

# MEMO

To: [REDACTED] inGauge

From: [REDACTED]

CC: [REDACTED]

Date: 12 December 2023

Re: Carpentaria 2H and Carpentaria 3H Flowback Wastewater Assessment

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## Introduction

Imperial Oil and Gas Pty Ltd ("Imperial") is conducting an exploration and appraisal program within Exploration Permit (EP)-187, located in the Beetaloo Sub-basin of the broader McArthur Basin in the Northern Territory (NT). As requested, EHS Support, PTY ("EHS Support") performed a risk assessment on flowback water from the Carpentaria 2H and Carpentaria 3H wells.

The McArthur Basin is located southeast of Katherine, NT, and covers approximately 180,000 square kilometres. Imperial has undertaken exploration activities within EP-187 since 2013. Imperial prepared an Environment Management Plan (EMP), titled Environmental Management Plan Imperial Oil & Gas 2021-2025 EP187 Work Program NT Exploration Permit (EP) 187 (IMP4-3) (Imperial, 2021). The EMP proposed Hydraulic Fracture Stimulation (HFS) to be conducted in 2021 through 2025 at the varied well locations. The EMP IMP4-3 for Imperial did not include use of flowback water for make-up water in the hydraulic fracturing process. Consistent with Regulation 22 of the Petroleum (Environment) Regulations 2016 as in force 1 January 2021 (NT, 2021), an assessment was completed in 2022 to modify regulated activities for the EMP IMP4-3 to include use of flowback water as make-up water in the hydraulic fracturing process (NT, 2022).

The primary objective of this assessment was to satisfy Condition 20 of the NT Government Approval Notice and Statement of Reasons (EMP Reference IMP4-3) which requires a comprehensive risk assessment at each new exploration well (NT, 2021). Additionally, the regulatory requirements for the Carpentaria 2H and Carpentaria 3H wells are under Item 2A of Regulation 37A under part 3A (reporting requirements for hydraulic fracturing) of the *Northern Territory Petroleum (Environment) Regulations* (2016) and the *Code of Practice: Onshore Petroleum Activities in the Northern Territory* ("Code of Practice") (NT, 2023). Regulation 37A states: *A report under subregulation (2) must be accompanied by a full human health risk assessment relating to any chemical found in the flowback fluid. 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 fracturing.*

This assessment leverages information in the following documents:



- Environment Management Plan (EMP) – Environmental Management Plan Imperial Oil & Gas 2021-2025 EP187 Work Program NT Exploration Permit (EP) 187 (IMP4-3) (Imperial, 2021).
- Hydraulic Stimulation Chemical Risk Assessment Update – Imperial Oil and Gas Exploration Permit 187 (Appendix 06 of the EMP; Imperial, 2021; and as updated)
- Regulation 22 Flowback Water Risk Assessment (EHS Support, 2022)

## Conceptual Exposure Model

Carpentaria 2H and Carpentaria 3H are located on the Carpentaria 2 well pad in a remote area of the northern NT (**Figure 1**). Approximately 10 kilometres (km) north of the Carpentaria Highway, the Carpentaria 2 well pad is approximately 6.2 hectare (ha) in area. **Figure 2** presents the layout of the Carpentaria 2 well pad, including the 12 megalitre (ML) flowback water storage tank.

Flowback water from the Carpentaria-2H well was used as makeup water for hydraulic stimulation of Carpentaria 3H. According to inGauge, flowback water will be stored on the Carpentaria 2 well lease in the open top tank until either re-use of the flowback as makeup water occurs or off-site disposal at a licensed facility. The next re-use opportunity for the flowback is not projected until second half of 2024. During the intervening time, inGauge anticipates significant reduction in Carpentaria 2H and Carpentaria 3H flowback water volume because approximately 5 millimetre (mm) of fluid is evaporated from the open top tank daily.

The Carpentaria 2 well lease is in a sparsely populated area of the NT (Imperial, 2021). Land use within EP187 is primarily undeveloped with agricultural (e.g., grazing stock) and mining the primary land uses. As shown in Table 10 of IMP4-3, Carpentaria 2 well pad (identified as CARP AA in the EMP) is 14 km from the nearest dwelling (Imperial, 2021). A search within EP187 for Parks, World Heritage Properties, National Heritage Places, Wetlands of International Importance, conservation areas or Sites of Conservation significance did not yield any results. The closest site of significance (Limmen National Park) is adjacent to the north-east boundary of EP187 and is greater than 50 km from the Carpentaria 2 well pad.

Climate within EP187 is tropical savannah within the humid zone with distinct wet and dry seasons; rainfall within the wet season averages between 600 to 800 mm per year (Imperial, 2021). Vegetation within EP187 is mostly open forests and woodlands (predominately Dawin Stringybark [*E. tetradonta*]). Carpentaria 2 well pad is located within the Gulf Fall and Uplands bioregion which includes water holes, gorges, and desiccated sandstone plateaus. Watercourses of varying stream orders are within the broader EP187 (Imperial, 2021). However, consistent with EMP IMP4-3, the Carpentaria 2 well pad is situated outside of sensitive receptor buffer zones, including water courses and is approximately 150 m from the closest stream (Table 10 of IMP4-3; Imperial, 2021). The closest spring to a well pad within EP187 is 22 km.

The Cambrian Limestone Aquifer (CLA) within the Top Springs Limestone, commonly referred to as Tindal Limestone or Gum Ridge Formation, is the shallowest regional aquifer within EP187 (EHS Support, 2023). Infiltration through sinkholes and preferential recharge through soil cavities are believed to be the likely groundwater recharge mechanisms for the CLA (Imperial, 2021). According to the EMP, well pads were to be constructed greater than 1 km from landowner bores and existing water supply bore used for domestic or stock consumption. As shown in Table 10 of IMP4-3, Carpentaria 2 well pad (identified as CARP AA in the EMP) is 8.5 km from the closest bore (Imperial, 2021).



**Figure 1** Carpentaria 2 location



**Figure 2** Carpentaria 2 site layout





In development of the EMP, potential exposures to humans and the environment to chemicals used in hydraulic stimulation were evaluated (Imperial, 2021). Multiple mitigation measures and control measures were specified within the EMP and associated Spill Management Plan (Appendix 07 of EMP) and Wastewater Management Plan (Appendix 06 of the EMP) to reduce residual risks from exposure to flowback water to As Low As Reasonably Practical (ALARP).

As discussed, flowback water from both Carpentaria 2H and Carpentaria 3H is managed in an open top tank on the Carpentaria well pad throughout the year. The flowback water is stored in a 12 ML triple lined tank with leak detections between each liner. A bunded area surrounds the tank to prevent overland flow with a capacity of 400 cubic metres (m<sup>3</sup>).

An assessment of potential release scenarios from storage tanks was completed as part of the Hydraulic Stimulation Chemical Risk Assessment (CRA) included in IMP4-3 (Appendix 06; Imperial, 2021). In a potential release scenario of 100,000 litres (L) outside of containment and the storage area, the maximum affected area of spreading was estimated to be less than 4.7 ha and limited to the proximity of the release area. Given buffer distances from water courses and size of Carpentaria 2 well pad, potential complete exposure pathways to surface water bodies associated with runoff from an accidental release from the flowback storage tank is considered unlikely and not assessed further. An infiltration assessment was also performed as part of the Hydraulic Stimulation CRA and determined that it would take groundwater 158 years (through siltstone) and 115 days if the surficial sequence is consistent with limestone to reach groundwater at a depth of approximately 50 m below ground level. Given the limited infiltration rate and distance from nearest bore, potential exposure to groundwater affected by a release of flowback water from the storage tank is not considered a complete exposure pathway.

Human receptors identified in the EMP with potential exposure to flowback water stored in tanks or during re-use activities include oil and gas workers (Imperial, 2021). The Carpentaria well pad site is fenced and controlled areas limit access to the public and preclude entry by livestock to the tank. Additionally, the well site is not visible from the closest highway, further reducing the likelihood of potential trespassers entering the secured well pad. Chemical exposures to workers are controlled through engineering, management controls and personal protective equipment, which are focused on elimination and mitigation of the potential for dermal contact and potential for incidental ingestion (therefore, the exposures are considered unlikely). Respiratory protection may not always be standard on hydraulic fracturing worksites; therefore, inhalation of vapours by oil and gas workers was considered a potentially complete exposure pathway for volatile constituents for chemicals used within the hydraulic stimulation process in the CRA. However, as flowback water is stored in open top tanks potential inhalation exposures are considered negligible and will be mitigated by natural ventilation (NICNAS, 2017). Therefore, no complete exposure pathways were identified for human receptors requiring further evaluation in this risk assessment.

Flowback water is typically hypersaline (i.e. total dissolved solids [TDS] greater than 50,000 milligrams per litre [mg/L]), which is unpalatable and a deterrent for avian receptors and other fauna from consuming and interacting with wastewater (Australian and New Zealand Guidelines [ANZG], 2023; Adams et al, 2013; Smith et al, 2010). This is due to the osmotic regulatory (or water balance) requirements of fauna. Ingestion of hypersaline water can lead to dehydration, weight loss, and mortality. The maximum observed salinity ingested by an avian species (Zebra Finch) was 47,000 mg/L TDS. TDS concentrations in the flowback samples from Carpentaria 2H and Carpentaria 3H ranged from 30,600 mg/L to 223,000 mg/L, with an average of 164,021 mg/L (**Attachment A, Table A-1**), and is consistent with a hypersaline characteristic. Avian receptors have reportedly been observed interact in the open top tanks; however, no mortalities have been documented in the



fauna register. Based on hypersaline nature of flowback water, potential exposure to avian receptors is considered low. However, as a conservative measure, potential exposure to avian receptors via incidental ingestion was evaluated in this risk assessment.

Management controls and mitigation measures outlined in the EMP are utilized to minimise potential for releases, including catastrophic failure, from storage tanks. However, as a conservative measure, evaluation of potential release of liquids to soils within the containment area was performed for the Carpentaria 2H and Carpentaria 3H flowback water and exposure to terrestrial receptors was included in this flowback risk assessment.

## Data Used in the Risk Assessment

Carpentaria 2H was stimulated 12 July to 1 August 2022; Carpentaria 3H was stimulated 8 December 2022 to 11 January 2023. Approximately 17,733 barrels (bbls) of produced water from Carpentaria 2H were used as makeup water for stimulation activities at Carpentaria 3H. Flowback water is stored in a 12 megalitre (ML) open top Hydrera steel tank with plastic liners. Consistent with the EMP, an open top tank is used to facilitate treatment by evaporation to reduce flowback water volume (Imperial, 2021).

Fifty-three samples of Carpentaria 2H and Carpentaria 3H flowback water were collected from 6 August 2022 to 5 October 2023. Samples of the flowback water was either collected from the choke manifold or from the storage tank where the flowback water is stored. **Attachment A, Table A-1** presents the analytical data from the weekly sampling events.

Based on the CEM, no potentially complete exposure pathways were identified for human receptors. For avian receptors, the point of exposure is flowback water stored in open-top tanks. Additionally, the terrestrial assessment evaluates releases of flowback water from these tanks. Samples collected from the choke manifold and flowback water tank were used in this risk assessment.

## Avian Risk Assessment

As a conservative measure, an avian risk assessment was completed to evaluate potential exposure of avian receptors to chemicals detected above screening criteria in flowback water samples from Carpentaria 2H and Carpentaria 3H. Laboratory analyses of these wastewater samples for inorganic, organic and radionuclide analytes was completed pursuant to the monitoring wastewater chemistry analytes specified in Section C.8 of the Code of Practice (NT, 2019).

Consistent with the avian risk assessment completed for the stimulation chemical risk assessment (EHS Support, 2023), this avian risk assessment conducted on the flowback water samples included the following two steps:

1. Screening Assessment – Identify chemicals of low ecological concern that do not require additional evaluation in the risk assessment process based on a comparison to the Australian and New Zealand Guidelines (AZNG) for Fresh & Marine Water Quality (ANZG, 2018) trigger values or, absent such values, alternative screening criteria as noted in **Attachment B**.
2. Quantitative Risk Evaluation – Identify chemicals that are a concern for avian receptors, and therefore require an additional evaluation to characterise the potential risks. The potential exposure was assessed using a quantitative evaluation of the potentially complete avian exposure pathway and the screening assessment.



## Tier 1 Screening Assessment

The screening assessment consisted of a focused evaluation of the potential risks to avian receptors if exposed to chemicals detected in flowback/produced water samples (**Attachment B, Table B-1**). The objective of the screening assessment was to identify chemicals of low concern to avian receptors that do not require additional evaluation in the risk assessment process.

The screening assessment used freshwater trigger values (ANZG, 2018) which are deemed to be protective of aquatic species such as fish, invertebrates, and algae assuming chronic, continual, and prolonged contact with surface water at a 95 percent (%) protection level. In instances where no trigger values were available, alternative screening criteria were employed and are noted as such in **Attachment B, Table B-1**. Inherently this approach is considered highly conservative given the following:

- In toxicological testing, aquatic species are more sensitive than terrestrial species to chemicals due to their emersion within the fluid, additional modes of action (for example, impacts on gill function) and the potential for secondary stressors to impact health.
- Even if exposed, avian receptors will have limited periods of duration in contact with the fluids. Roosting, breeding, and continuous access will not occur on the water body; therefore, contact will be episodic in nature and possibly only involve ingestion during dry periods.

Chemicals detected in the flowback/produced water samples with concentrations exceeding the conservatively adopted water quality criteria were carried through the quantitative risk evaluation.

The detected chemicals analysed in the wastewater samples that had concentrations exceeding the conservatively adopted water quality criteria and that may pose a potential risk to avian receptors include:

- |             |                           |  |
|-------------|---------------------------|--|
| • Aluminium | • Lithium                 | • Zinc                                       |
| • Antimony  | • Magnesium               | • C6-C10 Fraction minus BTEX (F1)            |
| • Arsenic   | • Nickel                  | • >C10 - C16 Fraction minus Naphthalene (F2) |
| • Barium    | • p-Cresol                | • >C16 - C34 Fraction (F3)                   |
| • Boron     | • Silver                  | • Gross alpha                                |
| • Cadmium   | • Strontium               | • Gross beta                                 |
| • Chromium  | • Total Residual Chlorine |  |
| • Cobalt    | • Ammonia as N            |  |
| • Copper    | • Total Phosphorus as P   |  |

Results for 3- and 4-methylphenol exceeded the alternative screening value selected for evaluation. However, the results for m-cresol (3-methylphenol) and p-cresol (4-methylphenol) were also available for flowback water. Results for m-cresol did not exceed the corresponding screening level; however, the result for p-cresol did. Therefore, p-cresol was retained to evaluate as a chemical that may potential pose a risk to avian receptors.

The maximum result of total nitrogen exceeded the water quality criteria. Total nitrogen is the sum of total Kjeldahl nitrogen (TKN), nitrate, and nitrite. In the Carpentaria 2H and 3H flowback water, nitrate and nitrite were either not detected or detected at negligible concentrations and TKN is equivalent to the reported total nitrogen concentrations. The maximum concentration of TKN did



not exceed the corresponding water quality criteria; therefore, total nitrogen will not be included for further assessment in this evaluation as the total nitrogen concentration is representative of TKN.

It should be noted that the gross alpha and gross beta screening criteria are only generic screening values for irrigation water. These values are based on risks to human health to due transfer of radionuclides to crop and animal products for human consumption (ANZECC, 2001; ANZG, 2023). These screening values are consistent with the Australian Drinking Water Guidelines (ADWG; National Health and Medical Research Council [NHMRC], National Resource Management Ministerial Council [NRMMC], 2011, and as updated), and if exceeded trigger a more detailed assessment. As outlined in the detailed assessment framework, an order-of-magnitude higher radiological exposure is acceptable as the natural background is higher than the screening level and thresholds for active intervention have been established at corresponding doses 10 to 50 times higher than the corresponding screening value.

In samples of flowback from Carpentaria 2H and Carpentaria 3H, gross alpha and gross beta ranged from 16.6 Bq/L to 669 Bq/L and 38.2 Bq/L to 294 Bq/L, respectively (**Attachment A**). Concentrations of gross beta observed in the Carpentaria-2H and Carpentaria 3-H flowback are within the range of flowback anticipated from the formation (2.08 Bq/L to 431 Bq/L; Kleinfelder, 2021). The observed range of gross alpha in flowback from the Carpentaria 1H well was 8 Bq/L to 82 Bq/L; the majority of gross alpha concentrations in Carpentaria 2H and Carpentaria 3H flowback water exceeded this range.

As discussed above, hypersaline water is unpalatable to fauna and unlikely to be consumed due to the inability for avian receptors. Additionally, precipitation of naturally occurring radioactive materials (NORMs) typically occurs in the flowback tank and accompany non-NORM solids that were produced with the flowback, rather than remaining dissolved in flowback water (Australian Radiation Protection and Nuclear Safety Agency [ARPANSA], 2008). This is supported by the reduction in gross alpha concentration to 102 Bq/L and gross beta concentration of 45.9 Bq/L. Solids within the frac tank will be managed in accordance with the EMP IMP4-3. Therefore, there is no further need to evaluate gross alpha and gross beta in this risk assessment.

**Attachment B, Table B-1** presents the results of the Tier 1 screening level assessment.

## Tier 2 Quantitative Risk Assessment

Potential exposure of avian receptors to the chemicals of concern in the flowback/produced water samples was quantitatively assessed for representative avian species that were previously evaluated in the stimulation chemical risk assessments (EHS Support, 2023). The potential avian exposure pathway was assessed based on the potential ingestion of flowback/produced water by avian receptors using standard methods and in accordance with the methodologies used in the previous avian risk assessments.

Potential dietary intake of water containing these chemicals was compared to toxicity reference values (TRVs) developed specifically for avian wildlife. Exposure assumptions for the dietary intake and TRV development were designed to be conservative to reduce uncertainty in the quantitative risk estimates. The potential risks were estimated using a chemical-specific HQ. As with the human health risk assessment, an HI is the sum of the HQs on an avian species-specific basis. A potential HI threshold level of less than 1 indicates there are no unacceptable exposures to the avian species.



**Table 1** summarises the results of the quantitative risk evaluation and includes a short-term (21-day) and long-term (1-year) scenario of fluid exposure. While there are no projected plans for short-term use or disposal of flowback water, the 21-day scenario provides a range of risk to avian receptors under different temporal scenarios. The HIs for all the assessed avian species were less than the threshold HI of 1 for the 21-day scenario exposure scenarios. Under the longer-term on-site storage scenario, the HIs exceeded the target of 1 and ranged from 6 to 7. Primary risk drivers for this scenario include barium and magnesium.

Given the hypersaline nature of the flowback water, it is unlikely that avian receptors would ingest the flowback water stored in open top tanks. In addition, the evaluation did not account for precipitation of chemicals within the tank or degradation over time. For example, barium and magnesium concentrations in samples collected from the storage tank reduced by 38 % and 57 % respectively from samples collected from the choke manifold. Therefore, the potential for unacceptable exposures to the avian species from potential ingestion of chemicals in flowback is unlikely.

**Table 1 Hazard Indices for Target Avian Species Exposed to Flowback Water**

Avian Species	Hazard Index for 21 days of Storage	Hazard Index for 1 year of Storage
Crested Pigeon	3E-01	6E+00
Willie Wagtail	4E-01	7E+00
Peaceful Dove	4E-01	7E+00
Cattle Egret	3E-01	6E+00
Brown Honeyeater	4E-01	7E+00

**Attachment B, Table B-2 through Table B-7** present the detailed calculations and outcomes of the quantitative risk evaluation for the target avian species in **Table 1**.

## Terrestrial Risk Assessment

This terrestrial soil risk assessment was conducted assuming chemicals detected in flowback water samples would ultimately be incorporated into soils within the bund that could pose an exposure risk to terrestrial receptors. To assess a potential release of liquids to soil within the containment area, concentrations of chemicals in soil that would result from a release of flowback/produced water to soil within the bunded area were calculated. These concentrations were compared, where possible, to ecological soil screening criteria.

### Calculation of Chemical Concentrations in Soil

This terrestrial risk assessment evaluated the potential for a release of flowback from the tank to the bunded area soils. The vertical depth of associated infiltration from this hypothetical release was estimated as 1 metre (m) based on modelling (EHS Support, 2023). Using this information, the area of the bund and the depth of infiltration of the volume of affected soil with the bund area were calculated at 5,000 cubic metres (m<sup>3</sup>). Maximum and median concentrations of detected chemicals in flowback/produced water from the sampled flowback/produced water samples were used to determine their respective maximum and median concentrations in soils (C<sub>soil</sub>) according to Equation 1 below.





$$C_{\text{soil}} = C_{\text{wat}} \times V_{\text{tank}} / M_{\text{soil}} / D_{\text{soil}} \quad \text{Eq. 1}$$

Where:

- $C_{\text{wat}}$  = maximum detected concentration of chemical in flowback
- $V_{\text{tank}}$  = volume of the water within the bund area in the event of a release (litres [L])
- $M_{\text{soil}}$  = mass of soil ( $6.75 \times 10^6$  kg)
- $D_{\text{soil}}$  = bulk density of soil (1,350 kilograms per cubic metre [ $\text{kg}/\text{m}^3$ ])

The capacity of the water storage tank on the Site is 12 ML and the bunded area capacity is  $400 \text{ m}^3$  (or 400,000 L) (correspondence from inGauge). To allow for precipitation, inGauge indicated that 0.5 m and 1.1 m of freeboard are maintained in the tank during the dry and wet seasons, respectively, which reduces the effective storage capacity to somewhat less than 12 ML. To evaluate the potential release to the bund area, a maximum volume of 400,000 L was used in the calculation of soil concentrations.

### Tier 1 Screening Assessment

Chemical calculated maximum and median soil concentrations are presented in (**Attachment C, Table D-1**). These concentrations reflect a range of chemical concentrations potentially expected in the 1-m stratum of soil adjacent to the enclosed storage tanks as a result of a release from the storage tank. Ecological soil screening levels defined by National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM) were used to determine a ratio of the calculated concentration in soil to screening criteria. In certain instances, where NEPM values were not available, other data available from the European Union, the USEPA, or background threshold values for the McArthur Basin surficial soils were used as the screening level.

To determine whether the maximum or median soil concentrations exceeded the screening level, a ratio of the soil concentration to the screening levels was calculated. If the ratio exceeded 1, the estimated concentration for the chemical exceeded the screening level. Calculated ratios did not exceed 1, except for bromide, lithium and strontium. The HQ calculated based on the maximum concentrations for these chemicals only slightly exceeded the target of 1 (2.5, 1.5, and 1.4, respectively) and only bromide resulted in a median concentration exceeding the HQ of 1 at 1.5. Therefore, with the exception of those chemicals, the calculated soil concentrations for both the maximum and median flowback concentrations did not exceed the terrestrial screening levels.

In accordance with the Waste and Wastewater Management Plan (Appendix 06 of the EMP IMP4-3), should a release occur, it would be reported in Imperial's incident reporting system and corrective action would be implemented in accordance with guidance.

### Assessment of BTEX

In addition to the risk evaluations, assessment of benzene, toluene, ethylbenzene, and xylene (BTEX) in flowback water was conducted pursuant to Section B.5 of the Code of Practice (Department of Environment and Natural Resources [DENR] and Department of Primary Industry and Resources [DPIR], 2019). Section B.5 states that recycled produced water used in hydraulic fracturing fluids must not contain BTEX levels greater than those expected in produce water from the well being drilled, or in the event BTEX levels expected in produced water are unknown, then BTEX levels in water cannot exceed levels prescribed in Table 8 of Section B.5.

As shown in **Attachment A, Table A-1**, benzene, toluene and xylene were detected in a subset of samples collected from the Carpentaria 2H and Carpentaria 3H flowback water. **Table 2** presents a



comparison of the maximum detection and limits of reporting from the Carpentaria 2H and Carpentaria 3H flowback data to the BTEX levels in water used for stimulation and drilling fluids from Table 8 in Section 8.5 of the Code of Practice (DENR and DPIR, 2019). Therefore, conditions set forth in Section B.5 of the Code of Practice regarding BTEX are satisfied.

**Table 2 BTEX Evaluation**

Chemical	ANZG (99% Protection Level) (µg/L)	Maximum Detection (µg/L)
Benzene	600	98
Toluene	180	60
Ethylbenzene	80	< 2
Xylene	200	11

Table Notes:  
 % = percent  
 µg/L = micrograms per litre  
 < = less than limit of detection  
 ANZG = Australian and New Zealand Guidelines

## Conclusions and Recommendations

In accordance with Regulation 37A under part 3A of the *Northern Territory Petroleum (Environment) Regulations (2023)* and pursuant to Condition 20 of the EMP approval (NT, 2022), a risk assessment of flowback water from the hydraulic fracturing phase of Carpentaria 2H and Carpentaria 3H wells was conducted. This assessment included determination of potential risk to humans and avian receptors exposed to flowback from wells Carpentaria 2H and Carpentaria 3H. Additionally, an assessment was conducted of a potential release of flowback water to soils within the banded area. As noted above, the risk evaluation methods used are consistent with those used for the EMP and the hydraulic fracturing fluid risk assessment conducted prior to approval of the activities at the Carpentaria 2H and 3H and well Site (Imperial, 2021).

No potentially complete exposure pathways for humans were identified for the storage of flowback water or potential reuse of water as make-up water. The risk assessment conducted for the avian receptors potentially exposed to flowback/produced water concluded there is no unacceptable risk to these receptors potentially exposed to chemicals in the Carpentaria 2H and Carpentaria 3H flowback water samples. Therefore, with respect to avian use of flowback water from wells Carpentaria 2H and Carpentaria 3H and the approved Site activities and associated management controls, no further action is recommended.

Likewise, a screening assessment was performed to determine the potential risk to terrestrial receptors exposed to soils affected by Carpentaria 2H and Carpentaria 3H flowback water based on a hypothetical release scenario. The assessment consisted of a screening level evaluation to determine if a further quantitative risk assessment would be required to assess the potential risk to terrestrial receptors. This screening level risk assessment concluded that no chemicals detected in the flowback water at their maximum or median concentrations, under a hypothetical maximum release scenario, would result in soil levels above screening criteria protective of terrestrial receptors, except for maximum concentrations of bromide, lithium and strontium, which slightly exceeded the target HQ. Should a release occur, incident notification would occur consistent with the WWMP (Imperial, 2021). Therefore, with the approved Site activities and associated management controls (e.g., maintenance of measures outlined in the EMP), no further action is recommended.



These findings are consistent with the flowback risk assessment that was completed for Carpentaria 1H, which also concluded that there were no unacceptable risks to human or avian receptors. This risk assessment satisfies Condition 20 of the EMP approval (NT, 2022) and requirement 3(a) of Regulation 37A of the Petroleum (Environment) Regulations 2016 (NT, 2023).

