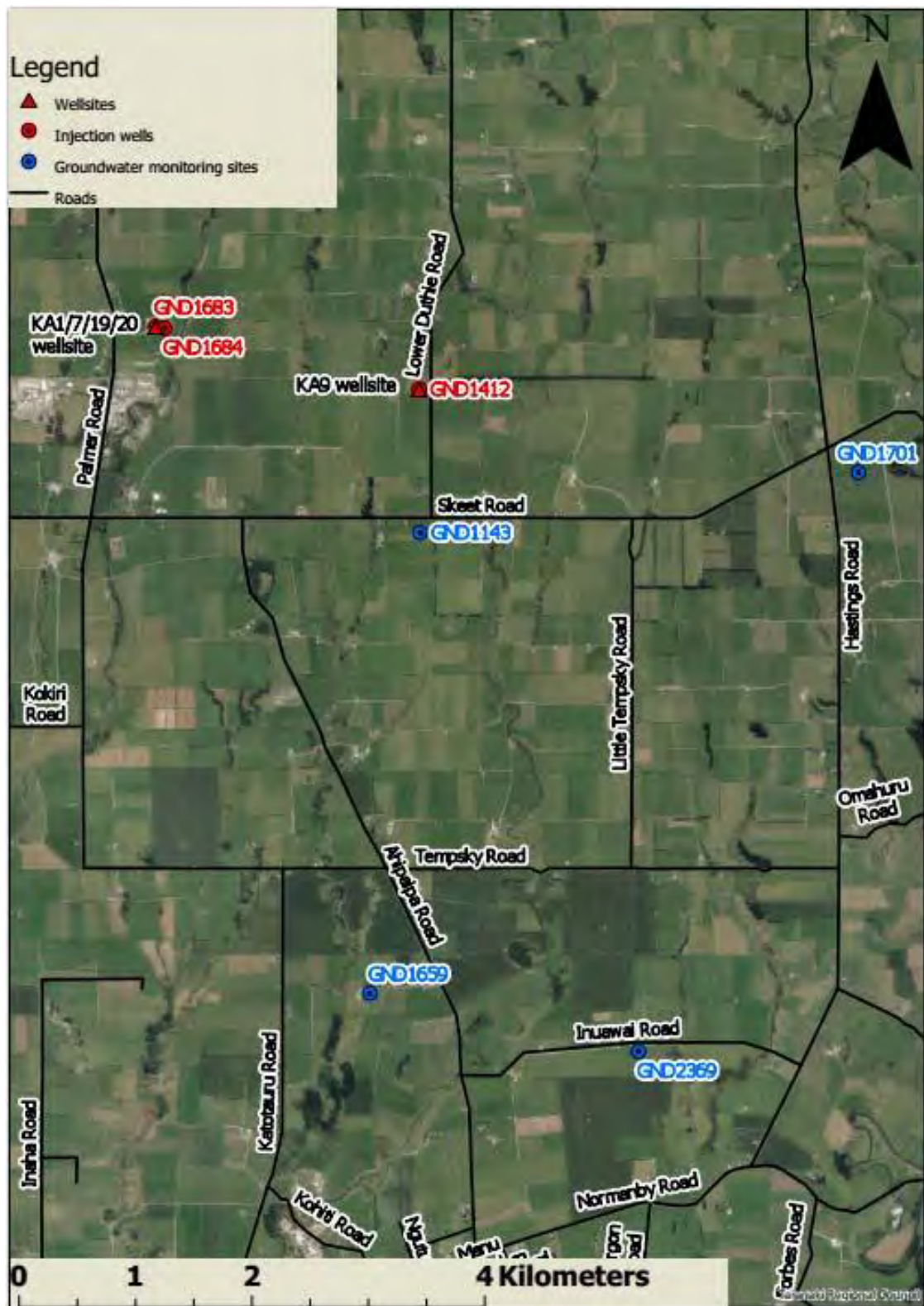


Figure 3 Groundwater monitoring bore sites in relation to injection wells



#### **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 respective DWI consents.

As required by the conditions of their consents, 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, rates and 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.

## 2. Results

### 2.1 Site inspections

One routine inspection of the Company's KA9 and KA1/7/19/20 wellsites was undertaken on 28 June 2016. Routine inspections included undertaking a general visual assessment of the operational equipment, storage facilities and associated equipment.

The inspecting officer concluded that the wellsites were in good condition and being well managed. There were no issues noted specific to the Company's DWI consents.

The Kapuni Production Station was also visited by a Council officer on two occasions during the monitoring year for the purpose of injectate sampling. This involved accessing the Company's bulk liquid storage tank at the production station. No issues were noted by staff during these visits.

### 2.2 Injectate sampling

Samples of injectate were obtained from the Company's storage tank on 9 October 2015 and 3 May 2016. The samples were submitted to the Council's laboratory on the same day for physicochemical analysis. Injectate samples are generally a composite of waste water from the Company's wellsites and other production facilities.

The results of the sample analyses are included below in Table 3. The range of results for each analyte since 2004 is also presented for comparison. The Company also undertakes additional injectate sampling on a monthly basis. The results from the Company's sampling programme are presented in Table 4.

The concentrations of each analyte measured over the 2015-2016 period are within the expected range for produced water samples at this site.

**Table 3** Results of injectate sampling undertaken by the Council

Sample details	Unit	Kapuni Production Station			
		Minimum	Maximum	Tank T604	
TRC sample number	-	-	-	TRC153212	TRC161471
Sample date	-	2004 - to date		09-Oct-15	03-May-16
Sample time	-	-	-	10:20	13:30
pH	pH Units	6.7	9.0	7.2	8.0
Conductivity	mS/m @ 20°C	1,400	3,540	2,702	2,810
Chloride	g/m <sup>3</sup>	6,070	12,000	6,370	7,240
Total petroleum hydrocarbons	g/m <sup>3</sup>	51	1,300	200	51
Alkalinity	g/m <sup>3</sup> CaCo <sub>3</sub>	84	10,700	10,700	10,000

**Table 4** Results of injectate sampling undertaken by the Company (2015-2016)

Sample details	Unit	Kapuni KA-07 well workover fluids		Kapuni produced water	
		June 2015 -May 2016		June 2015 -May 2016	
		min	max	min	max
pH	-	6.7	9.8	7.0	7.4
Conductivity	mS/m	31.4	1,213	-	-
Chloride	g/m <sup>3</sup>	48	6,597	5,995	8,117
Suspended solids	g/m <sup>3</sup>	69	3,170	10	40
Temperature	°C	18.9	21.5	-	-
Salinity	g/m <sup>3</sup>	17,400	18,900	9,200	22,500
Total dissolved solids	mg/L	-	-	29	41
Total petroleum hydrocarbons	g/m <sup>3</sup>	89	796	38	270

## 2.3 Groundwater sampling

During the period under review, the Company conducted groundwater sampling at four sites in the vicinity of the KA9 wellsite. Sampling was conducted on 20 August 2015 and 4 February 2016. The samples were collected by AECOM following standard groundwater sampling methodologies and were submitted to Hill Laboratories Limited for analysis. The results of the analyses are included in Appendix II and summarised in Table 5 and 6 below.

The samples collected from GND1143 were taken from a tap attached to a secondary storage tank housed in a pump shed close to the well. Samples from GND1701, GND2369 and GND1659 were collected from sampling ports close to the well head. No sample was collected from GND1659 during the February 2016 sampling round as there was insufficient pressure in the bore (AECOM, 2016).

The results show there have been no significant changes in groundwater composition over the monitoring period. This is demonstrated by the relatively narrow ranges between analyte concentrations. The subtle variations in some analyte concentrations are a result of natural seasonal fluctuation and sampling variability.

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

**Table 5** Results of groundwater sampling undertaken by the Company (2015-2016)

Sample details	Unit	KA9 Wellsite (consent 9970-1)			
		GND1143 ( Site 1)		GND1701 (Site 2)	
Sample date	-	20-Aug-15	4-Feb-16	20-Aug-15	4-Feb-16
pH	-	6.8	7.3	8.4	8.3
Electrical conductivity	mS/m	32.0	32.0	33.5	33.5
Chloride	g/m <sup>3</sup>	34.0	34.0	11.2	10.7
Total petroleum hydrocarbons	g/m <sup>3</sup>	<0.7	<0.7	<0.7	<0.7

**Table 6** Results of groundwater sampling undertaken by the Company (2015-2016)

Sample details	Unit	KA9 Wellsite (consent 9970-1)			
		GND2369 (Site 3)		GND1659 (site 4)	
Sample date	-	20-Aug-15	4-Feb-16	20-Aug-15	4-Feb-16
pH	-	8.9	8.7	8.1	-
Electrical conductivity	mS/m	31.6	31.9	37.0	-
Chloride	g/m <sup>3</sup>	11.5	10.8	12.2	-
Total petroleum hydrocarbons	g/m <sup>3</sup>	<0.7	<0.7	<0.7	-

## 2.4 Assessment of data submitted by the Company

The Company provided records of their injection activities during 2015-2016 monitoring period, including daily injection volumes, pumping duration and injection pressure.

Table 7 provides an overview of the Company's injection activities across both consents during the monitoring period.

No injection was undertaken under consent 1336-3 during the monitoring period. All DWI undertaken by the Company during the monitoring period was via the KW-2 injection well under consent 9970-1.

**Table 7** Summary of injection activity during the 2015-2016 monitoring year

Consent number	Wellsite	Injection well(s)	Total volume discharged (m <sup>3</sup> )	Discharge period		TRC well ID
				From	To	
1336-3*	KA9	KW-2	0	-	-	GND1142
	KA1/7/19/20	KA-01	0	-	-	GND1683
	KA1/7/19/20	KA-07	0	-	-	GND1684
9970-1	KA9	KW-2	35,830	1/07/2015	30/06/2016	GND1142
	KA1/7/19/20	KA-01	0	-	-	GND1683
	KA1/7/19/20	KA-07	0	-	-	GND1684

\*Surrendered 20 November 2015

Table 7 details the injection monitoring data received from the Company for the period under review. A summary of the Company's historical data for consents 1336-3 and 9970-1 are also presented in Table 8 below.

The data presented shows that the volume of fluid being injected decreased in 2014-2015 and 2015-2016 in comparison to earlier periods. The injection rates and pressures remained similar to those from previous years.

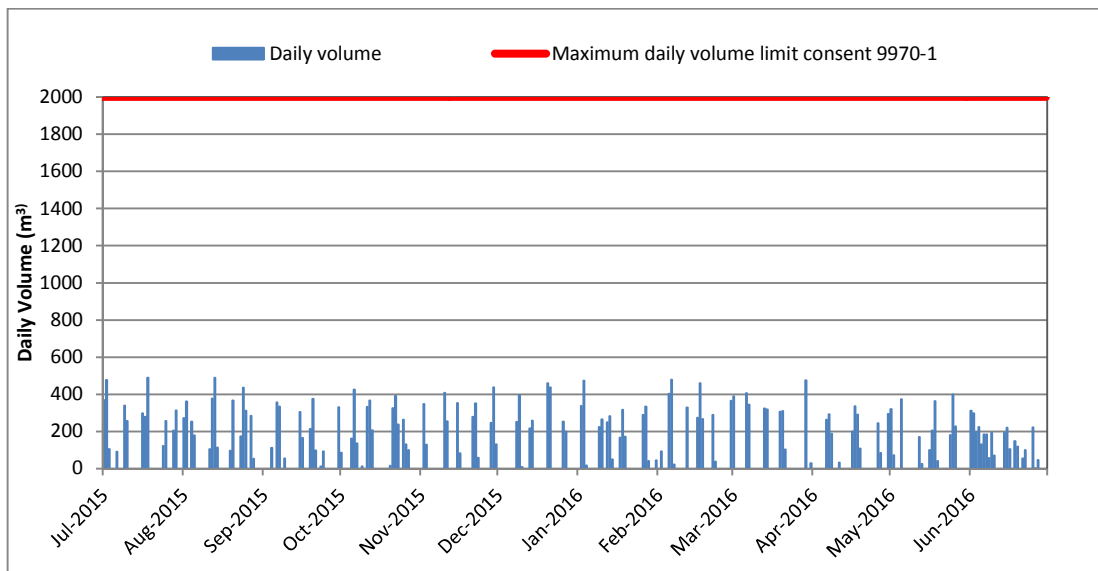
**Table 8** Summary of injection occurring under consent 1336-3 and 9970-1 (2013-2016)

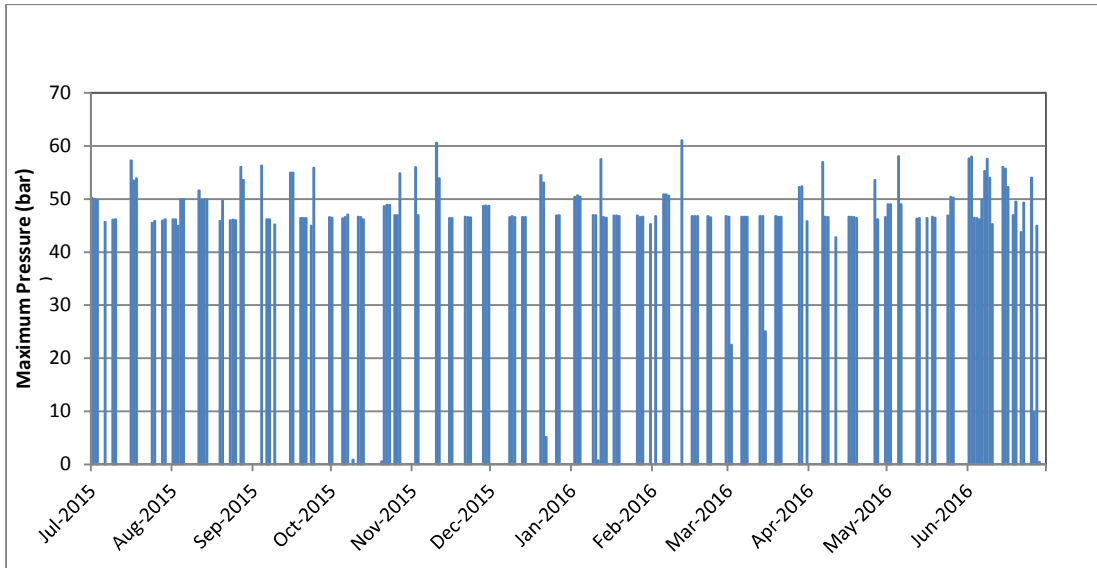
Consent 1336-3 and 9970-1 KA9 wellsite via the KW-2 injection well					
Year	Annual volume (m <sup>3</sup> )	Max. injection volume (m <sup>3</sup> /day)	Maximum injection rate (m <sup>3</sup> /hr)	Max. injection pressure (bar)	Avg. injection pressure (bar)
Consent limit	-	2,000	-	-	-
2015-2016	35,830	489	73	61	44
2014-2015	43,014	617		60	45
2013-2014	62,648	890	164	66	38
2012-2013	62,228	790	147	65	47

The highest maximum injection (61.1 bar) was recorded on 12 February 2016. An anomalous maximum injection pressure reading of 98.9 bar was recorded on 17 May 2015. However, this was determined to be false reading likely due to a pressure transmitter error and has been removed from the data set all other pressures recorded during the review period were much lower.

The highest injection rate recorded during the reporting period was 72.7 m<sup>3</sup>/hr on 11 April 2016. Anomalous injection rates of 797 m<sup>3</sup>/hr (27 October 2015) and 170.3 m<sup>3</sup>/hr (28 June 2016) were also reported. However, after further investigation these were found to be reporting errors.

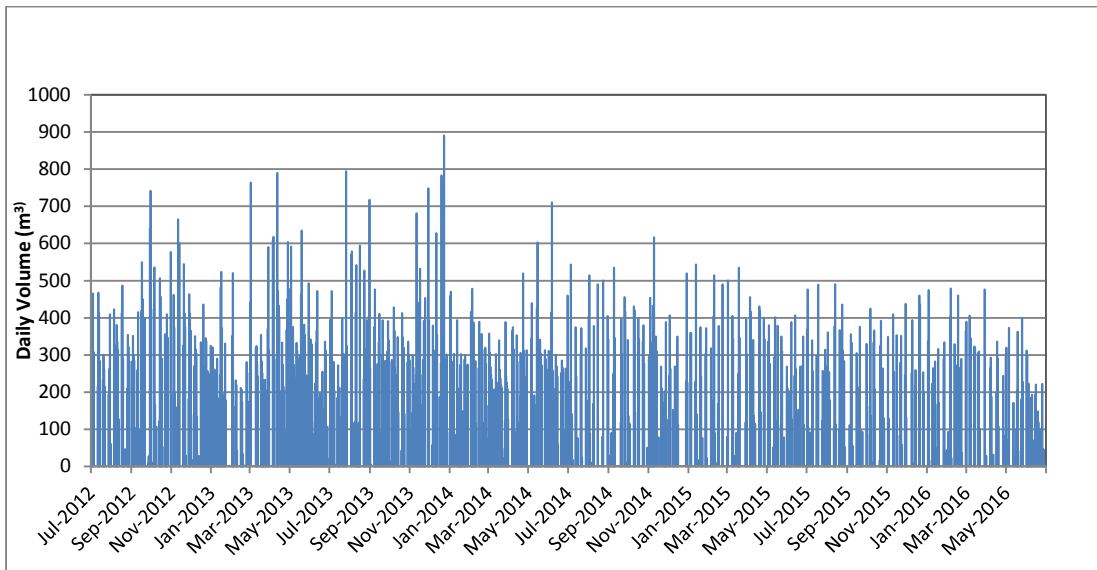
The data presented shows that the Company conducted their injection operations within all consented injection limits during the period being reported. The injection data is also presented graphically in Figure 4 and Figure 5 and illustrates that injection operations were undertaken well within consented limits.

