



IMP4-3 2023
Flowback Reg 37A and 37B Report
Carpentaria-3H

EP187
Beetaloo Sub-basin
Northern Territory, Australia

Document Control

Revision	Date	Author(s)	Reviewer
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List of Abbreviations

Acronym/Abbreviation	Description
bbbl	Billion barrels
EMP	Environmental Management Plan
EP	Exploration Permit
LEL	Lower Explosive Limit
NORM	Naturally Occurring Radioactive Material
NT	Northern Territory
PER	Petroleum (Environment) Regulations
SCF	Standard Cubic Feet
SCUF	Safe Control Unload and Flowback

1. Background

This report has been written to meet the requirements set out in the Northern Territory Petroleum (Environment) Regulations, section 37A and 37B Report about produced water. For the purposes of this report Imperial Oil and Gas Pty Ltd is “Imperial”

2. 37A Report about flowback fluid

An interest holder in relation to an activity that includes hydraulic fracturing must give the Minister a report about flowback fluid within 6 months of the flowback occurring. Flowback fluid means fluid that is a mixture of hydraulic fracturing fluid and formation fluid that is allowed to flow from the well following hydraulic fracturing. This report has been written to satisfy the requirement.

2.1. The report must contain the following information:

(a) the identity of any chemical or NORM found in the flowback fluid;

Identity of any chemical or Norm in the flowback water is listed in attachment 1 of this report.

(b) the concentration of any chemical or NORM found in the flowback fluid;

Concentration of chemicals in the flowback water is listed in attachment 1 of this report.

(c) details regarding how any chemical or NORM has been or will be managed;

Flowback water was directed to the storage tank in compliance with the Wastewater Management Plan in Appendix 06 of the approved EMP.

(d) details regarding how any chemical or NORM has been or will be transported;

All flowback fluid is stored at the wellsite and has not been transported, except for small volume samples sent for analysis. If fluid transport is required, fluid will be transported by a licensed waste transporter as per the Wastewater Management Plan in Appendix 06 of the approved EMP and “Code of Practice: Onshore Petroleum Activities in the Northern Territory.”

(e) details regarding how any chemical or NORM has been or will be treated;

Flowback fluid is being treated using evaporation at the wellsite in an above ground double-lined tank with leak detection system and monitoring of the fluid level.

(f) details regarding any action proposed to be taken to prevent any chemical or NORM spill;

The approved Environmental Management Plan, IMP4-3 requires activities that involve wastewater or chemical storage will be carried out according to:

- The Wastewater Management Plan, Appendix 06.
- The Spill Management Plan, Appendix 07.

(g) details of the emergency contingency plan included in the environment management plan to which the activity relates;

The approved Environmental Management Plan, IMP4-3 requires that in the event of any spill the spill management plan was to be used. The Spill Management Plan is provided in Appendix 07 of the approved EMP.

(h) The requirements in relation to the management of any chemical or NORM of the prescribed chemical legislation.

The approved Environmental Management Plan, IMP3-4 requires activities that involve wastewater or chemical storage will be carried out according to:

- The Wastewater Management Plan, Appendix 06.
- The Spill Management Plan, Appendix 07.

3. 37B Report about Produced fluid

An interest holder in relation to an activity that includes hydraulic fracturing must give the Minister a report about produced water within 6 months of the produced water occurring.

The Petroleum (Environment) Regulations define produced water as “*produced water means naturally occurring water that is extracted from the geological formation following hydraulic fracturing¹*” whereas flowback fluid is defined as “*fluid that is a mixture of hydraulic fracturing fluid and formation fluid that is allowed to flow from the well following hydraulic fracturing²*”.

The current volume of water received back from the well is approximately 28.8% of the total injected volume, see Figure 2. Shale formations such as the Beetaloo Velkerri Shale B do not have enough formation permeability to produce free water (permeability of organic shale formations is in tens to hundreds of a nano-Darcy range, i.e. lower than that of construction concrete). Moreover, gas shales are characterised by a low water saturation and injected fluid is often lost when it imbibes the pore space in shale: “The fracturing fluid imbibition into matrix pores has been regarded as the primary mechanism for inefficient water recovery in shale gas³” (i.e., water is more likely to be lost to formation than come out of it). One possible exception is production of water stored in natural fractures. At this stage of exploration activity, we do not have an indication that water-filled fractures exist. Figure 1 below shows a schematic representation of a shale rock matrix and pore system.