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## Attachment A Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix:	WATER	Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	
Workgroup:	RGES2300511	ALS Sample number:	ES2228939001	ES2228940001	ES2232274001	ES2232272001	ES2232272002	ES2234267001	ES2301750001	ES2301568001	ES2302561001	ES2302307001	ES2303545001	ES2303344001	
Project name/number:		Sample date:	6-Aug-22	12-Aug-22	3-Sep-22	10-Sep-22	11-Sep-22	24-Sep-22	17-Jan-23	17-Jan-23	22-Jan-23	23-Jan-23	01/31/2023	31-Jan-23	
		Sample time:	12:00	12:00	12:00	12:00	06:00	12:00	15:00	15:00	15:00	15:00	15:30	14:00	
Analyte grouping/Analyte	CAS Number	Units	LOR	Flowback_C2H_220806	Flowback_C2H_220812	FB_C2H_220903	FB_C2H_220910	Hydrera_carp_2	FB_C2H_220924	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	
<b>EA005P: pH by PC Titrator</b>															
pH Value		pH Unit	0.01	7.04	6.90	6.12	6.15	5.79	6.43	---	7.04	---	6.33	---	6.72
<b>EA010P: Conductivity by PC Titrator</b>															
Electrical Conductivity @ 25°C		µS/cm	1	87700	119000	155000	165000	62000	186000	---	38100	---	122000	---	148000
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C</b>															
Total Dissolved Solids @180°C		mg/L	10	70700	102000	148000	146000	42400	198000	---	30600	---	99800	---	145000
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>															
Suspended Solids (SS)		mg/L	5	48	236	111	186	79	166	---	16	---	203	---	79
<b>EA250: Gross Alpha and Beta Activity</b>															
Gross beta		Bq/L	0.10	38.2	76.7	---	---	---	152	<1.21	---	76.5	---	126	---
<b>ED009: Anions</b>															
Bromide	24959-67-9	mg/L	0.010	536	680	95.5	104	299	1400	---	183	---	869	---	842
<b>ED037P: Alkalinity by PC Titrator</b>															
Hydroxide Alkalinity as CaCO3	DMO-210-001	mg/L	1	<1	<1	<1	<1	<1	<1	---	<1	---	<1	---	<1
Carbonate Alkalinity as CaCO3	3812-32-6	mg/L	1	<1	<1	<1	<1	<1	<1	---	<1	---	<1	---	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	mg/L	1	233	156	107	76	236	132	---	386	---	178	---	144
Total Alkalinity as CaCO3		mg/L	1	233	156	107	76	236	132	---	386	---	178	---	144
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>															
Sulfate as SO4 - Turbidimetric	14808-79-8	mg/L	1	<10	<1	<50	<50	<1	<10	---	150	---	<10	---	<50
<b>ED045G: Chloride by Discrete Analyser</b>															
Chloride	16887-00-6	mg/L	1	39900	59700	72100	77100	22200	81600	---	13300	---	52700	---	92900
<b>ED093F: Dissolved Major Cations</b>															
Calcium	7440-70-2	mg/L	1	5020	8360	12800	13700	3590	18600	---	1330	---	9020	---	8990
Magnesium	7439-95-4	mg/L	1	946	1510	2470	2610	725	2730	---	294	---	1820	---	1860
Sodium	7440-23-5	mg/L	1	14500	20500	29900	31000	9950	32800	---	7070	---	26900	---	26100
Potassium	7440-09-7	mg/L	1	120	160	226	232	87	254	---	76	---	191	---	172
<b>ED093F: SAR and Hardness Calculations</b>															
Sodium Adsorption Ratio			0.01	49.2	54.2	63.4	63.6	39.6	59.4	---	45.7	---	67.5	---	65.4
<b>EG020F: Dissolved Metals by ICP-MS</b>															
Aluminium	7429-90-5	mg/L	0.01	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	---	<0.10	---	<0.10	---	<0.10
Antimony	7440-36-0	mg/L	0.001	0.019	0.013	<0.010	<0.010	<0.010	<0.010	---	0.048	---	<0.010	---	<0.010
Arsenic	7440-38-2	mg/L	0.001	0.039	0.024	0.015	<0.010	<0.010	0.013	---	0.055	---	0.020	---	<0.010
Beryllium	7440-41-7	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	<0.010	---	<0.010
Barium	7440-39-3	mg/L	0.001	235	560	1360	1460	240	1810	---	3.36	---	800	---	1030
Cadmium	7440-43-9	mg/L	0.0001	0.0014	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	---	<0.0010	---	0.0029	---	<0.0010
Chromium	7440-47-3	mg/L	0.001	0.020	0.021	0.029	0.010	0.011	0.033	---	0.013	---	0.021	---	0.019
Cobalt	7440-48-4	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	0.030	---	<0.010
Copper	7440-50-8	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	<0.010	---	<0.010
Lead	7439-92-1	mg/L	0.001	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	0.014	---	<0.010
Lithium	7439-93-2	mg/L	0.001	11.7	16.2	23.5	22.8	7.70	23.6	---	5.51	---	20.9	---	23.0
Manganese	7439-96-5	mg/L	0.001	8.39	12.4	19.4	20.9	5.92	23.4	---	4.40	---	18.6	---	16.2
Molybdenum	7439-98-7	mg/L	0.001	0.034	0.020	0.010	<0.010	<0.010	<0.010	---	0.112	---	0.030	---	0.012
Nickel	7440-02-0	mg/L	0.001	0.066	0.022	0.017	0.013	0.014	0.043	---	0.070	---	0.056	---	0.021
Selenium	7782-49-2	mg/L	0.01	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	---	<0.10	---	<0.10	---	<0.10
Silver	7440-22-4	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	<0.010	---	<0.010
Strontium	7440-24-6	mg/L	0.001	255	431	935	976	217	1110	---	63.2	---	647	---	743
Thorium	7440-29-1	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	<0.010	---	<0.010
Tin	7440-31-5	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	<0.010	---	<0.010
Uranium	7440-61-1	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	<0.010	---	<0.010
Vanadium	7440-62-2	mg/L	0.01	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	---	<0.10	---	<0.10	---	<0.10
Zinc	7440-66-6	mg/L	0.005	0.365	0.452	0.587	0.597	0.146	0.820	---	<0.050	---	1.00	---	0.688
Boron	7440-42-8	mg/L	0.05	27.9	21.8	17.1	14.8	23.0	13.5	---	52.2	---	26.0	---	20.5
Iron	7439-89-6	mg/L	0.05	53.9	77.5	109	80.6	33.9	127	---	12.1	---	64.6	---	60.9

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix:	WATER	Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	
Workgroup:	RGES2300511	ALS Sample number:	ES2228939001	ES2228940001	ES2232274001	ES2232272001	ES2232272002	ES2234267001	ES2301750001	ES2301568001	ES2302561001	ES2302307001	ES2303545001	ES2303344001	
Project name/number:		Sample date:	6-Aug-22	12-Aug-22	3-Sep-22	10-Sep-22	11-Sep-22	24-Sep-22	17-Jan-23	17-Jan-23	22-Jan-23	23-Jan-23	01/31/2023	31-Jan-23	
		Sample time:	12:00	12:00	12:00	12:00	06:00	12:00	15:00	15:00	15:00	15:00	15:30	14:00	
Analyte grouping/Analyte	CAS Number	Units	LOR	Flowback_C2H_220806	Flowback_C2H_220812	FB_C2H_220903	FB_C2H_220910	Hydrera_carp_2	FB_C2H_220924	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	
<b>EG020T: Total Metals by ICP-MS</b>															
Aluminium	7429-90-5	mg/L	0.01	<0.10	<0.10	<0.10	<0.10	0.24	<0.10	---	<0.10	---	0.92	---	<0.10
Antimony	7440-36-0	mg/L	0.001	0.020	0.014	<0.010	<0.010	0.014	<0.010	---	0.048	---	<0.010	---	<0.010
Arsenic	7440-38-2	mg/L	0.001	0.046	0.031	0.023	0.014	0.021	0.014	---	0.077	---	0.019	---	0.012
Beryllium	7440-41-7	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	<0.010	---	<0.010
Barium	7440-39-3	mg/L	0.001	311	715	1420	1580	258	1870	---	13.4	---	885	---	1120
Cadmium	7440-43-9	mg/L	0.0001	0.0016	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	---	<0.0010	---	0.0026	---	<0.0010
Chromium	7440-47-3	mg/L	0.001	0.021	0.031	0.044	0.038	0.016	0.033	---	0.018	---	0.116	---	0.032
Cobalt	7440-48-4	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	0.012	---	0.032	---	<0.010
Copper	7440-50-8	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	<0.010	---	<0.010
Lead	7439-92-1	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	0.018	---	0.013
Lithium	7439-93-2	mg/L	0.001	12.2	16.8	24.4	25.6	8.57	24.2	---	5.60	---	18.9	---	24.6
Manganese	7439-96-5	mg/L	0.001	9.69	14.2	20.6	22.1	6.32	24.0	---	4.04	---	18.7	---	17.3
Molybdenum	7439-98-7	mg/L	0.001	0.041	0.024	0.014	<0.010	0.025	<0.010	---	0.106	---	0.055	---	0.016
Nickel	7440-02-0	mg/L	0.001	0.079	0.049	0.030	0.018	0.033	0.043	---	0.066	---	0.111	---	0.033
Selenium	7782-49-2	mg/L	0.01	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	---	<0.10	---	<0.10	---	<0.10
Silver	7440-22-4	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	<0.010	---	<0.010
Strontium	7440-24-6	mg/L	0.001	334	590	984	1050	232	1130	---	59.9	---	704	---	819
Thorium	7440-29-1	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	<0.010	---	<0.010
Tin	7440-31-5	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	<0.010	---	<0.010
Uranium	7440-61-1	mg/L	0.001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	---	<0.010	---	<0.010	---	<0.010
Vanadium	7440-62-2	mg/L	0.01	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	---	<0.10	---	<0.10	---	<0.10
Zinc	7440-66-6	mg/L	0.005	0.461	0.492	0.671	0.656	0.206	0.858	---	<0.052	---	0.960	---	0.757
Boron	7440-42-8	mg/L	0.05	35.7	23.9	17.7	16.4	25.8	13.8	---	52.4	---	23.6	---	23.0
Iron	7439-89-6	mg/L	0.05	59.7	84.0	118	125	37.5	132	---	14.4	---	77.0	---	66.2
<b>EG032: Arsenic Speciation by LC-ICPMS</b>															
Arsenious Acid (As (III))		µg/L	0.5	---	---	9.1	12.7	11.2	<8.0	50.1	---	17.0	---	---	---
Arsenic Acid (As (V))		µg/L	0.5	---	---	<8.0	<8.0	<4.0	<8.0	34.0	---	<8.0	---	---	---
<b>EG035F: Dissolved Mercury by FIMS</b>															
Mercury	7439-97-6	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	---	<0.0001	---	<0.0001	---	<0.0001
<b>EG035T: Total Recoverable Mercury by FIMS</b>															
Mercury	7439-97-6	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	---	<0.0001	---	<0.0001	---	<0.0001
<b>EK010-1: Chlorine</b>															
Total Residual Chlorine		mg/L	0.02	<0.10	0.50	<0.40	<0.40	<0.20	0.80	---	<0.02	---	<0.20	---	0.40
Free Chlorine		mg/L	0.02	<0.10	<0.10	<0.40	<0.40	<0.20	0.40	---	<0.04	---	<0.20	---	0.20
<b>EK026SF: Total CN by Segmented Flow Analyser</b>															
Total Cyanide	57-12-5	mg/L	0.004	<0.020	<0.020	<0.020	<0.020	<0.020	<0.004	---	<0.004	---	<0.020	---	<0.020
<b>EK040P: Fluoride by PC Titrator</b>															
Fluoride	16984-48-8	mg/L	0.1	1.3	1.2	0.6	0.5	1.0	0.8	---	1.3	---	0.7	---	1.0
<b>EK055G: Ammonia as N by Discrete Analyser</b>															
Ammonia as N	7664-41-7	mg/L	0.01	42.6	52.4	66.2	73.3	38.2	68.8	---	19.8	---	56.4	---	59.9
<b>EK057G: Nitrite as N by Discrete Analyser</b>															
Nitrite as N	14797-65-0	mg/L	0.01	<0.10	0.03	<0.10	<0.10	<0.01	<0.10	---	<0.01	---	<0.10	---	<0.01
<b>EK058G: Nitrate as N by Discrete Analyser</b>															
Nitrate as N	14797-55-8	mg/L	0.01	<0.10	0.02	<0.10	<0.10	<0.01	<0.10	---	0.19	---	0.10	---	0.03
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>															
Nitrite + Nitrate as N		mg/L	0.01	<0.10	0.05	<0.10	<0.10	<0.01	<0.10	---	0.19	---	0.10	---	0.03
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>															
Total Kjeldahl Nitrogen as N		mg/L	0.1	130	149	81.5	143	66.5	155	---	71.8	---	98.7	---	140
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>															
Total Nitrogen as N		mg/L	0.1	130	149	81.5	143	66.5	155	---	72.0	---	98.8	---	140
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>															
Total Phosphorus as P		mg/L	0.01	2.19	1.68	1.18	1.12	0.66	<2.00	---	1.48	---	1.02	---	<10.0
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>															
Reactive Phosphorus as P	14265-44-2	mg/L	0.01	1.98	<0.25	1.59	1.62	0.35	<0.50	---	0.98	---	4.67	---	7.63
<b>EN055: Ionic Balance</b>															
Total Anions		meq/L	0.01	1130	1690	2040	2180	631	2300	---	386	---	1490	---	2620
Total Cations		meq/L	0.01	962	1440	2150	2250	674	2590	---	400	---	1770	---	1740
Ionic Balance		%	0.01	8.03	8.00	2.68	1.72	3.29	5.76	---	1.78	---	8.72	---	20.2
<b>EP002: Dissolved Organic Carbon (DOC)</b>															
Dissolved Organic Carbon		mg/L	1	783	659	550	---	416	459	---	759	---	668	---	570
<b>EP005: Total Organic Carbon (TOC)</b>															
Total Organic Carbon		mg/L	1	780	652	548	529	454	472	---	770	---	663	---	579
<b>EP010: Formaldehyde</b>															
Formaldehyde	50-00-0	mg/L	0.1	6.9	16.0	18.8	19.7	10.5	23.6	---	2.8	---	4.3	---	18.6
<b>EP025: Oxygen - Dissolved (DO)</b>															
Dissolved Oxygen		mg/L	0.1	4.4	3.3	3.3	2.7	1.8	4.8	---	9.8	---	5.4	---	8.5

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix:	WATER	Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
Workgroup:	RGES2300511	ALS Sample number:	ES2228939001	ES2228940001	ES2232274001	ES2232272001	ES2232272002	ES2234267001	ES2301750001	ES2301568001	ES2302561001	ES2302307001	ES2303545001	ES2303344001	
Project name/number:		Sample date:	6-Aug-22	12-Aug-22	3-Sep-22	10-Sep-22	11-Sep-22	24-Sep-22	17-Jan-23	17-Jan-23	22-Jan-23	23-Jan-23	01/31/2023	31-Jan-23	
		Sample time:	12:00	12:00	12:00	12:00	06:00	12:00	15:00	15:00	15:00	15:00	15:30	14:00	
Analyte grouping/Analyte	CAS Number	Units	LOR	Flowback_C2H_220806	Flowback_C2H_220812	FB_C2H_220903	FB_C2H_220910	Hydrera_carp_2	FB_C2H_220924	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback
<b>EP075(SIM)A: Phenolic Compounds</b>															
Phenol	108-95-2	µg/L	1.0	2.0	1.8	1.3	1.4	7.9	1.4	---	2.0	---	2.7	---	2.2
2-Chlorophenol	95-57-8	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
2-Methylphenol	95-48-7	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	2.7	<1.0	---	<1.0	---	<1.0	---	<1.0
3- & 4-Methylphenol	1319-77-3	µg/L	2.0	<2.0	<2.0	<2.0	<2.0	3.9	<2.0	---	13.3	---	6.6	---	4.8
2-Nitrophenol	88-75-5	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
2,4-Dimethylphenol	105-67-9	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
2,4-Dichlorophenol	120-83-2	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
2,6-Dichlorophenol	87-65-0	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
4-Chloro-3-methylphenol	59-50-7	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
2,4,6-Trichlorophenol	88-06-2	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
2,4,5-Trichlorophenol	95-95-4	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Pentachlorophenol	87-86-5	µg/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	---	<2.0	---	<2.0	---	<2.0
<b>EP075(SIM)B: Polynuclear Aromatic Hydrocarbons</b>															
Naphthalene	91-20-3	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Acenaphthylene	208-96-8	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Acenaphthene	83-32-9	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Fluorene	86-73-7	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Phenanthrene	85-01-8	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Anthracene	120-12-7	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Fluoranthene	206-44-0	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Pyrene	129-00-0	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Benz(a)anthracene	56-55-3	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Chrysene	218-01-9	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Benzo(b+j)fluoranthene	205-99-2 205-82-3	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Benzo(k)fluoranthene	207-08-9	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Benzo(a)pyrene	50-32-8	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	---	<0.5	---	<0.5	---	<0.5
3-Methylcholanthrene	56-49-5	µg/L	1.0	---	---	---	---	---	<1.0	---	---	---	---	---	---
Indeno(1.2.3.cd)pyrene	193-39-5	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
7.12-Dimethylbenz(a)anthracene	57-97-6	µg/L	1.0	---	---	---	---	---	<1.0	---	---	---	---	---	---
Dibenz(a,h)anthracene	53-70-3	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Benzo(g,h,i)perylene	191-24-2	µg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---	<1.0	---	<1.0	---	<1.0
Sum of polycyclic aromatic hydrocarbons		µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	---	<0.5	---	<0.5	---	<0.5
Benzo(a)pyrene TEQ (zero)		µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	---	<0.5	---	<0.5	---	<0.5
<b>EP080/071: Total Petroleum Hydrocarbons</b>															
C6 - C9 Fraction		µg/L	20	90	50	<20	70	300	<20	---	170	---	130	---	30
C10 - C14 Fraction		µg/L	50	<50	280	<50	<50	420	<50	---	100	---	<50	---	<50
C15 - C28 Fraction		µg/L	100	310	8710	<100	<100	400	<100	---	160	---	<100	---	<100
C29 - C36 Fraction		µg/L	50	<50	1360	<50	<50	<50	<50	---	<50	---	<50	---	<50
C10 - C36 Fraction (sum)		µg/L	50	310	10400	<50	<50	820	<50	---	260	---	<50	---	<50
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>															
C6 - C10 Fraction	C6_C10	µg/L	20	90	50	<20	80	300	20	---	170	---	130	---	30
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	µg/L	20	30	<20	<20	40	300	<20	---	<20	---	40	---	<20
>C10 - C16 Fraction		µg/L	100	120	460	<100	<100	420	<100	---	190	---	<100	---	<100
>C16 - C34 Fraction		µg/L	100	280	9030	<100	<100	210	<100	---	<100	---	<100	---	<100
>C34 - C40 Fraction		µg/L	100	<100	1010	<100	<100	<100	<100	---	<100	---	<100	---	<100
>C10 - C40 Fraction (sum)		µg/L	100	400	10500	<100	<100	630	<100	---	190	---	<100	---	<100
>C10 - C16 Fraction minus Naphthalene (F2)		µg/L	100	120	460	<100	<100	420	<100	---	190	---	<100	---	<100
<b>EP080: BTEXN</b>															
Benzene	71-43-2	µg/L	1	29	20	<1	24	2	6	---	98	---	45	---	8
Toluene	108-88-3	µg/L	2	27	18	<2	16	<2	6	---	60	---	38	---	6
Ethylbenzene	100-41-4	µg/L	2	<2	<2	<2	<2	<2	<2	---	<2	---	<2	---	<2
meta- & para-Xylene	108-38-3 106-42-3	µg/L	2	6	4	<2	3	<2	<2	---	8	---	7	---	<2
ortho-Xylene	95-47-6	µg/L	2	2	<2	<2	<2	<2	<2	---	3	---	<2	---	<2
Total Xylenes		µg/L	2	8	4	<2	3	<2	<2	---	11	---	7	---	<2
Sum of BTEX		µg/L	1	64	42	<1	43	2	12	---	169	---	90	---	14
Naphthalene	91-20-3	µg/L	5	<5	<5	<5	<5	<5	<5	---	<5	---	<5	---	<5
<b>EP132A: Phenolic Compounds</b>															
m-Cresol	108-39-4	µg/L	0.1	---	---	<0.2	0.1	0.2	<0.1	---	0.5	---	0.7	---	<0.1
p-Cresol	106-44-5	µg/L	0.1	---	---	<0.2	<0.1	4.9	<0.1	---	16.0	---	14.5	---	0.8
Hexachlorophene	70-30-4	µg/L	0.1	---	---	<0.2	<0.1	<0.2	<0.1	---	<0.1	---	<0.1	---	<0.1
4-Nitrophenol	100-02-7	µg/L	0.1	---	---	<0.2	<0.1	<0.2	<0.1	---	<0.1	---	<0.1	---	<0.1
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L	0.1	---	---	<0.2	<0.1	<0.2	<0.1	---	---	---	---	---	---
<b>EP132B: Polynuclear Aromatic Hydrocarbons</b>															
3-Methylcholanthrene	56-49-5	µg/L	0.1	---	---	---	<0.1	<0.2	---	---	---	---	---	---	---
7.12-Dimethylbenz(a)anthracene	57-97-6	µg/L	0.1	---	---	---	<0.1	<0.2	---	---	---	---	---	---	---



**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix: WATER		Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	
Workgroup: RGE52300511		ALS Sample number:	ES2228939001	ES2228940001	ES2232274001	ES2232272001	ES2232272002	ES2234267001	ES2301750001	ES2301568001	ES2302561001	ES2302307001	ES2303545001	ES2303344001	
Project name/number:		Sample date:	6-Aug-22	12-Aug-22	3-Sep-22	10-Sep-22	11-Sep-22	24-Sep-22	17-Jan-23	17-Jan-23	22-Jan-23	23-Jan-23	01/31/2023	31-Jan-23	
		Sample time:	12:00	12:00	12:00	12:00	06:00	12:00	15:00	15:00	15:00	15:00	15:30	14:00	
Analyte grouping/Analyte	CAS Number	Units	LOR	Flowback_C2H_220806	Flowback_C2H_220812	FB_C2H_220903	FB_C2H_220910	Hydrera_carp_2	FB_C2H_220924	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback
<b>EP247: Phenolics and Related Compounds</b>															
2,4-Dinitrophenol	51-28-5	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	----	<0.01	----	<0.01	----	<0.01
2-Methyl-4.6-dinitrophenol	8071-51-0	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	----	<0.05	----	<0.05	----	<0.05
Dinoseb	88-85-7	µg/L	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	----	<0.10	----	<0.10	----	<0.10
<b>EA250CA: Gross Alpha and Beta Activity</b>															
Gross alpha		Bq/L	0.05	<b>16.6</b>	<b>116</b>	----	----	----	<b>322</b>	<0.60	----	<b>45.9</b>	----	<b>126</b>	----
Gross beta		Bq/L	0.10	----	----	----	----	----	----	----	----	----	----	----	----
<b>EP075(SIM): Phenolic Compound Surrogates</b>															
Phenol-d6	13127-88-3	%	1.0	26.8	25.9	27.8	28.7	27.0	25.7	----	25.5	----	37.4	----	39.3
2-Chlorophenol-D4	93951-73-6	%	1.0	51.4	49.0	56.4	61.6	60.3	64.4	----	48.4	----	57.4	----	60.0
2.4.6-Tribromophenol	118-79-6	%	1.0	81.9	82.2	63.6	67.9	75.2	72.4	----	51.3	----	65.1	----	73.4
<b>EP075(SIM): PAH Surrogates</b>															
2-Fluorobiphenyl	321-60-8	%	1.0	59.6	55.3	61.2	72.0	65.4	73.1	----	57.6	----	57.3	----	71.1
Anthracene-d10	1719-06-8	%	1.0	71.0	63.2	70.6	74.5	71.9	99.8	----	63.6	----	69.8	----	77.8
4-Terphenyl-d14	1718-51-0	%	1.0	72.9	60.8	73.0	74.2	72.9	82.9	----	64.4	----	111	----	78.3
<b>EP080S: TPH(V)/BTEX Surrogates</b>															
1.2-Dichloroethane-D4	17060-07-0	%	2	97.4	106	106	109	133	90.0	----	134	----	98.0	----	97.2
Toluene-D8	2037-26-5	%	2	95.9	116	101	110	124	112	----	119	----	106	----	110
4-Bromofluorobenzene	460-00-4	%	2	94.0	108	110	110	124	98.2	----	123	----	115	----	102
<b>EP132S: Acid Extractable Surrogates</b>															
2-Fluorophenol	367-12-4	%	0.1	----	----	22.9	42.6	53.9	35.6	----	52.2	----	90.7	----	32.7
Phenol-d6	13127-88-3	%	0.1	----	----	20.0	42.4	40.2	47.8	----	39.3	----	69.1	----	32.0
2-Chlorophenol-D4	93951-73-6	%	0.1	----	----	37.3	55.6	69.0	50.2	----	76.7	----	118	----	46.2
2.4.6-Tribromophenol	118-79-6	%	0.1	----	----	32.7	34.7	67.6	33.2	----	85.2	----	128	----	15.6
<b>EP132T: Base/Neutral Extractable Surrogates</b>															
2-Fluorobiphenyl	321-60-8	%	0.1	----	----	57.3	64.0	65.2	86.5	----	72.2	----	114	----	66.6
Anthracene-d10	1719-06-8	%	0.1	----	----	76.2	51.1	92.4	73.2	----	79.9	----	124	----	53.0
4-Terphenyl-d14	1718-51-0	%	0.1	----	----	70.6	73.4	79.1	90.8	----	81.4	----	120	----	73.0

Notes:  
 % = percent  
 µg/L = micrograms per litre  
 µS/cm = microSiemens per centimetre  
 Bq/L = Bequerel per litre  
 CAS = chemical abstract service  
 LOR = limit of reporting  
 mg/L = milligrams per litre

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix:	WATER	Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG		
Workgroup:	RGES2300511	ALS Sample number:	ES2304170001	ES2303978001	ES2305255001	ES2305108001	ES2306797001	ES2307100001	ES2306795001	ES2307098001	ES2307097001	ES2308730001	ES2308922001		
Project name/number:		Sample date:	7-Feb-23	8-Feb-23	14-Feb-23	14-Feb-23	21-Feb-23	21-Feb-23	23-Feb-23	23-Feb-23	28-Feb-23	7-Mar-23	7-Mar-23		
		Sample time:	07:30	07:30	13:30	12:00	12:00	13:30	07:45	09:15	13:45	13:30	13:30		
		Units	LOR	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Hydrera Tank	Carp_3H_Hydrera Tank	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	
Analyte grouping/Analyte	CAS Number	Units	LOR												
<b>EA005P: pH by PC Titrator</b>															
pH Value		pH Unit	0.01	---	6.12	---	6.07	6.17	---	5.11	---	---	6.44	---	---
<b>EA010P: Conductivity by PC Titrator</b>															
Electrical Conductivity @ 25°C		µS/cm	1	---	150000	---	258000	170000	---	106000	---	---	183000	---	---
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C</b>															
Total Dissolved Solids @180°C		mg/L	10	---	154000	---	163000	156000	---	85200	---	---	206000	---	---
<b>EA025: Total Suspended Solids dried at 104 ± 2 °C</b>															
Suspended Solids (SS)		mg/L	5	---	91	---	122	135	---	46	---	---	88	---	---
<b>EA250: Gross Alpha and Beta Activity</b>															
Gross beta		Bq/L	0.10	101	---	73.1	---	---	123	---	45.9	168	---	---	206
<b>ED009: Anions</b>															
Bromide	24959-67-9	mg/L	0.010	---	1040	---	986	972	---	604	---	---	1890	---	---
<b>ED037P: Alkalinity by PC Titrator</b>															
Hydroxide Alkalinity as CaCO3	DMO-210-001	mg/L	1	---	<1	---	<1	<1	---	<1	---	---	<1	---	---
Carbonate Alkalinity as CaCO3	3812-32-6	mg/L	1	---	<1	---	<1	<1	---	<1	---	---	<1	---	---
Bicarbonate Alkalinity as CaCO3	71-52-3	mg/L	1	---	119	---	127	118	---	116	---	---	63	---	---
Total Alkalinity as CaCO3		mg/L	1	---	119	---	127	118	---	116	---	---	63	---	---
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>															
Sulfate as SO4 - Turbidimetric	14808-79-8	mg/L	1	---	<100	---	<100	<10	---	<10	---	---	<10	---	---
<b>ED045G: Chloride by Discrete Analyser</b>															
Chloride	16887-00-6	mg/L	1	---	84600	---	96300	82400	---	47600	---	---	113000	---	---
<b>ED093F: Dissolved Major Cations</b>															
Calcium	7440-70-2	mg/L	1	---	12900	---	13700	15100	---	8110	---	---	22000	---	---
Magnesium	7439-95-4	mg/L	1	---	2400	---	2650	2970	---	1500	---	---	3960	---	---
Sodium	7440-23-5	mg/L	1	---	32200	---	35400	40500	---	21200	---	---	45300	---	---
Potassium	7440-09-7	mg/L	1	---	240	---	248	278	---	161	---	---	295	---	---
<b>ED093F: SAR and Hardness Calculations</b>															
Sodium Adsorption Ratio			0.01	---	68.3	---	72.5	78.8	---	56.7	---	---	73.8	---	---
<b>EG020F: Dissolved Metals by ICP-MS</b>															
Aluminium	7429-90-5	mg/L	0.01	---	<0.10	---	<0.10	<0.10	---	<0.10	---	---	<0.20	---	---
Antimony	7440-36-0	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.020	---	---
Arsenic	7440-38-2	mg/L	0.001	---	0.010	---	0.012	0.011	---	0.010	---	---	<0.020	---	---
Beryllium	7440-41-7	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.020	---	---
Barium	7440-39-3	mg/L	0.001	---	1350	---	1600	1700	---	660	---	---	2110	---	---
Cadmium	7440-43-9	mg/L	0.0001	---	<0.0010	---	<0.0010	<0.0010	---	<0.0010	---	---	<0.0020	---	---
Chromium	7440-47-3	mg/L	0.001	---	0.021	---	0.028	0.034	---	0.013	---	---	<0.020	---	---
Cobalt	7440-48-4	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.020	---	---
Copper	7440-50-8	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.020	---	---
Lead	7439-92-1	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.020	---	---
Lithium	7439-93-2	mg/L	0.001	---	24.1	---	26.5	29.0	---	18.0	---	---	38.2	---	---
Manganese	7439-96-5	mg/L	0.001	---	21.3	---	25.6	28.5	---	14.2	---	---	31.5	---	---
Molybdenum	7439-98-7	mg/L	0.001	---	0.020	---	0.015	<0.010	---	0.016	---	---	<0.020	---	---
Nickel	7440-02-0	mg/L	0.001	---	0.015	---	0.027	0.022	---	0.045	---	---	<0.020	---	---
Selenium	7782-49-2	mg/L	0.01	---	<0.10	---	<0.10	<0.10	---	<0.10	---	---	<0.20	---	---
Silver	7440-22-4	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.020	---	---
Strontium	7440-24-6	mg/L	0.001	---	1103	---	1100	1170	---	539	---	---	1270	---	---
Thorium	7440-29-1	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.020	---	---
Tin	7440-31-5	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.020	---	---
Uranium	7440-61-1	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.020	---	---
Vanadium	7440-62-2	mg/L	0.01	---	<0.10	---	<0.10	<0.10	---	<0.10	---	---	<0.20	---	---
Zinc	7440-66-6	mg/L	0.005	---	0.940	---	0.904	1.40	---	0.679	---	---	0.846	---	---
Boron	7440-42-8	mg/L	0.05	---	19.6	---	21.2	17.4	---	26.3	---	---	10.2	---	---
Iron	7439-89-6	mg/L	0.05	---	83.8	---	95.7	124	---	67.9	---	---	133	---	---