**Figure 4** Total daily injection volume KW-2 well (2015-2016)

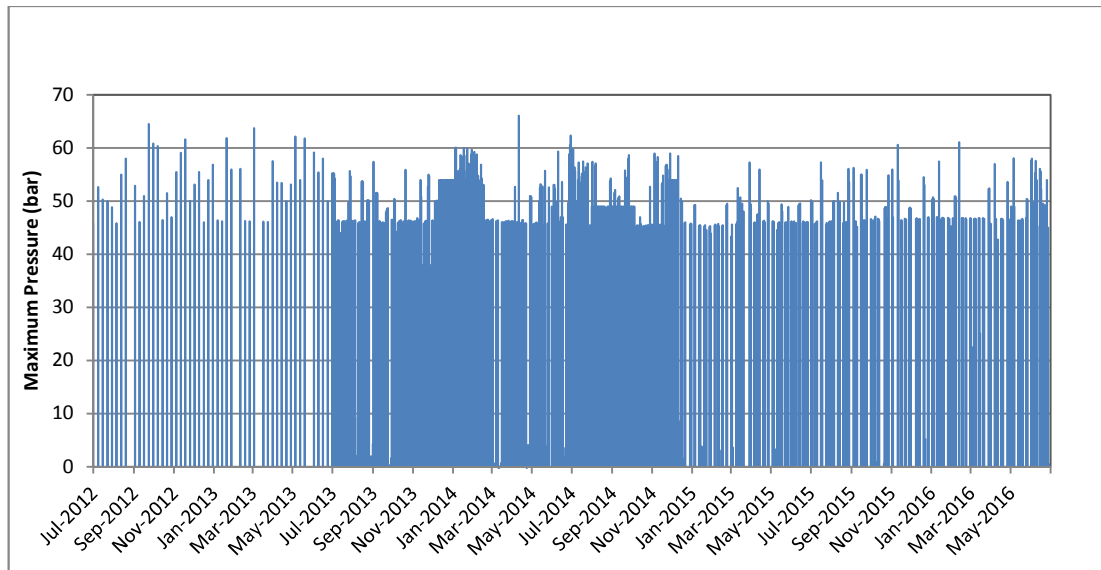


**Figure 5** Maximum daily injection pressure KW-2 well (2015-2016)

The daily volume and maximum daily injection pressures over the entire data record for the KW-2 well are presented in Figure 6 and Figure 7. A visual assessment of the data suggests that maximum well head pressures have remained relatively stable since 2012 with the exception of the anomalous reading recorded on 17 May 2016. Daily volumes fluctuate and have reduced slightly since 2012.



**Figure 6** Total daily injection volume KW-2 well (2012-2016)



**Figure 7** Maximum daily injection pressure consent KW-2 well (2012-2016)

## 2.5 Investigations, interventions, and incidents

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the Company. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual 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 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 2015-2016 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 exercised one resource consent for the injection of fluids by DWI (9970-1). Consent 9970-1 authorises the injection of fluids into the Matemateaonga Formation via the KW-2 well and into the Mangahewa Formation via the KA-01 and KA-07 wells.

Injection wells are fitted with engineering controls and in built safety systems to protect the wellbore against any process or subsurface related failures. In the event of any sudden pressure losses or increases, safety systems isolate the wellbore and shut down the injectate pumping system.

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 this data was submitted to the Council at the specified frequency.

A review of the 2015-2016 injection data provided by the Company shows that a total of 35,830 m<sup>3</sup> of fluid was injected under consent 9970-1. The data also shows that the maximum daily volume injected was 490 m<sup>3</sup>. This occurred on 13 August 2015 and is well below the consented limit of 2000 m<sup>3</sup>/day. The maximum daily injection pressure of 61.1 bar was recorded on 17 May 2016 and the maximum injection rate of 72.7 m<sup>3</sup>/hr was recorded on 11 April 2016.

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

#### **3.2 Environmental effects of exercise of consents**

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 three monitoring sites and one sample being taken from a forth site in the vicinity of the Company's active injection well. The results of the monitoring carried out show that the groundwater composition at each site has remained stable. 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 2015-2016 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 Table 9.

**Table 9** Summary of performance for consent 9970-1

<b>Purpose: To discharge waste fluids, associated with hydrocarbon exploration and production by deep well injection, into the Matemateaonga Formation via the KW-2 well, or into the Mangaheua Formation via wells KA-01 and/or KA-07 as a contingency</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. The volume of fluid injected shall not exceed 200 cubic metres per day	Review and analysis of injection data	Yes
2. By 1 January 2015, the consent holder shall submit an "Injection Operation Management Plan"	Receipt of satisfactory "Injection Operation Management Plan," by 1 January 2015	Yes
3. Injection well, geological and operational data submission requirements. This information can be included in the "Injection Operation Management Plan"	Receipt of satisfactory information by 1 January 2015	Yes
4. No injection permitted after 1 June 2024	Assessment of injection records and site inspection notices	N/A
5. The consent holder shall at all times adopt the best practicable option	Assessment of consent holder records and site inspection notices	Yes
6. No injection of fluids above 1,200 mbgl	Review of "Water Flooding Operation Management Plan," well construction log and injection data	Yes
7. Before Contingency wells are utilised, an "Injection Operation Management Plan" specific to the well being utilised must be provided to the Council	Receipt of satisfactory "Injection Operation Management Plan"	N/A
8. The consent holder shall ensure that the exercise of this consent does not result in the fracturing of the geological seals confining the injection zone	Assessment of injection records and results of groundwater sampling and analysis programme	Yes
9. 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
10. Only the listed fluids may be discharged	Receipt and assessment of injection data	Yes
11. These are the only other fluids that may be injected apart from those listed in condition 10	Receipt and assessment of injection data	Yes
12. Consent holder shall keep daily injection records	Receipt and assessment of injection data	Yes
13. Maintain records and undertake analysis to characterise each type of waste arriving on-site for discharge	Receipt and assessment of injection data	Yes

<b>Purpose: To discharge waste fluids, associated with hydrocarbon exploration and production by deep well injection, into the Matamateaonga Formation via the KW-2 well, or into the Mangaheua Formation via wells KA-01 and/or KA-07 as a contingency</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
14. If analysis required by condition 13 is not carried out in an IANZ laboratory, it shall be undertaken in accordance with a Quality Assurance Plan certified by the Council	Receipt and assessment of injection data	Yes
15. The data required by conditions 12 & 13 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
16. 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 before 1 June 2013,	Yes
17. 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	Implementation of Groundwater Monitoring Programme and assessment of results	Yes
18. 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
19. 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	Yes
20. Lapse Clause	Receive notice of exercise of consent	Yes
21. Consent review clause	N/A	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>

N/A = not applicable

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

### **3.4 Recommendations from the 2014-2015 Annual Report**

In the 2014-2015 Annual Report, it was recommended:

1. 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.
2. 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.

These recommendations were implemented during the 2015-2016 monitoring period.

### **3.5 Alterations to monitoring programmes for 2016-2017**

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 during the 2015-2016 period be continued during the 2016-2017 monitoring period.

Recommendations to this effect are included in Section 4 of this report.

### **3.6 Exercise of optional review of consent**

The next optional review dates for consent 9970-1 is provided for in June 2017.

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. A recommendation to this effect is presented in Section 4 of this report.

#### **4. Recommendations**

1. THAT the range of monitoring carried out during the 2015-2016 period be continued during the 2016-2017 monitoring period.
2. 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.
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 <sup>3</sup> ).
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.
Freshwater/saline water 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 <sup>3</sup>	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.
m <sup>3</sup>	Cubic metre.
pH	Numerical system for measuring acidity in solutions, with 7 as neutral. Values lower than 7 are acidic and higher than 7 are alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Produced water	Water associated with oil and gas reservoirs that is produced along with the oil and gas. Typically highly saline with salt concentrations similar to seawater and containing low levels of hydrocarbons.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	Resource Management Act 1991 and subsequent amendments.

TRC	Taranaki Regional Council (the Council).
TVD	True vertical depth.
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**

### **Resource consents held by Shell Todd Oil Services Limited**

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



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

Name of Consent Holder:	Shell Todd Oil Services Ltd Private Bag 2035 NEW PLYMOUTH 4342
Decision Date (Change):	9 August 2013
Commencement Date (Change):	9 August 2013     [Granted: 21 April 2005]

**Conditions of Consent**

Consent Granted:	To discharge up to 2,000 cubic metres/day of produced water and approved contaminants by deepwell injection into the Matemateaonga Formation via well KW-2 or into the Mangahewa Formation via contingency back-up wells KA-01 and KA-07
Expiry Date:	1 June 2023
Review Date(s):	June 2017
Site Location:	KW-2 wellsite, Lower Duthie Road, Kapuni; KA-01 & KA-07 wellsites, Palmer Road, Kapuni
Legal Description:	Lot 1 DP 11291 Pt Sec 14 Blk XVI Kaupokonui SD [KW-2]; Lots 1 & 2 DP 11138 Blk XVI Kaupokonui SD [KA-01, KA-07]
Grid Reference (NZTM)	1702850E-5629709N, 1701107E-5630144N and 1701159E-5630128N
Catchment:	Kapuni Inaha

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

### **General conditions**

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

### **Special conditions**

- 1. The consent holder shall 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 effects on the environment from the exercise of this consent.
- 2. The exercise of this consent shall be carried out in general accordance with the information submitted in support of application 3817. In the case of any contradiction between the documentation submitted in support of application 3817 and the conditions of this consent, the conditions of this consent shall prevail.
- 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, a log of the injection well, and an injection well operation management plan, to demonstrate that special condition 2 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 resource consent holder shall ensure that injection will not contaminate or endanger any actual or potential useable freshwater aquifer.
- 5. The consent holder shall keep weekly records of the nature and amounts of all material injected, including injection pressure and rate, and shall make the records available to the Taranaki Regional Council on an annual basis, and when there has been a significant pressure change event.
- 6. The consent holder shall monitor the injected wastes weekly for maximum and mean concentrations for pH, suspended solids, total dissolved solids, salinity, chlorides, and total hydrocarbons and shall make the records available to the Taranaki Regional Council on an annual basis.

## Consent 1336-3

7. The consent holder shall inject fluids at pressures below the pressure that would be required to fracture the stratigraphic seals of the injection formation.
8. The consent holder shall provide to the Taranaki Regional Council during the month of August of each year, for the duration of the consent, a written report on all matters required under special conditions 3, 4, 5, 6 and 7 above.
9. This consent shall lapse on the expiry of five years after the date of commencement of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(b) of the Resource Management Act 1991.
10. 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, 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.
11. The chemicals introduced to the produced water system and subsequently discharged by deepwell injection under this consent shall only be those listed in the product table on page 1 of the information submitted in support of application 6314, and other chemicals that:
  - a) can reasonably be expected to be used in petrochemical well maintenance and development in accordance with industry best practice;
  - b) have environmental effects that are no more adverse than those listed in the product table on page 1 of the information submitted in support of application 6314;
  - c) have been certified by the Chief Executive, Taranaki Regional Council as complying with a) and b) above; and
  - d) have been the subject of a specific request for certification in accordance with c) above that includes details of the concentration of the contaminant and an assessment of the effects of using the chemical in the manner proposed.

Signed at Stratford on 09 August 2013

For and on behalf of  
Taranaki Regional Council

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**Director-Resource Management**



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

Name of  
Consent Holder: Shell Todd Oil Services Limited  
Private Bag 2035  
New Plymouth 4342

Decision Date: 07 October 2014

Commencement Date: 07 October 2014

**Conditions of Consent**

Consent Granted: To discharge waste fluids, associated with hydrocarbon exploration and production by deepwell injection, into the Matemateaonga Formation via the KW-2 well, or into the Mangaheua Formation via wells KA-01 and/or KA-07 as a contingency

Expiry Date: 01 June 2029

Review Date(s): June annually

Site Location: KW-2 wellbore at KA09 wellsite, 83 Lower Duthie Road, Kapuni  
KA01/KA07 wellsite, 360 Palmer Road, Kapuni

Legal Description: Lot 1 DP 11291 Pt Sec 14 Blk XVI Kaupokonui SD  
(Discharge source & site)(KA09)  
Lots 1 & 2 DP 11138 Blk XVI Kaupokonui SD  
(Discharge source & site)(KA01/KA07)

Grid Reference (NZTM) 1702850E - 5629709N (KA09)  
1701152E - 5630141N (KA01/KA07)

Catchment: Inaha (KA09)  
Kapuni (KA01/KA07)

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

### **General condition**

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

### **Special conditions**

1. The volume discharged into the wellbore shall not exceed 2,000 cubic metres per day.
2. By 1 January 2015, 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.
3. Before exercising this 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; and
  - (e) confirmation of the depth to which fresh water resources, as defined in condition 9, are encountered below the site.

(Note: The information required by condition 3 may be included within the "Injection Operation Management Plan" required by condition 2).

4. There shall be no injection of any fluids after 1 June 2024.
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.
6. Fluids shall be injected at a minimum depth of 1,200 mbgl.
7. Before either contingency back-up wells (KA-01 and/or KA-07) are utilised for injection purposes, the consent holder must provide to the Chief Executive, Taranaki Regional Council an Injection Operation Management Plan specific to the well to be used, which includes all information required by condition 3.
8. 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.
9. 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.



10. Only the following types of fluid may be discharged:
  - (a) produced water;
  - (b) hydraulic fracturing and return fluids;
  - (c) well workover fluids;
  - (d) well servicing and intervention fluids;
  - (e) well drilling fluids;
  - (f) production chemicals
  - (g) production sludges;
  - (h) contaminated stormwater; and
  - (i) other fluids in accordance with condition 11 below.
11. The fluids discharged under this consent shall only be those listed in condition 10(a) to 10(h) above, and other fluids that:
  - (a) Can reasonably be expected to be used in petrochemical well maintenance and development in accordance with industry best practice;
  - (b) Have environmental effects that are no more adverse than those listed in 10(a)–10(h) above;
  - (c) Have been certified by the Chief Executive, Taranaki Regional Council as complying with 11(a) and 11(b) above; and
  - (d) Have been the subject of a specific request for certification, in accordance with 11(c) above, that includes details of the proposed contaminant.
12. 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.
13. 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 10);
  - (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.

(Note: The analysis required by condition 13 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).

14. If the analysis required by condition 13 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 13. 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.

15. The information required by conditions 12 and 13 above, for each calendar month, shall be provided to the Chief Executive, Taranaki Regional Council before the 28<sup>th</sup> day of the following month.
16. 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 9 (the 'Monitoring Programme'). The Monitoring Programme shall be designed to characterise local groundwater quality, and be submitted to the Chief Executive, Taranaki Regional Council, for certification before the exercising of this consent, and shall include:
  - (a) the location of sampling sites;
  - (b) wellsite/wellbore 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 injection well. 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.

17. 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 16 and 17, could be taken and analysed by the Taranaki Regional Council or other contracted party on behalf of the consent holder.*

18. 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 16.*

19. 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) A summary of injection activities over the period being reported;
  - b) an assessment of injection well performance;
  - c) an assessment of the on-going integrity and isolation of the wellbore; and
  - d) an assessment of the on-going integrity and isolation of the receiving formation.

## Consent 9970-1.0

20. This consent shall lapse on 31 December 2019, 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.
21. 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 each year, 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 07 October 2014

For and on behalf of  
Taranaki Regional Council

---

A D McLay  
**Director - Resource Management**



## **Appendix II**

### **Aecom Groundwater Sampling Results**



10 March 2016

Adam Wood  
Environmental Advisor  
Shell Todd Oil Services Limited  
Private Bag 2035  
New Plymouth 4342

Dear Adam

## **STOS Kapuni - Third Party Abstraction Wells - Groundwater Monitoring Event February 2016**

### **1.0 Terms of Reference**

This letter has been prepared for Shell Todd Oil Services Ltd (STOS) by AECOM Consulting Services (NZ) Ltd (AECOM) in accordance with the proposal dated 5 July 2012 and subsequent variations. It documents the findings of the ninth groundwater monitoring event (GME) completed at three, third party abstraction wells, located within the Kapuni area – M Barr, 873 Skeet Road (Site 1); PKW Farms, 468 Hastings Road (Site 2); and Kiley Estate, Inuawai Road (Site 3). It also presents the findings of the third GME completed at the former emergency bore located at the STOS KA9 well site, which is the location of STOS produced water re-injection well, KW-2. A fourth, third party abstraction well (Naplin Trust, Ahipaipa Road), which was sampled during previous GMEs, was not sampled during this event.

### **2.0 Objective and Background**

The objective of the groundwater monitoring is to assess groundwater quality in the subject wells located in the Kapuni area.

Eight previous GMEs of the third party abstraction wells have been completed. The dates and report references of the GMEs are provided in **Table 1** below.