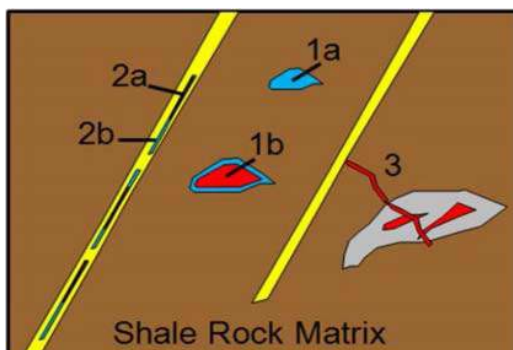


Figure 1 - shale rock matrix and pore systems diagram⁴

Shales have a Variety of Pore Systems: Mixed Wettability⁴

- 1a – Water saturated inorganic pore
- 1b – Water wet, gas saturated inorganic pore
- 2a – Gas in fractures
- 2b – Water in fractures
- 3 – Gas in organic pores

Knowing that the volume flowed back out of the well is less than the volume injected and there is no availability for water to move within the pore space of this shale, using the definition of flowback vs produced water, the water received to date should be classified as flowback water and not as the produced water.

At the Carpentaria-3H well the volume of water returned to the surface is less than what was used during hydraulic fracturing, so it is quite possible that formation did not contribute any appreciable amount of water. A high percentage of fluid recovery is not unheard of in unconventional formations where induced fractures remain open for an extended period of time. Once flowback water reaches greater than 100% of injected water, Imperial can say with full confidence that the well is flowing formation water.

¹ Petroleum (Environment) Regulations 2016, produced water definition on page 29

² Petroleum (Environment) Regulations 2016, flowback water definition on page 28

³ Yang, L.; Zhang, C.; Cai, J.; Lu, H. Experimental Investigation of Spontaneous Imbibition of Water into Hydrate Sediments Using Nuclear Magnetic Resonance Method. *Energies* 2020, *13*, 445. <https://doi.org/10.3390/en13020445>