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix: WATER		Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	
Workgroup: RGES2300511		ALS Sample number:	ES2304170001	ES2303978001	ES2305255001	ES2305108001	ES2306797001	ES2307100001	ES2306795001	ES2307098001	ES2307097001	ES2308730001	ES2308922001	
Project name/number:		Sample date:	7-Feb-23	8-Feb-23	14-Feb-23	14-Feb-23	21-Feb-23	21-Feb-23	23-Feb-23	23-Feb-23	28-Feb-23	7-Mar-23	7-Mar-23	
		Sample time:	07:30	07:30	13:30	12:00	12:00	13:30	07:45	09:15	13:45	13:30	13:30	
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Hydrera Tank	Carp_3H_Hydrera Tank	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	
<b>EG020T: Total Metals by ICP-MS</b>														
Aluminium	7429-90-5	mg/L	0.01	---	<0.10	---	<0.10	<0.10	---	<0.10	---	---	<0.21	---
Antimony	7440-36-0	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.021	---
Arsenic	7440-38-2	mg/L	0.001	---	<b>0.017</b>	---	<b>0.023</b>	<b>0.016</b>	---	<b>0.019</b>	---	---	<0.021	---
Beryllium	7440-41-7	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.021	---
Barium	7440-39-3	mg/L	0.001	---	<b>1540</b>	---	<b>1710</b>	<b>1770</b>	---	<b>757</b>	---	---	<b>2320</b>	---
Cadmium	7440-43-9	mg/L	0.0001	---	<0.0010	---	<0.0010	<0.0010	---	<0.0010	---	---	<0.0021	---
Chromium	7440-47-3	mg/L	0.001	---	<b>0.042</b>	---	<b>0.042</b>	<b>0.038</b>	---	<b>0.029</b>	---	---	<0.021	---
Cobalt	7440-48-4	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.021	---
Copper	7440-50-8	mg/L	0.001	---	<b>0.033</b>	---	<0.010	<0.010	---	<0.010	---	---	<0.021	---
Lead	7439-92-1	mg/L	0.001	---	<0.010	---	<b>0.016</b>	<0.010	---	<0.010	---	---	<0.021	---
Lithium	7439-93-2	mg/L	0.001	---	<b>24.6</b>	---	<b>33.8</b>	<b>39.4</b>	---	<b>23.2</b>	---	---	<b>34.5</b>	---
Manganese	7439-96-5	mg/L	0.001	---	<b>23.4</b>	---	<b>26.2</b>	<b>30.8</b>	---	<b>15.4</b>	---	---	<b>29.4</b>	---
Molybdenum	7439-98-7	mg/L	0.001	---	<b>0.017</b>	---	<b>0.017</b>	<b>0.014</b>	---	<b>0.021</b>	---	---	<0.021	---
Nickel	7440-02-0	mg/L	0.001	---	<b>0.057</b>	---	<b>0.042</b>	<b>0.031</b>	---	<b>0.036</b>	---	---	<0.021	---
Selenium	7782-49-2	mg/L	0.01	---	<0.10	---	<0.10	<0.10	---	<0.10	---	---	<0.21	---
Silver	7440-22-4	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.021	---
Strontium	7440-24-6	mg/L	0.001	---	<b>1150</b>	---	<b>1170</b>	<b>1190</b>	---	<b>576</b>	---	---	<b>1390</b>	---
Thorium	7440-29-1	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.021	---
Tin	7440-31-5	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.021	---
Uranium	7440-61-1	mg/L	0.001	---	<0.010	---	<0.010	<0.010	---	<0.010	---	---	<0.021	---
Vanadium	7440-62-2	mg/L	0.01	---	<0.10	---	<0.10	<0.10	---	<0.10	---	---	<0.21	---
Zinc	7440-66-6	mg/L	0.005	---	<b>1.11</b>	---	<b>0.996</b>	<b>0.846</b>	---	<b>0.670</b>	---	---	<b>1.08</b>	---
Boron	7440-42-8	mg/L	0.05	---	<b>20.6</b>	---	<b>21.7</b>	<b>26.5</b>	---	<b>34.5</b>	---	---	<b>12.4</b>	---
Iron	7439-89-6	mg/L	0.05	---	<b>91.8</b>	---	<b>98.8</b>	<b>120</b>	---	<b>68.7</b>	---	---	<b>151</b>	---
<b>EG032: Arsenic Speciation by LC-ICPMS</b>														
Arsenious Acid (As (III))		µg/L	0.5	<b>10.0</b>	---	<b>26.0</b>	---	---	<b>8.5</b>	---	<b>4.9</b>	<b>33.5</b>	---	<20.0
Arsenic Acid (As (V))		µg/L	0.5	<b>6.5</b>	---	<20.0	---	---	<4.0	---	<4.0	<8.0	---	<20.0
<b>EG035F: Dissolved Mercury by FIMS</b>														
Mercury	7439-97-6	mg/L	0.0001	---	<0.0001	---	<0.0001	<0.0001	---	<0.0001	---	---	<0.0001	---
<b>EG035T: Total Recoverable Mercury by FIMS</b>														
Mercury	7439-97-6	mg/L	0.0001	---	<0.0001	---	<0.0001	<0.0001	---	<0.0001	---	---	<0.0001	---
<b>EK010-1: Chlorine</b>														
Total Residual Chlorine		mg/L	0.02	---	<b>1.00</b>	---	<0.40	<0.40	---	<0.10	---	---	<0.20	---
Free Chlorine		mg/L	0.02	---	<0.20	---	<0.40	<0.40	---	<0.10	---	---	<0.20	---
<b>EK026SF: Total CN by Segmented Flow Analyser</b>														
Total Cyanide	57-12-5	mg/L	0.004	---	<0.020	---	<0.004	<0.004	---	<0.004	---	---	<0.004	---
<b>EK040P: Fluoride by PC Titrator</b>														
Fluoride	16984-48-8	mg/L	0.1	---	<b>0.6</b>	---	<b>0.6</b>	<b>0.5</b>	---	<b>0.7</b>	---	---	<b>0.9</b>	---
<b>EK055G: Ammonia as N by Discrete Analyser</b>														
Ammonia as N	7664-41-7	mg/L	0.01	---	<b>62.4</b>	---	<b>77.8</b>	<b>73.6</b>	---	<b>1.38</b>	---	---	<b>87.4</b>	---
<b>EK057G: Nitrite as N by Discrete Analyser</b>														
Nitrite as N	14797-65-0	mg/L	0.01	---	<0.01	---	<0.10	<0.01	---	<0.01	---	---	<0.10	---
<b>EK058G: Nitrate as N by Discrete Analyser</b>														
Nitrate as N	14797-55-8	mg/L	0.01	---	<b>0.02</b>	---	<0.10	<0.01	---	<0.01	---	---	<0.10	---
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>														
Nitrite + Nitrate as N		mg/L	0.01	---	<b>0.02</b>	---	<0.10	<0.01	---	<0.01	---	---	<0.01	---
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>														
Total Kjeldahl Nitrogen as N		mg/L	0.1	---	<b>114</b>	---	<b>131</b>	<b>105</b>	---	<b>74.0</b>	---	---	<b>154</b>	---
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>														
Total Nitrogen as N		mg/L	0.1	---	<b>114</b>	---	<b>131</b>	<b>105</b>	---	<b>74.0</b>	---	---	<b>154</b>	---
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>														
Total Phosphorus as P		mg/L	0.01	---	<10.0	---	<10.0	<10.0	---	<10.0	---	---	<0.50	---
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>														
Reactive Phosphorus as P	14265-44-2	mg/L	0.01	---	<10.0	---	<10.0	<b>9.68</b>	---	<b>4.46</b>	---	---	<b>0.11</b>	---
<b>EN055: Ionic Balance</b>														
Total Anions		meq/L	0.01	---	<b>2390</b>	---	<b>2720</b>	<b>2330</b>	---	<b>1340</b>	---	---	<b>3190</b>	---
Total Cations		meq/L	0.01	---	<b>2250</b>	---	<b>2450</b>	<b>2770</b>	---	<b>1450</b>	---	---	<b>3400</b>	---
Ionic Balance		%	0.01	---	<b>3.04</b>	---	<b>5.25</b>	<b>8.64</b>	---	<b>3.91</b>	---	---	<b>3.23</b>	---
<b>EP002: Dissolved Organic Carbon (DOC)</b>														
Dissolved Organic Carbon		mg/L	1	---	<b>444</b>	---	<b>404</b>	<b>373</b>	---	<b>357</b>	---	---	<b>340</b>	---
<b>EP005: Total Organic Carbon (TOC)</b>														
Total Organic Carbon		mg/L	1	---	<b>446</b>	---	<b>198</b>	<b>390</b>	---	<b>359</b>	---	---	<b>365</b>	---
<b>EP010: Formaldehyde</b>														
Formaldehyde	50-00-0	mg/L	0.1	---	<b>16.4</b>	---	<b>24.0</b>	<b>21.0</b>	---	<b>18.2</b>	---	---	<b>43.2</b>	---
<b>EP025: Oxygen - Dissolved (DO)</b>														
Dissolved Oxygen		mg/L	0.1	---	<b>5.5</b>	---	<b>5.6</b>	<b>5.2</b>	---	<b>5.1</b>	---	---	<b>5.5</b>	---

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix:	WATER	Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
Workgroup:	RGES2300511	ALS Sample number:	ES2304170001	ES2303978001	ES2305255001	ES2305108001	ES2306797001	ES2307100001	ES2306795001	ES2307098001	ES2307097001	ES2308730001	ES2308922001	
Project name/number:		Sample date:	7-Feb-23	8-Feb-23	14-Feb-23	14-Feb-23	21-Feb-23	21-Feb-23	23-Feb-23	23-Feb-23	28-Feb-23	7-Mar-23	7-Mar-23	
		Sample time:	07:30	07:30	13:30	12:00	12:00	13:30	07:45	09:15	13:45	13:30	13:30	
			Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Hydrera Tank	Carp_3H_Hydrera Tank	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	
Analyte grouping/Analyte	CAS Number	Units	LOR											
<b>EP075(SIM)A: Phenolic Compounds</b>														
Phenol	108-95-2	µg/L	1.0	---	2.5	---	2.2	2.2	---	5.4	---	---	1.7	---
2-Chlorophenol	95-57-8	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
2-Methylphenol	95-48-7	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	2.0	---	---	<1.0	---
3- & 4-Methylphenol	1319-77-3	µg/L	2.0	---	4.5	---	3.7	3.3	---	101	---	---	<2.0	---
2-Nitrophenol	88-75-5	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
2,4-Dimethylphenol	105-67-9	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
2,4-Dichlorophenol	120-83-2	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
2,6-Dichlorophenol	87-65-0	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
4-Chloro-3-methylphenol	59-50-7	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
2,4,6-Trichlorophenol	88-06-2	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
2,4,5-Trichlorophenol	95-95-4	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Pentachlorophenol	87-86-5	µg/L	2.0	---	<2.0	---	<2.0	<2.0	---	<2.0	---	---	<2.0	---
<b>EP075(SIM)B: Polynuclear Aromatic Hydrocarbons</b>														
Naphthalene	91-20-3	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Acenaphthylene	208-96-8	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Acenaphthene	83-32-9	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Fluorene	86-73-7	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Phenanthrene	85-01-8	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Anthracene	120-12-7	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Fluoranthene	206-44-0	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Pyrene	129-00-0	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Benz(a)anthracene	56-55-3	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Chrysene	218-01-9	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Benzo(b+j)fluoranthene	205-99-2	205-82-3	µg/L	1.0	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Benzo(k)fluoranthene	207-08-9	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Benzo(a)pyrene	50-32-8	µg/L	0.5	---	<0.5	---	<0.5	<0.5	---	<0.5	---	---	<0.5	---
3-Methylcholanthrene	56-49-5	µg/L	1.0	---	---	---	---	<1.0	---	<1.0	---	---	---	---
Indeno(1.2.3.cd)pyrene	193-39-5	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
7,12-Dimethylbenz(a)anthracene	57-97-6	µg/L	1.0	---	---	---	---	<1.0	---	<1.0	---	---	---	---
Dibenz(a,h)anthracene	53-70-3	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Benzo(g,h,i)perylene	191-24-2	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	---	---	<1.0	---
Sum of polycyclic aromatic hydrocarbons		µg/L	0.5	---	<0.5	---	<0.5	<0.5	---	<0.5	---	---	<0.5	---
Benzo(a)pyrene TEQ (zero)		µg/L	0.5	---	<0.5	---	<0.5	<0.5	---	<0.5	---	---	<0.5	---
<b>EP080/071: Total Petroleum Hydrocarbons</b>														
C6 - C9 Fraction		µg/L	20	---	30	---	<100	<100	---	580	---	---	<20	---
C10 - C14 Fraction		µg/L	50	---	<50	---	<50	<50	---	570	---	---	<50	---
C15 - C28 Fraction		µg/L	100	---	<100	---	<100	<100	---	740	---	---	<100	---
C29 - C36 Fraction		µg/L	50	---	<50	---	<50	<50	---	100	---	---	<50	---
C10 - C36 Fraction (sum)		µg/L	50	---	<50	---	<50	<50	---	1410	---	---	<50	---
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>														
C6 - C10 Fraction	C6_C10	µg/L	20	---	40	---	<100	<100	---	570	---	---	<20	---
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	µg/L	20	---	<20	---	<100	<100	---	570	---	---	<20	---
>C10 - C16 Fraction		µg/L	100	---	<100	---	<100	<100	---	690	---	---	<100	---
>C16 - C34 Fraction		µg/L	100	---	<100	---	<100	<100	---	620	---	---	<100	---
>C34 - C40 Fraction		µg/L	100	---	<100	---	<100	<100	---	<100	---	---	<100	---
>C10 - C40 Fraction (sum)		µg/L	100	---	<100	---	<100	<100	---	1310	---	---	<100	---
>C10 - C16 Fraction minus Naphthalene (F2)		µg/L	100	---	<100	---	<100	<100	---	690	---	---	<100	---
<b>EP080: BTEXN</b>														
Benzene	71-43-2	µg/L	1	---	11	---	9	14	---	2	---	---	6	---
Toluene	108-88-3	µg/L	2	---	10	---	7	10	---	<2	---	---	5	---
Ethylbenzene	100-41-4	µg/L	2	---	<2	---	<5	<5	---	<2	---	---	<2	---
meta- & para-Xylene	108-38-3	106-42-3	µg/L	2	---	<2	---	<5	---	<2	---	---	<2	---
ortho-Xylene	95-47-6	µg/L	2	---	<2	---	<5	<5	---	<2	---	---	<2	---
Total Xylenes		µg/L	2	---	<2	---	<2	<2	---	<2	---	---	<2	---
Sum of BTEX		µg/L	1	---	21	---	16	24	---	2	---	---	11	---
Naphthalene	91-20-3	µg/L	5	---	<5	---	<5	<5	---	<5	---	---	<5	---
<b>EP132A: Phenolic Compounds</b>														
m-Cresol	108-39-4	µg/L	0.1	---	0.1	---	<0.1	0.2	---	0.4	---	---	0.2	---
p-Cresol	106-44-5	µg/L	0.1	---	1.1	---	1.4	3.1	---	167	---	---	0.2	---
Hexachlorophene	70-30-4	µg/L	0.1	---	<0.1	---	<0.1	<0.1	---	<0.1	---	---	<0.2	---
4-Nitrophenol	100-02-7	µg/L	0.1	---	<0.1	---	<0.1	<0.1	---	<0.1	---	---	<0.2	---
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L	0.1	---	---	---	---	---	---	---	---	---	---	---
<b>EP132B: Polynuclear Aromatic Hydrocarbons</b>														
3-Methylcholanthrene	56-49-5	µg/L	0.1	---	---	---	---	---	---	---	---	---	---	---
7,12-Dimethylbenz(a)anthracene	57-97-6	µg/L	0.1	---	---	---	---	---	---	---	---	---	---	---



**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix: WATER		Sample Type: REG												
Workgroup: RGES2300511		ALS Sample number:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	
Project name/number:		Sample date:	7-Feb-23	8-Feb-23	14-Feb-23	14-Feb-23	21-Feb-23	21-Feb-23	23-Feb-23	23-Feb-23	28-Feb-23	7-Mar-23	7-Mar-23	
		Sample time:	07:30	07:30	13:30	12:00	12:00	13:30	07:45	09:15	13:45	13:30	13:30	
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_3H_Hydrera Tank	Carp_3H_Hydrera Tank	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback
<b>EP247: Phenolics and Related Compounds</b>														
2,4-Dinitrophenol	51-28-5	µg/L	0.01	---	<0.01	---	<0.01	<0.01	---	<0.01	---	---	<0.01	---
2-Methyl-4.6-dinitrophenol	8071-51-0	µg/L	0.05	---	<0.05	---	<0.10	<0.05	---	<0.05	---	---	<0.05	---
Dinoseb	88-85-7	µg/L	0.10	---	<0.10	---	<0.10	<0.10	---	<0.10	---	---	<0.10	---
<b>EA250CA: Gross Alpha and Beta Activity</b>														
Gross alpha		Bq/L	0.05	<b>205</b>	---	<b>163</b>	---	---	<b>254</b>	---	<b>102</b>	<b>426</b>	---	<b>514</b>
Gross beta		Bq/L	0.10	---	---	---	---	---	---	---	---	---	---	---
<b>EP075(SIM): Phenolic Compound Surrogates</b>														
Phenol-d6	13127-88-3	%	1.0	---	43.7	---	29.6	27.4	---	37.8	---	---	30.2	---
2-Chlorophenol-D4	93951-73-6	%	1.0	---	69.7	---	50.3	34.1	---	47.6	---	---	51.2	---
2.4.6-Tribromophenol	118-79-6	%	1.0	---	85.5	---	64.9	37.8	---	60.9	---	---	72.1	---
<b>EP075(SIM): PAH Surrogates</b>														
2-Fluorobiphenyl	321-60-8	%	1.0	---	81.7	---	68.9	35.0	---	49.7	---	---	64.2	---
Anthracene-d10	1719-06-8	%	1.0	---	83.9	---	79.2	32.2	---	57.9	---	---	95.8	---
4-Terphenyl-d14	1718-51-0	%	1.0	---	84.7	---	85.3	40.5	---	61.7	---	---	88.9	---
<b>EP080S: TPH(V)/BTEX Surrogates</b>														
1.2-Dichloroethane-D4	17060-07-0	%	2	---	98.8	---	123	122	---	125	---	---	111	---
Toluene-D8	2037-26-5	%	2	---	130	---	110	105	---	126	---	---	90.6	---
4-Bromofluorobenzene	460-00-4	%	2	---	118	---	111	110	---	125	---	---	106	---
<b>EP132S: Acid Extractable Surrogates</b>														
2-Fluorophenol	367-12-4	%	0.1	---	50.2	---	43.3	56.2	---	62.0	---	---	68.5	---
Phenol-d6	13127-88-3	%	0.1	---	46.7	---	36.2	47.2	---	50.3	---	---	65.5	---
2-Chlorophenol-D4	93951-73-6	%	0.1	---	69.7	---	64.2	68.9	---	88.2	---	---	75.8	---
2.4.6-Tribromophenol	118-79-6	%	0.1	---	29.4	---	48.2	73.7	---	91.4	---	---	37.0	---
<b>EP132T: Base/Neutral Extractable Surrogates</b>														
2-Fluorobiphenyl	321-60-8	%	0.1	---	82.7	---	69.4	64.5	---	87.7	---	---	79.2	---
Anthracene-d10	1719-06-8	%	0.1	---	71.0	---	65.2	64.1	---	80.4	---	---	85.7	---
4-Terphenyl-d14	1718-51-0	%	0.1	---	81.2	---	71.5	68.9	---	79.7	---	---	84.8	---

Notes:  
 % = percent  
 µg/L = micrograms per litre  
 µS/cm = microSiemens per centimetre  
 Bq/L = Bequerel per litre  
 CAS = chemical abstract service  
 LOR = limit of reporting  
 mg/L = milligrams per litre

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix: WATER		Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	
Workgroup: RGE2300511		ALS Sample number:	ES2308731001	ES2308923001	ES2310436001	ES2310777001	ES2310778001	ES2310642001	ES2311274001	ES2310953001	ES2312909001	ES2312599001	ES2313741001	ES2313985001	
Project name/number:		Sample date:	14-Mar-23	14-Mar-23	21-Mar-23	21-Mar-23	03/28/2023	28-Mar-23	1-Apr-23	1-Apr-23	11-Apr-23	11-Apr-23	18-Apr-23	18-Apr-23	
		Sample time:	13:45	13:45	14:00	14:00	13:30	13:30	16:30	16:30	19:00	19:00	12:30	12:30	
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	
<b>EA005P: pH by PC Titrator</b>															
pH Value		pH Unit	0.01	6.43	---	5.76	---	---	5.70	---	5.66	---	6.35	6.36	---
<b>EA010P: Conductivity by PC Titrator</b>															
Electrical Conductivity @ 25°C		µS/cm	1	185000	---	175000	---	---	169000	---	175000	---	174000	153000	---
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C</b>															
Total Dissolved Solids @180°C		mg/L	10	223000	---	202000	---	---	202000	---	193000	---	196000	193000	---
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>															
Suspended Solids (SS)		mg/L	5	80	---	67	---	---	40	---	34	---	30	103	---
<b>EA250: Gross Alpha and Beta Activity</b>															
Gross beta		Bq/L	0.10	---	205	---	219	233	---	233	---	202	---	---	294
<b>ED009: Anions</b>															
Bromide	24959-67-9	mg/L	0.010	1770	---	1490	---	---	1460	---	202	---	1640	2130	---
<b>ED037P: Alkalinity by PC Titrator</b>															
Hydroxide Alkalinity as CaCO3	DMO-210-001	mg/L	1	<1	---	<1	---	---	<1	---	<1	---	<1	<1	---
Carbonate Alkalinity as CaCO3	3812-32-6	mg/L	1	<1	---	<1	---	---	<1	---	<1	---	<1	<1	---
Bicarbonate Alkalinity as CaCO3	71-52-3	mg/L	1	55	---	44	---	---	51	---	55	---	86	46	---
Total Alkalinity as CaCO3		mg/L	1	55	---	44	---	---	51	---	55	---	86	46	---
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>															
Sulfate as SO4 - Turbidimetric	14808-79-8	mg/L	1	<10	---	<10	---	---	<10	---	<50	---	<10	<100	---
<b>ED045G: Chloride by Discrete Analyser</b>															
Chloride	16887-00-6	mg/L	1	115000	---	103000	---	---	96200	---	118000	---	115000	123000	---
<b>ED093F: Dissolved Major Cations</b>															
Calcium	7440-70-2	mg/L	1	19900	---	21500	---	---	22300	---	19800	---	22700	22600	---
Magnesium	7439-95-4	mg/L	1	3830	---	3880	---	---	4010	---	3770	---	4270	3950	---
Sodium	7440-23-5	mg/L	1	43000	---	43800	---	---	45200	---	42200	---	49000	44200	---
Potassium	7440-09-7	mg/L	1	300	---	298	---	---	304	---	295	---	320	303	---
<b>ED093F: SAR and Hardness Calculations</b>															
Sodium Adsorption Ratio			0.01	73.1	---	72.2	---	---	73.2	---	72.0	---	78.2	71.3	---
<b>EG020F: Dissolved Metals by ICP-MS</b>															
Aluminium	7429-90-5	mg/L	0.01	<0.20	---	<0.20	---	---	<0.20	---	<0.20	---	<0.20	<0.10	---
Antimony	7440-36-0	mg/L	0.001	<0.020	---	<0.020	---	---	<0.020	---	<0.020	---	<0.020	<0.010	---
Arsenic	7440-38-2	mg/L	0.001	<0.020	---	<0.020	---	---	<0.020	---	<0.020	---	<0.020	<0.010	---
Beryllium	7440-41-7	mg/L	0.001	<0.020	---	<0.020	---	---	<0.020	---	<0.020	---	<0.020	<0.010	---
Barium	7440-39-3	mg/L	0.001	2720	---	2560	---	---	2520	---	2340	---	2240	2740	---
Cadmium	7440-43-9	mg/L	0.0001	<0.0020	---	<0.0020	---	---	<0.0020	---	<0.0020	---	<0.0020	<0.0010	---
Chromium	7440-47-3	mg/L	0.001	<0.020	---	<0.020	---	---	<0.020	---	<0.020	---	<0.020	<0.010	---
Cobalt	7440-48-4	mg/L	0.001	<0.020	---	<0.020	---	---	<0.020	---	<0.020	---	<0.020	<0.010	---
Copper	7440-50-8	mg/L	0.001	<0.020	---	<0.020	---	---	<0.020	---	<0.020	---	<0.020	<0.010	---
Lead	7439-92-1	mg/L	0.001	<0.020	---	<0.020	---	---	<0.020	---	<0.020	---	<0.020	<0.010	---
Lithium	7439-93-2	mg/L	0.001	32.3	---	37.3	---	---	38.7	---	32.4	---	34.9	34.2	---
Manganese	7439-96-5	mg/L	0.001	31.4	---	32.6	---	---	33.6	---	30.7	---	36.0	34.2	---
Molybdenum	7439-98-7	mg/L	0.001	<0.020	---	<0.020	---	---	<0.020	---	<0.020	---	<0.020	<0.010	---
Nickel	7440-02-0	mg/L	0.001	<0.020	---	0.022	---	---	<0.020	---	<0.020	---	<0.020	0.013	---
Selenium	7782-49-2	mg/L	0.01	<0.20	---	<0.20	---	---	<0.20	---	<0.20	---	<0.20	<0.10	---
Silver	7440-22-4	mg/L	0.001	<0.020	---	<0.020	---	---	<0.020	---	<0.020	---	<0.020	<0.010	---
Strontium	7440-24-6	mg/L	0.001	1610	---	1520	---	---	1500	---	1400	---	1820	1700	---
Thorium	7440-29-1	mg/L	0.001	<0.020	---	<0.020	---	---	<0.020	---	<0.020	---	<0.020	<0.010	---
Tin	7440-31-5	mg/L	0.001	<0.020	---	<0.020	---	---	<0.020	---	<0.020	---	<0.020	<0.010	---
Uranium	7440-61-1	mg/L	0.001	<0.020	---	<0.020	---	---	<0.020	---	<0.020	---	<0.020	<0.010	---
Vanadium	7440-62-2	mg/L	0.01	<0.20	---	<0.20	---	---	<0.20	---	<0.20	---	<0.20	<0.10	---
Zinc	7440-66-6	mg/L	0.005	1.08	---	1.38	---	---	1.46	---	1.03	---	1.29	1.20	---
Boron	7440-42-8	mg/L	0.05	9.53	---	9.89	---	---	9.90	---	9.10	---	10.2	9.62	---
Iron	7439-89-6	mg/L	0.05	138	---	161	---	---	126	---	153	---	164	128	---

Table A-1  
 Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data  
 McArthur Basin  
 Imperial