**Table 1 STOS Kapuni - Third Party Abstraction Wells GMEs**

<b>Date(s)</b>	<b>Report Reference</b>
19 December 2012	Letter report to STOS, dated 16 April 2013 and entitled STOS Kapuni – Third Party Abstraction Well - Groundwater Monitoring
2 May 2013	Letter report to STOS, dated 12 June 2013 and entitled STOS Kapuni – Third Party Abstraction Well - Groundwater Monitoring Event May 2013
30 July 2013	Letter report to STOS, dated 20 September 2013 and entitled STOS Kapuni – Third Party Abstraction Well - Groundwater Monitoring Event July 2013
13 November 2013	Letter report to STOS, dated 19 December 2013 and entitled STOS Kapuni – Third Party Abstraction Well - Groundwater Monitoring Event November 2013
10 February 2014	Letter report to STOS, dated 29 April 2014 and entitled STOS Kapuni – Third Party Abstraction Wells - Groundwater Monitoring Event February 2014
12 August 2014	Letter report to STOS, 19 November 2014 and entitled STOS Kapuni – Third Party Abstraction Wells - Groundwater Monitoring Event August 2014
30 January and 23 March 2015	Letter report to STOS, 29 June 2015 and entitled STOS Kapuni – Third Party Abstraction Wells - Groundwater Monitoring Event January and March 2015
20 August 2015	Letter report to STOS, 10 September 2015 and entitled STOS Kapuni – Third Party Abstraction Wells – Groundwater Monitoring Event August 2015

This current letter report presents the results of the GME completed at the three of the four, third party abstraction wells and the former emergency bore at the STOS KA9 well site on 4 February 2016.

The three abstraction wells monitored are located at the following third party sites:

- Site 1 – M Barr, 873 Skeet Road
- Site 2 – PKW Farms, 468 Hastings Road

- Site 3 – Kiley Estate, Inuawai Road

The former emergency bore (Site KA9-EB) is located at the STOS KA9 well site off Lower Duthie Road (Rapid #83).

The location of each site is shown on **Figure 1** (attached).

### **3.0 Scope of Works**

The groundwater monitoring comprised the following scope of works:

- Purging and collection of groundwater samples from the third party wells and the former emergency bore.
- Laboratory analysis of groundwater samples.
- Preparation of this factual letter report.

### **4.0 Sampling Methodology**

Groundwater samples were collected from three of the four third party wells and KA9-EB on 4 February 2016. The sampling methodology for each site is summarised in the attached appendices as follows:

- **Appendix A** – Site 1 (M Barr, 873 Skeet Road)
- **Appendix B** – Site 2 (PKW Farms, 468 Hastings Road)
- **Appendix C** – Site 3 (Kiley Estate, Inuawai Road)
- **Appendix D** – Site KA9-EB (STOS KA9 well site, Lower Duthie Road)

The groundwater sample collected from Site 1 was collected directly from a tap attached to a secondary storage tank housed in a pump house close to the well. Groundwater samples collected from Site 2 and Site 3 were collected from sampling ports close to the wellhead of each abstraction well. The groundwater sample collected from Site KA9-EB was collected using a down hole bladder pump.

A groundwater sample was not obtained from the third party abstraction well at Naplin Trust, Ahipaipa Road, during the February 2016 monitoring event, owing to insufficient pressure in the bore.

Field sampling records for each site are attached.

#### **4.1 Groundwater Sample Collection and Analysis**

Groundwater samples were collected directly into laboratory supplied sample bottles. The samples were kept under chilled conditions and transported to Hill Laboratories Limited (Hill Laboratories) under standard chain of custody procedures.

Groundwater samples were analysed for the following:

- pH
- Conductivity
- Chloride
- Total petroleum hydrocarbons (TPH)
- Benzene, toluene, ethylbenzene, and xylenes (BTEX) (Site KA9-EB only)

Chain of custody documents and the laboratory report as received are attached.

#### **4.2 Quality Assurance/Quality Control (QA/QC)**

For quality assurance/quality control (QA/QC) purposes, a trip blank sample (identified as TB), and a duplicate sample collected from KA-9-EB (identified as KA9-Dup), were collected during the GME.

The trip blank sample was prepared in the laboratory with deionised water, prior to bottles being shipped.

The duplicate sample was collected directly into laboratory supplied jars, chilled and transported to Hill Laboratories under AECOM chain of custody procedures. The trip blank and duplicate samples were analysed for BTEX; the trip blank was additionally analysed for TPH.

Chain of custody documents and the laboratory report as received are attached.



## **5.0 Groundwater Sample Results**

### **5.1.1 Third Party Sites (Sites 1 to 3)**

The groundwater analysis results for the February 2016 monitoring event for each third party site have been tabulated and are presented in the site specific appendices attached. Results for the August 2015, January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events are included in the tables for these sites.

#### **General Groundwater Parameters**

General baseline groundwater parameters for groundwater samples collected from the third party wells in February 2016 were similar to results from the August 2015, January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events.

#### **Activity Parameters**

Concentrations of TPH were not detected above laboratory method detection limits (MDLs) in the groundwater samples collected from any of the third party abstraction wells sampled during the February 2016 monitoring event.

The results do not indicate contamination of third party abstraction wells by hydrocarbons or other contaminants of concern.

### **5.1.2 Site KA9-EB**

#### **General Groundwater Parameters**

General baseline groundwater parameters for the groundwater sample collected from Site KA9-EB in February 2016 were similar to the results from the August 2015 and March 2015 monitoring events.

#### **Activity Parameters**

Concentrations of TPH, benzene, ethylbenzene and xylenes were not detected above MDLs in the groundwater sample collected from Site KA9-EB. Toluene was detected in the groundwater sample at 0.0012 mg/L, compared with the MDL of 0.0010 mg/L. These results are similar to the results from the August 2015 and March 2015 monitoring events.

## **5.2 QA/QC Results**

The QA/QC results for Sites 1 to 3 and Site KA9-EB have been tabulated and are attached. The following points are noted:

- Concentrations of TPH and BTEX were not detected above the laboratory MDLs in the trip blank sample.
- Concentrations of benzene, ethylbenzene and xylenes were not detected above MDLs in the groundwater sample collected from Site KA9-EB. Toluene was detected in the duplicate sample at 0.0013 mg/L, compared with the primary sample result of 0.0012 mg/L and the MDL of 0.0010 mg/L.

The QA/QC results are considered to meet the data quality objectives for this investigation.

## **6.0 Summary**

The results of the GME completed for three of the four, third party abstraction wells in February 2016 do not indicate contamination of the deep abstraction wells by hydrocarbons or any other contaminants of concern. The results of the February 2016 monitoring event are consistent with the results of the August 2015, January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events.

The results of the GME completed for the former emergency bore at Site KA9-EB in February 2016 indicate that toluene is present at trace levels in the bore. These results are consistent with the results from the August 2015 and March 2015 monitoring events.

## **7.0 Closure**

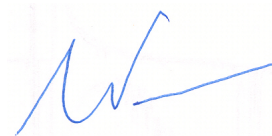
We trust that this report meets your requirements. Please do not hesitate to contact AECOM if you wish to discuss the results.

Yours sincerely



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encl: Limitations  
Figure 1 - Site Location Plan  
Groundwater Sampling Sheets  
Laboratory Analytical Results and Chain of Custody Documentation  
QA/QC Table

### **Appendices**

Appendix A – Site 1 (M Barr, 873 Skeet Road)  
Appendix B – Site 2 (PKW Farms, 468 Hastings Road)  
Appendix C – Site 3 (Kiley Estate, Inuawai Road)  
Appendix D – Site KA9-EB (Former Emergency Bore). STOS KA9 Well Site (Lower Duthie Road)

**Limitations**

All information in this report is provided strictly in accordance with and subject to the following limitations and recommendations:

- a) This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by AECOM for use of any part of this report in any other context.
- b) This conclusion is based solely on the information and findings contained in this report.
- c) This conclusion is based solely on the scope of work agreed between AECOM and Shell Todd Oil Services Limited and described in Section 3 ("Scope of Works") of this report.
- d) This report is based on the conditions encountered during the site monitoring conducted, and information reviewed, between February and March 2016. AECOM accepts no responsibility for any events arising from any changes in site conditions or in the information reviewed that have occurred after the completion of the site monitoring.
- e) The investigations carried out for the purposes of the report have been undertaken, and the report has been prepared, in accordance with normal prudent practice and by reference to applicable environmental regulatory authority and industry standards, guidelines and assessment criteria in existence at the date of this report.
- f) Where this report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in the report. AECOM assumes no liability for any inaccuracies in or omissions to that information.
- g) AECOM has tested only for those chemicals specifically referred to in this report. AECOM makes no statement or representation as to the existence (or otherwise) of any other chemicals.
- h) A site which appears to be unaffected by contamination at the time the report was prepared may later, due to natural phenomena or human intervention, become contaminated.
- i) Except as specifically stated above, AECOM makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the sites.
- j) This report has been prepared for the sole benefit of Shell Todd Oil Services Limited. Except as required by law, no third party may use or rely on this report unless otherwise agreed by AECOM in writing. Where such agreement is provided, AECOM will provide a letter of reliance to the agreed third party in the form required by AECOM.
- k) To the extent permitted by law, AECOM expressly disclaims and excludes liability for any loss, damage, cost or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this report. AECOM does not admit that any action, liability or claim may exist or be available to any third party.

**Figure 1 – Site Location Plan**



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Issue Status: FINAL

**THIRD PARTY WELL MONITORING**  
**SITE LOCATION PLAN**  
 SHELL TODD OIL SERVICES LIMITED (STOS)  
 Project No.: 42788630 Date: 2/06/2015

**AECOM**  
 Figure: 1



**Groundwater Sampling Sheets**

## STOS Offsite Bores GROUNDWATER SAMPLING DATA SHEET

Site No: 1 (873 Skeet Road)

Project No 42788630Project Name STOS Offsite MonitoringSampled by: SHDate 4/2/16Sample ID Site 1Duplicate ID       

## Purging

Time Started 17:58Time Stopped 18:12Flow Rate 15 L/mVolume Removed 125 LComments outlet dia too large for tubing, use ysi probe in bucket as flow cell.

## Sampling

Time Started ~~18:12~~ 18:14Time Stopped ~~18:12~~ 18:14Flow Rate 15 L/mComments yellow ~~haze~~, slightly cloudy

## Field Analyses

Time	Vol Removed (L)	TDS (ppm)	EC (uS/cm)	pH	T (C)	Redox (mV)	Dissolved Oxygen (%)	Dissolved Oxygen (ppm)	Comments (Color, turbidity)
18:00	20	—	323.3	6.98	18.7	58.0	6.2		cloudy (brown)
18:02	35	—	325.4	6.84	18.0	50.6	7.7		"
18:04	50	—	325.0	6.75	17.8	43.6	4.0		"
18:06	65	—	324.9	6.68	17.7	34.1	3.8		slightly cloudy (yellow)
18:08	80	—	325.0	6.67	17.5	25.1	4.1		"
18:10	95	—	324.5	6.63	17.5	23.0	7.2		"
18:12	110	—	324.1	6.62	17.5	25.3	9.6		<del>pink</del> yellow <del>haze</del> "
18:14	125	—	324.1	6.59	17.5	28.6	7.3		"

Prepared By: SHChecked By: KS

# STOS Offsite Bores GROUNDWATER SAMPLING DATA SHEET

Site No: 2 (468 Hastings Road)

Project No 42788630 Project Name STOS Offsite Monitoring Sampled by: SH

Date 4/2/16

Sample ID Site 2  
Duplicate ID       

## Purging

Time Started 18:29  
Time Stopped 18:37  
Flow Rate 2.5 L/m  
Volume Removed 20.0 L  
Comments clear

## Sampling

Time Started 18:37  
Time Stopped 18:38  
Flow Rate ~~2.0~~ 2.5 L/m  
Comments clear

## Field Analyses

Time	Vol Removed (L)	TDS (ppm)	EC (uS/cm)	pH	T (C)	Redox (mV)	Dissolved Oxygen (%)	Dissolved Oxygen (ppm)	Comments (Color, turbidity)
18:31	5.0	—	339.0	8.31	18.3	-222.8	2.1		clear
18:33	10.0	—	338.4	8.32	18.2	-227.5	1.9		"
18:35	15.0	—	338.2	8.33	18.1	-230.1	1.8		"
18:37	20.0	—	338.0	8.33	18.1	-231.1	1.8		"



## STOS Offsite Bores GROUNDWATER SAMPLING DATA SHEET

Site No: 3 (Kiley Trust Farm)

Project No 42788630Project Name STOS Offsite MonitoringSampled by: SHDate 4/2/16Sample ID Site 3Duplicate ID —

## Purging

Time Started 18:56Time Stopped 19:10Flow Rate 1.25 L/minVolume Removed 18 LComments faintly turbid

## Sampling

Time Started 19:10Time Stopped 19:10Flow Rate 1.25 L/minComments clear

## Field Analyses

Time	Vol Removed (L)	TDS (ppm)	EC (uS/cm)	pH	T (C)	Redox (mV)	Dissolved Oxygen (%)	Dissolved Oxygen (ppm)	Comments (Color, turbidity)
18:58	3.0	—	328.7	8.80	28.6	-149.7	2.6		faintly turbid
19:00	5.5	—	323.9	8.79	21.6	-160.0	1.9		"
19:02	8.0	—	321.9	8.67	20.4	-165.7	1.7		"
19:04	10.5	—	322.0	8.68	20.2	-136.3	1.7		"
19:06	13.0	—	322.0	8.72	20.1	-122.1	1.5		clear
19:08	15.5	—	322.3	8.74	20.0	-121.9	1.4		"
19:10	18.0	—	321.7	8.74	20.0	-123.2	1.6		"

## BORE DEVELOPMENT, PURGING AND GROUNDWATER SAMPLING DATA SHEET

SITE: KA9

Project No 42788630

Project Name STOS Offsite Monitoring

Sampled by: SH

Well: EB

### Development

Date \_\_\_\_\_

(Well volume =  $V = ((3.141 * D^2)/4) * d$  (Where D=diameter of well, d=depth of well, V=volume))

Development Method \_\_\_\_\_

Time Started \_\_\_\_\_

SWL (start) \_\_\_\_\_

Volume Removed \_\_\_\_\_

Bore Depth (start) \_\_\_\_\_

Head Space \_\_\_\_\_

Time Stopped \_\_\_\_\_

SWL (end) \_\_\_\_\_

Discharge Rate \_\_\_\_\_

Bore Depth (end) \_\_\_\_\_

Comments \_\_\_\_\_

NAPL Present \_\_\_\_\_

(If yes thickness) \_\_\_\_\_

### Purging

Date 4-Feb-16

Purge Method Low Flow Bladder

Purge Depth 20.0m

Time Started 16:30

SWL (start) 12.72

Bore Volume \_\_\_\_\_

Bore Depth (start) 35.5

Head Space 0.0

Time Stopped 16:47

SWL (end) 12.83

Volume Removed \_\_\_\_\_

Bore Depth (end) 35.5

Flow Rate 0.1 L/min

Comments very slow recharge - reduced pump speed to minimum over duration of purge = stable @ 10.1 cm

NAPL Present \_\_\_\_\_

(If yes thickness) \_\_\_\_\_

### Sampling

Date 4-Feb-16

### OVA Monitoring

Sample ID KA9-EB

Duplicate ID Dup (BTEX)

Sampling Method Low Flow Bladder

Sampling Depth 20.0

Time Started 16:48

SWL (start) 12.83

Time Stopped 17:14

SWL (end) 12.84

Flow Rate 0.1 L/min

Comments very slow pump speed. minor head loss during sampling. BTEX Dup collected at same time.