⁴ After Williams, 2012

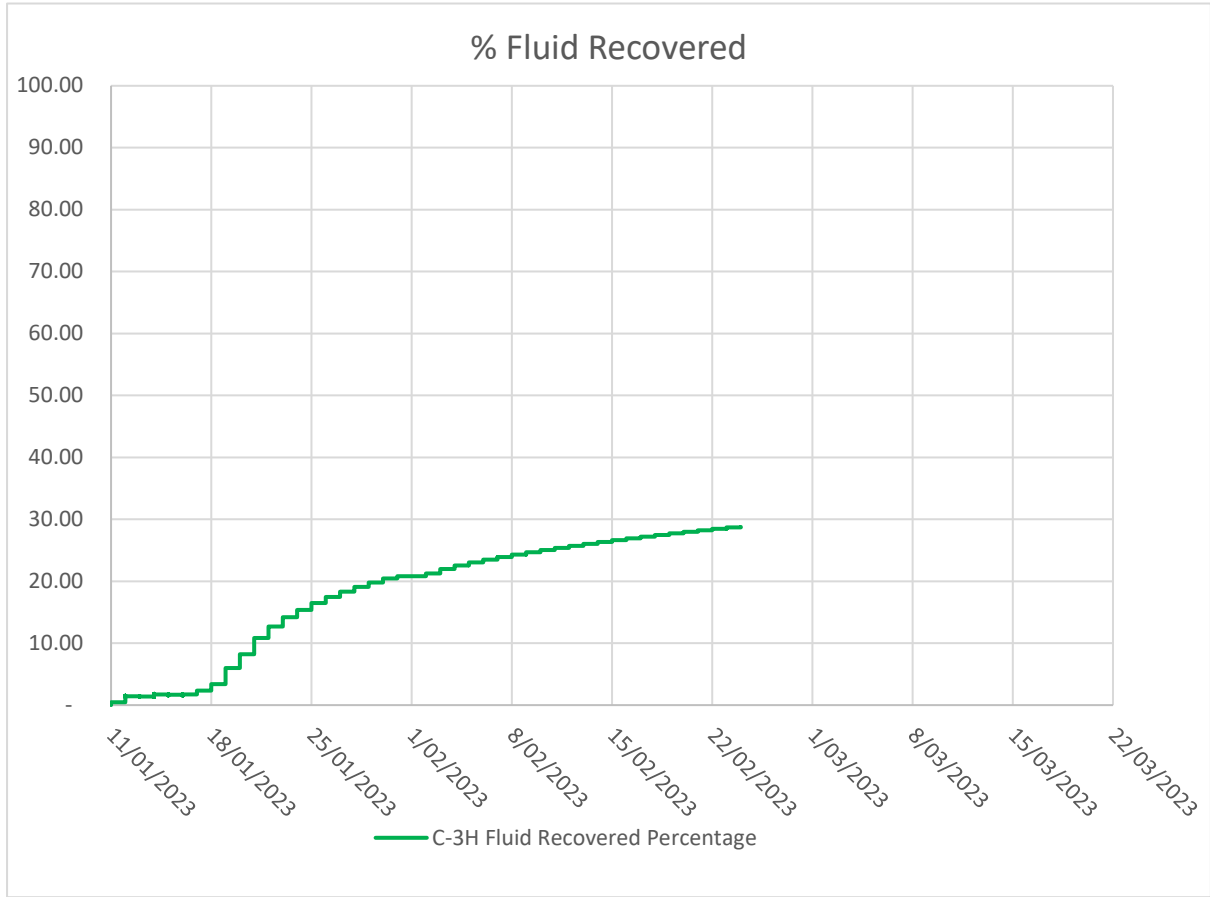


Figure 2 - water received back from the well

3.1. The report must contain the following information:

(a) the identity of any chemical or NORM found in the produced water;

No produced water occurred.

(b) the concentration of any chemical or NORM found in the produced water;

No produced water occurred.

(c) details regarding how any chemical or NORM has been or will be managed;

Produced water when it occurs will be managed in compliance with the Wastewater Management Plan in Appendix 06 of the approved EMP.

(d) details regarding how any chemical or NORM has been or will be transported;

Produced water when it occurs will be transported by a licensed waste transporter in compliance with the Wastewater Management Plan in Appendix 06 of the approved EMP and “Code of Practice: Onshore Petroleum Activities in the Northern Territory.”

(e) details regarding how any chemical or NORM has been or will be treated;

No produced water occurred, should it occur, it will be temporarily stored at the wellsite in a above ground double-lined tank with leak detection system and monitoring of the fluid level or treated using evaporation in an above ground double-lined tank with leak detection and fluid level monitoring.

(f) details regarding any action proposed to be taken to prevent any chemical or NORM spill;

The approved Environmental Management Plan, IMP4-3 requires activities that involve wastewater or chemical storage will be carried out according to:

- The Wastewater Management Plan, Appendix 06.
- The Spill Management Plan, Appendix 07.

(g) details of the emergency contingency plan included in the environment management plan to which the activity relates;

The approved Environmental Management Plan, IMP4-3 requires that in the event of any spill the spill management plan was to be used. The Spill Management Plan is provided in Appendix 07 of the approved EMP.

(h) the requirements in relation to the management of any

The approved Environmental Management Plan, IMP4-3 requires activities that involve wastewater or chemical storage will be carried out according to:

- The Wastewater Management Plan, Appendix 06.
- The Spill Management Plan, Appendix 07.

Appendix 1-

CERTIFICATE OF ANALYSIS

Work Order : **ES2306795**
Client : **IMPERIAL OIL AND GAS**
Contact : Nick Fraser
Address : LEVEL 7, 151 MACQUARIE STREET
 SYDNEY NSW, AUSTRALIA 2000

Telephone : ----
Project : EP187
Order number : ----
C-O-C number : ----
Sampler : SGS Crew - Carp 3
Site : ----
Quote number : SY/197/22
No. of samples received : 1
No. of samples analysed : 1

Page : 1 of 10
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone : +61-2-8784 8555
Date Samples Received : 03-Mar-2023 08:30
Date Analysis Commenced : 03-Mar-2023
Issue Date : 10-Mar-2023 15:17