Matrix: WATER		Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
Workgroup: RGES2300511		ALS Sample number:	ES2308731001	ES2308923001	ES2310436001	ES2310777001	ES2310778001	ES2310642001	ES2311274001	ES2310953001	ES2312909001	ES2312599001	ES2313741001	ES2313985001
Project name/number:		Sample date:	14-Mar-23	14-Mar-23	21-Mar-23	21-Mar-23	03/28/2023	28-Mar-23	1-Apr-23	1-Apr-23	11-Apr-23	11-Apr-23	18-Apr-23	18-Apr-23
		Sample time:	13:45	13:45	14:00	14:00	13:30	13:30	16:30	16:30	19:00	19:00	12:30	12:30
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback
<b>EG020T: Total Metals by ICP-MS</b>														
Aluminium	7429-90-5	mg/L	0.01	<0.21	---	<0.21	---	---	<0.21	---	<0.21	---	0.35	<0.10
Antimony	7440-36-0	mg/L	0.001	<0.021	---	<0.021	---	---	<0.021	---	<0.021	---	<0.021	<0.010
Arsenic	7440-38-2	mg/L	0.001	<0.021	---	<0.021	---	---	<0.021	---	<0.021	---	<0.021	0.019
Beryllium	7440-41-7	mg/L	0.001	<0.021	---	<0.021	---	---	<0.021	---	<0.021	---	<0.021	<0.010
Barium	7440-39-3	mg/L	0.001	2490	---	2650	---	---	2660	---	2400	---	2380	2990
Cadmium	7440-43-9	mg/L	0.0001	<0.0021	---	<0.0021	---	---	<0.0021	---	<0.0021	---	<0.0021	<0.0010
Chromium	7440-47-3	mg/L	0.001	<0.021	---	<0.021	---	---	0.023	---	<0.021	---	<0.021	0.028
Cobalt	7440-48-4	mg/L	0.001	<0.021	---	<0.021	---	---	<0.021	---	<0.021	---	<0.021	<0.010
Copper	7440-50-8	mg/L	0.001	<0.021	---	<0.021	---	---	<0.021	---	<0.021	---	<0.021	<0.010
Lead	7439-92-1	mg/L	0.001	<0.021	---	<0.021	---	---	<0.021	---	<0.021	---	<0.021	<0.010
Lithium	7439-93-2	mg/L	0.001	35.3	---	39.2	---	---	37.8	---	33.7	---	34.5	39.3
Manganese	7439-96-5	mg/L	0.001	32.1	---	33.9	---	---	34.0	---	31.5	---	34.5	36.2
Molybdenum	7439-98-7	mg/L	0.001	<0.021	---	<0.021	---	---	<0.021	---	<0.021	---	<0.021	0.016
Nickel	7440-02-0	mg/L	0.001	<0.021	---	<0.021	---	---	<0.021	---	<0.021	---	0.024	0.011
Selenium	7782-49-2	mg/L	0.01	<0.21	---	<0.21	---	---	<0.21	---	<0.21	---	<0.21	<0.10
Silver	7440-22-4	mg/L	0.001	<0.021	---	<0.021	---	---	<0.021	---	<0.021	---	<0.021	<0.010
Strontium	7440-24-6	mg/L	0.001	1490	---	1560	---	---	1580	---	1620	---	1690	1800
Thorium	7440-29-1	mg/L	0.001	<0.021	---	<0.021	---	---	<0.021	---	<0.021	---	<0.021	<0.010
Tin	7440-31-5	mg/L	0.001	<0.021	---	<0.021	---	---	<0.021	---	<0.021	---	<0.021	<0.010
Uranium	7440-61-1	mg/L	0.001	<0.021	---	<0.021	---	---	<0.021	---	<0.021	---	<0.021	<0.010
Vanadium	7440-62-2	mg/L	0.01	<0.21	---	<0.21	---	---	<0.21	---	<0.21	---	<0.21	<0.10
Zinc	7440-66-6	mg/L	0.005	1.18	---	1.45	---	---	1.37	---	1.12	---	1.22	1.23
Boron	7440-42-8	mg/L	0.05	11.6	---	9.19	---	---	8.72	---	9.81	---	9.44	10.9
Iron	7439-89-6	mg/L	0.05	156	---	158	---	---	171	---	150	---	158	187
<b>EG032: Arsenic Speciation by LC-ICPMS</b>														
Arsenious Acid (As (III))		µg/L	0.5	---	<20.0	---	<8.0	<8.0	---	<400	---	<40.0	---	<40.0
Arsenic Acid (As (V))		µg/L	0.5	---	<20.0	---	<8.0	<8.0	---	<400	---	<40.0	---	<40.0
<b>EG035F: Dissolved Mercury by FIMS</b>														
Mercury	7439-97-6	mg/L	0.0001	<0.0001	---	<0.0001	---	---	<0.0001	---	<0.0010	---	<0.0001	<0.0001
<b>EG035T: Total Recoverable Mercury by FIMS</b>														
Mercury	7439-97-6	mg/L	0.0001	<0.0001	---	<0.0001	---	---	<0.0001	---	<0.0001	---	<0.0010	<0.0010
<b>EK010-1: Chlorine</b>														
Total Residual Chlorine		mg/L	0.02	<0.20	---	<0.20	---	---	<0.20	---	<0.40	---	<0.40	0.80
Free Chlorine		mg/L	0.02	<0.20	---	<0.20	---	---	<0.20	---	<0.40	---	<0.40	<0.40
<b>EK026SF: Total CN by Segmented Flow Analyser</b>														
Total Cyanide	57-12-5	mg/L	0.004	<0.004	---	<0.004	---	---	<0.004	---	<0.004	---	<0.004	<0.004
<b>EK040P: Fluoride by PC Titrator</b>														
Fluoride	16984-48-8	mg/L	0.1	0.6	---	0.4	---	---	0.4	---	1.1	---	0.3	0.7
<b>EK055G: Ammonia as N by Discrete Analyser</b>														
Ammonia as N	7664-41-7	mg/L	0.01	88.9	---	87.6	---	---	90.2	---	80.8	---	88.8	1.66
<b>EK057G: Nitrite as N by Discrete Analyser</b>														
Nitrite as N	14797-65-0	mg/L	0.01	<0.01	---	<0.10	---	---	<0.10	---	<0.50	---	<0.10	<0.10
<b>EK058G: Nitrate as N by Discrete Analyser</b>														
Nitrate as N	14797-55-8	mg/L	0.01	<0.01	---	<0.10	---	---	<0.10	---	<0.50	---	<0.10	<0.10
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>														
Nitrite + Nitrate as N		mg/L	0.01	<0.01	---	<0.01	---	---	<0.10	---	<0.50	---	<0.10	<0.10
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>														
Total Kjeldahl Nitrogen as N		mg/L	0.1	131	---	139	---	---	138	---	147	---	147	146
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>														
Total Nitrogen as N		mg/L	0.1	131	---	139	---	---	138	---	147	---	147	146
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>														
Total Phosphorus as P		mg/L	0.01	<0.50	---	<10.0	---	---	<10.0	---	1.59	---	<1.00	<20.0
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>														
Reactive Phosphorus as P	14265-44-2	mg/L	0.01	0.08	---	11.6	---	---	13.5	---	<0.01	---	<1.00	16.7
<b>EN055: Ionic Balance</b>														
Total Anions		meq/L	0.01	3240	---	2910	---	---	2710	---	3330	---	3240	3470
Total Cations		meq/L	0.01	3190	---	3300	---	---	3420	---	3140	---	3620	3380
Ionic Balance		%	0.01	0.91	---	6.42	---	---	11.4	---	2.91	---	5.50	1.28
<b>EP002: Dissolved Organic Carbon (DOC)</b>														
Dissolved Organic Carbon		mg/L	1	344	---	312	---	---	288	---	313	---	288	269
<b>EP005: Total Organic Carbon (TOC)</b>														
Total Organic Carbon		mg/L	1	333	---	305	---	---	284	---	318	---	287	259
<b>EP010: Formaldehyde</b>														
Formaldehyde	50-00-0	mg/L	0.1	45.4	---	27.2	---	---	24.8	---	31.9	---	32.5	31.0
<b>EP025: Oxygen - Dissolved (DO)</b>														
Dissolved Oxygen		mg/L	0.1	4.7	---	7.1	---	---	6.2	---	4.2	---	4.4	5.6

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix:	WATER	Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
Workgroup:	RGES2300511	ALS Sample number:	ES2308731001	ES2308923001	ES2310436001	ES2310777001	ES2310778001	ES2310642001	ES2311274001	ES2310953001	ES2312909001	ES2312599001	ES2313741001	ES2313985001
Project name/number:		Sample date:	14-Mar-23	14-Mar-23	21-Mar-23	21-Mar-23	03/28/2023	28-Mar-23	1-Apr-23	1-Apr-23	11-Apr-23	11-Apr-23	18-Apr-23	18-Apr-23
		Sample time:	13:45	13:45	14:00	14:00	13:30	13:30	16:30	16:30	19:00	19:00	12:30	12:30
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback
<b>EP075(SIM)A: Phenolic Compounds</b>														
Phenol	108-95-2	µg/L	1.0	1.3	---	1.2	---	---	3.5	---	3.0	---	3.5	1.0
2-Chlorophenol	95-57-8	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
2-Methylphenol	95-48-7	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
3- & 4-Methylphenol	1319-77-3	µg/L	2.0	<2.0	---	<2.0	---	---	<2.0	---	<2.0	---	<2.0	<2.0
2-Nitrophenol	88-75-5	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
2,4-Dimethylphenol	105-67-9	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
2,4-Dichlorophenol	120-83-2	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
2,6-Dichlorophenol	87-65-0	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
4-Chloro-3-methylphenol	59-50-7	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
2,4,6-Trichlorophenol	88-06-2	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
2,4,5-Trichlorophenol	95-95-4	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Pentachlorophenol	87-86-5	µg/L	2.0	<2.0	---	<2.0	---	---	<2.0	---	<2.0	---	<2.0	<2.0
<b>EP075(SIM)B: Polynuclear Aromatic Hydrocarbons</b>														
Naphthalene	91-20-3	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Acenaphthylene	208-96-8	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Acenaphthene	83-32-9	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Fluorene	86-73-7	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Phenanthrene	85-01-8	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Anthracene	120-12-7	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Fluoranthene	206-44-0	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Pyrene	129-00-0	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Benz(a)anthracene	56-55-3	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Chrysene	218-01-9	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Benzo(b+j)fluoranthene	205-99-2	205-82-3	µg/L	1.0	<1.0	---	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Benzo(a)pyrene	50-32-8	µg/L	0.5	<0.5	---	<0.5	---	---	<0.5	---	<0.5	---	<0.5	<0.5
3-Methylcholanthrene	56-49-5	µg/L	1.0	---	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Indeno(1.2.3.cd)pyrene	193-39-5	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
7.12-Dimethylbenz(a)anthracene	57-97-6	µg/L	1.0	---	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Dibenz(a,h)anthracene	53-70-3	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Benzo(g,h,i)perylene	191-24-2	µg/L	1.0	<1.0	---	<1.0	---	---	<1.0	---	<1.0	---	<1.0	<1.0
Sum of polycyclic aromatic hydrocarbons		µg/L	0.5	<0.5	---	<0.5	---	---	<0.5	---	<0.5	---	<0.5	<0.5
Benzo(a)pyrene TEQ (zero)		µg/L	0.5	<0.5	---	<0.5	---	---	<0.5	---	<0.5	---	<0.5	<0.5
<b>EP080/071: Total Petroleum Hydrocarbons</b>														
C6 - C9 Fraction		µg/L	20	<100	---	<20	---	---	70	---	<100	---	140	<20
C10 - C14 Fraction		µg/L	50	<50	---	<50	---	---	<50	---	<50	---	<50	<50
C15 - C28 Fraction		µg/L	100	<100	---	<100	---	---	<100	---	<100	---	<100	<100
C29 - C36 Fraction		µg/L	50	<50	---	<50	---	---	<50	---	<50	---	<50	<50
C10 - C36 Fraction (sum)		µg/L	50	<50	---	<50	---	---	<50	---	<50	---	<50	<50
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>														
C6 - C10 Fraction	C6_C10	µg/L	20	<100	---	<20	---	---	70	---	<100	---	140	<20
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	µg/L	20	<100	---	<20	---	---	30	---	<100	---	<100	<20
>C10 - C16 Fraction		µg/L	100	<100	---	<100	---	---	<100	---	<100	---	<100	<100
>C16 - C34 Fraction		µg/L	100	<100	---	<100	---	---	<100	---	<100	---	<100	<100
>C34 - C40 Fraction		µg/L	100	<100	---	<100	---	---	<100	---	<100	---	<100	<100
>C10 - C40 Fraction (sum)		µg/L	100	<100	---	<100	---	---	<100	---	<100	---	<100	<100
>C10 - C16 Fraction minus Naphthalene (F2)		µg/L	100	<100	---	<100	---	---	<100	---	<100	---	<100	<100
<b>EP080: BTEXN</b>														
Benzene	71-43-2	µg/L	1	5	---	3	---	---	22	---	19	---	27	3
Toluene	108-88-3	µg/L	2	<5	---	3	---	---	17	---	12	---	17	3
Ethylbenzene	100-41-4	µg/L	2	<5	---	<2	---	---	<2	---	<5	---	<5	<2
meta- & para-Xylene	108-38-3	106-42-3	µg/L	2	<5	---	<2	---	2	---	<5	---	<5	<2
ortho-Xylene	95-47-6	µg/L	2	<5	---	<2	---	---	<2	---	<5	---	<5	<2
Total Xylenes		µg/L	2	<2	---	<2	---	---	2	---	<2	---	<2	<2
Sum of BTEX		µg/L	1	5	---	6	---	---	41	---	31	---	44	6
Naphthalene	91-20-3	µg/L	5	<5	---	<5	---	---	<5	---	<5	---	<5	<5
<b>EP132A: Phenolic Compounds</b>														
m-Cresol	108-39-4	µg/L	0.1	0.1	---	0.3	---	---	4.5	---	0.1	---	0.1	<0.1
p-Cresol	106-44-5	µg/L	0.1	0.2	---	0.4	---	---	11.1	---	0.5	---	0.5	0.1
Hexachlorophene	70-30-4	µg/L	0.1	<0.1	---	<0.1	---	---	<0.1	---	<0.1	---	<0.1	<0.1
4-Nitrophenol	100-02-7	µg/L	0.1	<0.1	---	<0.1	---	---	<0.1	---	<0.1	---	<0.1	<0.1
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L	0.1	---	---	---	---	---	---	---	---	---	---	---
<b>EP132B: Polynuclear Aromatic Hydrocarbons</b>														
3-Methylcholanthrene	56-49-5	µg/L	0.1	---	---	---	---	---	---	---	---	---	---	---
7.12-Dimethylbenz(a)anthracene	57-97-6	µg/L	0.1	---	---	---	---	---	---	---	---	---	---	---



**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix: WATER		Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	
Workgroup: RGES2300511		ALS Sample number:	ES2308731001	ES2308923001	ES2310436001	ES2310777001	ES2310778001	ES2310642001	ES2311274001	ES2310953001	ES2312909001	ES2312599001	ES2313741001	ES2313985001	
Project name/number:		Sample date:	14-Mar-23	14-Mar-23	21-Mar-23	21-Mar-23	03/28/2023	28-Mar-23	1-Apr-23	1-Apr-23	11-Apr-23	11-Apr-23	18-Apr-23	18-Apr-23	
		Sample time:	13:45	13:45	14:00	14:00	13:30	13:30	16:30	16:30	19:00	19:00	12:30	12:30	
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_3H_Flowback	Carp_3H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback
<b>EP247: Phenolics and Related Compounds</b>															
2,4-Dinitrophenol	51-28-5	µg/L	0.01	<0.01	---	<0.01	---	---	<0.01	---	<0.01	---	<0.01	<0.01	---
2-Methyl-4.6-dinitrophenol	8071-51-0	µg/L	0.05	<0.05	---	<0.05	---	---	<0.05	---	<0.05	---	<0.05	<0.05	---
Dinoseb	88-85-7	µg/L	0.10	<0.10	---	<0.10	---	---	<0.10	---	<0.10	---	<0.10	<0.10	---
<b>EA250CA: Gross Alpha and Beta Activity</b>															
Gross alpha		Bq/L	0.05	---	522	---	536	579	---	558	---	534	---	---	669
Gross beta		Bq/L	0.10	---	---	---	---	---	---	---	---	---	---	---	---
<b>EP075(SIM): Phenolic Compound Surrogates</b>															
Phenol-d6	13127-88-3	%	1.0	21.4	---	29.3	---	---	36.0	---	24.4	---	29.4	28.3	---
2-Chlorophenol-D4	93951-73-6	%	1.0	52.5	---	40.2	---	---	50.8	---	53.6	---	42.0	35.8	---
2.4.6-Tribromophenol	118-79-6	%	1.0	61.4	---	49.7	---	---	64.0	---	66.1	---	52.4	74.5	---
<b>EP075(SIM): PAH Surrogates</b>															
2-Fluorobiphenyl	321-60-8	%	1.0	56.2	---	49.2	---	---	64.0	---	68.0	---	53.2	52.5	---
Anthracene-d10	1719-06-8	%	1.0	83.7	---	55.5	---	---	73.7	---	71.3	---	60.2	62.0	---
4-Terphenyl-d14	1718-51-0	%	1.0	75.2	---	61.9	---	---	72.2	---	76.5	---	61.3	59.2	---
<b>EP080S: TPH(V)/BTEX Surrogates</b>															
1.2-Dichloroethane-D4	17060-07-0	%	2	105	---	76.8	---	---	104	---	88.5	---	109	83.8	---
Toluene-D8	2037-26-5	%	2	104	---	95.7	---	---	102	---	95.4	---	110	96.2	---
4-Bromofluorobenzene	460-00-4	%	2	103	---	86.5	---	---	97.2	---	97.2	---	114	89.5	---
<b>EP132S: Acid Extractable Surrogates</b>															
2-Fluorophenol	367-12-4	%	0.1	62.8	---	60.9	---	---	65.3	---	48.3	---	57.0	49.4	---
Phenol-d6	13127-88-3	%	0.1	63.6	---	47.0	---	---	43.2	---	43.7	---	64.5	54.7	---
2-Chlorophenol-D4	93951-73-6	%	0.1	77.5	---	93.8	---	---	99.7	---	61.5	---	107	78.6	---
2.4.6-Tribromophenol	118-79-6	%	0.1	21.0	---	84.0	---	---	99.2	---	60.8	---	64.9	54.1	---
<b>EP132T: Base/Neutral Extractable Surrogates</b>															
2-Fluorobiphenyl	321-60-8	%	0.1	77.6	---	75.0	---	---	79.3	---	59.0	---	65.0	94.0	---
Anthracene-d10	1719-06-8	%	0.1	76.6	---	76.0	---	---	75.8	---	63.2	---	66.0	67.9	---
4-Terphenyl-d14	1718-51-0	%	0.1	84.1	---	79.4	---	---	77.0	---	63.9	---	64.6	77.0	---

Notes:  
 % = percent  
 µg/L = micrograms per litre  
 µS/cm = microSiemens per centimetre  
 Bq/L = Bequerel per litre  
 CAS = chemical abstract service  
 LOR = limit of reporting  
 mg/L = milligrams per litre

Table A-1  
 Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data  
 McArthur Basin  
 Imperial

Matrix:	WATER	Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	
Workgroup:	RGES2300511	ALS Sample number:	ES2313984001	ES2313740001	ES2316146001	ES2315987001	ES2315987001	ES2316152001	ES2315989001	ES2315989001	ES2327754001	ES2328038001	
Project name/number:		Sample date:	25-Apr-23	25-Apr-23	2-May-23	2-May-23	2-May-23	9-May-23	9-May-23	9-May-23	16-Aug-23	16-Aug-23	
		Sample time:	13:00	13:00	12:30	12:30	12:30	12:30	12:30	12:30	06:30	06:30	
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp3H_Frac_Flowback_EXT	Carp3H_Frac_Flowback_EXT	
<b>EA005P: pH by PC Titrator</b>													
pH Value		pH Unit	0.01	---	6.45	---	5.72	5.72	---	5.76	5.76	5.79	---
<b>EA010P: Conductivity by PC Titrator</b>													
Electrical Conductivity @ 25°C		µS/cm	1	---	153000	---	178000	178000	---	174000	174000	184000	---
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C</b>													
Total Dissolved Solids @180°C		mg/L	10	---	193000	---	188000	188000	---	187000	187000	194000	---
<b>EA025: Total Suspended Solids dried at 104 ± 2 °C</b>													
Suspended Solids (SS)		mg/L	5	---	65	---	76	76	---	84	84	91	---
<b>EA250: Gross Alpha and Beta Activity</b>													
Gross beta		Bq/L	0.10	279	---	95.8	---	---	106	---	---	---	190
<b>ED009: Anions</b>													
Bromide	24959-67-9	mg/L	0.010	---	1310	---	1480	1480	---	1420	1420	1360	---
<b>ED037P: Alkalinity by PC Titrator</b>													
Hydroxide Alkalinity as CaCO3	DMO-210-001	mg/L	1	---	<1	---	<1	<1	---	<1	<1	<1	---
Carbonate Alkalinity as CaCO3	3812-32-6	mg/L	1	---	<1	---	<1	<1	---	<1	<1	<1	---
Bicarbonate Alkalinity as CaCO3	71-52-3	mg/L	1	---	52	---	48	48	---	47	47	62	---
Total Alkalinity as CaCO3		mg/L	1	---	52	---	48	48	---	47	47	62	---
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>													
Sulfate as SO4 - Turbidimetric	14808-79-8	mg/L	1	---	<100	---	<20	<20	---	<10	<10	<10	---
<b>ED045G: Chloride by Discrete Analyser</b>													
Chloride	16887-00-6	mg/L	1	---	134000	---	100000	100000	---	100000	100000	82000	---
<b>ED093F: Dissolved Major Cations</b>													
Calcium	7440-70-2	mg/L	1	---	21300	---	20200	20200	---	22200	22200	18400	---
Magnesium	7439-95-4	mg/L	1	---	3710	---	3440	3440	---	3780	3780	3320	---
Sodium	7440-23-5	mg/L	1	---	42300	---	42200	42200	---	45800	45800	39600	---
Potassium	7440-09-7	mg/L	1	---	287	---	239	239	---	260	260	276	---
<b>ED093F: SAR and Hardness Calculations</b>													
Sodium Adsorption Ratio			0.01	---	70.3	---	72.2	72.2	---	74.8	74.8	70.5	---
<b>EG020F: Dissolved Metals by ICP-MS</b>													
Aluminium	7429-90-5	mg/L	0.01	---	<0.10	---	<1.00	<1.00	---	<1.00	<1.00	<0.10	---
Antimony	7440-36-0	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	<0.010	---
Arsenic	7440-38-2	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	<0.010	---
Beryllium	7440-41-7	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	<0.010	---
Barium	7440-39-3	mg/L	0.001	---	2750	---	3340	3340	---	3600	3600	3000	---
Cadmium	7440-43-9	mg/L	0.0001	---	<0.0010	---	<0.0100	<0.0100	---	<0.0100	<0.0100	<0.0010	---
Chromium	7440-47-3	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	<0.010	---
Cobalt	7440-48-4	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	<0.010	---
Copper	7440-50-8	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	0.070	---
Lead	7439-92-1	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	0.010	---
Lithium	7439-93-2	mg/L	0.001	---	36.5	---	42.6	42.6	---	47.8	47.8	35.6	---
Manganese	7439-96-5	mg/L	0.001	---	33.7	---	36.2	36.2	---	40.0	40.0	39.0	---
Molybdenum	7439-98-7	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	<0.010	---
Nickel	7440-02-0	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	0.035	---
Selenium	7782-49-2	mg/L	0.01	---	<0.10	---	<1.00	<1.00	---	<1.00	<1.00	<0.10	---
Silver	7440-22-4	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	<0.010	---
Strontium	7440-24-6	mg/L	0.001	---	1660	---	1860	1860	---	2040	2040	1890	---
Thorium	7440-29-1	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	<0.010	---
Tin	7440-31-5	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	<0.010	---
Uranium	7440-61-1	mg/L	0.001	---	<0.010	---	<0.100	<0.100	---	<0.100	<0.100	<0.010	---
Vanadium	7440-62-2	mg/L	0.01	---	<0.10	---	<1.00	<1.00	---	<1.00	<1.00	<0.10	---
Zinc	7440-66-6	mg/L	0.005	---	1.09	---	1.31	1.31	---	1.47	1.47	1.10	---
Boron	7440-42-8	mg/L	0.05	---	9.86	---	7.50	7.50	---	8.95	8.95	13.4	---
Iron	7439-89-6	mg/L	0.05	---	117	---	135	135	---	144	144	93.0	---

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix:	WATER	Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
Workgroup:	RGES2300511	ALS Sample number:	ES2313984001	ES2313740001	ES2316146001	ES2315987001	ES2315987001	ES2316152001	ES2315989001	ES2315989001	ES2327754001	ES2328038001
Project name/number:		Sample date:	25-Apr-23	25-Apr-23	2-May-23	2-May-23	2-May-23	9-May-23	9-May-23	9-May-23	16-Aug-23	16-Aug-23
		Sample time:	13:00	13:00	12:30	12:30	12:30	12:30	12:30	12:30	06:30	06:30
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp3H_Frac_Flowback_EXT	Carp3H_Frac_Flowback_EXT
<b>EG020T: Total Metals by ICP-MS</b>												
Aluminium	7429-90-5	mg/L	0.01	---	<0.10	---	<1.05	<1.05	---	<1.05	<1.05	0.15
Antimony	7440-36-0	mg/L	0.001	---	<0.010	---	<0.105	<0.105	---	<0.105	<0.105	<0.010
Arsenic	7440-38-2	mg/L	0.001	---	<0.010	---	<0.105	<0.105	---	<0.105	<0.105	0.012
Beryllium	7440-41-7	mg/L	0.001	---	<0.010	---	<0.105	<0.105	---	<0.105	<0.105	<0.010
Barium	7440-39-3	mg/L	0.001	---	3020	---	3490	3490	---	3960	3960	3160
Cadmium	7440-43-9	mg/L	0.0001	---	<0.0010	---	<0.0105	<0.0105	---	<0.0105	<0.0105	<0.0010
Chromium	7440-47-3	mg/L	0.001	---	0.016	---	<0.105	<0.105	---	<0.105	<0.105	0.052
Cobalt	7440-48-4	mg/L	0.001	---	<0.010	---	<0.105	<0.105	---	<0.105	<0.105	<0.010
Copper	7440-50-8	mg/L	0.001	---	<0.010	---	<0.105	<0.105	---	<0.105	<0.105	0.076
Lead	7439-92-1	mg/L	0.001	---	<0.010	---	<0.105	<0.105	---	<0.105	<0.105	0.021
Lithium	7439-93-2	mg/L	0.001	---	39.4	---	35.5	35.5	---	41.2	41.2	38.6
Manganese	7439-96-5	mg/L	0.001	---	36.4	---	31.8	31.8	---	36.2	36.2	43.0
Molybdenum	7439-98-7	mg/L	0.001	---	0.011	---	<0.105	<0.105	---	<0.105	<0.105	0.015
Nickel	7440-02-0	mg/L	0.001	---	<0.010	---	<0.105	<0.105	---	<0.105	<0.105	0.056
Selenium	7782-49-2	mg/L	0.01	---	<0.10	---	<1.05	<1.05	---	<1.05	<1.05	<0.10
Silver	7440-22-4	mg/L	0.001	---	<0.010	---	<0.105	<0.105	---	<0.105	<0.105	0.061
Strontium	7440-24-6	mg/L	0.001	---	1830	---	1940	1940	---	2220	2220	2130
Thorium	7440-29-1	mg/L	0.001	---	<0.010	---	<0.105	<0.105	---	<0.105	<0.105	<0.010
Tin	7440-31-5	mg/L	0.001	---	<0.010	---	<0.105	<0.105	---	<0.105	<0.105	<0.010
Uranium	7440-61-1	mg/L	0.001	---	<0.010	---	<0.105	<0.105	---	<0.105	<0.105	<0.010
Vanadium	7440-62-2	mg/L	0.01	---	<0.10	---	<1.05	<1.05	---	<1.05	<1.05	<0.10
Zinc	7440-66-6	mg/L	0.005	---	1.24	---	1.30	1.30	---	1.57	1.57	2.09
Boron	7440-42-8	mg/L	0.05	---	10.4	---	8.68	8.68	---	10.2	10.2	13.2
Iron	7439-89-6	mg/L	0.05	---	172	---	140	140	---	148	148	143
<b>EG032: Arsenic Speciation by LC-ICPMS</b>												
Arsenious Acid (As (III))		µg/L	0.5	<40.0	---	<40.0	---	---	<40.0	---	---	<40.0
Arsenic Acid (As (V))		µg/L	0.5	<40.0	---	<40.0	---	---	<40.0	---	---	<40.0
<b>EG035F: Dissolved Mercury by FIMS</b>												
Mercury	7439-97-6	mg/L	0.0001	---	<0.0010	---	<0.0001	<0.0001	---	<0.0001	<0.0001	<0.0001
<b>EG035T: Total Recoverable Mercury by FIMS</b>												
Mercury	7439-97-6	mg/L	0.0001	---	<0.0001	---	<0.0001	<0.0001	---	<0.0001	<0.0001	<0.0001
<b>EK010-1: Chlorine</b>												
Total Residual Chlorine		mg/L	0.02	---	0.80	---	<0.40	<0.40	---	<0.40	<0.40	<0.02
Free Chlorine		mg/L	0.02	---	<0.40	---	<0.40	<0.40	---	<0.40	<0.40	<0.02
<b>EK026SF: Total CN by Segmented Flow Analyser</b>												
Total Cyanide	57-12-5	mg/L	0.004	---	<0.004	---	<0.004	<0.004	---	<0.004	<0.004	<0.004
<b>EK040P: Fluoride by PC Titrator</b>												
Fluoride	16984-48-8	mg/L	0.1	---	0.7	---	0.4	0.4	---	0.5	0.5	0.5
<b>EK055G: Ammonia as N by Discrete Analyser</b>												
Ammonia as N	7664-41-7	mg/L	0.01	---	1.21	---	101	101	---	84.5	84.5	94.8
<b>EK057G: Nitrite as N by Discrete Analyser</b>												
Nitrite as N	14797-65-0	mg/L	0.01	---	<0.10	---	<0.01	<0.01	---	<0.01	<0.01	<0.10
<b>EK058G: Nitrate as N by Discrete Analyser</b>												
Nitrate as N	14797-55-8	mg/L	0.01	---	<0.10	---	<0.01	<0.01	---	<0.01	<0.01	<0.10
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>												
Nitrite + Nitrate as N		mg/L	0.01	---	<0.10	---	<0.01	<0.01	---	<0.01	<0.01	<0.10
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>												
Total Kjeldahl Nitrogen as N		mg/L	0.1	---	146	---	128	128	---	125	125	119
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>												
Total Nitrogen as N		mg/L	0.1	---	146	---	128	128	---	125	125	119
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>												
Total Phosphorus as P		mg/L	0.01	---	<20.0	---	<20.0	<20.0	---	<20.0	<20.0	<10.0
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>												
Reactive Phosphorus as P	14265-44-2	mg/L	0.01	---	16.2	---	14.2	14.2	---	13.4	13.4	5.23
<b>EN055: Ionic Balance</b>												
Total Anions		meq/L	0.01	---	3780	---	2820	2820	---	2820	2820	2310
Total Cations		meq/L	0.01	---	3220	---	3130	3130	---	3420	3420	2920
Ionic Balance		%	0.01	---	8.08	---	5.22	5.22	---	9.55	9.55	11.6
<b>EP002: Dissolved Organic Carbon (DOC)</b>												
Dissolved Organic Carbon		mg/L	1	---	264	---	253	253	---	688	688	285
<b>EP005: Total Organic Carbon (TOC)</b>												
Total Organic Carbon		mg/L	1	---	274	---	258	258	---	683	683	294
<b>EP010: Formaldehyde</b>												
Formaldehyde	50-00-0	mg/L	0.1	---	42.7	---	45.7	45.7	---	60.2	60.2	38.0
<b>EP025: Oxygen - Dissolved (DO)</b>												
Dissolved Oxygen		mg/L	0.1	---	4.4	---	6.0	6.0	---	6.2	6.2	4.6