Time	Ambient	Bore Head	Discharge

BTEX X

TPH X

PAH -

Metals -

Other EC, pH, Cl

### Field Analyses

Static Water Level	Time	Vol Removed (L)	EC (uS/cm)	pH	T (C)	Redox (mV)	Dissolved Oxygen (%)	Comments (Color, turbidity)	TDS (ppm)
Stabilisation Criteria in 3 consecutive readings:			+/-3%	+/-0.2	+/-0.2	+/-20mV	10%	10%	-
12.75	16:33	0	638	7.38	18.8	-	3.34	faint brown hve	
12.77	16:35	0.4	646	7.38	16.8	-163.0	3.34	"	
12.80	16:37	0.65	637	7.33	16.5	-181.6	0.80	"	
12.81	16:39	0.8	639	7.38	17.3	-184.3	0.73	"	
12.82	16:41	0.95	640	7.40	17.9	-190.1	0.65	"	
12.82	16:43	1.05	642	7.40	18.0	-192.6	0.53	"	
12.825	16:45	1.15	640	7.43	18.4	-192.1	0.53	"	
12.830	16:47	1.25	642	7.45	19.2	-195.7	0.52	"	

**Laboratory Analytical Results and Chain of Custody Documentation**



## ANALYSIS REPORT

Page 1 of 2

<b>Client:</b>	AECOM New Zealand Limited	<b>Lab No:</b>	1535293	SPV1
<b>Contact:</b>	Sean Hudgens	<b>Date Registered:</b>	10-Feb-2016	
	C/- AECOM Consulting Services (NZ) Limited	<b>Date Reported:</b>	15-Feb-2016	
	PO Box 27277	<b>Quote No:</b>	43362	
	Wellington 6141	<b>Order No:</b>	60435985 2.00300	
		<b>Client Reference:</b>	60435985 2.00300 Shell Todd Oil Services Ltd.	
		<b>Submitted By:</b>	Sean Hudgens	

Sample Type: Aqueous						
Sample Name:		Site 1	Site 2	Site 3	KA9-EB	KA9-Dup
		04-Feb-2016	04-Feb-2016	04-Feb-2016	04-Feb-2016	04-Feb-2016
Lab Number:		1535293.1	1535293.2	1535293.3	1535293.4	1535293.5
Individual Tests						
pH	pH Units	7.3	8.3	8.7	7.6	-
Electrical Conductivity (EC)	mS/m	32.0	33.5	31.9	61.1	-
Chloride	g/m <sup>3</sup>	34	10.7	10.8	26	-
BTEX in Water by Headspace GC-MS						
Benzene	g/m <sup>3</sup>	-	-	-	< 0.0010	< 0.0010
Toluene	g/m <sup>3</sup>	-	-	-	0.0012	0.0013
Ethylbenzene	g/m <sup>3</sup>	-	-	-	< 0.0010	< 0.0010
m&p-Xylene	g/m <sup>3</sup>	-	-	-	< 0.002	< 0.002
o-Xylene	g/m <sup>3</sup>	-	-	-	< 0.0010	< 0.0010
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m <sup>3</sup>	< 0.10	< 0.10	< 0.10	< 0.10	-
C10 - C14	g/m <sup>3</sup>	< 0.2	< 0.2	< 0.2	< 0.2	-
C15 - C36	g/m <sup>3</sup>	< 0.4	< 0.4	< 0.4	< 0.4	-
Total hydrocarbons (C7 - C36)	g/m <sup>3</sup>	< 0.7	< 0.7	< 0.7	< 0.7	-

Sample Name:		TB 04-Feb-2016				
Lab Number:		1535293.6				
BTEX in Water by Headspace GC-MS						
Benzene	g/m <sup>3</sup>	< 0.0010	-	-	-	-
Toluene	g/m <sup>3</sup>	< 0.0010	-	-	-	-
Ethylbenzene	g/m <sup>3</sup>	< 0.0010	-	-	-	-
m&p-Xylene	g/m <sup>3</sup>	< 0.002	-	-	-	-
o-Xylene	g/m <sup>3</sup>	< 0.0010	-	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m <sup>3</sup>	< 0.10	-	-	-	-
C10 - C14	g/m <sup>3</sup>	< 0.2	-	-	-	-
C15 - C36	g/m <sup>3</sup>	< 0.4	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m <sup>3</sup>	< 0.7	-	-	-	-

### Analyst's Comments

Appendix No.1 - Chain of Custody

## SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No



Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629]	0.0010 - 0.002 g/m <sup>3</sup>	4-6
Total Petroleum Hydrocarbons in Water	Hexane extraction, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734]	0.10 - 0.7 g/m <sup>3</sup>	1-4, 6
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-4
pH	pH meter. APHA 4500-H <sup>+</sup> B 22 <sup>nd</sup> ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field.	0.1 pH Units	1-4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22 <sup>nd</sup> ed. 2012.	0.1 mS/m	1-4
Chloride	Filtered sample. Ferric thiocyanate colorimetry. Discrete Analyser. APHA 4500 Cl <sup>-</sup> E (modified from continuous flow analysis) 22 <sup>nd</sup> ed. 2012.	0.5 g/m <sup>3</sup>	1-4

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This report must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)  
Client Services Manager - Environmental Division



# CHAIN OF CUSTODY AND SAMPLE RECEIPT DOCUMENTATION

FROM:		TO:		ANALYSES REQUIRED											
<b>AECOM</b> 3, 80 The Terrace Wellington PO Box 27277 Ph: (04) 896 6000 Fax: (04) 896 6001		<b>R J Hill Laboratories Limited</b> 1 Clyde Street Hamilton Ph: (07) 858 2000 URS Client: <b>Shell Todd Oil Services Ltd.</b>		CONTAINERS	TPH250	VOC40 x 2	UP1L								
RESULTS ATTENTION: <b>Sean Hudgens</b> PROJECT NO: <b>60435985 2.00300</b> PURCHASE ORDER NO: SAMPLER(S): <b>Sean Hudgens</b>		LAB QUOTE NO: <input checked="" type="checkbox"/> 30443 Normal Priority <input type="checkbox"/> 30833 High Priority <input type="checkbox"/> 30481 Urgent Priority <input type="checkbox"/> Special Quote													
RESULTS REQUIRED BY:				ANALYTES	TPH	BTEX	Chloride	Conductivity	pH						
<b>SAMPLE ID</b>	<b>MATRIX</b>	<b>DATE/TIME</b>	<b>COMMENTS</b>												
Site 1	Aqueous	4-Feb-16			X		X	X	X						
Site 2	Aqueous	4-Feb-16			X		X	X	X						
Site 3	Aqueous	4-Feb-16			X		X	X	X						
<del>KA9 - EB</del>	<del>Aqueous</del>	<del>4-Feb-16</del>			<del>X</del>		<del>X</del>	<del>X</del>	<del>X</del>						
KA9 - EB	Aqueous	4-Feb-16				X	X	X	X						
Duo	Aqueous	4-Feb-16				X									
TB	Aqueous	4-Feb-16			X	X									
Total No. of Sample Bottles:				Including:				Blank or Duplicate Sample:							
<b>CHAIN OF CUSTODY DATA</b>															
RELINQUISHED BY				RECEIVED BY				METHOD OF							
NAME: Sean Hudgens				NAME:				DATE: 10.2.16				URS RE			
COMPANY: AECOM				COMPANY:				TIME:				HILLS E			
<b>SAMPLE RECEIPT DATA</b>															
PLEASE COMPLETE THIS SECTION (CIRCLE AS APPROPRIATE) AND RETURN FAX A COPY IMMEDIATELY AFTER RECEIVING SAMPLES)															
ALL SAMPLES AND ASSOCIATED DOCUMENTATION WERE RECEIVED IN GOOD ORDER				YES / NO		PLEASE CONTACT THE LABORATORY				CUSTODY SEAL INTACT: YES / NO / NA					
										SAMPLES CHILLED: YES / NO / NA Temp: 5 °C					
										LABORATORY BATCH NO:					
<b>SPECIAL HANDLING/STORAGE OR DISPOSAL INSTRUCTIONS:</b>				<b>REPORTING</b>											
<b>CAUTION - SAMPLES MAY CONTAIN HAZARDOUS SUBSTANCES</b>				REPORT FORM: FAX				LETTER				EMAIL <input checked="" type="checkbox"/>		DISK <input type="checkbox"/>	
				EMAIL ADDRESS: sean.hudgens@aecom.com											
<b>INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLEAF</b>															



Received by: Jennifer Singlewood

153 5293

Job No: Date Recv: 10-Feb-16 05:33



**Appendix A – M Barr - 873 Skeet Road (Site 1)**

<b>Site Name</b>	M Barr – 873 Skeet Road (Site 1)
<b>Well Details</b>	The abstraction well at 873 Skeet Road is approximately 65 m deep and is screened from 30 to 60 m below ground level. The static groundwater level is recorded as 18 m below ground level. The well is finished with an 100 mm diameter steel well casing that sticks up above ground level by approximately 400 mm. The well is operational with a pump and outlet risers permanently mounted to the well head. The well appears to fill a storage tank which feeds a small secondary above ground tank in a pump house used for reticulation.
<b>Pump Details</b>	Submersible pump of unknown model.
<b>Sampling Date</b>	4 February 2016.
<b>Sampler</b>	AECOM.
<b>Well use prior to sampling</b>	Unknown.
<b>Sampling Methodology</b>	<p>A groundwater sample was unable to be collected directly from the well and therefore the groundwater sample was collected by connecting silicone tubing directly to a tap attached to the secondary tank in the pump house. Groundwater was purged for approximately 14 minutes with a flow rate of approximately 15 L/min. A multi parameter probe (YSI Professional Plus) was used to measure conductivity, pH, temperature, dissolved oxygen and redox in the purged groundwater. The well was sampled when parameters had stabilised.</p> <p>Water was observed to be slightly cloudy and yellow during purging and sampling.</p> <p>The groundwater sample was collected directly into laboratory supplied sample bottles. The groundwater sample was kept under chilled conditions and transported to Hill Laboratories Limited (Hill Laboratories) under standard chain of custody procedures.</p>
<b>Laboratory Analysis</b>	<p>The groundwater sample was identified as “Site 1” and was analysed by Hill Laboratories for the following analytes:</p> <ul style="list-style-type: none"> <li>- pH</li> <li>- Conductivity</li> <li>- Chloride</li> <li>- Total petroleum hydrocarbons (TPH)</li> </ul>
<b>Results Discussion</b>	<p>Results for the February 2016, August 2015, January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events are tabulated and attached.</p> <p>Results for the February 2016 monitoring event are similar to those recorded previously, including TPH which was not detected.</p>

The information included within this Appendix has been provided to Shell Todd Oil Services Limited for the purpose of and in accordance with the conditions of our engagement “STOS Kapuni Off-Site Monitoring – PO 4512643987”.



Site 1 - Sample Details and Analytical Results

Sample Location		873 Skeet Road								
AECOM Sample Number	Units	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1
Laboratory Sample Reference		1084034.1	1131198.1	1162256.1	1202867.1	1234484.1	1310590.1	1379473.1	1465459.1	1535293.1
Date Sampled		19/12/12	2/05/13	30/07/13	13/11/13	10/02/14	12/08/14	30/01/15	20/08/15	4/02/16
Total Petroleum Hydrocarbons (TPH)										
C <sub>7</sub> -C <sub>9</sub>	mg/L	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C <sub>10</sub> -C <sub>14</sub>	mg/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C <sub>15</sub> -C <sub>36</sub>	mg/L	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	mg/L	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
BTEX Compounds										
Benzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-	-
Toluene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-	-
Ethylbenzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-	-
Total Xylenes	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-	-
Dissolved Metals										
Dissolved Barium	mg/L	0.026	0.030	0.029	0.028	0.030	0.031	0.032	-	-
Dissolved Calcium	mg/L	14.4	15.0	14.7	14.4	14.3	14.5	14.1	-	-
Dissolved Copper	mg/L	0.0007	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0005	< 0.0005	-	-
Dissolved Iron	mg/L	1.43	1.89	2.3	1.58	2.5	4.4	4.6	-	-
Dissolved Magnesium	mg/L	4.8	5.6	5.6	5.7	5.6	5.7	5.6	-	-
Dissolved Manganese	mg/L	0.52	0.61	0.61	0.64	0.61	0.66	0.54	-	-
Dissolved Mercury	mg/L	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	-	-
Dissolved Nickel	mg/L	0.0086	0.0165	0.0015	0.0015	0.0008	0.0117	0.0073	-	-
Dissolved Potassium	mg/L	11.5	12.1	12.5	12.9	12.3	12.8	13.3	-	-
Dissolved Sodium	mg/L	31	31	33	34	32	36	34	-	-
Dissolved Zinc	mg/L	0.31	0.49	0.42	0.182	0.157	0.183	0.066	-	-
Alkyl Quaternary Ammonium Compounds in Water by LCMSMS										
Benzalkonium Chloride (C12 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Benzalkonium Chloride (C14 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Benzalkonium Chloride (C16 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Benzalkonium Chloride (total)	mg/L	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	-	-
DDAC (Didecyl dimethyl ammonium chloride)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Dodine	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Ethylene Glycol in Water										
Ethylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-	-
Propylene Glycol in Water										
Propylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-	-
Methanol in Water - Aqueous Solvents										
Methanol	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-
Formaldehyde in Water by DNPH & LCMSMS										
Formaldehyde	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-	-
Gases in groundwater										
Ethane	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-	-
Ethylene	mg/L	< 0.003	< 0.004	< 0.004	< 0.003	< 0.004	< 0.003	< 0.003	-	-
Methane	mg/L	0.64	4.4	4.2	8.6	7.5	7.9	9.4	-	-
Other Analyses										
Sum of Anions	meq/L	3.0	3.2	3.2	3.1	3.1	3.1	3.1	-	-
Sum of Cations	meq/L	2.8	3.0	3.1	3.1	3.0	3.3	3.2	-	-
pH	pH Units	7	6.8	6.8	7	7.1	6.9	7	6.8	7.3
Total Alkalinity	mg/L as CaCO <sub>3</sub>	105	113	111	107	108	104	107	-	-
Bicarbonate	mg/L at 25°C	127	137	135	130	131	127	130	-	-
Total Hardness	mg/L as CaCO <sub>3</sub>	55	61	60	59	59	60	58	-	-
Electrical Conductivity (EC)	mS/m	31.9	32.3	32.6	30.8	32.1	32.3	32.4	32.0	32.0
Total Dissolved Solids (TDS)	mg/L	210	220	220	260	220	220	230	-	-
Bromide	mg/L	0.15	0.14	0.06	0.12	0.06	0.14	0.12	-	-
Chloride	mg/L	34	35	33	34	34	35	34	34	34
Nitrite-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.02	0.002	-	-
Nitrate-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.02	< 0.002	-	-
Nitrate-N + Nitrite-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	0.002	< 0.02	0.004	-	-
Sulphate	mg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	-	-

**Appendix B – PKW Farms - 468 Hastings Road (Site 2)**

<b>Site Name</b>	PKW Farms – 468 Hastings Road (Site 2)
<b>Well Details</b>	The abstraction well at 468 Hastings Road is 337 m deep and is cased to 92 m below ground level (bgl). The depth to groundwater is unknown. The well casing is steel with a diameter of approximately 90 mm and is finished above ground. The well is operational with pump and outlet tubes permanently mounted to the well head. The well is pumped every day to supply the farm and dairy shed. Approximately 130,000 litres of groundwater is pumped each day.
<b>Pump Details</b>	Submersible pump of unknown model.
<b>Sampling Date</b>	4 February 2016.
<b>Sampler</b>	AECOM.
<b>Well use prior to sampling</b>	Unknown.
<b>Sampling Methodology</b>	<p>A groundwater sample was collected by attaching silicone tubing directly to the outlet of the well and opening a valve on the outlet. Groundwater was purged for approximately 8 minutes with a flow rate of approximately 2.5 L/min. An inline flow cell was used in conjunction with a multi parameter probe (YSI Professional Plus) to measure conductivity, pH, temperature, dissolved oxygen and redox in the purged groundwater. The well was sampled when parameters had stabilised.</p> <p>Water was observed to be clear during purging and sampling.</p> <p>The groundwater sample was collected directly into laboratory supplied sample bottles. The groundwater sample was kept under chilled conditions and transported to Hill Laboratories Limited (Hill Laboratories) under standard chain of custody procedures.</p>
<b>Laboratory Analysis</b>	<p>The groundwater sample was identified as “Site 2” and was analysed by Hill Laboratories for the following analytes:</p> <ul style="list-style-type: none"> <li>- pH</li> <li>- Conductivity</li> <li>- Chloride</li> <li>- Total petroleum hydrocarbons (TPH)</li> </ul>
<b>Results Discussion</b>	<p>Results for the February 2016, August 2015, January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events are tabulated and attached.</p> <p>Results for the February 2016 monitoring event are similar to those recorded previously, including TPH which was not detected.</p>

The information included within this Appendix has been provided to Shell Todd Oil Services Limited for the purpose of and in accordance with the conditions of our engagement “STOS Kapuni Off-Site Monitoring – PO 4512643987”.

Site 2 - Sample Details and Analytical Results

Sample Location		468 Hastings Road								
AECOM Sample Number	Units	Site 2	Site 2	Site 2	Site 2	Site 2	Site 2	Site 2	Site 2	Site 2
Laboratory Sample Reference		1084034.2	1131198.2	1162256.2	1202867.2	1234484.2	1310590.2	1379473.2	1465459.2	1535293.2
Date Sampled		19/12/12	2/05/13	30/07/13	13/11/13	10/02/14	12/08/14	30/01/15	20/08/15	4/02/16
Total Petroleum Hydrocarbons (TPH)										
C <sub>7</sub> -C <sub>9</sub>	mg/L	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C <sub>10</sub> -C <sub>14</sub>	mg/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C <sub>15</sub> -C <sub>36</sub>	mg/L	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	mg/L	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
BTEX Compounds										
Benzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-	-
Toluene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-	-
Ethylbenzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-	-
Total Xylenes	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-	-
Dissolved Metals										
Dissolved Barium	mg/L	0.00199	0.0021	0.00195	0.0021	0.00199	0.00196	0.00197	-	-
Dissolved Calcium	mg/L	13.8	13.1	12.9	12.9	13.2	13.2	13.3	-	-
Dissolved Copper	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-	-
Dissolved Iron	mg/L	0.05	0.06	0.05	0.04	0.05	0.04	0.03	-	-
Dissolved Magnesium	mg/L	4.2	4.4	4.5	4.7	4.8	4.7	5	-	-
Dissolved Manganese	mg/L	0.015	0.0129	0.0133	0.013	0.0134	0.0134	0.0136	-	-
Dissolved Mercury	mg/L	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	-	-
Dissolved Nickel	mg/L	0.0024	0.0008	0.0008	0.0013	0.0006	0.0085	0.0077	-	-
Dissolved Potassium	mg/L	1.41	1.43	1.46	1.45	1.41	1.38	1.73	-	-
Dissolved Sodium	mg/L	58	56	60	65	57	64	68	-	-
Dissolved Zinc	mg/L	0.0053	0.0012	0.0018	0.0045	0.0017	0.0018	0.0041	-	-
Alkyl Quaternary Ammonium Compounds in Water by LCMSMS										
Benzalkonium Chloride (C12 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Benzalkonium Chloride (C14 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Benzalkonium Chloride (C16 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Benzalkonium Chloride (total)	mg/L	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	-	-
DDAC (Didecyl dimethyl ammonium chloride)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Dodine	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Ethylene Glycol in Water										
Ethylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-	-
Propylene Glycol in Water										
Propylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-	-
Methanol in Water - Aqueous Solvents										
Methanol	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-
Formaldehyde in Water by DNPH & LCMSMS										
Formaldehyde	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-	-
Gases in groundwater										
Ethane	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-	-
Ethylene	mg/L	< 0.004	< 0.004	< 0.004	< 0.003	< 0.004	< 0.003	< 0.003	-	-
Methane	mg/L	2.3	5.4	3.9	5.8	6.8	7.0	9.4	-	-
Other Analyses										
Sum of Anions	meq/L	3.7	3.7	3.6	3.6	3.6	3.6	3.6	-	-
Sum of Cations	meq/L	3.6	3.5	3.7	3.9	3.6	3.9	4.1	-	-
pH	pH Units	8.4	8.4	8.4	8.3	8.3	8.4	8.3	8.4	8.3
Total Alkalinity	mg/L as CaCO <sub>3</sub>	169	166	166	166	166	164	165	-	-
Bicarbonate	mg/L at 25°C	200	198	198	199	198	196	197	-	-
Total Hardness	mg/L as CaCO <sub>3</sub>	52	51	51	51	53	52	54	-	-
Electrical Conductivity (EC)	mS/m	33.8	33.3	33.5	33.4	33.3	33.6	34.1	33.5	33.5
Total Dissolved Solids (TDS)	mg/L	200	210	200	220	200	200	196	-	-
Bromide	mg/L	0.06	0.07	< 0.05	0.05	< 0.05	0.07	0.08	-	-
Chloride	mg/L	11.4	12.0	10.9	10.7	10.4	11.1	11.2	11.2	10.7
Nitrite-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-	-
Nitrate-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-	-
Nitrate-N + Nitrite-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-	-
Sulphate	mg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	-	-