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED041G: LOR raised for Sulfate on sample no:1 due to sample matrix.
- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1,2,3-cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO₂ and Fluoride to the Anions.
- EK010: LOR raised due to sample matrix.
- EK010, LOR raised due to sample matrix.
- EG035: Poor matrix spike recovery was obtained for Mercury on sample ES2306795 # 1. Confirmed by re-analysis.
- EK040: Poor spike recovery for Fluoride due to matrix interferences(confirmed by re-analysis).
- EG020: LOR's have been raised due to matrix interference. (High Total Dissolved Solids)
- Results for Carp_3H(ES 6795-1) is confirmed by re-analysis and re-run.
- EG020: It is recognised that total concentration is less than dissolved for some metal analytes. However, the difference is within experimental variation of the methods.
- EK067G: LOR raised for TP on sample no: 1 due to sample matrix.
- EP132: Where reported, Total PAH reported as the sum of Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene and Benzo(g,h,i)perylene.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Sample ID			Carp_3H_Hydrera Tank	----	----	----	----
		Sampling date / time			23-Feb-2023 06:15	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2306795-001	-----	-----	-----	-----	-----
				Result	----	----	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	5.11	----	----	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	106000	----	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L	85200	----	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L	46	----	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	116	----	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	116	----	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<10	----	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	47600	----	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	8110	----	----	----	----	----
Magnesium	7439-95-4	1	mg/L	1500	----	----	----	----	----
Sodium	7440-23-5	1	mg/L	21200	----	----	----	----	----
Potassium	7440-09-7	1	mg/L	161	----	----	----	----	----
ED093F: SAR and Hardness Calculations									
^ Sodium Adsorption Ratio	----	0.01	-	56.7	----	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	<0.10	----	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.010	----	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	0.010	----	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.010	----	----	----	----	----
Barium	7440-39-3	0.001	mg/L	660	----	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0010	----	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	0.013	----	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.010	----	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.010	----	----	----	----	----



Analytical Results

Sub-Matrix: WATER
 (Matrix: WATER)

Sample ID

				Carp_3H_Hydrera Tank	----	----	----	----
				23-Feb-2023 06:15	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2306795-001	-----	-----	-----	-----
				Result	----	----	----	----

EG020F: Dissolved Metals by ICP-MS - Continued

Lead	7439-92-1	0.001	mg/L	<0.010	----	----	----	----
Lithium	7439-93-2	0.001	mg/L	18.0	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	14.2	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	0.016	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.045	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.10	----	----	----	----
Silver	7440-22-4	0.001	mg/L	<0.010	----	----	----	----
Strontium	7440-24-6	0.001	mg/L	539	----	----	----	----
Thorium	7440-29-1	0.001	mg/L	<0.010	----	----	----	----
Tin	7440-31-5	0.001	mg/L	<0.010	----	----	----	----
Uranium	7440-61-1	0.001	mg/L	<0.010	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.10	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.679	----	----	----	----
Boron	7440-42-8	0.05	mg/L	26.3	----	----	----	----
Iron	7439-89-6	0.05	mg/L	67.9	----	----	----	----