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix:	WATER	Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG
Workgroup:	RGES2300511	ALS Sample number:	ES2313984001	ES2313740001	ES2316146001	ES2315987001	ES2315987001	ES2316152001	ES2315989001	ES2315989001	ES2327754001	ES2328038001	
Project name/number:		Sample date:	25-Apr-23	25-Apr-23	2-May-23	2-May-23	2-May-23	9-May-23	9-May-23	9-May-23	16-Aug-23	16-Aug-23	
		Sample time:	13:00	13:00	12:30	12:30	12:30	12:30	12:30	12:30	06:30	06:30	
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp3H_Frac_Flowback_EXT	Carp3H_Frac_Flowback_EXT	
<b>EP075(SIM)A: Phenolic Compounds</b>													
Phenol	108-95-2	µg/L	1.0	---	1.2	---	1.4	1.4	---	<1.0	<1.0	1.3	---
2-Chlorophenol	95-57-8	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
2-Methylphenol	95-48-7	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
3- & 4-Methylphenol	1319-77-3	µg/L	2.0	---	<2.0	---	<2.0	<2.0	---	<2.0	<2.0	<2.0	---
2-Nitrophenol	88-75-5	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
2,4-Dimethylphenol	105-67-9	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
2,4-Dichlorophenol	120-83-2	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
2,6-Dichlorophenol	87-65-0	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
4-Chloro-3-methylphenol	59-50-7	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
2,4,6-Trichlorophenol	88-06-2	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
2,4,5-Trichlorophenol	95-95-4	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Pentachlorophenol	87-86-5	µg/L	2.0	---	<2.0	---	<2.0	<2.0	---	<2.0	<2.0	<2.0	---
<b>EP075(SIM)B: Polynuclear Aromatic Hydrocarbons</b>													
Naphthalene	91-20-3	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Acenaphthylene	208-96-8	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Acenaphthene	83-32-9	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Fluorene	86-73-7	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Phenanthrene	85-01-8	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Anthracene	120-12-7	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Fluoranthene	206-44-0	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Pyrene	129-00-0	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Benz(a)anthracene	56-55-3	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Chrysene	218-01-9	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Benzo(b+j)fluoranthene	205-99-2 205-82-3	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Benzo(k)fluoranthene	207-08-9	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Benzo(a)pyrene	50-32-8	µg/L	0.5	---	<0.5	---	<0.5	<0.5	---	<0.5	<0.5	<0.5	---
3-Methylcholanthrene	56-49-5	µg/L	1.0	---	---	---	<1.0	<1.0	---	---	<1.0	<1.0	---
Indeno(1.2.3.cd)pyrene	193-39-5	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
7,12-Dimethylbenz(a)anthracene	57-97-6	µg/L	1.0	---	---	---	<1.0	<1.0	---	---	<1.0	<1.0	---
Dibenz(a,h)anthracene	53-70-3	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Benzo(g,h,i)perylene	191-24-2	µg/L	1.0	---	<1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	---
Sum of polycyclic aromatic hydrocarbons		µg/L	0.5	---	<0.5	---	<0.5	<0.5	---	<0.5	<0.5	<0.5	---
Benzo(a)pyrene TEQ (zero)		µg/L	0.5	---	<0.5	---	<0.5	<0.5	---	<0.5	<0.5	<0.5	---
<b>EP080/071: Total Petroleum Hydrocarbons</b>													
C6 - C9 Fraction		µg/L	20	---	<20	---	<100	<100	---	20	20	<20	---
C10 - C14 Fraction		µg/L	50	---	<50	---	<50	<50	---	<50	<50	<50	---
C15 - C28 Fraction		µg/L	100	---	<100	---	<100	<100	---	<100	<100	<100	---
C29 - C36 Fraction		µg/L	50	---	<50	---	<50	<50	---	<50	<50	<50	---
C10 - C36 Fraction (sum)		µg/L	50	---	<50	---	<50	<50	---	<50	<50	<50	---
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>													
C6 - C10 Fraction	C6_C10	µg/L	20	---	<20	---	<100	<100	---	20	20	<20	---
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	µg/L	20	---	<20	---	<100	<100	---	<20	<20	<20	---
>C10 - C16 Fraction		µg/L	100	---	<100	---	<100	<100	---	<100	<100	<100	---
>C16 - C34 Fraction		µg/L	100	---	<100	---	<100	<100	---	<100	<100	<100	---
>C34 - C40 Fraction		µg/L	100	---	<100	---	<100	<100	---	<100	<100	<100	---
>C10 - C40 Fraction (sum)		µg/L	100	---	<100	---	<100	<100	---	<100	<100	<100	---
>C10 - C16 Fraction minus Naphthalene (F2)		µg/L	100	---	<100	---	<100	<100	---	<100	<100	<100	---
<b>EP080: BTEXN</b>													
Benzene	71-43-2	µg/L	1	---	4	---	7	7	---	5	5	8	---
Toluene	108-88-3	µg/L	2	---	3	---	5	5	---	4	4	7	---
Ethylbenzene	100-41-4	µg/L	2	---	<2	---	<5	<5	---	<2	<2	<2	---
meta- & para-Xylene	108-38-3 106-42-3	µg/L	2	---	<2	---	<5	<5	---	<2	<2	<2	---
ortho-Xylene	95-47-6	µg/L	2	---	<2	---	<5	<5	---	<2	<2	<2	---
Total Xylenes		µg/L	2	---	<2	---	<2	<2	---	<2	<2	<2	---
Sum of BTEX		µg/L	1	---	7	---	12	12	---	9	9	15	---
Naphthalene	91-20-3	µg/L	5	---	<5	---	9	9	---	<5	<5	<5	---
<b>EP132A: Phenolic Compounds</b>													
m-Cresol	108-39-4	µg/L	0.1	---	<0.1	---	<0.1	<0.1	---	<0.1	<0.1	<0.1	---
p-Cresol	106-44-5	µg/L	0.1	---	0.1	---	0.1	0.1	---	0.1	0.1	0.6	---
Hexachlorophene	70-30-4	µg/L	0.1	---	<0.1	---	<0.1	<0.1	---	<0.1	<0.1	<0.1	---
4-Nitrophenol	100-02-7	µg/L	0.1	---	<0.1	---	<0.1	<0.1	---	<0.1	<0.1	<0.1	---
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L	0.1	---	---	---	---	---	---	---	---	---	---
<b>EP132B: Polynuclear Aromatic Hydrocarbons</b>													
3-Methylcholanthrene	56-49-5	µg/L	0.1	---	---	---	---	---	---	---	---	<0.1	---
7,12-Dimethylbenz(a)anthracene	57-97-6	µg/L	0.1	---	---	---	---	---	---	---	---	<0.1	---

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix: WATER		Sample Type: REG												
Workgroup: RGES2300511		ALS Sample number:	REG	REG	REG	REG	REG	REG	REG	REG	REG	REG		
Project name/number:		Sample date:	25-Apr-23	25-Apr-23	2-May-23	2-May-23	2-May-23	9-May-23	9-May-23	9-May-23	16-Aug-23	16-Aug-23		
		Sample time:	13:00	13:00	12:30	12:30	12:30	12:30	12:30	12:30	06:30	06:30		
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback	Carp_2H_Flowback_EXT	Carp_2H_Flowback_EXT
<b>EP247: Phenolics and Related Compounds</b>														
2,4-Dinitrophenol	51-28-5	µg/L	0.01	---	<0.01	---	<0.01	<0.01	---	<0.01	<0.01	<0.01	<0.01	---
2-Methyl-4.6-dinitrophenol	8071-51-0	µg/L	0.05	---	<0.05	---	<0.05	<0.05	---	<0.05	<0.05	<0.05	<0.05	---
Dinoseb	88-85-7	µg/L	0.10	---	<0.10	---	<0.10	<0.10	---	<0.10	<0.10	<0.10	<0.10	---
<b>EA250CA: Gross Alpha and Beta Activity</b>														
Gross alpha		Bq/L	0.05	<b>647</b>	---	<b>334</b>	---	---	<b>352</b>	---	---	---	---	<b>458</b>
Gross beta		Bq/L	0.10	---	---	---	---	---	---	---	---	---	---	---
<b>EP075(SIM): Phenolic Compound Surrogates</b>														
Phenol-d6	13127-88-3	%	1.0	---	28.7	---	33.4	33.4	---	27.6	27.6	29.5	---	---
2-Chlorophenol-D4	93951-73-6	%	1.0	---	41.8	---	49.6	49.6	---	39.8	39.8	57.6	---	---
2.4.6-Tribromophenol	118-79-6	%	1.0	---	57.0	---	53.0	53.0	---	39.2	39.2	66.4	---	---
<b>EP075(SIM): PAH Surrogates</b>														
2-Fluorobiphenyl	321-60-8	%	1.0	---	56.0	---	51.4	51.4	---	39.8	39.8	57.6	---	---
Anthracene-d10	1719-06-8	%	1.0	---	57.6	---	67.4	67.4	---	52.9	52.9	79.2	---	---
4-Terphenyl-d14	1718-51-0	%	1.0	---	61.7	---	71.0	71.0	---	55.1	55.1	86.0	---	---
<b>EP080S: TPH(V)/BTEX Surrogates</b>														
1.2-Dichloroethane-D4	17060-07-0	%	2	---	79.3	---	111	111	---	96.8	96.8	107	---	---
Toluene-D8	2037-26-5	%	2	---	98.9	---	107	107	---	106	106	115	---	---
4-Bromofluorobenzene	460-00-4	%	2	---	94.1	---	101	101	---	88.2	88.2	120	---	---
<b>EP132S: Acid Extractable Surrogates</b>														
2-Fluorophenol	367-12-4	%	0.1	---	46.0	---	54.5	54.5	---	51.2	51.2	40.0	---	---
Phenol-d6	13127-88-3	%	0.1	---	49.9	---	50.1	50.1	---	47.5	47.5	42.1	---	---
2-Chlorophenol-D4	93951-73-6	%	0.1	---	68.8	---	70.4	70.4	---	70.3	70.3	67.4	---	---
2.4.6-Tribromophenol	118-79-6	%	0.1	---	57.4	---	26.8	26.8	---	29.9	29.9	23.2	---	---
<b>EP132T: Base/Neutral Extractable Surrogates</b>														
2-Fluorobiphenyl	321-60-8	%	0.1	---	77.8	---	104	104	---	105	105	75.8	---	---
Anthracene-d10	1719-06-8	%	0.1	---	59.9	---	44.0	44.0	---	75.1	75.1	68.7	---	---
4-Terphenyl-d14	1718-51-0	%	0.1	---	72.2	---	54.0	54.0	---	84.7	84.7	89.2	---	---

Notes:  
 % = percent  
 µg/L = micrograms per litre  
 µS/cm = microSiemens per centimetre  
 Bq/L = Bequerel per litre  
 CAS = chemical abstract service  
 LOR = limit of reporting  
 mg/L = milligrams per litre



**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix: WATER		Sample Type:		REG	REG	REG	REG	REG	REG	REG	REG
Workgroup: RGE2300511		ALS Sample number:		ES2329743001	ES2329563001	ES2331408001	ES2331660001	ES2333325001	ES2333323001	ES2334731001	ES2334732001
Project name/number:		Sample date:		31-Aug-23	31-Aug-23	12-Sep-23	12-Sep-23	19-Sep-23	26-Sep-23	3-Oct-23	5-Oct-23
		Sample time:		06:30	06:30	13:00	13:00	13:00	07:30	09:00	17:30
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp3H_Frac_Flowback_EXT	Carp3H_Frac_Flowback_EXT	Carpentaria 3H	Carpentaria 3H	Carpentaria 3H	Carpentaria 3H	Carpentaria 3H	Carp. 2-3 Tank
<b>EA005P: pH by PC Titrator</b>											
pH Value		pH Unit	0.01	---	5.90	5.87	---	5.87	5.94	5.75	5.92
<b>EA010P: Conductivity by PC Titrator</b>											
Electrical Conductivity @ 25°C		µS/cm	1	---	189000	181000	---	187000	188000	184000	144000
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C</b>											
Total Dissolved Solids @180°C		mg/L	10	---	213000	211000	---	198000	204000	195000	135000
<b>EA025: Total Suspended Solids dried at 104 ± 2 °C</b>											
Suspended Solids (SS)		mg/L	5	---	71	83	---	72	85	148	26
<b>EA250: Gross Alpha and Beta Activity</b>											
Gross beta		Bq/L	0.10	292	---	---	---	---	---	---	---
<b>ED009: Anions</b>											
Bromide	24959-67-9	mg/L	0.010	---	1300	662	---	1460	1280	1450	806
<b>ED037P: Alkalinity by PC Titrator</b>											
Hydroxide Alkalinity as CaCO3	DMO-210-001	mg/L	1	---	<1	<1	---	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	mg/L	1	---	<1	<1	---	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	mg/L	1	---	64	60	---	53	60	64	152
Total Alkalinity as CaCO3		mg/L	1	---	64	60	---	53	60	64	152
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>											
Sulfate as SO4 - Turbidimetric	14808-79-8	mg/L	1	---	<10	<20	---	<1	<1	<100	<100
<b>ED045G: Chloride by Discrete Analyser</b>											
Chloride	16887-00-6	mg/L	1	---	105000	103000	---	120000	132000	129000	84400
<b>ED093F: Dissolved Major Cations</b>											
Calcium	7440-70-2	mg/L	1	---	20500	18400	---	20600	21600	21200	14200
Magnesium	7439-95-4	mg/L	1	---	3970	3820	---	3910	4130	4050	2430
Sodium	7440-23-5	mg/L	1	---	47100	46700	---	45700	48300	47400	33800
Potassium	7440-09-7	mg/L	1	---	323	295	---	326	336	323	231
<b>ED093F: SAR and Hardness Calculations</b>											
Sodium Adsorption Ratio			0.01	---	78.8	81.8	---	76.5	78.9	78.1	69.0
<b>EG020F: Dissolved Metals by ICP-MS</b>											
Aluminium	7429-90-5	mg/L	0.01	---	<0.10	<1.00	---	<0.10	<0.10	<0.10	<0.10
Antimony	7440-36-0	mg/L	0.001	---	<0.010	<0.100	---	<0.010	<0.010	<0.010	<0.010
Arsenic	7440-38-2	mg/L	0.001	---	<0.010	<0.100	---	<0.010	<0.010	<0.010	<0.010
Beryllium	7440-41-7	mg/L	0.001	---	<0.010	<0.100	---	<0.010	<0.010	<0.010	<0.010
Barium	7440-39-3	mg/L	0.001	---	2820	2960	---	2910	3130	2960	1500
Cadmium	7440-43-9	mg/L	0.0001	---	<0.0010	<0.0100	---	<0.0010	<0.0010	<0.0010	<0.0010
Chromium	7440-47-3	mg/L	0.001	---	<0.010	<0.100	---	0.014	0.018	0.014	<0.010
Cobalt	7440-48-4	mg/L	0.001	---	<0.010	<0.100	---	<0.010	<0.010	<0.010	<0.010
Copper	7440-50-8	mg/L	0.001	---	<0.010	<0.100	---	<0.010	<0.010	<0.010	0.028
Lead	7439-92-1	mg/L	0.001	---	<0.010	<0.100	---	<0.010	<0.010	<0.010	<0.010
Lithium	7439-93-2	mg/L	0.001	---	35.0	45.7	---	36.2	36.4	37.8	26.7
Manganese	7439-96-5	mg/L	0.001	---	40.2	43.7	---	39.0	41.4	39.8	25.7
Molybdenum	7439-98-7	mg/L	0.001	---	<0.010	<0.100	---	<0.010	<0.010	<0.010	<0.010
Nickel	7440-02-0	mg/L	0.001	---	<0.010	<0.100	---	0.015	0.016	0.013	0.024
Selenium	7782-49-2	mg/L	0.01	---	<0.10	<1.00	---	<0.10	<0.10	<0.10	<0.10
Silver	7440-22-4	mg/L	0.001	---	<0.010	<0.100	---	<0.010	<0.010	<0.010	<0.010
Strontium	7440-24-6	mg/L	0.001	---	1780	1910	---	1940	2020	1850	1020
Thorium	7440-29-1	mg/L	0.001	---	<0.010	<0.100	---	<0.010	<0.010	<0.010	<0.010
Tin	7440-31-5	mg/L	0.001	---	<0.010	<0.100	---	<0.010	<0.010	<0.010	<0.010
Uranium	7440-61-1	mg/L	0.001	---	<0.010	<0.100	---	<0.010	<0.010	<0.010	<0.010
Vanadium	7440-62-2	mg/L	0.01	---	<0.10	<1.00	---	<0.10	<0.10	<0.10	<0.10
Zinc	7440-66-6	mg/L	0.005	---	0.995	0.671	---	1.11	1.14	0.873	0.627
Boron	7440-42-8	mg/L	0.05	---	12.9	9.92	---	12.7	12.5	12.6	30.0
Iron	7439-89-6	mg/L	0.05	---	107	160	---	128	136	132	111

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Analyte grouping/Analyte	CAS Number	Units	LOR	Sample Type: REG									
				ALS Sample number:		REG	REG	REG	REG	REG	REG	REG	REG
				Sample date:		REG	REG	REG	REG	REG	REG	REG	REG
				Sample time:		REG	REG	REG	REG	REG	REG	REG	REG
Matrix: WATER	Workgroup: RGES2300511	Project name/number:		ES2329743001	ES2329563001	ES2331408001	ES2331660001	ES2333325001	ES2333323001	ES2334731001	ES2334732001		
				31-Aug-23	31-Aug-23	12-Sep-23	12-Sep-23	19-Sep-23	26-Sep-23	3-Oct-23	5-Oct-23		
				06:30	06:30	13:00	13:00	13:00	07:30	09:00	17:30		
				Carp3H_Frac_Flowback_EXT	Carp3H_Frac_Flowback_EXT	Carpentaria 3H	Carpentaria 3H	Carpentaria 3H	Carpentaria 3H	Carpentaria 3H	Carp. 2-3 Tank		
<b>EG020T: Total Metals by ICP-MS</b>													
Aluminium	7429-90-5	mg/L	0.01	---	<0.10	<1.05	---	0.11	<0.10	<0.10	<0.10		
Antimony	7440-36-0	mg/L	0.001	---	<0.010	<0.105	---	<0.010	<0.010	<0.010	<0.010		
Arsenic	7440-38-2	mg/L	0.001	---	<0.010	<0.105	---	0.014	0.011	0.011	0.014		
Beryllium	7440-41-7	mg/L	0.001	---	<0.010	<0.105	---	<0.010	<0.010	<0.010	<0.010		
Barium	7440-39-3	mg/L	0.001	---	2900	2980	---	3010	2940	2880	1540		
Cadmium	7440-43-9	mg/L	0.0001	---	<0.0010	<0.0105	---	<0.0010	<0.0010	<0.0010	<0.0010		
Chromium	7440-47-3	mg/L	0.001	---	0.011	<0.105	---	0.024	0.025	0.026	0.013		
Cobalt	7440-48-4	mg/L	0.001	---	<0.010	<0.105	---	<0.010	<0.010	<0.010	<0.010		
Copper	7440-50-8	mg/L	0.001	---	<0.010	<0.105	---	0.070	0.220	0.119	0.027		
Lead	7439-92-1	mg/L	0.001	---	<0.010	<0.105	---	0.015	0.024	<0.010	<0.010		
Lithium	7439-93-2	mg/L	0.001	---	50.2	46.4	---	39.6	35.4	44.2	30.9		
Manganese	7439-96-5	mg/L	0.001	---	47.6	42.9	---	40.4	38.6	45.4	25.8		
Molybdenum	7439-98-7	mg/L	0.001	---	<0.010	<0.105	---	<0.010	<0.010	0.011	0.015		
Nickel	7440-02-0	mg/L	0.001	---	<0.010	<0.105	---	0.020	0.042	0.020	0.028		
Selenium	7782-49-2	mg/L	0.01	---	<0.10	<1.05	---	<0.10	<0.10	<0.10	<0.10		
Silver	7440-22-4	mg/L	0.001	---	0.018	<0.105	---	<0.010	<0.010	0.018	<0.010		
Strontium	7440-24-6	mg/L	0.001	---	2050	1930	---	2030	1940	1910	1100		
Thorium	7440-29-1	mg/L	0.001	---	<0.010	<0.105	---	<0.010	<0.010	<0.010	<0.010		
Tin	7440-31-5	mg/L	0.001	---	<0.010	<0.105	---	<0.010	<0.010	<0.010	<0.010		
Uranium	7440-61-1	mg/L	0.001	---	<0.010	<0.105	---	<0.010	<0.010	<0.010	<0.010		
Vanadium	7440-62-2	mg/L	0.01	---	<0.10	<1.05	---	<0.10	<0.10	<0.10	<0.10		
Zinc	7440-66-6	mg/L	0.005	---	1.77	0.855	---	1.19	1.20	0.964	0.586		
Boron	7440-42-8	mg/L	0.05	---	16.8	10.1	---	13.9	12.1	14.0	36.3		
Iron	7439-89-6	mg/L	0.05	---	135	154	---	132	126	151	112		
<b>EG032: Arsenic Speciation by LC-ICPMS</b>													
Arsenious Acid (As (III))		µg/L	0.5	<10.0	---	---	<8.0	---	---	---	---		
Arsenic Acid (As (V))		µg/L	0.5	10.6	---	---	<8.0	---	---	---	---		
<b>EG035F: Dissolved Mercury by FIMS</b>													
Mercury	7439-97-6	mg/L	0.0001	---	<0.0001	<0.0001	---	<0.0001	<0.0001	<0.0001	<0.0001		
<b>EG035T: Total Recoverable Mercury by FIMS</b>													
Mercury	7439-97-6	mg/L	0.0001	---	<0.0001	<0.0001	---	<0.0001	<0.0001	<0.0001	<0.0001		
<b>EK010-1: Chlorine</b>													
Total Residual Chlorine		mg/L	0.02	---	<0.02	<0.02	---	<0.02	<0.02	<0.02	<0.02		
Free Chlorine		mg/L	0.02	---	<0.02	<0.02	---	<0.02	<0.02	<0.02	<0.02		
<b>EK026SF: Total CN by Segmented Flow Analyser</b>													
Total Cyanide	57-12-5	mg/L	0.004	---	<0.040	<0.004	---	<0.004	<0.004	<0.004	<0.004		
<b>EK040P: Fluoride by PC Titrator</b>													
Fluoride	16984-48-8	mg/L	0.1	---	0.4	0.4	---	0.4	0.4	0.4	0.7		
<b>EK055G: Ammonia as N by Discrete Analyser</b>													
Ammonia as N	7664-41-7	mg/L	0.01	---	89.1	94.9	---	91.1	86.3	87.4	79.3		
<b>EK057G: Nitrite as N by Discrete Analyser</b>													
Nitrite as N	14797-65-0	mg/L	0.01	---	<0.10	<0.01	---	<0.01	<0.01	<0.10	<0.10		
<b>EK058G: Nitrate as N by Discrete Analyser</b>													
Nitrate as N	14797-55-8	mg/L	0.01	---	<0.10	<0.01	---	<0.01	<0.01	<0.10	<0.10		
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>													
Nitrite + Nitrate as N		mg/L	0.01	---	<0.10	<0.01	---	<0.01	<0.01	<0.10	<0.10		
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>													
Total Kjeldahl Nitrogen as N		mg/L	0.1	---	124	97.4	---	110	113	136	126		
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>													
Total Nitrogen as N		mg/L	0.1	---	124	97.4	---	110	113	136	126		
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>													
Total Phosphorus as P		mg/L	0.01	---	<100	0.76	---	0.69	0.50	<1.00	<10.0		
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>													
Reactive Phosphorus as P	14265-44-2	mg/L	0.01	---	77.2	<0.01	---	<0.01	<0.01	<1.00	7.47		
<b>EN055: Ionic Balance</b>													
Total Anions		meq/L	0.01	---	2960	2910	---	3390	3720	3640	2380		
Total Cations		meq/L	0.01	---	3410	3270	---	3340	3530	3460	2380		
Ionic Balance		%	0.01	---	6.96	5.90	---	0.60	2.72	2.52	0.02		
<b>EP002: Dissolved Organic Carbon (DOC)</b>													
Dissolved Organic Carbon		mg/L	1	---	232	255	---	222	226	223	431		
<b>EP005: Total Organic Carbon (TOC)</b>													
Total Organic Carbon		mg/L	1	---	252	255	---	230	230	220	427		
<b>EP010: Formaldehyde</b>													
Formaldehyde	50-00-0	mg/L	0.1	---	28.8	31.5	---	31.8	24.0	34.8	27.0		
<b>EP025: Oxygen - Dissolved (DO)</b>													
Dissolved Oxygen		mg/L	0.1	---	4.4	5.7	---	6.6	6.3	6.5	5.1		

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix:	WATER	Sample Type:	REG	REG	REG	REG	REG	REG	REG	REG	REG
Workgroup:	RGES2300511	ALS Sample number:	ES2329743001	ES2329563001	ES2331408001	ES2331660001	ES2333325001	ES2333323001	ES2334731001	ES2334732001	ES2334732001
Project name/number:		Sample date:	31-Aug-23	31-Aug-23	12-Sep-23	12-Sep-23	19-Sep-23	26-Sep-23	3-Oct-23	5-Oct-23	
		Sample time:	06:30	06:30	13:00	13:00	13:00	07:30	09:00	17:30	
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp3H_Frac_Flowback_EXT	Carp3H_Frac_Flowback_EXT	Carpentaria 3H	Carpentaria 3H	Carpentaria 3H	Carpentaria 3H	Carpentaria 3H	Carp. 2-3 Tank
<b>EP075(SIM)A: Phenolic Compounds</b>											
Phenol	108-95-2	µg/L	1.0	---	1.5	1.8	---	1.2	1.4	<1.0	10.0
2-Chlorophenol	95-57-8	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
2-Methylphenol	95-48-7	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
3- & 4-Methylphenol	1319-77-3	µg/L	2.0	---	2.0	<2.0	---	<2.0	<2.0	<2.0	253
2-Nitrophenol	88-75-5	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	105-67-9	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
2,4-Dichlorophenol	120-83-2	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
2,6-Dichlorophenol	87-65-0	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
4-Chloro-3-methylphenol	59-50-7	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
2,4,6-Trichlorophenol	88-06-2	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
2,4,5-Trichlorophenol	95-95-4	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	87-86-5	µg/L	2.0	---	<2.0	<2.0	---	<2.0	<2.0	<2.0	<2.0
<b>EP075(SIM)B: Polynuclear Aromatic Hydrocarbons</b>											
Naphthalene	91-20-3	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Fluoranthene	206-44-0	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Chrysene	218-01-9	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Benzo(b+j)fluoranthene	205-99-2 205-82-3	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	µg/L	0.5	---	<0.5	<0.5	---	<0.5	<0.5	<0.5	<0.5
3-Methylcholanthrene	56-49-5	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Indeno(1.2.3.cd)pyrene	193-39-5	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
7,12-Dimethylbenz(a)anthracene	57-97-6	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Dibenz(a,h)anthracene	53-70-3	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Benzo(g,h,i)perylene	191-24-2	µg/L	1.0	---	<1.0	<1.0	---	<1.0	<1.0	<1.0	<1.0
Sum of polycyclic aromatic hydrocarbons		µg/L	0.5	---	<0.5	<0.5	---	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ (zero)		µg/L	0.5	---	<0.5	<0.5	---	<0.5	<0.5	<0.5	<0.5
<b>EP080/071: Total Petroleum Hydrocarbons</b>											
C6 - C9 Fraction		µg/L	20	---	<20	60	---	<100	<20	<100	<100
C10 - C14 Fraction		µg/L	50	---	<50	<50	---	<50	<50	<50	330
C15 - C28 Fraction		µg/L	100	---	<100	<100	---	<100	<100	<100	260
C29 - C36 Fraction		µg/L	50	---	<50	<50	---	<50	<50	<50	<50
C10 - C36 Fraction (sum)		µg/L	50	---	<50	<50	---	<50	<50	<50	590
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>											
C6 - C10 Fraction	C6_C10	µg/L	20	---	20	60	---	<100	<20	<100	<100
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	µg/L	20	---	<20	40	---	<100	<20	<100	<100
>C10 - C16 Fraction		µg/L	100	---	<100	<100	---	<100	<100	<100	510
>C16 - C34 Fraction		µg/L	100	---	<100	<100	---	<100	<100	<100	<100
>C34 - C40 Fraction		µg/L	100	---	<100	<100	---	<100	<100	<100	<100
>C10 - C40 Fraction (sum)		µg/L	100	---	<100	<100	---	<100	<100	<100	510
>C10 - C16 Fraction minus Naphthalene (F2)		µg/L	100	---	<100	<100	---	<100	<100	<100	510
<b>EP080: BTEXN</b>											
Benzene	71-43-2	µg/L	1	---	5	8	---	5	6	7	<5
Toluene	108-88-3	µg/L	2	---	4	7	---	<5	4	5	<5
Ethylbenzene	100-41-4	µg/L	2	---	<2	<2	---	<5	<2	<5	<5
meta- & para-Xylene	108-38-3 106-42-3	µg/L	2	---	<2	<2	---	<10	<2	<10	<10
ortho-Xylene	95-47-6	µg/L	2	---	<2	<2	---	<5	<2	<5	<5
Total Xylenes		µg/L	2	---	<2	<2	---	<2	<2	<2	<2
Sum of BTEX		µg/L	1	---	9	15	---	5	10	12	<2
Naphthalene	91-20-3	µg/L	5	---	<5	<5	---	<5	<5	7	<5
<b>EP132A: Phenolic Compounds</b>											
m-Cresol	108-39-4	µg/L	0.1	---	0.2	<0.1	---	0.1	0.2	<0.1	<0.1
p-Cresol	106-44-5	µg/L	0.1	---	2.9	<0.1	---	1.0	0.9	0.6	203
Hexachlorophene	70-30-4	µg/L	0.1	---	<0.1	<0.1	---	<0.1	<0.1	<0.1	<0.1
4-Nitrophenol	100-02-7	µg/L	0.1	---	<0.1	<0.1	---	<0.1	<0.1	<0.1	<0.1
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L	0.1	---	---	---	---	---	---	---	---
<b>EP132B: Polynuclear Aromatic Hydrocarbons</b>											
3-Methylcholanthrene	56-49-5	µg/L	0.1	---	---	---	---	---	---	---	---
7,12-Dimethylbenz(a)anthracene	57-97-6	µg/L	0.1	---	---	---	---	---	---	---	---