**Appendix C – Kiley Estate - Inuawai Road (Site 3)**

<b>Site Name</b>	Kiley Estate - Inuawai Road (Site 3)
<b>Well Details</b>	The abstraction well at Kiley Estate is 448 m deep and is cased to 280 m below ground level. The depth to groundwater is unknown. The well casing is steel with a diameter of approximately 90 mm and is finished above ground. The well is operational with pump and outlet tubes permanently mounted to the well head. The well is pumped to supply water to the dairy shed.
<b>Pump Details</b>	Submersible pump of unknown model. Potential also for artesian supply.
<b>Sampling Date</b>	4 February 2016.
<b>Sampler</b>	AECOM.
<b>Well use prior to sampling</b>	Unknown.
<b>Sampling Methodology</b>	<p>A groundwater sample was collected by attaching silicone tubing directly to the outlet of the well and opening a valve on the outlet. Groundwater was purged for approximately 14 minutes with a flow rate of approximately 1.25 L/min. An inline flow cell was used in conjunction with a multi parameter probe (YSI Professional Plus) to measure conductivity, pH, temperature, dissolved oxygen and redox in the purged groundwater. The well was sampled when parameters had stabilised.</p> <p>Water was observed to be faintly turbid during initial purging, but clear upon sampling.</p> <p>The groundwater sample was collected directly into laboratory supplied sample bottles. The groundwater sample was kept under chilled conditions and transported to Hill Laboratories Limited (Hill Laboratories) under standard chain of custody procedures.</p>
<b>Laboratory Analysis</b>	<p>The groundwater sample was identified as “Site 3” and was analysed by Hill Laboratories for the following analytes:</p> <ul style="list-style-type: none"> <li>- pH</li> <li>- Conductivity</li> <li>- Chloride</li> <li>- Total petroleum hydrocarbons (TPH)</li> </ul>
<b>Results Discussion</b>	<p>Results for the February 2016, August 2015, January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events are tabulated and attached.</p> <p>Results for the February 2016 monitoring event are similar to those recorded previously, including TPH which was not detected.</p>

The information included within this Appendix has been provided to Shell Todd Oil Services Limited for the purpose of and in accordance with the conditions of our engagement “STOS Kapuni Off-Site Monitoring – PO 4512643987”.

Site 3 - Sample Details and Analytical Results

Sample Location		Inuawai Road								
AECOM Sample Number	Units	Site 3	Site 3	Site 3	Site 3	Site 3	Site 3	Site 3	Site 3	Site 3
Laboratory Sample Reference		1084034.3	1131198.3	1162256.3	1202867.3	1234484.3	1310590.3	1379473.3	1465459.3	1535293.3
Date Sampled		19/12/12	2/05/13	30/07/13	13/11/13	10/02/14	12/08/14	30/01/15	20/08/15	04-Feb-2016
Total Petroleum Hydrocarbons (TPH)										
C <sub>7</sub> -C <sub>9</sub>	mg/L	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C <sub>10</sub> -C <sub>14</sub>	mg/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C <sub>15</sub> -C <sub>36</sub>	mg/L	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	mg/L	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
BTEx Compounds										
Benzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-	-
Toluene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-	-
Ethylbenzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-	-
Total Xylenes	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-	-
Dissolved Metals										
Dissolved Barium	mg/L	0.00108	0.00110	0.00138	0.00129	0.00107	0.00116	0.00107	-	-
Dissolved Calcium	mg/L	3.8	4.0	3.6	3.8	3.8	3.7	3.8	-	-
Dissolved Copper	mg/L	< 0.0005	< 0.0005	0.0006	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-	-
Dissolved Iron	mg/L	< 0.02	0.07	0.02	< 0.02	0.02	0.02	< 0.02	-	-
Dissolved Magnesium	mg/L	0.9	0.87	0.84	0.9	0.89	0.88	0.93	-	-
Dissolved Manganese	mg/L	0.0066	0.0073	0.0069	0.0064	0.0063	0.0065	0.0067	-	-
Dissolved Mercury	mg/L	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	-	-
Dissolved Nickel	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-	-
Dissolved Potassium	mg/L	0.78	0.85	0.84	0.82	0.84	0.78	0.77	-	-
Dissolved Sodium	mg/L	67	70	74	78	71	80	66	-	-
Dissolved Zinc	mg/L	< 0.0010	0.0029	< 0.0010	0.0014	< 0.0010	< 0.0010	< 0.0010	-	-
Alkyl Quaternary Ammonium Compounds in Water by LCMSMS										
Benzalkonium Chloride (C12 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Benzalkonium Chloride (C14 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Benzalkonium Chloride (C16 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Benzalkonium Chloride (total)	mg/L	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	-	-
DDAC (Didecylmethylammonium chloride)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Dodine	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	-
Ethylene Glycol in Water										
Ethylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-	-
Propylene Glycol in Water										
Propylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-	-
Methanol in Water - Aqueous Solvents										
Methanol	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-
Formaldehyde in Water by DNPH & LCMSMS										
Formaldehyde	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-	-
Gases in groundwater										
Ethane	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-	-
Ethylene	mg/L	< 0.004	< 0.004	< 0.004	< 0.003	< 0.004	< 0.003	< 0.003	-	-
Methane	mg/L	1.94	4.9	4.1	6.7	7.8	8.5	6.4	-	-
Other Analyses										
Sum of Anions	meq/L	3.5	3.4	3.4	3.4	3.4	3.4	3.4	-	-
Sum of Cations	meq/L	3.2	3.3	3.5	3.7	3.4	3.7	3.2	-	-
pH	pH Units	8.8	8.9	8.9	8.7	8.8	8.9	8.8	8.9	8.7
Total Alkalinity	mg/L as CaCO <sub>3</sub>	158	154	153	155	156	153	154	-	-
Bicarbonate	mg/L at 25°C	181	175	172	179	179	174	178	-	-
Total Hardness	mg/L as CaCO <sub>3</sub>	13.3	13.4	12.5	13.3	13.1	12.7	13.4	-	-
Electrical Conductivity (EC)	mS/m	31.8	31.4	31.6	31.4	31.7	31.7	32.3	31.6	31.9
Total Dissolved Solids (TDS)	mg/L	199	198	197	210	200	193	200	-	-
Bromide	mg/L	0.07	0.07	< 0.05	0.05	< 0.05	0.07	0.06	-	-
Chloride	mg/L	11.6	12.3	11.4	11.1	10.7	11.6	11.6	11.5	10.8
Nitrite-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-	-
Nitrate-N	mg/L	0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-	-
Nitrate-N + Nitrite-N	mg/L	0.003	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-	-
Sulphate	mg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	-	-

**Appendix D –Site KA9-EB (Former Emergency Bore). STOS KA9 Well Site (Lower Duthie Road)**

<b>Site Name</b>	STOS KA9 Well Site, Lower Duthie Road (Site KA9-EB)
<b>Well Details</b>	The well at Site KA9-EB is between 35 m and 55 m deep and is cased through the water table to approximately 35 m below ground level. The depth to groundwater is approximately 13 m. The well casing is steel with a diameter of approximately 100 mm and is finished above ground. The well was formerly used as a firewater abstraction bore but is not currently used and no pump is installed in the well.
<b>Pump Details</b>	No pump installed.
<b>Sampling Date</b>	4 February 2016.
<b>Sampler</b>	AECOM.
<b>Well use prior to sampling</b>	None.
<b>Sampling Methodology</b>	<p>A groundwater sample was collected by inserting a downhole bladder pump into the well, connected via dedicated low density polyethylene (LDPE) tubing to the surface. Groundwater was purged for approximately 17 minutes with a flow rate of approximately 0.1 L/min. An inline flow cell was used in conjunction with a multi parameter probe (YSI Professional Plus) to measure conductivity, pH, temperature, dissolved oxygen and redox in the purged groundwater. The well was sampled when parameters had stabilised.</p> <p>Water was observed to have a faint brown hue during initial purging, but was clear upon sampling.</p> <p>The groundwater sample was collected directly into laboratory supplied sample bottles. The groundwater sample was kept under chilled conditions and transported to Hill Laboratories Limited (Hill Laboratories) under standard chain of custody procedures.</p>
<b>Laboratory Analysis</b>	<p>The groundwater sample was identified as “KA9 – EB” and was analysed by Hill Laboratories for the following analytes:</p> <ul style="list-style-type: none"> <li>- pH</li> <li>- Conductivity</li> <li>- Chloride</li> <li>- Total petroleum hydrocarbons (TPH)</li> <li>- Benzene, toluene, ethylbenzene, and xylenes (BTEX)</li> </ul> <p>A groundwater sample identified as “KA9 – Dup” was also collected from the well, and was analysed for BTEX.</p>
<b>Results Discussion</b>	<p>Results for the February 2016, August 2015 and March 2015 monitoring events are tabulated and attached.</p> <p>General baseline groundwater parameters for the groundwater sample collected from Site KA9-EB are similar to those recorded previously.</p> <p>Concentrations of TPH, benzene, ethylbenzene and xylenes were not detected above MDLs in the groundwater sample collected from Site KA9-EB. Toluene was detected in the groundwater sample at 0.0012 mg/L, compared with the MDL of 0.0010 mg/L. These results are consistent with the August 2015 and March 2015 sampling events.</p>

The information included within this Appendix has been provided to Shell Todd Oil Services Limited for the purpose of and in accordance with the conditions of our engagement “STOS Kapuni Off-Site Monitoring – PO 4512643987”.

Site KA9-EB (Former Emergency Bore)

Sample Location	Units	Lower Duthie Road			
AECOM Sample Number		KA9 - Emergency Bore	KA9 - Emergency Bore	KA9 - Emergency Bore	KA9 - Emergency Bore
Laboratory Sample Reference		1402708.1	1403749.1	1465459.7	1535293.4
Date Sampled		23/03/15	23/03/15	20/08/15	4/02/2016
Total Petroleum Hydrocarbons (TPH)					
C <sub>7</sub> -C <sub>9</sub>	mg/L	-	< 0.10	< 0.10	< 0.10
C <sub>10</sub> -C <sub>14</sub>	mg/L	-	< 0.2	< 0.2	< 0.2
C <sub>15</sub> -C <sub>36</sub>	mg/L	-	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	mg/L	-	< 0.7	< 0.7	< 0.7
BTEX Compounds					
Benzene	mg/L	-	< 0.0010	< 0.0010	< 0.0010
Toluene	mg/L	-	0.002	0.0015	0.0012
Ethylbenzene	mg/L	-	< 0.0010	< 0.0010	< 0.0010
Total Xylenes	mg/L	-	< 0.0030	< 0.0030	< 0.0030
Dissolved Metals					
Dissolved Barium	mg/L	0.082	-	-	-
Dissolved Calcium	mg/L	28	-	-	-
Dissolved Copper	mg/L	< 0.0005	-	-	-
Dissolved Iron	mg/L	3.6	-	-	-
Dissolved Magnesium	mg/L	20	-	-	-
Dissolved Manganese	mg/L	0.24	-	-	-
Dissolved Mercury	mg/L	< 0.00008	-	-	-
Dissolved Nickel	mg/L	0.0008	-	-	-
Dissolved Potassium	mg/L	17.1	-	-	-
Dissolved Sodium	mg/L	51	-	-	-
Dissolved Zinc	mg/L	23	-	-	-
Alkyl Quaternary Ammonium Compounds in Water by LCMSMS					
Benzalkonium Chloride (C12 homologue)	mg/L	< 0.010	-	-	-
Benzalkonium Chloride (C14 homologue)	mg/L	< 0.010	-	-	-
Benzalkonium Chloride (C16 homologue)	mg/L	< 0.010	-	-	-
Benzalkonium Chloride (total)	mg/L	< 0.018	-	-	-
DDAC (Didecyltrimethylammonium chloride)	mg/L	< 0.010	-	-	-
Dodine	mg/L	< 0.010	-	-	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/L	< 0.010	-	-	-
Ethylene Glycol in Water					
Ethylene glycol	mg/L	< 4	-	-	-
Propylene Glycol in Water					
Propylene glycol	mg/L	< 4	-	-	-
Methanol in Water - Aqueous Solvents					
Methanol	mg/L	< 2	-	-	-
Formaldehyde in Water by DNPH & LCMSMS					
Formaldehyde	mg/L	< 0.02	-	-	-
Gases in groundwater					
Ethane	mg/L	< 0.003	-	-	-
Ethylene	mg/L	< 0.003	-	-	-
Methane	mg/L	13.8	-	-	-
Other Analyses					
Sum of Anions	meq/L	6.8	-	-	-
Sum of Cations	meq/L	6.6	-	-	-
pH	pH Units	7.5	-	7.5	7.6
Total Alkalinity	mg/L as CaCO <sub>3</sub>	300	-	-	-
Bicarbonate	mg/L at 25 °C	370	-	-	-
Total Hardness	mg/L as CaCO <sub>3</sub>	155	-	-	-
Electrical Conductivity (EC)	mS/m	62.7	-	54.8	61.1
Total Dissolved Solids (TDS)	mg/L	310	-	-	-
Bromide	mg/L	-	-	-	-
Chloride	mg/L	25	-	23	26
Nitrite-N	mg/L	< 0.002	-	-	-
Nitrate-N	mg/L	< 0.002	-	-	-
Nitrate-N + Nitrite-N	mg/L	< 0.002	-	-	-
Sulphate	mg/L	< 0.5	-	-	-

10 September 2015

Adam Wood  
 Environmental Advisor  
 Shell Todd Oil Services Limited  
 Private Bag 2035  
 New Plymouth 4342

Dear Adam

## STOS Kapuni - Third Party Abstraction Wells - Groundwater Monitoring Event August 2015

### 1.0 Terms of Reference

This letter has been prepared for Shell Todd Oil Services Ltd (STOS) by AECOM Consulting Services (NZ) Ltd (AECOM) in accordance with the proposal dated 5 July 2012 and subsequent variations. It documents the findings of the eighth groundwater monitoring event (GME) completed at four, third party abstraction wells, located within the Kapuni area; it also presents the findings of the second GME completed at the former emergency bore located at the STOS KA9 well site, which is the location of STOS produced water re-injection well, KW-2.

### 2.0 Objective and Background

The objective of the groundwater monitoring is to assess groundwater quality in the subject wells located in the Kapuni area.

Seven previous GMEs of the third party abstraction wells have been completed. The dates and report references of the GMEs are provided in **Table 1** below.

**Table 1 STOS Kapuni - Third Party Abstraction Wells GMEs**

Date(s)	Report Reference
19 December 2012	Letter report to STOS, dated 16 April 2013 and entitled STOS Kapuni – Third Party Abstraction Well - Groundwater Monitoring
2 May 2013	Letter report to STOS, dated 12 June 2013 and entitled STOS Kapuni – Third Party Abstraction Well - Groundwater Monitoring Event May 2013
30 July 2013	Letter report to STOS, dated 20 September 2013 and entitled STOS Kapuni – Third Party Abstraction Well - Groundwater Monitoring Event July 2013
13 November 2013	Letter report to STOS, dated 19 December 2013 and entitled STOS Kapuni – Third Party Abstraction Well - Groundwater Monitoring Event November 2013
10 February 2014	Letter report to STOS, dated 29 April 2014 and entitled STOS Kapuni – Third Party Abstraction Wells - Groundwater Monitoring Event February 2014
12 August 2014	Letter report to STOS, 19 November 2014 and entitled STOS Kapuni – Third Party Abstraction Wells - Groundwater Monitoring Event August 2014
30 January and 23 March 2015	Letter report to STOS, 29 June 2015 and entitled STOS Kapuni – Third Party Abstraction Wells - Groundwater Monitoring Event January and March 2015

This current letter report presents the results of the GME completed at the four, third party abstraction wells and the former emergency bore at the STOS KA9 well site on 20 August 2015.

The four abstraction wells monitored are located at the following third party sites:

- Site 1 – M Barr, 873 Skeet Road
- Site 2 – PKW Farms, 468 Hastings Road
- Site 3 – Kiley Estate, Inuawai Road
- Site 4 – Naplin Trust, Ahipaipa Road

The former emergency bore (Site KA9-EB) is located at the STOS KA9 well site off Lower Duthie Road (Rapid #83).



The location of each site is shown on **Figure 1** (attached).

### **3.0 Scope of Works**

The groundwater monitoring comprised the following scope of works:

- Purging and collection of groundwater samples from the third party wells and the former emergency bore.
- Laboratory analysis of groundwater samples.
- Preparation of this factual letter report.