EG020T: Total Metals by ICP-MS

Aluminium	7429-90-5	0.01	mg/L	<0.10	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.010	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	0.019	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.010	----	----	----	----
Barium	7440-39-3	0.001	mg/L	757	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0010	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	0.029	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.010	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.010	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.010	----	----	----	----
Lithium	7439-93-2	0.001	mg/L	23.2	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	15.4	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	0.021	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.036	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.10	----	----	----	----
Silver	7440-22-4	0.001	mg/L	<0.010	----	----	----	----
Strontium	7440-24-6	0.001	mg/L	576	----	----	----	----
Thorium	7440-29-1	0.001	mg/L	<0.010	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Carp_3H_Hydrera Tank	----	----	----	----
Sampling date / time				23-Feb-2023 06:15	----	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2306795-001	-----	-----	-----	-----	-----
				Result	----	----	----	----	----
EG020T: Total Metals by ICP-MS - Continued									
Tin	7440-31-5	0.001	mg/L	<0.010	----	----	----	----	----
Uranium	7440-61-1	0.001	mg/L	<0.010	----	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.10	----	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.670	----	----	----	----	----
Boron	7440-42-8	0.05	mg/L	34.5	----	----	----	----	----
Iron	7439-89-6	0.05	mg/L	68.7	----	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----	----
EK010-1: Chlorine									
Total Residual Chlorine	----	0.02	mg/L	<0.10	----	----	----	----	----
Free Chlorine	----	0.02	mg/L	<0.10	----	----	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L	<0.004	----	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.7	----	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	1.38	----	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	----	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	----	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	----	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	74.0	----	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L	74.0	----	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	<10.0	----	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	4.46	----	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Carp_3H_Hydrera Tank	---	---	---	---
Sampling date / time				23-Feb-2023 06:15	---	---	---	---	---
Compound	CAS Number	LOR	Unit	ES2306795-001	-----	-----	-----	-----	-----
				Result	---	---	---	---	---
EN055: Ionic Balance									
∅ Total Anions	---	0.01	meq/L	1340	---	---	---	---	---
∅ Total Cations	---	0.01	meq/L	1450	---	---	---	---	---
∅ Ionic Balance	---	0.01	%	3.91	---	---	---	---	---
EP002: Dissolved Organic Carbon (DOC)									
Dissolved Organic Carbon	---	1	mg/L	357	---	---	---	---	---
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	---	1	mg/L	359	---	---	---	---	---
EP010: Formaldehyde									
Formaldehyde	50-00-0	0.1	mg/L	18.2	---	---	---	---	---
EP025: Oxygen - Dissolved (DO)									
Dissolved Oxygen	---	0.1	mg/L	5.1	---	---	---	---	---
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L	5.4	---	---	---	---	---
2-Chlorophenol	95-57-8	1.0	µg/L	<1.0	---	---	---	---	---
2-Methylphenol	95-48-7	1.0	µg/L	2.0	---	---	---	---	---
3- & 4-Methylphenol	1319-77-3	2.0	µg/L	101	---	---	---	---	---
2-Nitrophenol	88-75-5	1.0	µg/L	<1.0	---	---	---	---	---
2,4-Dimethylphenol	105-67-9	1.0	µg/L	<1.0	---	---	---	---	---
2,4-Dichlorophenol	120-83-2	1.0	µg/L	<1.0	---	---	---	---	---
2,6-Dichlorophenol	87-65-0	1.0	µg/L	<1.0	---	---	---	---	---
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L	<1.0	---	---	---	---	---
2,4,6-Trichlorophenol	88-06-2	1.0	µg/L	<1.0	---	---	---	---	---
2,4,5-Trichlorophenol	95-95-4	1.0	µg/L	<1.0	---	---	---	---	---
Pentachlorophenol	87-86-5	2.0	µg/L	<2.0	---	---	---	---	---
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L	<1.0	---	---	---	---	---
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	---	---	---	---	---
Acenaphthene	83-32-9	1.0	µg/L	<1.0	---	---	---	---	---
Fluorene	86-73-7	1.0	µg/L	<1.0	---	---	---	---	---
Phenanthrene	85-01-8	1.0	µg/L	<1.0	---	---	---	---	---
Anthracene	120-12-7	1.0	µg/L	<1.0	---	---	---	---	---
Fluoranthene	206-44-0	1.0	µg/L	<1.0	---	---	---	---	---
Pyrene	129-00-0	1.0	µg/L	<1.0	---	---	---	---	---
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	---	---	---	---	---