**Table A-1**  
**Carpentaria 2H and Carpentaria 3H Flowback Water Analytical Data**  
**McArthur Basin**  
**Imperial**

Matrix: WATER		Sample Type: REG		REG	REG	REG	REG	REG	REG	REG	REG
Workgroup: RGE52300511		ALS Sample number:	ES2329743001	ES2329563001	ES2331408001	ES2331660001	ES2333325001	ES2333323001	ES2334731001	ES2334732001	
Project name/number:		Sample date:	31-Aug-23	31-Aug-23	12-Sep-23	12-Sep-23	19-Sep-23	26-Sep-23	3-Oct-23	5-Oct-23	
		Sample time:	06:30	06:30	13:00	13:00	13:00	07:30	09:00	17:30	
Analyte grouping/Analyte	CAS Number	Units	LOR	Carp3H_Frac_Flowback_EXT	Carp3H_Frac_Flowback_EXT	Carpentaria 3H	Carpentaria 3H	Carpentaria 3H	Carpentaria 3H	Carpentaria 3H	Carp. 2-3 Tank
<b>EP247: Phenolics and Related Compounds</b>											
2,4-Dinitrophenol	51-28-5	µg/L	0.01	---	<0.01	<0.01	---	<0.01	<0.01	<0.01	<0.01
2-Methyl-4.6-dinitrophenol	8071-51-0	µg/L	0.05	---	<0.05	<0.05	---	<0.05	<0.05	<0.05	<0.05
Dinoseb	88-85-7	µg/L	0.10	---	<0.10	<0.10	---	<0.10	<0.10	<0.10	<0.10
<b>EA250CA: Gross Alpha and Beta Activity</b>											
Gross alpha		Bq/L	0.05	<b>614</b>	---	---	<b>659</b>	---	---	---	---
Gross beta		Bq/L	0.10	---	---	---	<b>312</b>	---	---	---	---
<b>EP075(SIM): Phenolic Compound Surrogates</b>											
Phenol-d6	13127-88-3	%	1.0	---	23.4	18.0	---	32.8	28.6	31.2	28.2
2-Chlorophenol-D4	93951-73-6	%	1.0	---	61.3	65.4	---	44.0	47.0	49.9	43.8
2.4.6-Tribromophenol	118-79-6	%	1.0	---	81.9	66.9	---	58.8	61.2	44.2	57.1
<b>EP075(SIM): PAH Surrogates</b>											
2-Fluorobiphenyl	321-60-8	%	1.0	---	73.6	63.6	---	60.1	51.2	67.1	58.6
Anthracene-d10	1719-06-8	%	1.0	---	88.5	59.7	---	57.5	57.2	67.4	63.9
4-Terphenyl-d14	1718-51-0	%	1.0	---	91.7	89.6	---	59.0	74.1	71.5	59.1
<b>EP080S: TPH(V)/BTEX Surrogates</b>											
1.2-Dichloroethane-D4	17060-07-0	%	2	---	129	127	---	94.3	93.2	105	115
Toluene-D8	2037-26-5	%	2	---	130	102	---	100	84.9	105	116
4-Bromofluorobenzene	460-00-4	%	2	---	131	106	---	113	75.8	119	130
<b>EP132S: Acid Extractable Surrogates</b>											
2-Fluorophenol	367-12-4	%	0.1	---	91.8	57.2	---	61.0	51.9	39.6	48.2
Phenol-d6	13127-88-3	%	0.1	---	82.0	50.9	---	58.5	49.5	33.4	38.2
2-Chlorophenol-D4	93951-73-6	%	0.1	---	99.4	72.6	---	76.7	67.8	53.2	65.6
2.4.6-Tribromophenol	118-79-6	%	0.1	---	110	50.5	---	60.5	52.0	25.5	47.5
<b>EP132T: Base/Neutral Extractable Surrogates</b>											
2-Fluorobiphenyl	321-60-8	%	0.1	---	95.3	90.1	---	75.3	61.4	57.4	78.4
Anthracene-d10	1719-06-8	%	0.1	---	98.4	68.8	---	65.7	58.8	58.5	73.4
4-Terphenyl-d14	1718-51-0	%	0.1	---	101	92.8	---	74.3	67.0	65.5	79.3

Notes:  
 % = percent  
 µg/L = micrograms per litre  
 µS/cm = microSiemens per centimetre  
 Bq/L = Bequerel per litre  
 CAS = chemical abstract service  
 LOR = limit of reporting  
 mg/L = milligrams per litre



## Attachment B Avian Risk Assessment – Carpentaria 2H and Carpentaria 3H Flowback Water

**Table B-1**  
**Tier 1 Avian Screening Assessment**  
**Carpentaria 2H and Carpentaria 3H Flowback Water**

Analyte grouping/Analyte	CAS Number	Units	LOR	Minimum Detected	Maximum Detected	Average Detected	Median Detected	Sample Count	Detection Frequency	Freshwater Trigger Value				Alternative SW 5	Reference
										by Protection Level (% Species)					
										99%	95%	90%	80%		
<b>EA005P: pH by PC Titrator</b>															
pH Value		pH Unit	0.01	5.11	7.04	6.098125	6.005	32	32 / 32	NC	NC	NC	NC		Screening Benchmark
<b>EA010P: Conductivity by PC Titrator</b>															
Electrical Conductivity @ 25°C		µS/cm	1	38100	258000	159212.5	174000	32	32 / 32	NC	NC	NC	NC		
<b>EA015: Total Dissolved Solids dried at 180 ± 5 °C</b>															
Total Dissolved Solids @180°C		mg/L	10	30600	223000	164021.9	188000	32	32 / 32	NC	NC	NC	NC		
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>															
Suspended Solids (SS)		mg/L	5	16	236	91.28125	81.5	32	32 / 32	NC	NC	NC	NC		
<b>EA250: Gross Alpha and Beta Activity</b>															
Gross beta		Bq/L	0.10	38.2	294	160.6909	160	23	22 / 23	NC	NC	NC	NC	0.5	d
<b>ED009: Anions</b>															
Bromide	24959-67-9	mg/L	0.010	95.5	2130	1081.891	1290	32	32 / 32	NC	NC	NC	NC		
<b>ED037P: Alkalinity by PC Titrator</b>															
Hydroxide Alkalinity as CaCO3	DMO-210-001	mg/L	1	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Carbonate Alkalinity as CaCO3	3812-32-6	mg/L	1	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Bicarbonate Alkalinity as CaCO3	71-52-3	mg/L	1	44	386	102.6563	64	32	32 / 32	NC	NC	NC	NC		
Total Alkalinity as CaCO3		mg/L	1	44	386	102.6563	64	32	32 / 32	NC	NC	NC	NC		
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>															
Sulfate as SO4 - Turbidimetric	14808-79-8	mg/L	1	150	150	150	150	32	1 / 32	NC	NC	NC	NC	2000	
<b>ED045G: Chloride by Discrete Analyser</b>															
Chloride	16887-00-6	mg/L	1	13300	134000	90468.75	98150	32	32 / 32	NC	NC	NC	NC	NC	
<b>ED093F: Dissolved Major Cations</b>															
Calcium	7440-70-2	mg/L	1	1330	22700	16344.38	19200	32	32 / 32	NC	NC	NC	NC		
Magnesium	7439-95-4	mg/L	1	294	4270	2997.969	3440	32	32 / 32	NC	NC	NC	NC	2000	a
Sodium	7440-23-5	mg/L	1	7070	49000	36488.13	42200	32	32 / 32	NC	NC	NC	NC	NC	
Potassium	7440-09-7	mg/L	1	76	336	248.5938	260	32	32 / 32	NC	NC	NC	NC	NC	
<b>ED093F: SAR and Hardness Calculations</b>															
Sodium Adsorption Ratio			0.01	39.6	81.8	68.625	72.1	32	32 / 32	NC	NC	NC	NC		
<b>EG020T: Total Metals by ICP-MS</b>															
Aluminium	7429-90-5	mg/L	0.01	0.11	0.92	0.354	0.24	32	5 / 32	0.027	0.055	0.08	0.15		
Antimony	7440-36-0	mg/L	0.001	0.014	0.048	0.024	0.017	32	4 / 32	NC	NC	NC	NC	0.009	h
Arsenic	7440-38-2	mg/L	0.001	0.011	0.077	0.021737	0.017	32	19 / 32	0.0008	0.013	0.042	0.14		
Beryllium	7440-41-7	mg/L	0.001	-	-	-	-	32	0 / 32	0.66	0.66	0.66	0.66		
Barium	7440-39-3	mg/L	0.001	13.4	3960	2161.544	2390	32	32 / 32	4	4	4	4		
Cadmium	7440-43-9	mg/L	0.0001	0.0016	0.0026	0.0021	0.0021	32	2 / 32	0.00006	0.0002	0.0004	0.0008		
Chromium	7440-47-3	mg/L	0.001	0.011	0.116	0.032636	0.0285	32	22 / 32	0.00001	0.001	0.006	0.04		
Cobalt	7440-48-4	mg/L	0.001	0.012	0.032	0.022	0.022	32	2 / 32	0.0014	0.0014	0.0014	0.0014		
Copper	7440-50-8	mg/L	0.001	0.027	0.22	0.090833	0.073	32	6 / 32	0.001	0.0014	0.0018	0.0025		
Lead	7439-92-1	mg/L	0.001	0.013	0.024	0.017833	0.017	32	6 / 32	1	3.4	5.6	9.4		
Lithium	7439-93-2	mg/L	0.001	5.6	50.2	31.69594	34.9	32	32 / 32	NC	NC	NC	NC	2.5	i
Manganese	7439-96-5	mg/L	0.001	4.04	47.6	28.76406	31.65	32	32 / 32	1200	1900	2500	3600		
Molybdenum	7439-98-7	mg/L	0.001	0.011	0.106	0.026125	0.0165	32	16 / 32	NC	NC	NC	NC		h
Nickel	7440-02-0	mg/L	0.001	0.011	0.111	0.04145	0.0345	32	20 / 32	0.008	0.011	0.013	0.017		
Selenium	7782-49-2	mg/L	0.01	-	-	-	-	32	0 / 32	5	11	18	34		
Silver	7440-22-4	mg/L	0.001	0.018	0.061	0.032333	0.018	32	3 / 32	0.00002	0.00005	0.0001	0.0002		
Strontium	7440-24-6	mg/L	0.001	59.9	2220	1386.216	1525	32	32 / 32	NC	NC	NC	NC	1500	d
Thorium	7440-29-1	mg/L	0.001	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Tin	7440-31-5	mg/L	0.001	-	-	-	-	32	0 / 32	73	73	73	73		
Uranium	7440-61-1	mg/L	0.001	-	-	-	-	32	0 / 32	NC	NC	NC	NC	0.00005	h
Vanadium	7440-62-2	mg/L	0.01	-	-	-	-	32	0 / 32	NC	NC	NC	NC	0.006	h
Zinc	7440-66-6	mg/L	0.005	0.206	2.09	1.063484	1.11	32	31 / 32	0.0024	0.008	0.015	0.031		
Boron	7440-42-8	mg/L	0.05	8.68	52.4	17.88188	13.85	32	32 / 32	0.34	0.94	1.5	2.5		
Iron	7439-89-6	mg/L	0.05	14.4	187	122.6594	133.5	32	32 / 32	300	300	300	300		



**Table B-1**  
**Tier 1 Avian Screening Assessment**  
**Carpentaria 2H and Carpentaria 3H Flowback Water**

Analyte grouping/Analyte	CAS Number	Units	LOR	Minimum Detected	Maximum Detected	Average Detected	Median Detected	Sample Count	Detection Frequency	Freshwater Trigger Value by Protection Level (% Species)				Alternative SW 5	Reference
										99%	95%	90%	80%		
										<b>EG032: Arsenic Speciation by LC-ICPMS</b>					
Arsenious Acid (As (III))		µg/L	0.5	4.9	50.1	18.3	11.95	24	10 / 24					NC	
Arsenic Acid (As (V))		µg/L	0.5	6.5	34	17.03333	10.6	24	3 / 24					NC	
<b>EG035F: Dissolved Mercury by FIMS</b>															
Mercury	7439-97-6	mg/L	0.0001	-	-	-	-	32	0 / 32	0.00006	0.0006	0.0019	0.0054		
<b>EG035T: Total Recoverable Mercury by FIMS</b>															
Mercury	7439-97-6	mg/L	0.0001	-	-	-	-	32	0 / 32	0.00006	0.0006	0.0019	0.0054		
<b>EK010-1: Chlorine</b>															
Total Residual Chlorine		mg/L	0.02	0.4	1	0.716667	0.8	32	6 / 32	0.0004	0.003	0.006	0.013		
Free Chlorine		mg/L	0.02	0.2	0.4	0.3	0.3	32	2 / 32						
<b>EK026SF: Total CN by Segmented Flow Analyser</b>															
Total Cyanide	57-12-5	mg/L	0.004	-	-	-	-	32	0 / 32	0.004	0.007	0.011	0.018		
<b>EK040P: Fluoride by PC Titrator</b>															
Fluoride	16984-48-8	mg/L	0.1	0.3	1.3	0.653125	0.6	32	32 / 32	1300	3100	4800	8200		
<b>EK055G: Ammonia as N by Discrete Analyser</b>															
Ammonia as N	7664-41-7	mg/L	0.01	1.21	101	69.16406	80.05	32	32 / 32	0.32	0.9	1.43	2.3	0.01	b
<b>EK057G: Nitrite as N by Discrete Analyser</b>															
Nitrite as N	14797-65-0	mg/L	0.01	0.03	0.03	0.03	0.03	32	1 / 32	NC	NC	NC	NC		
<b>EK058G: Nitrate as N by Discrete Analyser</b>															
Nitrate as N	14797-55-8	mg/L	0.01	0.02	0.19	0.072	0.03	32	5 / 32	NC	NC	NC	NC		
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>															
Nitrite + Nitrate as N		mg/L	0.01	0.02	0.19	0.078	0.05	32	5 / 32	NC	NC	NC	NC		
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>															
Total Kjeldahl Nitrogen as N		mg/L	0.1	66.5	155	123.0906	128	32	32 / 32	350	350	350	350		
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>															
Total Nitrogen as N		mg/L	0.1	66.5	155	123.1	128	32	32 / 32	NC	NC	NC	NC	0.35	b
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>															
Total Phosphorus as P		mg/L	0.01	0.5	2.19	1.17	1.12	32	11 / 32	NC	NC	NC	NC	0.01	b
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>															
Reactive Phosphorus as P	14265-44-2	mg/L	0.01	0.08	77.2	10.73864	7.55	32	22 / 32	NC	NC	NC	NC	NC	
<b>EN055: Ionic Balance</b>															
Total Anions		meq/L	0.01	386	3780	2553.344	2770	32	32 / 32	NC	NC	NC	NC		
Total Cations		meq/L	0.01	400	3620	2655.5	3130	32	32 / 32	NC	NC	NC	NC		
Ionic Balance		%	0.01	0.02	20.2	5.644063	5.235	32	32 / 32	NC	NC	NC	NC		
<b>EP002: Dissolved Organic Carbon (DOC)</b>															
Dissolved Organic Carbon		mg/L	1	222	783	406.9677	344	31	31 / 31	NC	NC	NC	NC		
<b>EP005: Total Organic Carbon (TOC)</b>															
Total Organic Carbon		mg/L	1	198	780	407.9688	346	32	32 / 32	NC	NC	NC	NC		
<b>EP010: Formaldehyde</b>															
Formaldehyde	50-00-0	mg/L	0.1	2.8	60.2	28.35	27.1	32	32 / 32	NC	NC	NC	NC	1610	c
<b>EP025: Oxygen - Dissolved (DO)</b>															
Dissolved Oxygen		mg/L	0.1	1.8	9.8	5.346875	5.45	32	32 / 32	NC	NC	NC	NC	>5	g
<b>EP075(SIM)A: Phenolic Compounds</b>															
Phenol	108-95-2	µg/L	1.0	1	10	2.462069	1.8	32	29 / 32	85	320	600	1200		1
2-Chlorophenol	95-57-8	µg/L	1.0	-	-	-	-	32	0 / 32	340	490	630	870		
2-Methylphenol	95-48-7	µg/L	1.0	2	2.7	2.35	2.35	32	2 / 32					NC	
3- & 4-Methylphenol	1319-77-3	µg/L	2.0	2	253	39.61	4.65	32	10 / 32	NC	NC	NC	NC	100	g
2-Nitrophenol	88-75-5	µg/L	1.0	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
2,4-Dimethylphenol	105-67-9	µg/L	1.0	-	-	-	-	32	0 / 32	NC	2	NC	NC	2	h
2,4-Dichlorophenol	120-83-2	µg/L	1.0	-	-	-	-	32	0 / 32	120	160	200	270		
2,6-Dichlorophenol	87-65-0	µg/L	1.0	-	-	-	-	32	0 / 32	NC	34	NC	NC	34	h
4-Chloro-3-methylphenol	59-50-7	µg/L	1.0	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
2,4,6-Trichlorophenol	88-06-2	µg/L	1.0	-	-	-	-	32	0 / 32	3	20	40	95		
2,4,5-Trichlorophenol	95-95-4	µg/L	1.0	-	-	-	-	32	0 / 32	NC	0.5	NC	NC		
Pentachlorophenol	87-86-5	µg/L	2.0	-	-	-	-	32	0 / 32	3.6	10	17	27		

**Table B-1**  
**Tier 1 Avian Screening Assessment**  
**Carpentaria 2H and Carpentaria 3H Flowback Water**

Analyte grouping/Analyte	CAS Number	Units	LOR	Minimum Detected	Maximum Detected	Average Detected	Median Detected	Sample Count	Detection Frequency	Freshwater Trigger Value				Alternative SW 5	Reference
										by Protection Level (% Species)					
										99%	95%	90%	80%		
<b>EP075(SIM)B: Polynuclear Aromatic Hydrocarbons</b>															
Naphthalene	91-20-3	µg/L	1.0	-	-	-	-	32	0 / 32	2.5	16	37	85		
Acenaphthylene	208-96-8	µg/L	1.0	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Acenaphthene	83-32-9	µg/L	1.0	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Fluorene	86-73-7	µg/L	1.0	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Phenanthrene	85-01-8	µg/L	1.0	-	-	-	-	32	0 / 32	0.6	2	4	8		
Anthracene	120-12-7	µg/L	1.0	-	-	-	-	32	0 / 32	0.01	0.4	1.5	7		
Fluoranthene	206-44-0	µg/L	1.0	-	-	-	-	32	0 / 32	1	1.4	1.7	2		
Pyrene	129-00-0	µg/L	1.0	-	-	-	-	32	0 / 32	0.025	0.025	0.025	0.025		
Benz(a)anthracene	56-55-3	µg/L	1.0	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Chrysene	218-01-9	µg/L	1.0	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Benzo(b+j)fluoranthene	205-99-2 205-82-3	µg/L	1.0	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Benzo(k)fluoranthene	207-08-9	µg/L	1.0	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Benzo(a)pyrene	50-32-8	µg/L	0.5	-	-	-	-	32	0 / 32	0.1	0.2	0.4	0.7		
3-Methylcholanthrene	56-49-5	µg/L	1.0	-	-	-	-	12	0 / 12	NC	NC	NC	NC		
Indeno(1.2.3.cd)pyrene	193-39-5	µg/L	1.0	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
7.12-Dimethylbenz(a)anthracene	57-97-6	µg/L	1.0	-	-	-	-	12	0 / 12	NC	NC	NC	NC		
Dibenz(a,h)anthracene	53-70-3	µg/L	1.0	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Benzo(g,h,i)perylene	191-24-2	µg/L	1.0	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Sum of polycyclic aromatic hydrocarbons		µg/L	0.5	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
Benzo(a)pyrene TEQ (zero)		µg/L	0.5	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
<b>EP080/071: Total Petroleum Hydrocarbons</b>															
C6 - C9 Fraction		µg/L	20	20	580	125.7143	70	32	14 / 32					NC	
C10 - C14 Fraction		µg/L	50	100	570	340	330	32	5 / 32					NC	
C15 - C28 Fraction		µg/L	100	160	8710	1763.333	355	32	6 / 32					NC	
C29 - C36 Fraction		µg/L	50	100	1360	730	730	32	2 / 32					NC	
C10 - C36 Fraction (sum)		µg/L	50	260	10400	2298.333	705	32	6 / 32					NC	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>															
C6 - C10 Fraction	C6_C10	µg/L	20	20	570	113.125	65	32	16 / 32	NC	NC	NC	NC		
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	µg/L	20	30	570	150	40	32	7 / 32	NC	NC	NC	NC	500	f
>C10 - C16 Fraction		µg/L	100	120	690	398.3333	440	32	6 / 32	NC	NC	NC	NC		
>C16 - C34 Fraction		µg/L	100	210	9030	2535	450	32	4 / 32	NC	NC	NC	NC	640	f
>C34 - C40 Fraction		µg/L	100	1010	1010	1010	1010	32	1 / 32					NC	
>C10 - C40 Fraction (sum)		µg/L	100	190	10500	2256.667	570	32	6 / 32	NC	NC	NC	NC		
>C10 - C16 Fraction minus Naphthalene (F2)		µg/L	100	120	690	398.3333	440	32	6 / 32	NC	NC	NC	NC	500	f
<b>EP080: BTEXN</b>															
Benzene	71-43-2	µg/L	1	2	98	14	7	32	30 / 32	600	950	1300	2000		
Toluene	108-88-3	µg/L	2	3	60	11.65385	6.5	32	26 / 32	110	180	230	330		
Ethylbenzene	100-41-4	µg/L	2	-	-	-	-	32	0 / 32	50	80	110	160		
meta- & para-Xylene	108-38-3 106-42-3	µg/L	2	2	8	5	5	32	6 / 32	50	75	100	150		
ortho-Xylene	95-47-6	µg/L	2	2	3	2.5	2.5	32	2 / 32	200	350	470	640		
Total Xylenes		µg/L	2	2	11	5.833333	5.5	32	6 / 32	NC	NC	NC	NC		
Sum of BTEX		µg/L	1	2	169	25.26667	12	32	30 / 32					NC	
Naphthalene	91-20-3	µg/L	5	7	9	8.333333	9	32	3 / 32	2.5	16	37	85		
<b>EP132A: Phenolic Compounds</b>															
m-Cresol	108-39-4	µg/L	0.1	0.1	4.5	0.5	0.2	30	16 / 30	NC	NC	NC	NC	200	g
p-Cresol	106-44-5	µg/L	0.1	0.1	203	16.58846	0.7	30	26 / 30	NC	NC	NC	NC	100	g
Hexachlorophene	70-30-4	µg/L	0.1	-	-	-	-	30	0 / 30	NC	NC	NC	NC		
4-Nitrophenol	100-02-7	µg/L	0.1	-	-	-	-	30	0 / 30	NC	58	NC	NC		
2,3,4,6-Tetrachlorophenol	58-90-2	µg/L	0.1	-	-	-	-	4	0 / 4	10	20	25	30		
<b>EP132B: Polynuclear Aromatic Hydrocarbons</b>															
3-Methylcholanthrene	56-49-5	µg/L	0.1	-	-	-	-	3	0 / 3	NC	NC	NC	NC		
7.12-Dimethylbenz(a)anthracene	57-97-6	µg/L	0.1	-	-	-	-	3	0 / 3	NC	NC	NC	NC		
<b>EP247: Phenolics and Related Compounds</b>															
2,4-Dinitrophenol	51-28-5	µg/L	0.01	-	-	-	-	32	0 / 32	13	45	80	140		

**Table B-1**  
**Tier 1 Avian Screening Assessment**  
**Carpentaria 2H and Carpentaria 3H Flowback Water**

Analyte grouping/Analyte	CAS Number	Units	LOR	Minimum Detected	Maximum Detected	Average Detected	Median Detected	Sample Count	Detection Frequency	Freshwater Trigger Value by Protection Level (% Species)				Alternative SW 5	Reference
										99%	95%	90%	80%		
										2-Methyl-4,6-dinitrophenol	8071-51-0	µg/L	0.05		
Dinoseb	88-85-7	µg/L	0.10	-	-	-	-	32	0 / 32	NC	NC	NC	NC		
<b>EA250CA: Gross Alpha and Beta Activity</b>															
Gross alpha		Bq/L	0.05	16.6	669	380.5435	426	24	23 / 24	NC	NC	NC	NC	0.5	
Gross beta		Bq/L	0.10	312	312	312	312	1	1 / 1	NC	NC	NC	NC	0.5	d

**Notes**

< less than limit of reporting  
°C = degrees Celsius  
µg/L = micrograms per liter  
µS/cm = microsiemen per centimetre  
Bq/L = becquerel per litre  
BTEX = benzene, toluene, ethylbenzene, xylene  
CaCO3 = calcium carbonate  
LOR = limit of reporting  
meq/L = milliequivalents per litre  
mg/L = milligrams per litre

NC = no criteria  
PAH = polycyclic aromatic hydrocarbons  
SO4 2- = sulfate  
TEQ = toxic equivalence quotient  
USEPA = United States Environmental Protection Agency

WATER QUALITY SCREENING CRITERIA EXCEEDANCE KEY
Results underlined exceeds Freshwater Trigger Value 80%
Results in italic exceeds Freshwater Trigger Value 90%
Results shaded exceeds Freshwater Trigger Value 95%
Results in bold red exceeds Freshwater Trigger Value 99%
Bold Green exceeds alternative screening criterion

ALTERNATIVE WATER SCREENING CRITERIA NOTES
NC - No appropriate screening criterion
1 - API Publication 4709 September 2001. Frequently Asked Questions About TPH Analytical Methods for Crude Oil
a - Major ions of concern for livestock drinking water quality - <a href="https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf">https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf</a>
b - Default trigger values for physical and chemical stressors for Tropical Australia for slightly disturbed ecosystems (Table 3.3.4). FW Lakes and Reservoirs. <a href="https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf">https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf</a>
c - Chronic aquatic life water quality criterion from Hohreiter DW1, Rigg DK. Derivation of ambient water quality criteria for formaldehyde. Chemosphere. 2001. Chemosphere. Nov;45(4-5):471-86. <a href="https://www.ncbi.nlm.nih.gov/pubmed/11680743">https://www.ncbi.nlm.nih.gov/pubmed/11680743</a>
d - Trigger values for radioactive contaminants for irrigation water. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. <a href="https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf">https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf</a>
e - Australian and New Zealand Guidelines for Fresh and Marine Water Quality Screening Benchmarks (October 2000) from (From Oak Ridge National Laboratory - Risk Assessment Information System) <a href="https://rais.ornl.gov/tools/eco_search.php">https://rais.ornl.gov/tools/eco_search.php</a>
f - CRWQCB . 2007. Screening For Environmental Concerns at Sites with Contaminated Soil and Groundwater. California Regional Water Quality Control Board. INTERIM FINAL - November 2007. Table F4-b, Freshwater Criterion Region 2 Basin Plan
g - Minimum guideline for m-cresol and p-cresol. Guidelines for chemical compounds in water found to cause tainting of fish flesh and other aquatic organisms (Table 4.4.5) - <a href="https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf">https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf</a>
h - Freshwater trigger value with unknown level of species protection.
i - Default short-term trigger value for irrigation (Table 4.2.10). <a href="https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf">https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf</a>

**Attachment B - Table B-2**  
**Avian Receptor Summary**  
**Carpentaria 2H and Carpentaria 3H Flowback Water - Avian Risk Assessment**  
**InGauge**

Common Name	Scientific Name	Body Mass								Drinking WIR (L/day) <sup>3,4</sup>
		Sex <sup>1</sup>	N	Mean (kg)	Standard Deviation (kg)	Min (kg)	Max (kg)	Location	Source ID <sup>2</sup>	Mean
Crested Pigeon	<i>Ocyphaps lophotes</i>	B	21	0.204	---	0.142	0.26	Australia	515a	<b>0.020</b>
Willie Wagtail	<i>Rhipidura leucophrys picata</i>	B	13	0.0201	---	0.0145	0.0255	Australia	518a	<b>0.004</b>
Peaceful Dove	<i>Geopelia placida</i>	B	38	0.0478	---	0.035	0.065	Australia	515a	<b>0.008</b>
Cattle Egret	<i>Bubulcus ibis</i>	M	27	0.372	---	0.296	0.46	FL, USA	1207	0.0304
Cattle Egret	<i>Bubulcus ibis</i>	F	59	0.36	---	0.27	0.512	FL, USA	1207	<b>0.0298</b>
Brown Honeyeater	<i>Lichmera indistincta</i>	M	37	0.0118	0.0015	0.009	0.015	Australia	517	0.0030
Brown Honeyeater	<i>Lichmera indistincta</i>	F	15	0.0106	0.0021	0.008	0.014	Australia	517	<b>0.0028</b>

**Notes:**

<sup>1</sup> Sex: M, Male; F, Female; B, Both

<sup>2</sup> Body mass statistics compiled in Dunning (2008); Original source documents based on Source ID in Dunning (2008) include: Dunning, J. 2008. CRC Handbook of Avian Body Masses 2nd Edition. CRC Press; 2 edition Boca Raton : CRC Press, [2008].