### **4.0 Sampling Methodology**

Groundwater samples were collected from the third party wells and KA9-EB on 20 August 2015. The sampling methodology for each site is summarised in the attached appendices as follows:

- **Appendix A** – Site 1 (M Barr, 873 Skeet Road)
- **Appendix B** – Site 2 (PKW Farms, 468 Hastings Road)
- **Appendix C** – Site 3 (Kiley Estate, Inuawai Road)
- **Appendix D** – Site 4 (Naplin Trust, Ahipaipa Road)
- **Appendix E** – Site KA9-EB (STOS KA9 well site, Lower Duthie Road)

The groundwater sample collected from Site 1 was collected directly from a tap attached to a secondary storage tank housed in a pump house close to the well. Groundwater samples collected from Site 2, Site 3 and Site 4 were collected from sampling ports close to the wellhead of each abstraction well. The groundwater sample collected from Site KA9-EB was collected using a down hole bladder pump.

Field sampling records for each site are attached.

#### **4.1 Groundwater Sample Collection and Analysis**

Groundwater samples were collected directly into laboratory supplied sample bottles. The samples were kept under chilled conditions and transported to Hill Laboratories Limited (Hill Laboratories) under standard chain of custody procedures.

Groundwater samples were analysed for the following:

- pH
- Conductivity
- Chloride
- Total petroleum hydrocarbons (TPH)
- Benzene, toluene, ethylbenzene, and xylenes (BTEX) (Site KA9-EB only)

Chain of custody documents and the laboratory report as received are attached.

#### **4.2 Quality Assurance/Quality Control (QA/QC)**

For quality assurance/quality control (QA/QC) purposes, a trip blank sample (identified as TB) and a duplicate sample collected from Site 4 (identified as Dup) were collected during the GME.

The trip blank sample was prepared in the laboratory with deionised water, prior to bottles being shipped.

The duplicate sample was collected directly into laboratory supplied jars, chilled and transported to Hill Laboratories under AECOM chain of custody procedures. The trip blank and duplicate samples were analysed for TPH.

Chain of custody documents and the laboratory report as received are attached.

## **5.0 Groundwater Sample Results**

### **5.1.1 Third Party Sites (Sites 1 to 4)**

The groundwater analysis results for the August 2015 monitoring event for each third party site have been tabulated and are presented in the site specific appendices attached. Results for the January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events are included in the tables for these sites.

#### **General Groundwater Parameters**

General baseline groundwater parameters for groundwater samples collected from the third party wells in August 2015 were similar to results from the January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events.

#### **Activity Parameters**

Concentrations of TPH were not detected above laboratory method detection limits (MDLs) in the groundwater samples collected from any of the four third party abstraction wells.

The results do not indicate contamination of third party abstraction wells by hydrocarbons or other contaminants of concern.

### **5.1.2 Site KA9-EB**

#### **General Groundwater Parameters**

General baseline groundwater parameters for the groundwater sample collected from Site KA9-EB in August 2015 were similar to the results from the March 2015 monitoring event.

#### **Activity Parameters**

Concentrations of TPH, benzene, ethylbenzene and xylenes were not detected above MDLs in the groundwater sample collected from Site KA9-EB. Toluene was detected in the groundwater sample at 0.0015 mg/L, compared with the MDL of 0.0010 mg/L. These results are similar to the results from the March 2015 monitoring event.

## **5.2 QA/QC Results**

The QA/QC results for Sites 1 to 4 and Site KA9-EB have been tabulated and are attached. The following points are noted:

- Concentrations of TPH were not detected above the laboratory MDLs in the trip blank sample.
- Concentrations of TPH were not detected above the laboratory MDLs in the primary or duplicate groundwater sample collected from Site 4.

The QA/QC results are considered to meet the data quality objectives for this investigation.

## **6.0 Summary**

The results of the GME completed for the four, third party abstraction wells in August 2015 do not indicate contamination of the deep abstraction wells by hydrocarbons or any other contaminants of concern. The results of the August 2015 monitoring event are consistent with the results of the January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events.

The results of the GME completed for the former emergency bore at Site KA9-EB in August 2015 indicate that toluene is present at trace levels in the bore. These results are consistent with the results from the March 2015 monitoring event.

**7.0 Closure**

We trust that this report meets your requirements. Please do not hesitate to contact AECOM if you wish to discuss the results.

Yours sincerely



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encl: Limitations  
Figure 1 - Site Location Plan  
Groundwater Sampling Sheets  
Laboratory Analytical Results and Chain of Custody Documentation  
QA/QC Table

**Appendices**

Appendix A – Site 1 (M Barr, 873 Skeet Road)  
Appendix B – Site 2 (PKW Farms, 468 Hastings Road)  
Appendix C – Site 3 (Kiley Estate, Inuawai Road)  
Appendix D – Site 4 (Naplin Trust, Ahipaipa Road)  
Appendix E – Site KA9-EB (Former Emergency Bore). STOS KA9 Well Site (Lower Duthie Road)

**Limitations**

All information in this Report is provided strictly in accordance with and subject to the following limitations and recommendations:

- a) This Report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by AECOM for use of any part of this Report in any other context.
- b) This conclusion is based solely on the information and findings contained in this Report.
- c) This conclusion is based solely on the scope of work agreed between AECOM and Shell Todd Oil Services Limited and described in section 3 ("Scope of Works") of this Report.
- d) This Report is based on the conditions encountered during the site monitoring conducted, and information reviewed, between August and September 2015. AECOM accepts no responsibility for any events arising from any changes in site conditions or in the information reviewed that have occurred after the completion of the site monitoring.
- e) The investigations carried out for the purposes of the Report have been undertaken, and the Report has been prepared, in accordance with normal prudent practice and by reference to applicable environmental regulatory authority and industry standards, guidelines and assessment criteria in existence at the date of this Report.
- f) Where this Report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in the Report. AECOM assumes no liability for any inaccuracies in or omissions to that information.
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**Figure 1 – Site Location Plan**





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Issue Status: FINAL

**THIRD PARTY WELL MONITORING**  
**SITE LOCATION PLAN**  
 SHELL TODD OIL SERVICES LIMITED (STOS)  
 Project No.: 42788630 Date: 2/06/2015

**AECOM**  
 Figure: 1

**Groundwater Sampling Sheets**

Project No **60435985**

Project Name **STOS Kapuni Farm Bores**

Sampled by: **Richie Miller**

Well: **Emerg. Bore**

### Development

Date \_\_\_\_\_

(Well volume =  $V = ((3.141 * D^2)/4) * d$  (Where D=diameter of well, d=depth of well, V=volume))

Development Method \_\_\_\_\_

Time Started \_\_\_\_\_

SWL (start) \_\_\_\_\_

Volume Removed \_\_\_\_\_

Bore Depth (start) \_\_\_\_\_

Head Space \_\_\_\_\_

Time Stopped \_\_\_\_\_

SWL (end) \_\_\_\_\_

Discharge Rate \_\_\_\_\_

Bore Depth (end) \_\_\_\_\_

Comments \_\_\_\_\_

NAPL Present \_\_\_\_\_

(If yes thickness) \_\_\_\_\_

### Purging

Date **20/8/15**

Purge Method **Low Flow Peristaltic**

Purge Depth **13.5**

Time Started **10:16**

SWL (start) **12.55 mbToc**

Bore Volume \_\_\_\_\_

Bore Depth (start) **36.26 mbToc**

Head Space **0.0**

Time Stopped **10:48**

SWL (end) \_\_\_\_\_

Volume Removed \_\_\_\_\_

Bore Depth (end) \_\_\_\_\_

Flow Rate \_\_\_\_\_

Comments \_\_\_\_\_

NAPL Present \_\_\_\_\_

(If yes thickness) \_\_\_\_\_

### Sampling

Date \_\_\_\_\_

Sampling Method **Low Flow**

Sampling Depth **13.5**

Time Started **10:48**

SWL (start) **12.635**

Time Stopped **11:01**

SWL (end) **12.675**

Flow Rate \_\_\_\_\_

Comments \_\_\_\_\_

### OVA Monitoring

Time	Ambient	Bore Head	Discharge

Sample ID \_\_\_\_\_

Duplicate ID \_\_\_\_\_

**BTEX** ~~VOCs~~ ☒

TPH ☒

PAH ☒

Metals ☒

Other ☒

→ Conductivity  
chloride  
pH

### Field Analyses

Static Water Level	Time	Vol Removed (L)	EC (uS/cm)	pH	T (C)	Redox (mV)	Dissolved Oxygen (%)	Comments (Color, turbidity)	TDS (ppm)
Stabilisation Criteria in 3 consecutive readings:			+/-3%	+/-0.2	+/-0.2	+/-20mV	10% → 10%	-	-
12.58	10:24	0.25	553.2	7.14	12.7	22.0	78.0	Clear	12.87
12.59	10:29	0.3	563.8	7.45	12.2	-71.6	47.9	"	"
12.60	10:32	0.5	562.5	7.47	12.6	-92.6	43.7	"	"
12.61	10:35	0.7	566.7	7.80	12.5	-107.6	424.3	"	"
12.62	10:38	0.8	566.6	7.52	12.4	-121.1	16.0	"	"
12.625	10:41	0.9	566.4	7.53	12.4	-124.9	13.0	"	"
12.63	10:44	10.0	565.7	7.55	12.4	-129.7	10.8	"	"
12.635	10:47	10.1	566.0	7.86	12.3		10.0	"	"



**Site No: 1 (873 Skeet Road)**

Date 20/08/2015

## Purging

Time Stopped 14:50

Flow Rate \_\_\_\_\_

Volume Removed 36 L

Comments used probes in porous  
protective casing placed  
in bucket.

Time Started 14:50Time Stopped 14:51

Flow Rate \_\_\_\_\_

Comments TPH, pH, Conductivity + Chloride Samples

Time	Vol Removed (L)	TDS (ppm)	EC (uS/cm)	pH	T (C)	Redox (mV)	Dissolved Oxygen (%)	Dissolved Oxygen (ppm)	Comments (Color, turbidity)
14:35	5.5		320.0	6.87	11.2	34.0	70.8		light brown - low susp.
14:38	12		319.9	6.73	11.3	43.6	41.1		" low cloudy/susp sol
14:41	18		319.9	6.65	11.3	52.0	22.0		" "
14:44	24		319.8	6.65	11.3	57.1	16.1		" "
14:47	30		319.6	6.66	11.3	61.4	12.3		" "
14:50	36		319.5	6.67	11.3	64.9	12.9		" "

Prepared By:.....*Rm*.....  
Checked By:.....

## STOS Offsite Bores GROUNDWATER SAMPLING DATA SHEET

Site No: 2 (468 Hastings Road)

Project No 60435985 Project Name STOS Offsite Monitoring Sampled by: Richie MillerDate 20/08/2015Sample ID Site 2  
Duplicate ID -

## Purging

Time Started 15:34Time Stopped ~~15:36~~ 15:56

Flow Rate \_\_\_\_\_

Volume Removed \_\_\_\_\_

Comments \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Sampling

Time Started 15:56Time Stopped ~~15:56~~ 15:57

Flow Rate \_\_\_\_\_

Comments \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Field Analyses

Time	Vol Removed (L)	TDS (ppm)	EC (uS/cm)	pH	T (C)	Redox (mV)	Dissolved Oxygen (%)	Dissolved Oxygen (ppm)	Comments (Color, turbidity)
15:35	0.5		338.0	8.18	16.0	27.3	84.6		Clear
15:38	4.5		338.0	8.35	17.5	-2.8	11.5		"
15:41	8.5		337.3	8.35	17.6	-24.9	6.6		"
15:44	12.5		336.4	8.36	17.6	-40.6	5.0		"
15:47	16.5		337.2	8.36	17.6	-74.0	5.1		"
15:50	20.5		338.1	8.36	17.6	-105.8	5.2		"
15:53	24.5		338.1	8.36	17.6	-138.1	4.9		"
15:56	28.5		338.2	8.36	17.6	-146.8	5.1		"

**Site No: 3 (Kiley Trust Farm)**Date 20/08/2015

Sample ID	Site 3
Duplicate ID	-

## Sampling

Time Started 12:57Time Stopped 12:58

Flow Rate \_\_\_\_\_

Comments \_\_\_\_\_

Comments \_\_\_\_\_

Time	Vol Removed (L)	TDS (ppm)	EC (uS/cm)	pH	T (C)	Redox (mV)	Dissolved Oxygen (%)	Dissolved Oxygen (ppm)	Comments (Color, turbidity)
12:39	5		312.6	8.89	17.6	20.3	11.8		clear.
12:42	11		315.3	8.90	18.0	-6.6	6.9		"
12:45	17		314.8	8.90	18.1	-24.9	4.7		"
12:48	23		313.5	8.90	18.1	-41.5	3.9		"
12:51	29		312.6	8.90	18.2	-58.8	4.0		"
12:54	35		312.8	8.90	18.2	-71.5	4.0		"
12:57	41		313.7	8.89	18.2	-87.9	3.8		"

**Site No: 4 (Naplin Trust Farm)**

Sample ID \_\_\_\_\_ Site 4 \_\_\_\_\_  
Duplicate ID \_\_\_\_\_ DUP \_\_\_\_\_

## Sampling

Time Started 14:02Time Stopped 14:03

Flow Rate \_\_\_\_\_

Comments

Comments

Time	Vol Removed (L)	TDS (ppm)	EC (uS/cm)	pH	T (C)	Redox (mV)	Dissolved Oxygen (%)	Dissolved Oxygen (ppm)	Comments (Color, turbidity)
13:50	1		377.3	7.94	17.2	-39.6	7.5		Clear
13:53	5		377.4	7.98	17.3	-79.1	4.5		"
13:56	10		374.1	7.99	17.3	-109.9	3.7		"
13:59	15		373.3	7.98	17.3	-130.6	4.1		"
14:02	20		372.3	7.99	17.3	-136.7	3.9		"

## Laboratory Analytical Results and Chain of Custody Documentation



## ANALYSIS REPORT

Page 1 of 2

<b>Client:</b>	AECOM Consulting Services (NZ) Limited	<b>Lab No:</b>	1465459	SPV1
<b>Contact:</b>	Sean Hudgens	<b>Date Registered:</b>	21-Aug-2015	
	C/- AECOM Consulting Services (NZ) Limited	<b>Date Reported:</b>	26-Aug-2015	
	PO Box 3367	<b>Quote No:</b>		
	WELLINGTON 6140	<b>Order No:</b>	60435985 2.00300	
		<b>Client Reference:</b>	60435985 2.00300 Shell Todd Oil Services Ltd	
		<b>Submitted By:</b>	R Miller	

Sample Type: Aqueous						
Sample Name:	Site 1 20-Aug-2015	Site 2 20-Aug-2015	Site 3 20-Aug-2015	Site 4 20-Aug-2015	TB 20-Aug-2015	
Lab Number:	1465459.1	1465459.2	1465459.3	1465459.4	1465459.5	
Individual Tests						
pH	pH Units	6.8	8.4	8.9	8.1	-
Electrical Conductivity (EC)	mS/m	32.0	33.5	31.6	37.0	-
Chloride	g/m³	34	11.2	11.5	12.2	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m³	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36	g/m³	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

Sample Name:	Dup 20-Aug-2015	KA9 - EB 20-Aug-2015			
Lab Number:	1465459.6	1465459.7			
Individual Tests					
pH	pH Units	-	7.5	-	-
Electrical Conductivity (EC)	mS/m	-	54.8	-	-
Chloride	g/m <sup>3</sup>	-	23	-	-
BTEX in Water by Headspace GC-MS					
Benzene	g/m <sup>3</sup>	-	< 0.0010	-	-
Toluene	g/m <sup>3</sup>	-	0.0015	-	-
Ethylbenzene	g/m <sup>3</sup>	-	< 0.0010	-	-
m&p-Xylene	g/m <sup>3</sup>	-	< 0.002	-	-
o-Xylene	g/m <sup>3</sup>	-	< 0.0010	-	-
Total Petroleum Hydrocarbons in Water					
C7 - C9	g/m <sup>3</sup>	< 0.10	< 0.10	-	-
C10 - C14	g/m <sup>3</sup>	< 0.2	< 0.2	-	-
C15 - C36	g/m <sup>3</sup>	< 0.4	< 0.4	-	-
Total hydrocarbons (C7 - C36)	g/m <sup>3</sup>	< 0.7	< 0.7	-	-

### Analyst's Comments

Appendix No.1 - Chain of Custody

## SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
BTEX in Water by Headspace GC-MS	Headspace GC-MS analysis, US EPA 8260B [KBIs:26687,3629]	0.0010 - 0.002 g/m <sup>3</sup>	7



Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Total Petroleum Hydrocarbons in Water	Hexane extraction, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734]	0.10 - 0.7 g/m <sup>3</sup>	1-7
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-4, 7
pH	pH meter. APHA 4500-H <sup>+</sup> B 22 <sup>nd</sup> ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field.	0.1 pH Units	1-4, 7
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22 <sup>nd</sup> ed. 2012.	0.1 mS/m	1-4, 7
Chloride	Filtered sample. Ferric thiocyanate colorimetry. Discrete Analyser. APHA 4500 Cl <sup>-</sup> E (modified from continuous flow analysis) 22 <sup>nd</sup> ed. 2012.	0.5 g/m <sup>3</sup>	1-4, 7

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This report must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)  
Client Services Manager - Environmental Division