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Sample ID			Carp_3H_Hydrera Tank	----	----	----	----
Sampling date / time		23-Feb-2023 06:15			----	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2306795-001	-----	-----	-----	-----	-----
				Result	----	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Chrysene	218-01-9	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	----	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	----	----	----	----	----
3-Methylcholanthrene	56-49-5	1.0	µg/L	<1.0	----	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	----	----	----	----	----
Benzo(g,h,i)perylene	191-24-2	1.0	µg/L	<1.0	----	----	----	----	----
7.12-Dimethylbenz(a)anthracene	57-97-6	1.0	µg/L	<1.0	----	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	----	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	----	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L	580	----	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	570	----	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	740	----	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	100	----	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	1410	----	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L	570	----	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	570	----	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L	690	----	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	620	----	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	1310	----	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	690	----	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	2	----	----	----	----	----
Toluene	108-88-3	2	µg/L	<2	----	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	----	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	----	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	----	----	----	----	----
^ Total Xylenes	----	2	µg/L	<2	----	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Sample ID			Carp_3H_Hydrera Tank	----	----	----	----
Sampling date / time		23-Feb-2023 06:15			----	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2306795-001	-----	-----	-----	-----	-----
				Result	----	----	----	----	----
EP080: BTEXN - Continued									
^ Sum of BTEX		----	1	µg/L	2	----	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	----	----	----	----	----
EP132A: Phenolic Compounds									
m-Cresol	108-39-4	0.1	µg/L	0.4	----	----	----	----	----
p-Cresol	106-44-5	0.1	µg/L	167	----	----	----	----	----
Hexachlorophene	70-30-4	0.1	µg/L	<0.1	----	----	----	----	----
4-Nitrophenol	100-02-7	0.1	µg/L	<0.1	----	----	----	----	----
EP247: Phenolics and Related Compounds									
2,4-Dinitrophenol	51-28-5	0.01	µg/L	<0.01	----	----	----	----	----
2-Methyl-4,6-dinitrophenol	8071-51-0	0.05	µg/L	<0.05	----	----	----	----	----
Dinoseb	88-85-7	0.10	µg/L	<0.10	----	----	----	----	----
ED009: Anions									
Bromide	24959-67-9	0.010	mg/L	604	----	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%	37.8	----	----	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%	47.6	----	----	----	----	----
2,4,6-Tribromophenol	118-79-6	1.0	%	60.9	----	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%	49.7	----	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%	57.9	----	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%	61.7	----	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%	125	----	----	----	----	----
Toluene-D8	2037-26-5	2	%	126	----	----	----	----	----
4-Bromofluorobenzene	460-00-4	2	%	125	----	----	----	----	----
EP132S: Acid Extractable Surrogates									
2-Fluorophenol	367-12-4	0.1	%	62.0	----	----	----	----	----
Phenol-d6	13127-88-3	0.1	%	50.3	----	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%	88.2	----	----	----	----	----
2,4,6-Tribromophenol	118-79-6	0.1	%	91.4	----	----	----	----	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%	87.7	----	----	----	----	----
Anthracene-d10	1719-06-8	0.1	%	80.4	----	----	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Carp_3H_Hydrera Tank	----	----	----	----
				Sampling date / time	23-Feb-2023 06:15	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2306795-001	-----	-----	-----	-----
					Result	---	---	---	---
EP132T: Base/Neutral Extractable Surrogates - Continued									
4-Terphenyl-d14	1718-51-0	0.1	%		79.7	---	---	---	---



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2,4,6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128
EP132S: Acid Extractable Surrogates			
2-Fluorophenol	367-12-4	12	94
Phenol-d6	13127-88-3	10	65
2-Chlorophenol-D4	93951-73-6	37	139
2,4,6-Tribromophenol	118-79-6	35	151
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	43	135
Anthracene-d10	1719-06-8	48	138
4-Terphenyl-d14	1718-51-0	48	144

CERTIFICATE OF ANALYSIS

Work Order	: ES2307097	Page	: 1 of 2
Client	: IMPERIAL OIL AND GAS	Laboratory	: Environmental Division Sydney
Contact	: Nick Fraser	Contact	: Customer Services ES
Address	: LEVEL 7, 151 MACQUARIE STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: EP187	Date Samples Received	: 03-Mar-2023 08:30
Order number	: ----	Date Analysis Commenced	: 13-Mar-2023
C-O-C number	: ----	Issue Date	: 15-Mar-2023 16:13
Sampler	: SGS Crew - Carp 3		
Site	: ----		
Quote number	: SY/197/22		
No. of samples received	: 1		
No. of samples analysed	: 1		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Titus Vimalasiri	Metals Teamleader	Radionuclides, Fyshwick, ACT



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 ^ = This result is computed from individual analyte detections at or above the level of reporting
 ø = ALS is not NATA accredited for these tests.
 ~ = Indicates an estimated value.

- EG032: LOR's have been raised due to matrix interference. (High Total Dissolved Solids)
- LOR for Gross Alpha and Gross Beta raised due to high solid content.

Analytical Results

Sub-Matrix: **WATER**
 (Matrix: **WATER**)

Sample ID

Carp_2H_Flowback

				28-Feb-2023 12:15	----	----	----	----
Sampling date / time				28-Feb-2023 12:15	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2307097-001	-----	-----	-----	-----
				Result	----	----	----	----
EA250: Gross Alpha and Beta Activity								
Gross beta	----	0.10	Bq/L	168	----	----	----	----
EG032: Arsenic Speciation by LC-ICPMS								
Arsenious Acid (As (III))	----	0.5	µg/L	33.5	----	----	----	----
Arsenic Acid (As (V))	----	0.5	µg/L	<8.0	----	----	----	----
EA250CA: Gross Alpha and Beta Activity								
Gross alpha	----	0.05	Bq/L	426	----	----	----	----

Inter-Laboratory Testing

Analysis conducted by ALS Canberra, NATA accreditation no. 992.

(WATER) EA250: Gross Alpha and Beta Activity

(WATER) EA250CA: Gross Alpha and Beta Activity