515a. Higgins, P.J. and S.J.J.F. Davies. 1996. *Handbook of Australian, New Zealand and Antarctic birds*. Oxford University Press, Melbourne, Australia. Volume 3.

518a. Higgins, P.J., J.M. Peter, and S.J. Cowling. 2006. *Handbook of Australian, New Zealand and Antarctic birds*. Oxford University Press, Melbourne, Australia. Volume 7.

1207. Telfair, R.C. 1994. *Cattle Egret (Bubulcus ibis)* In *The Birds of North America*. A. Poole and F. Gill (editors). The Birds of North America, Inc, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC. Number 113.

517. Higgins, P.J., J.M. Peter, and W.K. Steele. 2001. *Handbook of Australian, New Zealand and Antarctic birds*. Oxford University Press, Melbourne, Australia. Volume 5.

<sup>3</sup> Drinking WIR based on the allometric relationship developed by Calder and Braun (1983). *Scaling of osmotic regulation in mammals and birds*. Am J Physiol. 1983 May;244(5): R601-6., where WIR (L/day) = 0.059 x BW (Kg)<sup>0.67</sup>

<sup>4</sup> Proposed WIR shown in bold, estimated based on the arithmetic mean of female or combined body mass; WIR may be estimated based on other body mass statistics depending on the appropriate exposure scenario.

--- = no data

BW = body weight

N = number

kg = kilogram

L = litre

WIR = water ingestion rate

**Attachment B - Table B-3**  
**Crested Pigeon**  
**Carpentaria 2H and Carpentaria 3H Flowback Water - Avian Risk Assessment**  
**InGauge**

Constituent Name	CAS No.	Mammal NOAEL (mg/kg-day)	Mammal NOAEL		Avian NOAEL <sup>1</sup> (mg/kg-day)	Avian NOAEL		Avian Receptor		
			Test Animal			Test Animal		Crested Pigeon		
			Animal	Body Weight (kg)		Animal	Body Weight (kg)	Body Weight (kg)	Derived TRV	
Aluminium (ECHA - as aluminium citrate)	7429-90-5	200	Rat	0.35	NA	NA	NA	0.204	2.3E+02	
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	250	Rat	0.35	NA	NA	NA	0.204	2.9E+02	
Antimony (ADWG)	7440-36-0	0.43	Rat	0.35	NA	NA	NA	0.204	4.9E-01	
Arsenic (ECHA)	7440-38-2	NA	NA	NA	2.24	Mallard Duck	1.58	a	0.204	3.74E+00
Barium	7440-39-3	45	Rat	0.35	NA	NA	NA		0.204	5.2E+01
Boron (Released from disodium octaborate tetrahydrate)	7440-42-8	10.3	Rat	0.35	28.8	Mallard Duck	1.580		0.204	4.8E+01
Cadmium	7440-43-9	0.20	Rat	0.35	NA	NA	NA		0.204	2.3E-01
Chromium (ECHA - as chromium III)	7440-47-3	1368.0	Rat	0.35	NA	NA	NA		0.204	1.6E+03
Cobalt	7440-48-4	3.00	Rat	0.35	7.61	Chicken	0.77	b	0.204	1.1E+01
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	4.2	Mouse	0.012	NA	NA	NA		0.204	2.1E+00
Lithium	7439-93-2	9	Rat	0.35	NA	NA	NA		0.204	1.1E+01
Magnesium	7439-95-4	300	Rat	0.35	NA	NA	NA		0.204	3.4E+02
Nickel (ADWG)	7440-02-0	5.0	Rat	0.35	NA	NA	NA		0.204	5.7E+00
p-Cresol (ECHA)	106-44-5	50	Rat	0.35	NA	NA	NA		0.204	5.7E+01
Silver	7440-22-4	30	Rat	0.35	NA	NA	NA		0.204	3.4E+01
Strontium	7440-24-6	263	Rat	0.35	NA	NA	NA		0.204	3.0E+02
Total Residual Chlorine	7681-52-9	17	Rat	0.35	NA	NA	NA		0.204	1.9E+01
Total Phosphorus as P (Organic Phosphate as P)	7723-14-0	1000	Rat	0.35	NA	NA	NA		0.204	1.1E+03
Zinc (as ZnSO4 - ECHA)	7440-66-6	13.0	Rat	0.35	15	White Leghorn Hen	1.766		0.204	2.6E+01
C6-C10 Fraction minus BTEX (F1)	C6_C10-BTEX	48.7	Rat	0.35	NA	NA	NA		0.204	5.6E+01
>C10 - C16 Fraction minus Naphthalene F2 (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	750	Rat	0.35	NA	NA	NA		0.204	8.6E+02
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	50	Rat	0.35	NA	NA	NA		0.204	5.7E+01

**Notes:**

<sup>1</sup> - If an avian NOAEL was not available, the mammal NOAEL was used to derive the TRV for the avian receptor.

a -Oak Ridge National Laboratory. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Risk Assessment Program Health Sciences Research Division Oak Ridge, Tennessee 37831

b- USEPA Ecological Screening Levels for Cobalt. Interim Final OSWER Directive 9285.7-67 [https://www.epa.gov/sites/default/files/2015-09/documents/eco-ssl\\_cobalt\\_.pdf](https://www.epa.gov/sites/default/files/2015-09/documents/eco-ssl_cobalt_.pdf)

ADWG = Australian Drinking Water Guidelines

CAS = Chemical Abstracts Service

ECHA = European Chemical Agency

kg = kilogram

mg = milligram

NA = not applicable

ND = no data available

NOAEL = No observed adverse effect level

NOAEL<sub>test</sub> = No observed adverse effect level test animal - mg/kg/day

TRV = toxicity reference value

$$Derived\ TRV = NOAEL_{test} * \left( \frac{Body\ Weight_{test}}{Body\ Weight_{Avian}} \right)^{(1/4)}$$

Exposure Route	Parameter Code	Parameter Definition	Units (a)	Parameter Value	Source (b)
Ingestion	IR	Ingestion rate	L/day	0.020	Table B-1
	EF <sub>shortterm</sub>	Exposure frequency	day/yr	21	BPJ
	EF <sub>longterm</sub>	Exposure frequency	day/yr	365	BPJ
	ED	Exposure duration	yr	1	BPJ
	BW	Body weight	kg	0.204	Table B-1
	AT-NC	Averaging time - noncancer	days	365	BPJ

**Notes:**

a/ Units:

L/day = litres per day

day/yr = days per year

yr = year

kg = kilogram

b/ Source:

BPJ = Best Professional Judgement

**Attachment B - Table B-3**  
**Crested Pigeon**  
**Carpentaria 2H and Carpentaria 3H Flowback Water - Avian Risk Assessment**  
**InGauge**

Constituent Name	CAS No.	EPC <sup>1</sup> Average CW (mg/L)	Toxicity TRVs	Short-Term Storage (21 days)		Long-Term Storage (1 year)	
				Total Intake (mg/kg/day)	Hazard Quotient Ingestion	Total Intake (mg/kg/day)	Hazard Quotient Ingestion
				Aluminium (ECHA - as aluminium citrate)	7429-90-5	0.354	2.29E+02
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	69.2	2.86E+02	4.0E-01	1.4E-03	6.90E+00	2.4E-02
Antimony (ADWG)	7440-36-0	0.024	4.92E-01	1.4E-04	2.8E-04	2.39E-03	4.9E-03
Arsenic (ECHA)	7440-38-2	0.0217	3.74E+00	1.2E-04	3.3E-05	2.16E-03	5.8E-04
Barium	7440-39-3	2161	5.15E+01	1.2E+01	2.4E-01	2.15E+02	4.2E+00
Boron	7440-42-8	18	4.80E+01	1.0E-01	2.1E-03	1.78E+00	3.7E-02
Cadmium	7440-43-9	0.0021	2.29E-01	1.2E-05	5.3E-05	2.09E-04	9.1E-04
Chromium (ECHA - as chromium III)	7440-47-3	0.033	1.57E+03	1.9E-04	1.2E-07	3.25E-03	2.1E-06
Cobalt	7440-48-4	0.022	1.06E+01	1.3E-04	1.2E-05	2.19E-03	2.1E-04
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	0.091	2.07E+00	5.2E-04	2.5E-04	9.07E-03	4.4E-03
Lithium	7439-93-2	31.7	1.08E+01	1.8E-01	1.7E-02	3.16E+00	2.9E-01
Magnesium	7439-95-4	2997.000	3.43E+02	1.7E+01	5.0E-02	2.99E+02	8.7E-01
Nickel (ADWG)	7440-02-0	0.0415	5.72E+00	2.4E-04	4.2E-05	4.14E-03	7.2E-04
p-Cresol	106-44-5	0.0166	5.72E+01	9.5E-05	1.7E-06	1.65E-03	2.9E-05
Silver	7440-22-4	0.0323	3.43E+01	1.9E-04	5.4E-06	3.22E-03	9.4E-05
Strontium	7440-24-6	1386	3.01E+02	7.9E+00	2.6E-02	1.38E+02	4.6E-01
Total Residual Chlorine	7681-52-9	0.72	1.91E+01	4.1E-03	2.2E-04	7.18E-02	3.8E-03
Total Phosphorus as P (Organic Phosphate as P)	7723-14-0	1.17	1.14E+03	6.7E-03	5.9E-06	1.17E-01	1.0E-04
Zinc	7440-66-6	1.06	2.57E+01	6.1E-03	2.4E-04	1.06E-01	4.1E-03
C6-C10 Fraction minus BTEX (F1)	C6_C10-BTEX	0.150	5.57E+01	8.6E-04	1.5E-05	1.50E-02	2.7E-04
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	0.398	8.58E+02	2.3E-03	2.7E-06	3.97E-02	4.6E-05
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	2.535	5.72E+01	1.5E-02	2.5E-04	2.53E-01	4.4E-03
<b>Cumulative:</b>				<b>3E-01</b>	<b>Cumulative:</b>		<b>6E+00</b>

**Notes:**  
ADWG = Australian Drinking Water Guidelines  
BW = body weight  
CAS = Chemical Abstracts Service  
CW = concentration in water  
ECHA = European Chemical Agency  
ED = exposure duration  
EF = exposure frequency  
EPC = exposure point concentration  
IR = ingestion rate  
mg/kg/day = milligrams per kilograms per day  
mg/L = milligrams per litre  
NA = not available/applicable  
TRV = toxicity reference value  
1 - EPC is average concentration presented in Attachment A.

$$Total\ Intake = \frac{EPC \times IR \times EF \times ED}{BW \times ED \times 365 \frac{days}{year}}$$

$$Hazard\ Quotient = \frac{Total\ Intake \left( \frac{mg}{kg-day} \right)}{TRV \left( \frac{mg}{kg-day} \right)}$$



**Attachment B - Table B-4**  
**Willie Wagtail**  
**Carpentaria 2H and Carpentaria 3H Flowback Water - Avian Risk Assessment**  
**InGauge**

Constituent Name	CAS No.	Mammal NOAEL (mg/kg-day)	Mammal NOAEL		Avian NOAEL <sup>1</sup> (mg/kg-day)	Avian NOAEL		Avian Receptor	
			Test Animal			Test Animal		Willie Wagtail	
			Animal	Body Weight (kg)		Animal	Body Weight (kg)	Body Weight (kg)	Derived TRV
Aluminium (ECHA - as aluminium citrate)	7429-90-5	200	Rat	0.35	NA	NA	NA	0.0201	4.09E+02
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	250	Rat	0.35	NA	NA	NA	0.0201	5.11E+02
Antimony (ADWG)	7440-36-0	0.43	Rat	0.35	NA	NA	NA	0.0201	8.78E-01
Arsenic (ECHA)	7440-38-2	NA	NA	NA	2.24	Mallard Duck	1.58	0.0201	6.67E+00
Barium	7440-39-3	45	Rat	0.35	NA	NA	NA	0.0201	9.19E+01
Boron (Released from disodium octaborate tetrahydrate)	7440-42-8	10.3	Rat	0.35	28.8	Mallard Duck	1.580	0.0201	8.58E+01
Cadmium	7440-43-9	0.20	Rat	0.35	NA	NA	NA	0.0201	4.09E-01
Chromium (ECHA - as chromium III)	7440-47-3	1368.0	Rat	0.35	NA	NA	NA	0.0201	2.79E+03
Cobalt	7440-48-4	3.00	Rat	0.35	7.61	Chicken	0.77	0.0201	1.89E+01
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	4.2	Mouse	0.012	NA	NA	NA	0.0201	3.69E+00
Lithium	7439-93-2	9	Rat	0.35	NA	NA	NA	0.0201	1.92E+01
Magnesium	7439-95-4	300	Rat	0.35	NA	NA	NA	0.0201	6.13E+02
Nickel (ADWG)	7440-02-0	5.0	Rat	0.35	NA	NA	NA	0.0201	1.02E+01
p-Cresol	106-44-5	50	Rat	0.35	NA	NA	NA	0.0201	1.02E+02
Silver	7440-22-4	30	Rat	0.35	NA	NA	NA	0.0201	6.13E+01
Strontium	7440-24-6	263	Rat	0.35	NA	NA	NA	0.0201	5.37E+02
Total Residual Chlorine	7681-52-9	17	Rat	0.35	NA	NA	NA	0.0201	3.41E+01
Total Phosphorus as P (Organic Phosphate as P)	7723-14-0	1000	Rat	0.35	NA	NA	NA	0.0201	2.04E+03
Zinc	7440-66-6	13.0	Rat	0.35	15	White Leghorn Hen	1.766	0.0201	4.59E+01
C6-C10 Fraction minus BTEX (F1)	C6_C10-BTEX	48.7	Rat	0.35	NA	NA	NA	0.0201	9.95E+01
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	750	Rat	0.35	NA	NA	NA	0.0201	1.53E+03
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	50	Rat	0.35	NA	NA	NA	0.0201	1.02E+02

**Notes:**

ADWG = Australian Drinking Water Guidelines

CAS = Chemical Abstracts Service

ECHA = European Chemical Agency

kg = kilogram

mg = milligram

NA = not applicable

NOAEL = No observed adverse effect level

NOAEL<sub>test</sub> = No observed adverse effect level test animal

TRV = toxicity reference value

1/ If an avian NOAEL was not available, the mammal NOAEL was used to derive the TRV for the avian receptor.

$$Derived\ TRV = NOAEL_{test} * \left( \frac{Body\ Weight_{test}}{Body\ Weight_{Avian}} \right)^{(1/4)}$$

Exposure Route	Parameter Code	Parameter Definition	Units (a)	Parameter Value	Source (b)
Ingestion	IR	Ingestion rate	L/day	0.004	Table B-1
	EF <sub>shortterm</sub>	Exposure frequency	day/yr	21	BPJ
	EF <sub>longterm</sub>	Exposure frequency	day/yr	365	BPJ
	ED	Exposure duration	yr	1	BPJ
	BW	Body weight	kg	0.0201	Table B-1
	AT-NC	Averaging time - noncancer	days	365	BPJ

**Notes:**

a/ Units:

L/day = litres per day

day/yr = days per year

yr = year

kg = kilogram

b/ Source:

BPJ = Best Professional Judgement

**Attachment B - Table B-4**  
**Willie Wagtail**  
**Carpentaria 2H and Carpentaria 3H Flowback Water - Avian Risk Assessment**  
**InGauge**

Constituent Name	CAS No.	EPC <sup>1</sup>		Short-Term Storage (21 days)		Long-Term Storage (1 year)	
		CW (mg/L)	Toxicity TRVs	Total Intake (mg/kg/day)	Hazard Quotient Ingestion	Total Intake (mg/kg/day)	Hazard Quotient Ingestion
Aluminium (ECHA - as aluminium citrate)	7429-90-5	0.354	4.09E+02	4.4E-03	1.1E-05	7.6E-02	1.9E-04
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	69.2	5.11E+02	8.5E-01	1.7E-03	1.5E+01	2.9E-02
Antimony (ADWG)	7440-36-0	0.024	8.78E-01	3.0E-04	3.4E-04	5.1E-03	5.9E-03
Arsenic (ECHA)	7440-38-2	0.0217	6.67E+00	2.7E-04	4.0E-05	4.6E-03	7.0E-04
Barium	7440-39-3	2161	9.19E+01	2.7E+01	2.9E-01	4.6E+02	5.0E+00
Boron	7440-42-8	18	8.58E+01	2.2E-01	2.6E-03	3.8E+00	4.5E-02
Cadmium	7440-43-9	0.0021	4.09E-01	2.6E-05	6.3E-05	4.5E-04	1.1E-03
Chromium (ECHA - as chromium III)	7440-47-3	0.033	2.79E+03	4.0E-04	1.4E-07	7.0E-03	2.5E-06
Cobalt	7440-48-4	0.022	1.89E+01	2.7E-04	1.4E-05	4.7E-03	2.5E-04
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	0.091	3.69E+00	1.1E-03	3.0E-04	1.9E-02	5.3E-03
Lithium	7439-93-2	31.7	1.92E+01	3.9E-01	2.0E-02	6.8E+00	3.5E-01
Magnesium	7439-95-4	2997.000	6.13E+02	3.7E+01	6.0E-02	6.4E+02	1.0E+00
Nickel (ADWG)	7440-02-0	0.0415	1.02E+01	5.1E-04	5.0E-05	8.9E-03	8.7E-04
p-Cresol	106-44-5	0.0166	1.02E+02	2.0E-04	2.0E-06	3.6E-03	3.5E-05
Silver	7440-22-4	0.0323	6.13E+01	4.0E-04	6.5E-06	6.9E-03	1.1E-04
Strontium	7440-24-6	1386	5.37E+02	1.7E+01	3.2E-02	3.0E+02	5.5E-01
Total Residual Chlorine	7681-52-9	0.72	3.41E+01	8.9E-03	2.6E-04	1.5E-01	4.5E-03
Total Phosphorus as P (Organic Phosphate as P)	7723-14-0	1.17	2.04E+03	1.4E-02	7.1E-06	2.5E-01	1.2E-04
Zinc	7440-66-6	1.06	4.59E+01	1.3E-02	2.8E-04	2.3E-01	4.9E-03
C6-C10 Fraction minus BTEX (F1)	C6_C10-BTEX	0	9.95E+01	1.8E-03	1.9E-05	3.2E-02	3.2E-04
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	0	1.53E+03	4.9E-03	3.2E-06	8.5E-02	5.6E-05
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	3	1.53E+03	3.1E-02	2.0E-05	5.4E-01	3.5E-04
<b>Cumulative:</b>				<b>4E-01</b>	<b>Cumulative:</b>	<b>7E+00</b>	

**Notes:**

- ADWG = Australian Drinking Water Guidelines
- BW = body weight
- CAS = Chemical Abstracts Service
- CW = concentration in water
- ECHA = European Chemical Agency
- ED = exposure duration
- EF = exposure frequency
- EPC = exposure point concentration
- IR = ingestion rate
- mg/kg/day = milligrams per kilograms per day
- mg/L = milligrams per litre
- TRV = toxicity reference value

1 - EPC is average concentration presented in Attachment A. If constituent was not detected, 1/2 the detection limit was used to calculate the average.

$$Total\ Intake = \frac{EPC \times IR \times EF \times ED}{BW \times ED \times 365\ days/year}$$

$$Hazard\ Quotient = \frac{Total\ Intake\ \left(\frac{mg}{kg\ -\ day}\right)}{TRV\ \left(\frac{mg}{kg\ -\ day}\right)}$$

**Attachment B - Table B-5**  
**Peaceful Dove**  
**Carpentaria 2H and Carpentaria 3H Flowback Water - Avian Risk Assessment**  
**InGauge**

Constituent Name	CAS No.	Mammal NOAEL (mg/kg-day)	Mammal NOAEL		Avian NOAEL <sup>1</sup> (mg/kg-day)	Avian NOAEL		Avian Receptor	
			Test Animal			Test Animal		Peaceful Dove	
			Animal	Body Weight (kg)		Animal	Body Weight (kg)	Body Weight (kg)	Derived TRV
Aluminium (ECHA - as aluminium citrate)	7429-90-5	200	Rat	0.35	NA	NA	NA	0.0478	3.29E+02
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	250	Rat	0.35	NA	NA	NA	0.0478	4.11E+02
Antimony (ADWG)	7440-36-0	0.43	Rat	0.35	NA	NA	NA	0.0478	7.07E-01
Arsenic (ECHA)	7440-38-2	NA	NA	NA	2.24	Mallard Duck	1.58	0.0478	5.37E+00
Barium	7440-39-3	45	Rat	0.35	NA	NA	NA	0.0478	7.40E+01
Boron (Released from disodium octaborate tetrahydrate)	7440-42-8	10.3	Rat	0.35	28.8	Mallard Duck	1.580	0.0478	6.91E+01
Cadmium	7440-43-9	0.20	Rat	0.35	NA	NA	NA	0.0478	3.29E-01
Chromium (ECHA - as chromium III)	7440-47-3	1368.0	Rat	0.35	NA	NA	NA	0.0478	2.25E+03
Cobalt	7440-48-4	3.0	Rat	0.35	8	Chicken	1	0.0478	1.52E+01
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	4.2	Mouse	0.012	NA	NA	NA	0.0478	2.97E+00
Lithium	7439-93-2	9.4	Rat	0.35	NA	NA	NA	0.0478	1.55E+01
Magnesium	7439-95-4	300.0	Rat	0.35	NA	NA	NA	0.0478	4.93E+02
Nickel (ADWG)	7440-02-0	5.0	Rat	0.35	NA	NA	NA	0.0478	8.22E+00
p-Cresol	106-44-5	50.0	Rat	0.35	NA	NA	NA	0.0478	8.22E+01
Silver	7440-22-4	30	Rat	0.35	NA	NA	NA	0.0478	4.93E+01
Strontium	7440-24-6	263	Rat	0.35	NA	NA	NA	0.0478	4.33E+02
Total Residual Chlorine	7681-52-9	17	Rat	0.35	NA	NA	NA	0.0478	2.75E+01
Total Phosphorus as P (Organic Phosphate as P)	7723-14-0	1000	Rat	0.35	NA	NA	NA	0.0478	1.64E+03
Zinc	7440-66-6	13	Rat	0.35	15	White Leghorn Hen	2	0.0478	3.70E+01
C6-C10 Fraction minus BTEX (F1)	C6_C10-BTEX	48.7	Rat	0.35	NA	NA	NA	0.0478	8.01E+01
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	750	Rat	0.35	NA	NA	NA	0.0478	1.23E+03
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	50	Rat	0.35	NA	NA	NA	0.0478	8.22E+01

**Notes:**

ADWG = Australian Drinking Water Guidelines

CAS = Chemical Abstracts Service

ECHA = European Chemical Agency

kg = kilogram

mg = milligram

NA = not applicable

NOAEL = No observed adverse effect level

NOAEL<sub>t</sub> = No observed adverse effect level test animal

TRV = toxicity reference value

1/ If an avian NOAEL was not available, the mammal NOAEL was used to derive the TRV for the avian receptor.

$$Derived\ TRV = NOAEL_{test} * \left( \frac{Body\ Weight_{test}}{Body\ Weight_{Avian}} \right)^{(1/4)}$$

Exposure Route	Parameter Code	Parameter Definition	Units (a)	Parameter Value	Source (b)
Ingestion	IR	Ingestion rate	L/day	0.008	Table B-1
	EF <sub>shortterm</sub>	Exposure frequency	day/yr	21	BPJ
	EF <sub>longterm</sub>	Exposure frequency	day/yr	365	BPJ
	ED	Exposure duration	yr	1	BPJ
	BW	Body weight	kg	0.0478	Table B-1
	AT-NC	Averaging time - noncancer	days	365	BPJ

**Notes:**

a/ Units:

L/day = litres per day

day/yr = days per year

yr = year

kg = kilogram

b/ Source:

BPJ = Best Professional Judgement

**Attachment B - Table B-5**  
**Peaceful Dove**  
**Carpentaria 2H and Carpentaria 3H Flowback Water - Avian Risk Assessment**  
**InGauge**

Constituent Name	CAS No.	EPC <sup>1</sup> CW (mg/L)	Toxicity TRVs	Short-Term Storage (21 days)		Long-Term Storage (1 year)	
				Total Intake (mg/kg/day)	Hazard Quotient	Total Intake (mg/kg/day)	Hazard Quotient
					Ingestion		Ingestion
Aluminium (ECHA - as aluminium citrate)	7429-90-5	0.354	3.29E+02	3.3E-03	1.0E-05	5.7E-02	1.7E-04
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	69.2	4.11E+02	6.4E-01	1.6E-03	1.1E+01	2.7E-02
Antimony (ADWG)	7440-36-0	0.024	7.07E-01	2.2E-04	3.1E-04	3.9E-03	5.5E-03
Arsenic (ECHA)	7440-38-2	0.0217	5.37E+00	2.0E-04	3.7E-05	3.5E-03	6.5E-04
Barium	7440-39-3	2161	7.40E+01	2.0E+01	2.7E-01	3.5E+02	4.7E+00
Boron	7440-42-8	18	6.91E+01	1.7E-01	2.4E-03	2.9E+00	4.2E-02
Cadmium	7440-43-9	0.0021	3.29E+01	1.9E-05	5.9E-05	3.4E-04	1.0E-03
Chromium (ECHA - as chromium III)	7440-47-3	0.033	2.25E+03	3.0E-04	1.3E-07	5.2E-03	2.3E-06
Cobalt	7440-48-4	0.022	1.52E+01	2.0E-04	1.3E-05	3.5E-03	2.3E-04
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	0.091	2.97E+00	8.4E-04	2.8E-04	1.5E-02	4.9E-03
Lithium	7439-93-2	31.7	1.55E+01	2.9E-01	1.9E-02	5.1E+00	3.3E-01
Magnesium	7439-95-4	2997.000	4.93E+02	2.8E+01	5.6E-02	4.8E+02	9.8E-01
Nickel (ADWG)	7440-02-0	0.0415	8.22E+00	3.8E-04	4.7E-05	6.7E-03	8.1E-04
p-Cresol	106-44-5	0.0166	8.22E+01	1.5E-04	1.9E-06	2.7E-03	3.2E-05
Silver	7440-22-4	0.0323	4.93E+01	3.0E-04	6.1E-06	5.2E-03	1.1E-04
Strontium	7440-24-6	1386	4.33E+02	1.3E+01	3.0E-02	2.2E+02	5.2E-01
Total Residual Chlorine	7681-52-9	0.72	2.75E+01	6.7E-03	2.4E-04	1.2E-01	4.2E-03
Total Phosphorus as P (Organic Phosphate as P)	7723-14-0	1.17	1.64E+03	1.1E-02	6.6E-06	1.9E-01	1.1E-04
Zinc	7440-66-6	1.06	3.70E+01	9.8E-03	2.7E-04	1.7E-01	4.6E-03
C6-C10 Fraction minus BTEX (F1)	C6_C10-BTEX	0	8.01E+01	1.4E-03	1.7E-05	2.4E-02	3.0E-04
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	0	1.23E+03	3.7E-03	3.0E-06	6.4E-02	5.2E-05
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	3	8.22E+01	2.3E-02	2.9E-04	4.1E-01	5.0E-03
				<b>Cumulative:</b>	<b>4E-01</b>	<b>Cumulative:</b>	<b>7E+00</b>

**Notes:**

- ADWG = Australian Drinking Water Guidelines
- BW = body weight
- CAS = Chemical Abstracts Service
- CW = concentration in water
- ECHA = European Chemical Agency
- ED = exposure duration
- EF = exposure frequency
- EPC = exposure point concentration
- IR = ingestion rate
- mg/kg/day = milligrams per kilograms per day
- mg/L = milligrams per litre
- NA = not available/applicable
- TRV = toxicity reference value
- 1 - EPC is average concentration presented in Attachment A. If constituent was not detected, 1/2 the detection limit was used to calculate the average.

$$Total\ Intake = \frac{EPC \times IR \times EF \times ED}{BW \times ED \times 365 \frac{days}{year}}$$

$$Hazard\ Quotient = \frac{Total\ Intake \left( \frac{mg}{kg - day} \right)}{TRV \left( \frac{mg}{kg - day} \right)}$$

**Attachment B - Table B-6**  
**Cattle Egret**  
**Carpentaria 2H and Carpentaria 3H Flowback Water - Avian Risk Assessment**  
**InGauge**