CHAIN OF CUSTODY AND  
SAMPLE RECEIPT DOCUMENTATION

FROM:		TO:		ANALYSES REQUIRED													
<b>AECOM</b> 3, 80 The Terrace Wellington PO Box 27277 Ph: (04) 896 6000 Fax: (04) 896 6001		<b>R J Hill Laboratories Limited</b> 1 Clyde Street Hamilton Ph: (07) 858 2000  URS Client: <b>Shell Todd Oil Services Ltd.</b>		<b>CONTAINERS</b>	TPH250	VOC40 x 2	UP1L										
RESULTS ATTENTION: <b>Sean Hudgens</b> PROJECT NO: <b>60435985 2.00300</b> PURCHASE ORDER NO: SAMPLER(S): <b>Richie Miller</b>		LAB QUOTE NO: <input checked="" type="checkbox"/> 30443 Normal Priority <input type="checkbox"/> 30833 High Priority <input type="checkbox"/> 30481 Urgent Priority <input type="checkbox"/> Special Quote						<b>ANALYTES</b>	TPH	BTEX	Chloride	Conductivity	pH				
		RESULTS REQUIRED BY:															
<b>SAMPLE ID</b>	<b>MATRIX</b>	<b>DATE/TIME</b>	<b>COMMENTS</b>														
Site 1	Aqueous	20-Aug-15			X		X	X	X								
Site 2	Aqueous	20-Aug-15			X		X	X	X								
Site 3	Aqueous	20-Aug-15			X		X	X	X								
Site 4	Aqueous	20-Aug-15			X		X	X	X								
TB	Aqueous	20-Aug-15			X												
Dup	Aqueous	20-Aug-15			X												
KA9 - EB	Aqueous	20-Aug-15			X	X	X	X	X								
Total No. of Sample Bottles:		14		Including:		2											
<b>CHAIN OF CUSTODY DATA</b>																	
RELINQUISHED BY				RECEIVED BY				METHOD OF S									
NAME: Richie Miller				DATE: 21/8/15				NAME: Sean Hudgens				DATE: 21/8/15					
COMPANY: AECOM				TIME:				COMPANY: URS				TIME:					
<b>SAMPLE RECEIPT DATA</b>																	
PLEASE COMPLETE THIS SECTION (CIRCLE AS APPROPRIATE) AND RETURN FAX A COPY IMMEDIATELY AFTER RECEIVING SAMPLES)																	
ALL SAMPLES AND ASSOCIATED DOCUMENTATION WERE RECEIVED IN GOOD ORDER				YES / NO		PLEASE CONTACT THE LABORATORY				CUSTODY SEAL INTACT:		YES / NO / NA					
										SAMPLES CHILLED:		YES / NO / NA		Temp:			
										LABORATORY BATCH NO:							
<b>SPECIAL HANDLING/STORAGE OR DISPOSAL INSTRUCTIONS:</b>				<b>REPORTING</b>													
<b>CAUTION - SAMPLES MAY CONTAIN HAZARDOUS SUBSTANCES</b>				REPORT FORMAT: FAX <input type="checkbox"/> LETTER <input type="checkbox"/> EMAIL <input checked="" type="checkbox"/> DISK <input type="checkbox"/>													
				EMAIL ADDRESS: sean.hudgens@aecom.com													
				<b>INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLE</b>													

Received by: Jennifer Singlewood

Job No: 146 5459  
Date Recv: 21-Aug-15 05:27



**QA/QC Table**

## QA/QC - Sample Details and Analytical Results

Sample Location	Units	QA/QC	
		Trip Blank	Duplicate of sample collected from Site 4
URS Sample Number		TB	Dup
Laboratory Sample Reference		1465459.5	1465459.6
Date Sampled		20/08/15	20/08/15
Total Petroleum Hydrocarbons (TPH)			
C <sub>7</sub> -C <sub>9</sub>	mg/L	< 0.10	< 0.10
C <sub>10</sub> -C <sub>14</sub>	mg/L	< 0.2	< 0.2
C <sub>15</sub> -C <sub>36</sub>	mg/L	< 0.4	< 0.4
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	mg/L	< 0.7	< 0.7

## Appendix A – M Barr - 873 Skeet Road (Site 1)

<b>Site Name</b>	M Barr – 873 Skeet Road (Site 1)
<b>Well Details</b>	The abstraction well at 873 Skeet Road is approximately 65 m deep and is screened from 30 to 60 m below ground level. The static groundwater level is recorded as 18 m below ground level. The well is finished with an 100 mm diameter steel well casing that sticks up above ground level by approximately 400 mm. The well is operational with a pump and outlet risers permanently mounted to the well head. The well appears to fill a storage tank which feeds a small secondary above ground tank in a pump house used for reticulation.
<b>Pump Details</b>	Submersible pump of unknown model.
<b>Sampling Date</b>	20 August 2015.
<b>Sampler</b>	AECOM.
<b>Well use prior to sampling</b>	Unknown.
<b>Sampling Methodology</b>	<p>A groundwater sample was unable to be collected directly from the well and therefore the groundwater sample was collected by connecting silicone tubing directly to a tap attached to the secondary tank in the pump house. Groundwater was purged for approximately 17 minutes with a flow rate of approximately 2.1 L/min. A multi parameter probe (YSI Professional Plus) was used to measure conductivity, pH, temperature, dissolved oxygen and redox in the purged groundwater. The well was sampled when parameters had stabilised.</p> <p>Water was observed to be light brown and cloudy throughout purging and sampling.</p> <p>The groundwater sample was collected directly into laboratory supplied sample bottles. The groundwater sample was kept under chilled conditions and transported to Hill Laboratories Limited (Hill Laboratories) under standard chain of custody procedures.</p>
<b>Laboratory Analysis</b>	<p>The groundwater sample was identified as “Site 1” and was analysed by Hill Laboratories for the following analytes:</p> <ul style="list-style-type: none"> <li>- pH</li> <li>- Conductivity</li> <li>- Chloride</li> <li>- Total petroleum hydrocarbons (TPH)</li> </ul>
<b>Results Discussion</b>	<p>Results for the August 2015, January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events are tabulated and attached.</p> <p>Results for the August 2015 monitoring event are similar to those recorded previously, including TPH which was not detected.</p>

The information included within this Appendix has been provided to Shell Todd Oil Services Limited for the purpose of and in accordance with the conditions of our engagement “STOS Kapuni Off-Site Monitoring – PO 4512463143”.

Site 1 - Sample Details and Analytical Results

Sample Location	Units	873 Skeet Road							
URS Sample Number		Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1	Site 1
Laboratory Sample Reference		1084034.1	1131198.1	1162256.1	1202867.1	1234484.1	1310590.1	1379473.1	1465459.1
Date Sampled		19/12/12	20/5/13	30/07/13	13/11/13	10/02/14	12/08/14	30/01/15	20/08/15
Total Petroleum Hydrocarbons (TPH)									
C <sub>7</sub> -C <sub>9</sub>	mg/L	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C <sub>10</sub> -C <sub>14</sub>	mg/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C <sub>15</sub> -C <sub>36</sub>	mg/L	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	mg/L	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
BTEX Compounds									
Benzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Toluene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Ethylbenzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Total Xylenes	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-
Dissolved Metals									
Dissolved Barium	mg/L	0.026	0.030	0.029	0.028	0.030	0.031	0.032	-
Dissolved Calcium	mg/L	14.4	15.0	14.7	14.4	14.3	14.5	14.1	-
Dissolved Copper	mg/L	0.0007	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0005	< 0.0005	-
Dissolved Iron	mg/L	1.43	1.89	2.3	1.58	2.5	4.4	4.6	-
Dissolved Magnesium	mg/L	4.8	5.6	5.6	5.7	5.6	5.7	5.6	-
Dissolved Manganese	mg/L	0.52	0.61	0.61	0.64	0.61	0.66	0.54	-
Dissolved Mercury	mg/L	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	-
Dissolved Nickel	mg/L	0.0086	0.0165	0.0015	0.0015	0.0008	0.0117	0.0073	-
Dissolved Potassium	mg/L	11.5	12.1	12.5	12.9	12.3	12.8	13.3	-
Dissolved Sodium	mg/L	31	31	33	34	32	36	34	-
Dissolved Zinc	mg/L	0.31	0.49	0.42	0.182	0.157	0.183	0.066	-
Alkyl Quaternary Ammonium Compounds in Water by LCMSMS									
Benzalkonium Chloride (C12 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Benzalkonium Chloride (C14 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Benzalkonium Chloride (C16 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Benzalkonium Chloride (total)	mg/L	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	-
DDAC (Didecyltrimethylammonium chloride)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Dodine	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Ethylene Glycol in Water									
Ethylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-
Propylene Glycol in Water									
Propylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-
Methanol in Water - Aqueous Solvents									
Methanol	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-
Formaldehyde in Water by DNPH & LCMSMS									
Formaldehyde	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-
Gases in groundwater									
Ethane	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-
Ethylene	mg/L	< 0.003	< 0.004	< 0.004	< 0.003	< 0.004	< 0.003	< 0.003	-
Methane	mg/L	0.64	4.4	4.2	8.6	7.5	7.9	9.4	-
Other Analyses									
Sum of Anions	meq/L	3.0	3.2	3.2	3.1	3.1	3.1	3.1	-
Sum of Cations	meq/L	2.8	3.0	3.1	3.1	3.0	3.3	3.2	-
pH	pH Units	7	6.8	6.8	7	7.1	6.9	7	6.8
Total Alkalinity	mg/L as CaCO <sub>3</sub>	105	113	111	107	108	104	107	-
Bicarbonate	mg/L at 25°C	127	137	135	130	131	127	130	-
Total Hardness	mg/L as CaCO <sub>3</sub>	55	61	60	59	59	60	58	-
Electrical Conductivity (EC)	mS/m	31.9	32.3	32.6	30.8	32.1	32.3	32.4	32.0
Total Dissolved Solids (TDS)	mg/L	210	220	220	260	220	220	230	-
Bromide	mg/L	0.15	0.14	0.06	0.12	0.06	0.14	0.12	-
Chloride	mg/L	34	35	33	34	34	35	34	34
Nitrite-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.02	0.002	-
Nitrate-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.02	< 0.002	-
Nitrate-N + Nitrite-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	0.002	< 0.02	0.004	-
Sulphate	mg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	-

## Appendix B – PKW Farms - 468 Hastings Road (Site 2)

<b>Site Name</b>	PKW Farms – 468 Hastings Road (Site 2)
<b>Well Details</b>	The abstraction well at 468 Hastings Road is 337 m deep and is cased to 92 m below ground level (bgl). The depth to groundwater is unknown. The well casing is steel with a diameter of approximately 90 mm and is finished above ground. The well is operational with pump and outlet tubes permanently mounted to the well head. The well is pumped every day to supply the farm and dairy shed. Approximately 130,000 litres of groundwater is pumped each day.
<b>Pump Details</b>	Submersible pump of unknown model.
<b>Sampling Date</b>	20 August 2015.
<b>Sampler</b>	AECOM.
<b>Well use prior to sampling</b>	Unknown.
<b>Sampling Methodology</b>	<p>A groundwater sample was collected by attaching silicone tubing directly to the outlet of the well and opening a valve on the outlet. Groundwater was purged for approximately 22 minutes with a flow rate of approximately 1.3 L/min. An inline flow cell was used in conjunction with a multi parameter probe (YSI Professional Plus) to measure conductivity, pH, temperature, dissolved oxygen and redox in the purged groundwater. The well was sampled when parameters had stabilised.</p> <p>Water was observed to be clear during purging and sampling.</p> <p>The groundwater sample was collected directly into laboratory supplied sample bottles. The groundwater sample was kept under chilled conditions and transported to Hill Laboratories Limited (Hill Laboratories) under standard chain of custody procedures.</p>
<b>Laboratory Analysis</b>	<p>The groundwater sample was identified as “Site 2” and was analysed by Hill Laboratories for the following analytes:</p> <ul style="list-style-type: none"> <li>- pH</li> <li>- Conductivity</li> <li>- Chloride</li> <li>- Total petroleum hydrocarbons (TPH)</li> </ul>
<b>Results Discussion</b>	<p>Results for the August 2015, January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events are tabulated and attached.</p> <p>Results for the August 2015 monitoring event are similar to those recorded previously, including TPH which was not detected.</p>

The information included within this Appendix has been provided to Shell Todd Oil Services Limited for the purpose of and in accordance with the conditions of our engagement “STOS Kapuni Off-Site Monitoring – PO 4512463143”.

Site 2 - Sample Details and Analytical Results

Sample Location	Units	468 Hastings Road							
URS Sample Number		Site 2	Site 2	Site 2	Site 2	Site 2	Site 2	Site 2	Site 2
Laboratory Sample Reference		1084034.2	1131198.2	1162256.2	1202867.2	1234484.2	1310590.2	1379473.2	1465459.2
Date Sampled		19/12/12	2/05/13	30/07/13	13/11/13	10/02/14	12/08/14	30/01/15	20/08/15
Total Petroleum Hydrocarbons (TPH)									
C <sub>7</sub> -C <sub>9</sub>	mg/L	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C <sub>10</sub> -C <sub>14</sub>	mg/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C <sub>15</sub> -C <sub>36</sub>	mg/L	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	mg/L	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
BTEX Compounds									
Benzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Toluene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Ethylbenzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Total Xylenes	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-
Dissolved Metals									
Dissolved Barium	mg/L	0.00199	0.0021	0.00195	0.0021	0.00199	0.00196	0.00197	-
Dissolved Calcium	mg/L	13.8	13.1	12.9	12.9	13.2	13.2	13.3	-
Dissolved Copper	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Dissolved Iron	mg/L	0.05	0.06	0.05	0.04	0.05	0.04	0.03	-
Dissolved Magnesium	mg/L	4.2	4.4	4.5	4.7	4.8	4.7	5	-
Dissolved Manganese	mg/L	0.015	0.0129	0.0133	0.013	0.0134	0.0134	0.0136	-
Dissolved Mercury	mg/L	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	-
Dissolved Nickel	mg/L	0.0024	0.0008	< 0.0005	0.0013	0.0006	0.0085	0.0077	-
Dissolved Potassium	mg/L	1.41	1.43	1.46	1.45	1.41	1.38	1.73	-
Dissolved Sodium	mg/L	58	56	60	65	57	64	68	-
Dissolved Zinc	mg/L	0.0053	0.0012	0.0018	0.0045	0.0017	0.0018	0.0041	-
Alkyl Quaternary Ammonium Compounds in Water by LCMSMS									
Benzalkonium Chloride (C12 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Benzalkonium Chloride (C14 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Benzalkonium Chloride (C16 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Benzalkonium Chloride (total)	mg/L	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	-
DDAC (Didecyltrimethylammonium chloride)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Dodine	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Ethylene Glycol in Water									
Ethylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-
Propylene Glycol in Water									
Propylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-
Methanol in Water - Aqueous Solvents									
Methanol	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-
Formaldehyde in Water by DNPH & LCMSMS									
Formaldehyde	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-
Gases in groundwater									
Ethane	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-
Ethylene	mg/L	< 0.004	< 0.004	< 0.004	< 0.003	< 0.004	< 0.003	< 0.003	-
Methane	mg/L	2.3	5.4	3.9	5.8	6.8	7.0	9.4	-
Other Analyses									
Sum of Anions	meq/L	3.7	3.7	3.6	3.6	3.6	3.6	3.6	-
Sum of Cations	meq/L	3.6	3.5	3.7	3.9	3.6	3.9	4.1	-
pH	pH Units	8.4	8.4	8.4	8.3	8.3	8.4	8.3	8.4
Total Alkalinity	mg/L as CaCO <sub>3</sub>	169	166	166	166	166	164	165	-
Bicarbonate	mg/L at 25°C	200	198	198	199	198	196	197	-
Total Hardness	mg/L as CaCO <sub>3</sub>	52	51	51	51	53	52	54	-
Electrical Conductivity (EC)	mS/m	33.8	33.3	33.5	33.4	33.3	33.6	34.1	33.5
Total Dissolved Solids (TDS)	mg/L	200	210	200	220	200	200	196	-
Bromide	mg/L	0.06	0.07	< 0.05	0.05	< 0.05	0.07	0.08	-
Chloride	mg/L	11.4	12.0	10.9	10.7	10.4	11.1	11.2	11.2
Nitrite-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-
Nitrate-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-
Nitrate-N + Nitrite-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-
Sulphate	mg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	-

### Appendix C – Kiley Estate - Inuawai Road (Site 3)

<b>Site Name</b>	Kiley Estate - Inuawai Road (Site 3)
<b>Well Details</b>	The abstraction well at Kiley Estate is 448 m deep and is cased to 280 m below ground level. The depth to groundwater is unknown. The well casing is steel with a diameter of approximately 90 mm and is finished above ground. The well is operational with pump and outlet tubes permanently mounted to the well head. The well is pumped to supply water to the dairy shed.
<b>Pump Details</b>	Submersible pump of unknown model. Potential also for artesian supply.
<b>Sampling Date</b>	20 August 2015.
<b>Sampler</b>	AECOM.
<b>Well use prior to sampling</b>	Unknown.
<b>Sampling Methodology</b>	<p>A groundwater sample was collected by attaching silicone tubing directly to the outlet of the well and opening a valve on the outlet. Groundwater was purged for approximately 18 minutes with a flow rate of approximately 2.3 L/min. An inline flow cell was used in conjunction with a multi parameter probe (YSI Professional Plus) to measure conductivity, pH, temperature, dissolved oxygen and redox in the purged groundwater. The well was sampled when parameters had stabilised.</p> <p>Water was observed to be clear during purging and sampling.</p> <p>The groundwater sample was collected directly into laboratory supplied sample bottles. The groundwater sample was kept under chilled conditions and transported to Hill Laboratories Limited (Hill Laboratories) under standard chain of custody procedures.</p>
<b>Laboratory Analysis</b>	<p>The groundwater sample was identified as “Site 3” and was analysed by Hill Laboratories for the following analytes:</p> <ul style="list-style-type: none"> <li>- pH</li> <li>- Conductivity</li> <li>- Chloride</li> <li>- Total petroleum hydrocarbons (TPH)</li> </ul>
<b>Results Discussion</b>	<p>Results for the August 2015, January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events are tabulated and attached.</p> <p>Results for the August 2015 monitoring event are similar to those recorded previously, including TPH which was not detected.</p>

The information included within this Appendix has been provided to Shell Todd Oil Services Limited for the purpose of and in accordance with the conditions of our engagement “STOS Kapuni Off-Site Monitoring – PO 4512463143”.