Constituent Name	CAS No.	Mammal NOAEL (mg/kg-day)	Mammal NOAEL		Avian NOAEL <sup>1</sup> (mg/kg-day)	Avian NOAEL		Avian Receptor	
			Test Animal			Test Animal		Cattle Egret	
			Animal	Body Weight (kg)		Animal	Body Weight (kg)	Body Weight (kg)	Derived TRV
Aluminium (ECHA - as aluminium citrate)	7429-90-5	200	Rat	0.35	NA	NA	NA	0.36	1.99E+02
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	250	Rat	0.35	NA	NA	NA	0.36	2.48E+02
Antimony (ADWG)	7440-36-0	0.43	Rat	0.35	NA	NA	NA	0.36	4.27E-01
Arsenic (ECHA)	7440-38-2	NA	NA	NA	2.24	Mallard Duck	1.58	0.36	3.24E+00
Barium	7440-39-3	45	Rat	0.35	NA	NA	NA	0.36	4.47E+01
Boron (Released from disodium octaborate tetrahydrate)	7440-42-8	10.3	Rat	0.35	28.8	Mallard Duck	1.580	0.36	4.17E+01
Cadmium	7440-43-9	0.20	Rat	0.35	NA	NA	NA	0.36	1.99E-01
Chromium (ECHA - as chromium III)	7440-47-3	1368.0	Rat	0.35	NA	NA	NA	0.36	1.36E+03
Cobalt	7440-48-4	3.0	Rat	0.35	8	Chicken	1	0.36	9.20E+00
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	4.2	Mouse	0.012	NA	NA	NA	0.36	1.79E+00
Lithium	7439-93-2	9.4	Rat	0.35	NA	NA	NA	0.36	9.33E+00
Magnesium	7439-95-4	300.0	Rat	0.35	NA	NA	NA	0.36	2.98E+02
Nickel (ADWG)	7440-02-0	5.0	Rat	0.35	NA	NA	NA	0.36	4.96E+00
p-Cresol	106-44-5	50.0	Rat	0.35	NA	NA	NA	0.36	4.96E+01
Silver	7440-22-4	30	Rat	0.35	NA	NA	NA	0.36	2.98E+01
Strontium	7440-24-6	263	Rat	0.35	NA	NA	NA	0.36	2.61E+02
Total Residual Chlorine	7681-52-9	17	Rat	0.35	NA	NA	NA	0.36	1.66E+01
Total Phosphorus as P (Organic Phosphate as P)	7723-14-0	1000	Rat	0.35	NA	NA	NA	0.36	9.93E+02
Zinc	7440-66-6	13	Rat	0.35	15	White Leghorn Her	2	0.36	2.23E+01
C6-C10 Fraction minus BTEX (F1)	C6_C10-BTEX	48.7	Rat	0.35	NA	NA	NA	0.36	4.84E+01
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	750	Rat	0.35	NA	NA	NA	0.36	7.45E+02
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	50	Rat	0.35	NA	NA	NA	0.36	4.96E+01

**Notes:**

ADWG = Australian Drinking Water Guidelines

CAS = Chemical Abstracts Service

ECHA = European Chemical Agency

kg = kilogram

mg = milligram

NA = not applicable

NOAEL = No observed adverse effect level

NOAEL<sub>test</sub> = No observed adverse effect level test animal

TRV = toxicity reference value

1/ If an avian NOAEL was not available, the mammal NOAEL was used to derive the TRV for the avian receptor.

$$Derived\ TRV = NOAEL_{test} * \left( \frac{Body\ Weight_{test}}{Body\ Weight_{Avian}} \right)^{1/4}$$

Exposure Route	Parameter Code	Parameter Definition	Units (a)	Parameter Value	Source (b)
Ingestion	IR	Ingestion rate	L/day	0.0298	Table B-1
	EF <sub>shortterm</sub>	Exposure frequency	day/yr	21	BPJ
	EF <sub>longterm</sub>	Exposure frequency	day/yr	365	BPJ
	ED	Exposure duration	yr	1	BPJ
	BW	Body weight	kg	0.36	Table B-1
	AT-NC	Averaging time - noncancer	days	365	BPJ

**Notes:**

a/ Units:

L/day = litres per day

day/yr = days per year

yr = year

kg = kilogram

b/ Source:

BPJ = Best Professional Judgement

**Attachment B - Table B-6**  
**Cattle Egret**  
**Carpentaria 2H and Carpentaria 3H Flowback Water - Avian Risk Assessment**  
**InGauge**

Constituent Name	CAS No.	EPC <sup>1</sup>	Toxicity	Short-Term Storage (21 days)		Long-Term Storage (1 year)	
				Total Intake (mg/kg/day)	Hazard Quotient	Total Intake (mg/kg/day)	Hazard Quotient
					Ingestion		Ingestion
		CW (mg/L)	TRVs				
Aluminium (ECHA - as aluminium citrate)	7429-90-5	0.354	1.99E+02	1.7E-03	8.5E-06	2.9E-02	1.5E-04
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	69.2	2.48E+02	3.3E-01	1.3E-03	5.7E+00	2.3E-02
Antimony (ADWG)	7440-36-0	0.024	4.27E-01	1.1E-04	2.7E-04	2.0E-03	4.6E-03
Arsenic (ECHA)	7440-38-2	0.0217	3.24E+00	1.0E-04	3.2E-05	1.8E-03	5.5E-04
Barium	7440-39-3	2161	4.47E+01	1.0E+01	2.3E-01	1.8E+02	4.0E+00
Boron	7440-42-8	18	4.17E+01	8.5E-02	2.0E-03	1.5E+00	3.5E-02
Cadmium	7440-43-9	0.0021	1.99E-01	1.0E-05	5.0E-05	1.7E-04	8.7E-04
Chromium (ECHA - as chromium III)	7440-47-3	0.033	1.36E+03	1.6E-04	1.1E-07	2.7E-03	2.0E-06
Cobalt	7440-48-4	0.022	9.20E+00	1.0E-04	1.1E-05	1.8E-03	2.0E-04
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	0.091	1.79E+00	4.3E-04	2.4E-04	7.5E-03	4.2E-03
Lithium	7439-93-2	31.7	9.33E+00	1.5E-01	1.6E-02	2.6E+00	2.8E-01
Magnesium	7439-95-4	2997.000	2.98E+02	1.4E+01	4.8E-02	2.5E+02	8.3E-01
Nickel (ADWG)	7440-02-0	0.0415	4.96E+00	2.0E-04	4.0E-05	3.4E-03	6.9E-04
p-Cresol	106-44-5	0.0166	4.96E+01	7.9E-05	1.6E-06	1.4E-03	2.8E-05
Silver	7440-22-4	0.0323	2.98E+01	1.5E-04	5.2E-06	2.7E-03	9.0E-05
Strontium	7440-24-6	1386	2.61E+02	6.6E+00	2.5E-02	1.1E+02	4.4E-01
Total Residual Chlorine	7681-52-9	0.72	1.66E+01	3.4E-03	2.1E-04	6.0E-02	3.6E-03
Total Phosphorus as P (Organic Phosphate as P)	7723-14-0	1.17	9.93E+02	5.6E-03	5.6E-06	9.7E-02	9.7E-05
Zinc	7440-66-6	1.06	2.23E+01	5.0E-03	2.3E-04	8.8E-02	3.9E-03
C6-C10 Fraction minus BTEX (F1)	C6_C10-BTEX	0	4.84E+01	7.1E-04	1.5E-05	1.2E-02	2.6E-04
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	0	7.45E+02	1.9E-03	2.5E-06	3.3E-02	4.4E-05
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	3	4.96E+01	1.2E-02	2.4E-04	2.1E-01	4.2E-03
				<b>Cumulative:</b>	<b>3E-01</b>	<b>Cumulative:</b>	<b>6E+00</b>

**Notes:**

- ADWG = Australian Drinking Water Guidelines
- BW = body weight
- CAS = Chemical Abstracts Service
- CW = concentration in water
- ECHA = European Chemical Agency
- ED = exposure duration
- EF = exposure frequency
- EPC = exposure point concentration
- IR = ingestion rate
- mg/kg/day = milligrams per kilograms per day
- mg/L = milligrams per litre
- NA = not available/applicable
- TRV = toxicity reference value
- 1 - EPC is average concentration presented in Attachment A. If constituent was not detected, 1/2 the detection limit was used to calculate the average.

$$Total\ Intake = \frac{EPC \times IR \times EF \times ED}{BW \times ED \times 365\ days/year}$$

$$Hazard\ Quotient = \frac{Total\ Intake\ \left(\frac{mg}{kg\ -\ day}\right)}{TRV\ \left(\frac{mg}{kg\ -\ day}\right)}$$



**Attachment B - Table B-7**  
**Brown Honeyeater**  
**Carpentaria 2H and Carpentaria 3H Flowback Water - Avian Risk Assessment**  
**InGauge**

Constituent Name	CAS No.	Mammal NOAEL (mg/kg-day)	Mammal NOAEL		Avian NOAEL <sup>1</sup> (mg/kg-day)	Avian NOAEL		Avian Receptor	
			Test Animal			Test Animal		Brown Honeyeater	
			Animal	Body Weight (kg)		Animal	Body Weight (kg)	Body Weight (kg)	Derived TRV
Aluminium (ECHA - as aluminium citrate)	7429-90-5	200	Rat	0.35	NA	NA	NA	0.0106	4.8E+02
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	250	Rat	0.35	NA	NA	NA	0.0106	6.0E+02
Antimony (ADWG)	7440-36-0	0.43	Rat	0.35	NA	NA	NA	0.0106	1.0E+00
Arsenic (ECHA)	7440-38-2	NA	NA	NA	2.24	Mallard Duck	1.58	0.0106	7.8E+00
Barium	7440-39-3	45	Rat	0.35	NA	NA	NA	0.0106	1.1E+02
Boron (Released from disodium octaborate tetrahydrate)	7440-42-8	10.3	Rat	0.35	28.8	Mallard Duck	1.580	0.0106	1.0E+02
Cadmium	7440-43-9	0.20	Rat	0.35	NA	NA	NA	0.0106	4.8E-01
Chromium (ECHA - as chromium III)	7440-47-3	1368.0	Rat	0.35	NA	NA	NA	0.0106	3.3E+03
Cobalt	7440-48-4	3.0	Rat	0.35	8	Chicken	1	0.0106	2.2E+01
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	4.2	Mouse	0.012	NA	NA	NA	0.0106	4.3E+00
Lithium	7439-93-2	9.4	Rat	0.35	NA	NA	NA	0.0106	2.3E+01
Magnesium	7439-95-4	300.0	Rat	0.35	NA	NA	NA	0.0106	7.2E+02
Nickel (ADWG)	7440-02-0	5.0	Rat	0.35	NA	NA	NA	0.0106	1.2E+01
p-Cresol	106-44-5	50.0	Rat	0.35	NA	NA	NA	0.0106	1.2E+02
Silver	7440-22-4	30	Rat	0.35	NA	NA	NA	0.0106	7.2E+01
Strontium	7440-24-6	263	Rat	0.35	NA	NA	NA	0.0106	6.3E+02
Total Residual Chlorine	7681-52-9	17	Rat	0.35	NA	NA	NA	0.0106	4.0E+01
Total Phosphorus as P (Organic Phosphate as P)	7723-14-0	1000	Rat	0.35	NA	NA	NA	0.0106	2.4E+03
Zinc	7440-66-6	13	Rat	0.35	15	White Leghorn Hen	2	0.0106	5.4E+01
C6-C10 Fraction minus BTEX (F1)	C6_C10-BTEX	48.7	Rat	0.35	NA	NA	NA	0.0106	1.2E+02
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate hydrocarbon)	93763-35-0	750	Rat	0.35	NA	NA	NA	0.0106	1.8E+03
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbon)	EC 940-734-7	50	Rat	0.35	NA	NA	NA	0.0106	1.2E+02

**Notes:**

ADWG = Australian Drinking Water Guidelines

CAS = Chemical Abstracts Service

ECHA = European Chemical Agency

kg = kilogram

mg = milligram

NA = not applicable

NOAEL = No observed adverse effect level

NOAELtest = No observed adverse effect level test animal

TRV = toxicity reference value

1/ If an avian NOAEL was not available, the mammal NOAEL was used to derive the TRV for the avian receptor.

2/ LOAEL for copper used.

$$Derived\ TRV = NOAEL_{test} * \left( \frac{Body\ Weight_{test}}{Body\ Weight_{Avian}} \right)^{(1/4)}$$

Exposure Route	Parameter Code	Parameter Definition	Units (a)	Parameter Value	Source (b)
Ingestion	IR	Ingestion rate	L/day	0.0028	Table B-1
	EF <sub>shortterm</sub>	Exposure frequency	day/yr	21	BPJ
	EF <sub>longterm</sub>	Exposure frequency	day/yr	365	BPJ
	ED	Exposure duration	yr	1	BPJ
	BW	Body weight	kg	0.0106	Table B-1
	AT-NC	Averaging time - noncancer	days	365	BPJ

**Notes:**

a/ Units:

L/day = litres per day

day/yr = days per year

yr = year

kg = kilogram

b/ Source:

BPJ = Best Professional Judgement

**Attachment B - Table B-7**  
**Brown Honeyeater**  
**Carpentaria 2H and Carpentaria 3H Flowback Water - Avian Risk Assessment**  
**InGauge**

Constituent Name	CAS No.	EPC <sup>1</sup>	Toxicity	Short-Term Storage (21 days)		Long-Term Storage (1 year)	
				Total Intake (mg/kg/day)	Hazard Quotient	Total Intake (mg/kg/day)	Hazard Quotient
					Ingestion		Ingestion
		CW (mg/L)	TRVs				
Aluminium (ECHA - as aluminium citrate)	7429-90-5	0.4	4.8E+02	5.4E-03	1.1E-05	9.4E-02	2.0E-04
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	69.200	6.0E+02	1.1E+00	1.8E-03	1.8E+01	3.1E-02
Antimony (ADWG)	7440-36-0	0.0240	1.0E+00	3.7E-04	3.5E-04	6.3E-03	6.2E-03
Arsenic (ECHA)	7440-38-2	0.02	7.8E+00	3.3E-04	4.2E-05	5.7E-03	7.3E-04
Barium	7440-39-3	2161.000	1.1E+02	3.3E+01	3.0E-01	5.7E+02	5.3E+00
Boron	7440-42-8	17.900	1.0E+02	2.7E-01	2.7E-03	4.7E+00	4.7E-02
Cadmium	7440-43-9	0.002	4.8E-01	3.2E-05	6.7E-05	5.6E-04	1.2E-03
Chromium (ECHA - as chromium III)	7440-47-3	0.033	3.3E+03	5.0E-04	1.5E-07	8.6E-03	2.6E-06
Cobalt	7440-48-4	0.022	2.2E+01	3.3E-04	1.5E-05	5.8E-03	2.6E-04
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	0.091	4.3E+00	1.4E-03	3.2E-04	2.4E-02	5.6E-03
Lithium	7439-93-2	31.700	2.3E+01	4.8E-01	2.1E-02	8.4E+00	3.7E-01
Magnesium	7439-95-4	2997.000	7.2E+02	4.6E+01	6.3E-02	7.9E+02	1.1E+00
Nickel (ADWG)	7440-02-0	0.042	1.2E+01	6.3E-04	5.3E-05	1.1E-02	9.2E-04
p-Cresol	106-44-5	0.017	1.2E+02	2.5E-04	2.1E-06	4.4E-03	3.7E-05
Silver	7440-22-4	0.032	7.2E+01	4.9E-04	6.8E-06	8.5E-03	1.2E-04
Strontium	7440-24-6	1386.000	6.3E+02	2.1E+01	3.3E-02	3.7E+02	5.8E-01
Total Residual Chlorine	7681-52-9	0.72	4.0E+01	1.1E-02	2.7E-04	1.9E-01	4.8E-03
Total Phosphorus as P (Organic Phosphate as P)	7723-14-0	1.17	2.4E+03	1.8E-02	7.4E-06	3.1E-01	1.3E-04
Zinc	7440-66-6	1.060	5.4E+01	1.6E-02	3.0E-04	2.8E-01	5.2E-03
C6-C10 Fraction minus BTEX (F1)	C6_C10-BTEX	0.15	1.2E+02	2.3E-03	2.0E-05	4.0E-02	3.4E-04
>C10 - C16 Fraction minus Naphthalene (ECHA: Su)	93763-35-0	0.398	1.8E+03	6.1E-03	3.4E-06	1.1E-01	5.9E-05
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocar)	EC 940-734-7	2.535	1.2E+02	3.9E-02	3.2E-04	6.7E-01	5.6E-03
<b>Cumulative:</b>				<b>4E-01</b>	<b>Cumulative:</b>		<b>7E+00</b>

**Notes:**

- ADWG = Australian Drinking Water Guidelines
- BW = body weight
- CAS = Chemical Abstracts Service
- CW = concentration in water
- ECHA = European Chemical Agency
- ED = exposure duration
- EF = exposure frequency
- EPC = exposure point concentration
- IR = ingestion rate
- mg/kg/day = milligrams per kilograms per day
- mg/L = milligrams per litre
- NA = not available/applicable
- TRV = toxicity reference value
- 1 - EPC is average concentration presented in Attachment A. If constituent was not detected, 1/2 the detection limit was used to calculate the average.

$$Total\ Intake = \frac{EPC \times IR \times EF \times ED}{BW \times ED \times 365 \frac{days}{year}}$$

$$Hazard\ Quotient = \frac{Total\ Intake \left( \frac{mg}{kg \cdot day} \right)}{TRV \left( \frac{mg}{kg \cdot day} \right)}$$



## Attachment C Terrestrial Risk Assessment – Carpentaria 2H and Carpentaria 3H Flowback Water

**Table C-1**  
**Summary of Terrestrial Tier 1 Screening Evaluation**  
**Carpentaria-2H and Carpentaria-3H Flowback Water Assessment**  
**Imperial**

Analyte grouping/Analyte	CAS Number	Units	Maximum Detected Concentration in Water (mg/L)	Maximum Calculated Concentration in Soil (mg/kg)	Soil Screening Level (mg/kg)	Note	Maximum Concentration/Soil Screening Level Ratio	Median Detected Concentration in Water (mg/L)	Median Calculated Concentration in Soil (mg/kg)*	Soil Screening Level (mg/kg)	Note	Median Concentration/Soil Screening Level Ratio
Bromide	24959-67-9	mg/L	2130	1.3E+02	50	6	2.5E+00	1290	7.64E+01	50	6	1.5E+00
Sulfate as SO4 - Turbidimetric	14808-79-8	mg/L	150	8.9E+00	NV		NA	150	8.89E+00	NV	0	NA
Chloride	16887-00-6	mg/L	134000	7.9E+03	NV		NA	98150	5.82E+03	NV	0	NA
Calcium	7440-70-2	mg/L	22700	1.3E+03	NV		NA	19200	1.14E+03	NV	0	NA
Magnesium	7439-95-4	mg/L	4270	2.5E+02	1469	9	1.7E-01	3440	2.04E+02	1469	9	1.4E-01
Sodium	7440-23-5	mg/L	49000	2.9E+03	NV		NA	42200	2.50E+03	NV	0	NA
Aluminium	7429-90-5	mg/L	0.92	5.5E-02	NV		NA	0.24	1.42E-02	NV	0	NA
Antimony	7440-36-0	mg/L	0.048	2.8E-03	0.27	2	1.1E-02	0.017	1.01E-03	0.27	2	3.7E-03
Arsenic	7440-38-2	mg/L	0.077	4.6E-03	40	3	1.1E-04	0.017	1.01E-03	40	3	2.5E-05
Barium	7440-39-3	mg/L	3960	2.3E+02	820	4	2.9E-01	2390	1.42E+02	820	4	1.7E-01
Cadmium	7440-43-9	mg/L	0.0026	1.5E-04	0.36	2	4.3E-04	0.0021	1.24E-04	0.36	2	3.5E-04
Chromium	7440-47-3	mg/L	0.116	6.9E-03	100	7	6.9E-05	0.0285	1.69E-03	100	7	1.7E-05
Cobalt	7440-48-4	mg/L	0.032	1.9E-03	13	16	1.5E-04	0.022	1.30E-03	13	16	1.0E-04
Copper	7440-50-8	mg/L	0.22	1.3E-02	20	8	6.5E-04	0.073	4.33E-03	20	8	2.2E-04
Lead	7439-92-1	mg/L	0.024	1.4E-03	470	14	3.0E-06	0.017	1.01E-03	470	14	2.1E-06
Lithium	7439-93-2	mg/L	50.2	3.0E+00	2	16	1.5E+00	34.9	2.07E+00	2	16	1.0E+00
Manganese	7439-96-5	mg/L	47.6	2.8E+00	4300	10	6.6E-04	31.65	1.88E+00	4300	10	4.4E-04
Molybdenum	7439-98-7	mg/L	0.106	6.3E-03	9.9	11	6.3E-04	0.0165	9.78E-04	9.9	11	9.9E-05
Nickel	7440-02-0	mg/L	0.111	6.6E-03	5	12	1.3E-03	0.0345	2.04E-03	5	12	4.1E-04
Silver	7440-22-4	mg/L	0.061	3.6E-03	4.2	4	8.6E-04	0.018	1.07E-03	4.2	4	2.5E-04
Strontium	7440-24-6	mg/L	2220	1.3E+02	95	4	1.4E+00	1525	9.04E+01	95	4	9.5E-01
Zinc	7440-66-6	mg/L	2.09	1.2E-01	15	13	8.3E-03	1.11	6.58E-02	15	13	4.4E-03
Boron	7440-42-8	mg/L	52.4	3.1E+00	5.7	5	5.4E-01	13.85	8.21E-01	5.7	5	1.4E-01
Iron	7439-89-6	mg/L	187	1.1E+01	19566	9	5.7E-04	133.5	7.91E+00	19566	9	4.0E-04
Fluoride	16984-48-8	mg/L	1.3	7.7E-02	120	4	6.4E-04	0.6	3.56E-02	120	4	3.0E-04
Ammonia as N	7664-41-7	mg/L	101	6.0E+00	NV		NA	80.05	4.74E+00	NV	0	NA
Nitrite as N	14797-65-0	mg/L	0.03	1.8E-03	NV		NA	0.03	1.78E-03	NV	0	NA
Nitrate as N	14797-55-8	mg/L	0.19	1.1E-02	NV		NA	0.03	1.78E-03	NV	0	NA
Nitrite + Nitrate as N		mg/L	0.19	1.1E-02	NV		NA	0.05	2.96E-03	NV	0	NA
Total Kjeldahl Nitrogen as N		mg/L	155	9.2E+00	NV		NA	128	7.59E+00	NV	0	NA
Total Nitrogen as N		mg/L	155	9.2E+00	NV		NA	128	7.59E+00	NV	0	NA
Total Phosphorus as P		mg/L	2.19	1.3E-01	NV		NA	1.12	6.64E-02	NV	0	NA
Reactive Phosphorus as P	14265-44-2	mg/L	77.2	4.6E+00	NV		NA	7.55	4.47E-01	NV	0	NA
Formaldehyde	50-00-0	mg/L	60.2	3.6E+00	NV		NA	27.1	1.61E+00	NV	0	NA
Phenol	108-95-2	µg/L	0.01	5.9E-04	0.79	16	7.5E-04	0.0018	1.07E-04	0.79	16	1.4E-04
2-Methylphenol	95-48-7	µg/L	0.0027	1.6E-04	0.1	15	1.6E-03	0.00235	1.39E-04	0.1	15	1.4E-03
3- & 4-Methylphenol	1319-77-3	µg/L	0.253	1.5E-02	0.08	15	1.9E-01	0.00465	2.76E-04	0.08	15	3.4E-03
C6 - C9 Fraction		µg/L	0.58	3.4E-02	NV		NA	0.07	4.15E-03	NV	0	NA
C10 - C14 Fraction		µg/L	0.57	3.4E-02	NV		NA	0.33	1.96E-02	NV	0	NA
C15 - C28 Fraction		µg/L	8.71	5.2E-01	NV		NA	0.355	2.10E-02	NV	0	NA
C29 - C36 Fraction		µg/L	1.36	8.1E-02	NV		NA	0.73	4.33E-02	NV	0	NA
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	µg/L	0.57	3.4E-02	NV		NA	0.04	2.37E-03	NV	0	NA
>C10 - C16 Fraction		µg/L	0.69	4.1E-02	NV		NA	0.44	2.61E-02	NV	0	NA
>C16 - C34 Fraction		µg/L	9.03	5.4E-01	300	1	1.8E-03	0.45	2.67E-02	300	1	8.9E-05
>C34 - C40 Fraction		µg/L	1.01	6.0E-02	2800	1	2.1E-05	1.01	5.99E-02	2800	1	2.1E-05
>C10 - C40 Fraction (sum)		µg/L	10.5	6.2E-01	NV		NA	0.57	3.38E-02	NV	0	NA
>C10 - C16 Fraction minus Naphthalene (F2)		µg/L	0.69	4.1E-02	120	1	3.4E-04	0.44	2.61E-02	120	1	2.2E-04
Benzene	71-43-2	µg/L	0.098	5.8E-03	0.12	15	4.8E-02	0.007	4.15E-04	0.12	15	3.5E-03
Toluene	108-88-3	µg/L	0.06	3.6E-03	0.15	15	2.4E-02	0.0065	3.85E-04	0.15	15	2.6E-03
meta- & para-Xylene	108-38-3 106-42-3	µg/L	0.008	4.7E-04	0.1	15	4.7E-03	0.005	2.96E-04	0.1	15	3.0E-03
ortho-Xylene	95-47-6	µg/L	0.003	1.8E-04	0.1	15	1.8E-03	0.0025	1.48E-04	0.1	15	1.5E-03
Naphthalene	91-20-3	µg/L	0.009	5.3E-04	10	3	5.3E-05	0.009	5.33E-04	10	3	5.3E-05
m-Cresol	108-39-4	µg/L	0.0045	2.7E-04	0.09	15	3.0E-03	0.0002	1.19E-05	0.09	15	1.3E-04
p-Cresol	106-44-5	µg/L	0.203	1.2E-02	0.08	15	1.5E-01	0.0007	4.15E-05	0.08	15	5.2E-04

**Table C-1**  
**Summary of Terrestrial Tier 1 Screening Evaluation**  
**Carpentaria-2H and Carpentaria-3H Flowback Water Assessment**  
**Imperial**

**Notes:**

ACL = Added contaminant limits  
As = Arsenic  
BTEX = Benzene, Toluene, Ethylbenzene, and Xylene  
CEC = Cation Exchange Capacity  
Cu = Copper  
D = dissolved  
DDT = dichlorodiphenyltrichloroethane  
ECHA = European Chemical Agency  
EIL = Ecological Investigation Level  
ESL = Ecological Screening Level  
HQ = hazard quotient

mg/kg = milligrams per kilogram  
mg/L = milligrams per litre  
N = null  
NEPM = National Environment Protection Measures  
NOAEL = no-observed-adverse-effect-level  
NV = No readily available screening criterion  
PNEC = predicted no effect concentration  
T = total  
TPH = total petroleum hydrocarbons  
UCL = upper confidence limit  
USEPA = United States Environmental Protection Agency

- 1 = NEPM. 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011. Table 1B(6) Schedule B (1) - ESLs for TPH fractions F1 – F4, BTEX and benzo(a)pyrene in soil Urban residential and public open spaces.
- 2 = USEPA 2018. Region 4 Ecological Risk Assessment Supplemental Guidance. Table 3 Region 4 Soil Screening Values for Hazardous Waste Sites Value for mammalian species
- 3 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 Table 1B(5) Table 1B(6) Schedule B (1) - Generic EILs for aged As, fresh DDT and fresh naphthalene in soils irrespective of their physicochemical properties.
- 4 = USEPA 2018. Region 4 Ecological Risk Assessment Supplemental Guidance. Table 3 Region 4 Soil Screening Values for Hazardous Waste Sites Value for avian species.
- 6 = ECHA 2020. Boron Predicted no effect concentration (PNEC) in soil for terrestrial species. <https://echa.europa.eu/brief-profile/-/briefprofile/100.028.319>
- 5 = ECHA 2020. NOAEL as concentration in food source for Wistar Han rat
- 6 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 Table 1B(3) Schedule B (1) Soil-specific added contaminant limits for aged chromium III and nickel in soil. Areas of ecological significance.
- 7 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 Schedule B (1) Table 1B(2) ACL for aged Cu at pH 4.5 and CEC 5.
- 8 = Background threshold value based on 95 percent upper confidence limit (UCL) of mean for McArthur Basin surficial soils. Note, UCL of the mean represents a central tendency and is conservative to use a central tendency value for comparison.
- 9 = USEPA 2007. Ecological Soil Screening Levels for Manganese Interim Final OSWER Directive 9285.7-71. Table 2.1-Avian Wildlife Manganese Eco-SSLs (mg/kg dry weight in soil).
- 10 = ECHA 2020. Molybdenum predicted no effect concentration (PNEC) in soil for terrestrial species. Hazard for Terrestrial Organism.
- 11 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 Table 1B(3) Soil-specific added contaminant limits for aged chromium III and nickel in soil. Areas of ecological significance Schedule B (1)
- 12 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 Schedule B (1), Table 1B(3) Soil-specific added contaminant limits for aged chromium III and nickel in soil. Areas of ecological significance
- 13 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 Schedule B (1), Table 1B(1) Soil-specific added contaminant limits for aged zinc in soil at pH 4 and CEC 5.
- 14 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 Schedule B (1) Table 1B(4) Generic added contaminant limits for lead in soils irrespective of their physicochemical properties. Areas of ecological significance.
- 15 = USEPA 2018. Region 4 Ecological Risk Assessment Supplemental Guidance. Table 3 Region 4 Soil Screening Values for Hazardous Waste Sites Value for soil invertebrates.
- 16 = USEPA 2018. Region 4 Ecological Risk Assessment Supplemental Guidance. Table 3 Region 4 Soil Screening Values for Hazardous Waste Sites Value for plants.