Site 3 - Sample Details and Analytical Results

Sample Location	Units	Inuawai Road							
URS Sample Number		Site 3	Site 3	Site 3	Site 3	Site 3	Site 3	Site 3	Site 3
Laboratory Sample Reference		1084034.3	1131198.3	1162256.3	1202867.3	1234484.3	1310590.3	1379473.3	1465459.3
Date Sampled		19/12/12	2/05/13	30/07/13	13/11/13	10/02/14	12/08/14	30/01/15	20/08/15
Total Petroleum Hydrocarbons (TPH)									
C <sub>7</sub> -C <sub>9</sub>	mg/L	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C <sub>10</sub> -C <sub>14</sub>	mg/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C <sub>15</sub> -C <sub>36</sub>	mg/L	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	mg/L	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
BTEX Compounds									
Benzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Toluene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Ethylbenzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Total Xylenes	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-
Dissolved Metals									
Dissolved Barium	mg/L	0.00108	0.00110	0.00138	0.00129	0.00107	0.00116	0.00107	-
Dissolved Calcium	mg/L	3.8	4.0	3.6	3.8	3.8	3.7	3.8	-
Dissolved Copper	mg/L	< 0.0005	< 0.0005	0.0006	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Dissolved Iron	mg/L	< 0.02	0.07	0.02	< 0.02	0.02	< 0.02	< 0.02	-
Dissolved Magnesium	mg/L	0.9	0.87	0.84	0.9	0.89	0.88	0.93	-
Dissolved Manganese	mg/L	0.0066	0.0073	0.0069	0.0064	0.0063	0.0065	0.0067	-
Dissolved Mercury	mg/L	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	-
Dissolved Nickel	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Dissolved Potassium	mg/L	0.78	0.85	0.84	0.82	0.84	0.78	0.77	-
Dissolved Sodium	mg/L	67	70	74	78	71	80	66	-
Dissolved Zinc	mg/L	< 0.0010	0.0029	< 0.0010	0.0014	< 0.0010	< 0.0010	< 0.0010	-
Alkyl Quaternary Ammonium Compounds in Water by LCMSMS									
Benzalkonium Chloride (C12 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Benzalkonium Chloride (C14 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Benzalkonium Chloride (C16 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Benzalkonium Chloride (total)	mg/L	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	-
DDAC (Didecyltrimethylammonium chloride)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Dodine	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Ethylene Glycol in Water									
Ethylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-
Propylene Glycol in Water									
Propylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-
Methanol in Water - Aqueous Solvents									
Methanol	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-
Formaldehyde in Water by DNPH & LCMSMS									
Formaldehyde	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-
Gases in groundwater									
Ethane	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-
Ethylene	mg/L	< 0.004	< 0.004	< 0.004	< 0.003	< 0.004	< 0.003	< 0.003	-
Methane	mg/L	1.94	4.9	4.1	6.7	7.8	8.5	6.4	-
Other Analyses									
Sum of Anions	meq/L	3.5	3.4	3.4	3.4	3.4	3.4	3.4	-
Sum of Cations	meq/L	3.2	3.3	3.5	3.7	3.4	3.7	3.2	-
pH	pH Units	8.8	8.9	8.9	8.7	8.8	8.9	8.8	8.9
Total Alkalinity	mg/L as CaCO <sub>3</sub>	158	154	153	155	156	153	154	-
Bicarbonate	mg/L at 25°C	181	175	172	179	179	174	178	-
Total Hardness	mg/L as CaCO <sub>3</sub>	13.3	13.4	12.5	13.3	13.1	12.7	13.4	-
Electrical Conductivity (EC)	mS/m	31.8	31.4	31.6	31.4	31.7	31.7	32.3	31.6
Total Dissolved Solids (TDS)	mg/L	199	198	197	210	200	193	200	-
Bromide	mg/L	0.07	0.07	< 0.05	0.05	< 0.05	0.07	0.06	-
Chloride	mg/L	11.6	12.3	11.4	11.1	10.7	11.6	11.6	11.5
Nitrite-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-
Nitrate-N	mg/L	0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-
Nitrate-N + Nitrite-N	mg/L	0.003	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-
Sulphate	mg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	-



#### Appendix D – Naplin Trust - Ahipaipa Road (Site 4)

<b>Site Name</b>	Naplin Trust - Ahipaipa Road (Site 4)
<b>Well Details</b>	The abstraction well at Naplin Trust is 432 m deep and is cased to 123 m below ground level. The depth to groundwater is unknown. The well casing is steel with a diameter of approximately 125 mm and is finished above ground. The well is operational with pump and outlet tubes permanently mounted to the well head. The well is artesian and fills a storage tank adjacent to the dairy shed.
<b>Pump Details</b>	Artesian.
<b>Sampling Date</b>	20 August 2015.
<b>Sampler</b>	AECOM.
<b>Well use prior to sampling</b>	Unknown.
<b>Sampling Methodology</b>	<p>A groundwater sample was collected by attaching silicone tubing directly to the outlet of the well and opening a valve on the outlet. Groundwater was purged for approximately 13 minutes with a flow rate of approximately 1.5 L/min. An inline flow cell was used in conjunction with a multi parameter probe (YSI Professional Plus) to measure conductivity, pH, temperature, dissolved oxygen and redox in the purged groundwater. The well was sampled when parameters had stabilised.</p> <p>Water was observed to be clear during purging and sampling.</p> <p>The groundwater sample was collected directly into laboratory supplied sample bottles. The groundwater sample was kept under chilled conditions and transported to Hill Laboratories Limited (Hill Laboratories) under standard chain of custody procedures.</p>
<b>Laboratory Analysis</b>	<p>The groundwater sample was identified as “Site 4” and was analysed by Hill Laboratories for the following analytes:</p> <ul style="list-style-type: none"> <li>- pH</li> <li>- Conductivity</li> <li>- Chloride</li> <li>- Total petroleum hydrocarbons (TPH)</li> </ul>
<b>Results Discussion</b>	<p>Results for the August 2015, January 2015, August 2014, February 2014, November 2013, July 2013, May 2013 and December 2012 monitoring events are tabulated and attached.</p> <p>Results for the August 2015 monitoring event are similar to those recorded previously, including TPH which was not detected.</p>

The information included within this Appendix has been provided to Shell Todd Oil Services Limited for the purpose of and in accordance with the conditions of our engagement “STOS Kapuni Off-Site Monitoring – PO 4512463143”.

Site 4 - Sample Details and Analytical Results

Sample Location	Units	Ahipaipa Road							
URS Sample Number		Site 4	Site 4	Site 4	Site 4	Site 4	Site 4	Site 4	Site 4
Laboratory Sample Reference		1084034.4	1131198.4	1162256.4	1202867.4	1234484.4	1310590.4	1379473.4	1465459.4
Date Sampled		19/12/12	2/05/13	30/07/13	13/11/13	10/02/14	12/08/14	30/01/15	20/08/15
Total Petroleum Hydrocarbons (TPH)									
C <sub>7</sub> -C <sub>9</sub>	mg/L	< 0.10	< 0.10	< 0.10	< 0.10	< 0.15	< 0.10	< 0.10	< 0.10
C <sub>10</sub> -C <sub>14</sub>	mg/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.4	< 0.2	< 0.2	< 0.2
C <sub>15</sub> -C <sub>36</sub>	mg/L	< 0.4	< 0.4	< 0.4	< 0.4	< 0.8	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	mg/L	< 0.7	< 0.7	< 0.7	< 0.7	< 1.4	< 0.7	< 0.7	< 0.7
BTEX Compounds									
Benzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Toluene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Ethylbenzene	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-
Total Xylenes	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-
Dissolved Metals									
Dissolved Barium	mg/L	0.006	0.0070	0.0064	0.0065	0.0064	0.0066	0.0064	-
Dissolved Calcium	mg/L	24	27	24	24	24	24	24	-
Dissolved Copper	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Dissolved Iron	mg/L	0.17	0.20	0.12	0.13	0.12	0.12	0.13	-
Dissolved Magnesium	mg/L	9.6	11.3	11.2	12.3	11.2	12.0	11.6	-
Dissolved Manganese	mg/L	0.03	0.030	0.028	0.029	0.028	0.027	0.027	-
Dissolved Mercury	mg/L	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	< 0.00008	-
Dissolved Nickel	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-
Dissolved Potassium	mg/L	2.8	3.3	3.1	3	3	2.8	3.4	-
Dissolved Sodium	mg/L	39	42	42	45	41	45	46	-
Dissolved Zinc	mg/L	0.0068	0.0022	0.0029	0.0045	0.0027	0.0018	0.0034	-
Alkyl Quaternary Ammonium Compounds in Water by LCMSMS									
Benzalkonium Chloride (C12 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Benzalkonium Chloride (C14 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Benzalkonium Chloride (C16 homologue)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Benzalkonium Chloride (total)	mg/L	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	-
DDAC (Didecyltrimethylammonium chloride)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Dodine	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/L	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
Ethylene Glycol in Water									
Ethylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-
Propylene Glycol in Water									
Propylene glycol	mg/L	< 4	< 4	< 4	< 4	< 4	< 4	< 4	-
Methanol in Water - Aqueous Solvents									
Methanol	mg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-
Formaldehyde in Water by DNPH & LCMSMS									
Formaldehyde	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-
Gases in groundwater									
Ethane	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-
Ethylene	mg/L	< 0.004	< 0.004	< 0.004	< 0.003	< 0.004	< 0.003	< 0.003	-
Methane	mg/L	2.8	6.4	5.7	9.3	7.9	10.8	11.6	-
Other Analyses									
Sum of Anions	meq/L	4.1	4.1	4.1	4.1	4.0	4.0	4.0	-
Sum of Cations	meq/L	3.8	4.2	4.0	4.2	4.0	4.2	4.3	-
pH	pH Units	8.1	8.1	8.1	8.1	8.2	8.1	8	8.1
Total Alkalinity	mg/L as CaCO <sub>3</sub>	188	185	186	186	186	185	186	-
Bicarbonate	mg/L at 25°C	230	220	220	220	220	220	220	-
Total Hardness	mg/L as CaCO <sub>3</sub>	101	113	106	111	106	109	108	-
Electrical Conductivity (EC)	mS/m	37.3	36.6	37.2	37	36.9	37.8	37.9	37.0
Total Dissolved Solids (TDS)	mg/L	220	230	220	250	230	230	230	-
Bromide	mg/L	0.07	0.07	< 0.05	0.05	< 0.05	0.07	0.06	-
Chloride	mg/L	12	12.9	12.0	11.6	11.2	12.2	12	12.2
Nitrite-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-
Nitrate-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-
Nitrate-N + Nitrite-N	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	-
Sulphate	mg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	-

**Appendix E –Site KA9-EB (Former Emergency Bore). STOS KA9 Well Site (Lower Duthie Road)**

<b>Site Name</b>	STOS KA9 Well Site, Lower Duthie Road (Site KA9-EB)
<b>Well Details</b>	The well at Site KA9-EB is between 35 m and 55 m deep and is cased through the water table to approximately 35 m below ground level. The depth to groundwater is approximately 13 m. The well casing is steel with a diameter of approximately 100 mm and is finished above ground. The well was formerly used as a firewater abstraction bore but is not currently used and no pump is installed in the well.
<b>Pump Details</b>	No pump installed.
<b>Sampling Date</b>	20 August 2015.
<b>Sampler</b>	AECOM.
<b>Well use prior to sampling</b>	None.
<b>Sampling Methodology</b>	<p>A groundwater sample was collected by inserting a downhole bladder pump into the well, connected via dedicated low density polyethylene (LDPE) tubing to the surface. Groundwater was purged for approximately 32 minutes with a flow rate of approximately 0.03 L/min. An inline flow cell was used in conjunction with a multi parameter probe (YSI Professional Plus) to measure conductivity, pH, temperature, dissolved oxygen and redox in the purged groundwater. The well was sampled when parameters had stabilised.</p> <p>Water was observed to be clear during purging and sampling.</p> <p>The groundwater sample was collected directly into laboratory supplied sample bottles. The groundwater sample was kept under chilled conditions and transported to Hill Laboratories Limited (Hill Laboratories) under standard chain of custody procedures.</p>
<b>Laboratory Analysis</b>	<p>The groundwater sample was identified as “KA9 – EB” and was analysed by Hill Laboratories for the following analytes:</p> <ul style="list-style-type: none"> <li>- pH</li> <li>- Conductivity</li> <li>- Chloride</li> <li>- Total petroleum hydrocarbons (TPH)</li> <li>- Benzene, toluene, ethylbenzene, and xylenes (BTEX)</li> </ul>
<b>Results Discussion</b>	<p>Results for the August 2015 and March 2015 monitoring events are tabulated and attached.</p> <p>General baseline groundwater parameters for the groundwater sample collected from Site KA9-EB are consistent with the March 2015 sampling event.</p> <p>Concentrations of TPH, benzene, ethylbenzene and xylenes were not detected above MDLs in the groundwater sample collected from Site KA9-EB. Toluene was detected in the groundwater sample at 0.0015 mg/L, compared with the MDL of 0.0010 mg/L. These results are consistent with the March 2015 sampling event.</p>

The information included within this Appendix has been provided to Shell Todd Oil Services Limited for the purpose of and in accordance with the conditions of our engagement “STOS Kapuni Off-Site Monitoring – PO 4512463143”.

Site KA9-EB (Former Emergency Bore)

Sample Location	Units	Lower Duthie Road		
URS Sample Number		KA9 - Emergency Bore	KA9 - Emergency Bore	KA9 - Emergency Bore
Laboratory Sample Reference		1402708.1	1403749.1	1465459.7
Date Sampled		23/03/15	23/03/15	20/08/15
Total Petroleum Hydrocarbons (TPH)				
C <sub>7</sub> -C <sub>9</sub>	mg/L	-	< 0.10	< 0.10
C <sub>10</sub> -C <sub>14</sub>	mg/L	-	< 0.2	< 0.2
C <sub>15</sub> -C <sub>36</sub>	mg/L	-	< 0.4	< 0.4
Total hydrocarbons (C <sub>7</sub> - C <sub>36</sub> )	mg/L	-	< 0.7	< 0.7
BTEX Compounds				
Benzene	mg/L	-	< 0.0010	< 0.0010
Toluene	mg/L	-	0.002	0.0015
Ethylbenzene	mg/L	-	< 0.0010	< 0.0010
Total Xylenes	mg/L	-	< 0.003	< 0.003
Dissolved Metals				
Dissolved Barium	mg/L	0.082	-	-
Dissolved Calcium	mg/L	28	-	-
Dissolved Copper	mg/L	< 0.0005	-	-
Dissolved Iron	mg/L	3.6	-	-
Dissolved Magnesium	mg/L	20	-	-
Dissolved Manganese	mg/L	0.24	-	-
Dissolved Mercury	mg/L	< 0.00008	-	-
Dissolved Nickel	mg/L	0.0008	-	-
Dissolved Potassium	mg/L	17.1	-	-
Dissolved Sodium	mg/L	51	-	-
Dissolved Zinc	mg/L	23	-	-
Alkyl Quaternary Ammonium Compounds in Water by LCMSMS				
Benzalkonium Chloride (C12 homologue)	mg/L	< 0.010	-	-
Benzalkonium Chloride (C14 homologue)	mg/L	< 0.010	-	-
Benzalkonium Chloride (C16 homologue)	mg/L	< 0.010	-	-
Benzalkonium Chloride (total)	mg/L	< 0.018	-	-
DDAC (Didecylmethylammonium chloride)	mg/L	< 0.010	-	-
Dodine	mg/L	< 0.010	-	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/L	< 0.010	-	-
Ethylene Glycol in Water				
Ethylene glycol	mg/L	< 4	-	-
Propylene Glycol in Water				
Propylene glycol	mg/L	< 4	-	-
Methanol in Water - Aqueous Solvents				
Methanol	mg/L	< 2	-	-
Formaldehyde in Water by DNPH & LCMSMS				
Formaldehyde	mg/L	< 0.02	-	-
Gases in groundwater				
Ethane	mg/L	< 0.003	-	-
Ethylene	mg/L	< 0.003	-	-
Methane	mg/L	13.8	-	-
Other Analyses				
Sum of Anions	meq/L	6.8	-	-
Sum of Cations	meq/L	6.6	-	-
pH	pH Units	7.5	-	7.5
Total Alkalinity	mg/L as CaCO <sub>3</sub>	300	-	-
Bicarbonate	mg/L at 25°C	370	-	-
Total Hardness	mg/L as CaCO <sub>3</sub>	155	-	-
Electrical Conductivity (EC)	mS/m	62.7	-	54.8
Total Dissolved Solids (TDS)	mg/L	310	-	-
Bromide	mg/L	-	-	-
Chloride	mg/L	25	-	23
Nitrite-N	mg/L	< 0.002	-	-
Nitrate-N	mg/L	< 0.002	-	-
Nitrate-N + Nitrite-N	mg/L	< 0.002	-	-
Sulphate	mg/L	< 0.5	-	-