EPL228 Annual Environmental Monitoring Report 2024-2025

Report

Document No.: L060-AH-REP-70087
Security Classification: Public

Revision	Date	Issue Reason	Prepared	Checked	Endorsed	Approved
A	5/08/2025	Issued for Review	Joelene Puntoriero Kenneth Pannell Brendan Dry	Jamie Carle Obelia Akerman Steven Jeffcote Ben Davis		
B	27/08/2025	Issued to ERM for Review	Brendan Dry Kenneth Pannell Steven Jeffcote	Jamie Carle		
0	03/10/2025	Issued for Use	Brendan Dry Jamie Carle	Obelia Akerman Ben Davis	Chris Serginson	Adrian Parody

RECORD OF AMENDMENT

Revision	Section	Amendment

DOCUMENT DISTRIBUTION

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Abbreviation and definitions

Abbreviation	Description
µg/L	microgram per litre
µm	micrometre
µs/cm	microsiemens per centimetre
AEMR	annual environmental monitoring report
AGI	acid gas incinerator
AGRU	acid gas removal unit
aMDEA	activated methyl diethanolamine
AOC	accidentally oil contaminated
AQMS	air quality monitoring stations
AS	Australian Standard
ASU	artificial settlement unit
BTEX	benzene, toluene, ethylbenzene, xylenes
BTX	benzene, toluene, xylenes
CCPP	combined cycle power plant
CCR	central control room
CFI	calibrated field instrument
CFU	colony-forming unit
cm	centimetre
CO	carbon monoxide
COA	certificate of analysis
COC	continuously oily contaminated
COD	chemical oxygen demand
DO	dissolved oxygen
EC	electrical conductivity
E. coli	*Escherichia coli*

Abbreviation	Description
EPL228	Environment Protection Licence 228 (as amended)
FRP	filterable reactive phosphorus
GEP	gas export pipeline
GTG	gas turbine generator
H_2S	hydrogen sulphide
Hg	mercury
HM	hinterland margin
HRSG	heat recovery steam generator
Ichthys LNG	collectively, the onshore gas export pipeline and the gas processing plant
INPEX	Ichthys LNG Pty Ltd
km	kilometre
LIMS	laboratory information management system
LNG	liquified natural gas
LOR	limit of reporting
LPG	liquified propane gas
m	metre
mm	millimetres
MEG	mono ethylene glycol
MDEA	methyl diethanolamine
mg/kg	milligram per kilogram
ml	millilitres
m^3/h	cubic metres per hour
MPN	most probable number
NATA	National Association of Testing Authorities, Australia
NCW	non-contaminated water
NGERS	National Greenhouse and Energy Reporting Scheme
NO	nitrogen monoxide
NO_2	nitrogen dioxide
NO_x	nitrogen oxides (as the sum of NO and/or NO_2)

Abbreviation	Description
NPI	National Pollutant Inventory
NSW	New South Wales
NT	Northern Territory
NT DITT	Northern Territory Department of Industry, Tourism and Trade
NT EPA	Northern Territory Environment Protection Authority
O_2	oxygen
OEMP	Onshore Operations Environmental Management Plan (L060-AH-PLN-60005)
PAH	polycyclic aromatic hydrocarbons
PCS	process control system
pH	measure of acidity or alkalinity
PM	particulate matter
$PM_{2.5}$	particulate matter with aerodynamic diameter less than 2.5 µm
PM_{10}	particulate matter with aerodynamic diameter less than 10 µm
ppm	parts per million
ppmv	parts per million by volume
PSD	particle size distribution
QA/QC	quality assurance/quality control
RBL	rating background level
REMP	Receiving Environment Monitoring Program
SFLA	sample for laboratory analysis
SQGV	sediment quality guideline value
SWL	standing water level
TC	tidal creek
TF	tidal flat
TKN	total Kjeldahl nitrogen
TN	total nitrogen
TOC	total organic carbon
TP	total phosphorus
TPH	total petroleum hydrocarbons

Abbreviation	Description
TRH	total recoverable hydrocarbons
TSS	total suspended solid
USEPA	United States Environmental Protection Authority
UV	Ultraviolet

EXECUTIVE SUMMARY

Ichthys LNG Pty Ltd (INPEX) was issued Environment Protection Licence 228 (as amended from time to time) on 13 December 2017 (EPL228). Activation of EPL228 occurred on 14 September 2018 triggering several EPL228 monitoring conditions and Onshore Operations Environmental Management Plan (OEMP) monitoring commitments.

Condition 76 of EPL228-05[1] requires an Annual Environmental Monitoring Report (AEMR) to be submitted to the Northern Territory Environment Protection Authority (NT EPA) for each year of the licence, unless otherwise agreed, for scheduled activities conducted during the preceding 12 months (i.e., the reporting period) from 1 July to 30 June. For this AEMR, the reporting period is defined as 1 July 2024 to 30 June 2025. This AEMR has been developed to meet the requirements of Condition 77 of EPL228-05.

Monitoring undertaken during the reporting period found that liquid effluent discharges were typically within EPL228 discharge limits, and these discharges had no discernible impact on Darwin Harbour.

All other terrestrial and marine monitoring programs (e.g. groundwater, mangroves, weeds, etc.) found that monitoring results were consistent with those reported during the previous years' AEMR and construction phase.

Based on monitoring results for the reporting period, there were no adverse effects to the declared beneficial uses and objectives of Darwin Harbour.

The point source emission monitoring reported that all permanent plant and equipment were typically within EPL228 air emission limits, and the emissions had no discernible impact on the ambient air quality of the Darwin Region.

[1] EPL228-05 came into effect on 13 December 2022.

1 INTRODUCTION

Ichthys LNG Pty Ltd (hereafter referred to as INPEX) was issued Environment Protection Licence 228 (as amended and hereafter referred to as the EPL228) for the purposes of:

Operating premises for processing hydrocarbons so as to produce, store and/or despatch liquefied natural gas or methanol, where:

a. the premises are designed to produce more than 500,000 tonnes annually of liquefied natural gas and/or methanol; and

b. no lease, licence or permit under the Petroleum Act or the Petroleum (Submerged lands) Act relates to the land on which the premises are situated.

All the activities in relation to onshore production design capacity of 12.89 million tonnes per annum of hydrocarbons[2]*, being up to:*

9.64 million tonnes of liquefied natural gas per annum from two LNG processing trains;

1.65 million tonnes of liquefied petroleum gas per annum; and

20,000 barrels of condensate per day (1.6 million tonnes of condensate per annum).

Since the 2019/2020 Annual Environmental Monitoring Report, the Ichthys LNG facility has been in steady state operations. The key milestones are shown in Section 1.4.1.

1.1 Purpose

The purpose of the AEMR is to satisfy Condition 76 of EPL228-05 for the Licensed Premises (hereafter Ichthys LNG)[3]. The reporting period for this AEMR is 1 July 2024 to 30 June 2025.

1.2 AEMR Condition requirements

Table 1-1 provides details of Condition 77 of EPL228-05 as they relate to the AEMR requirements and the relevant section for where the conditions have been addressed within this report.

Table 1-1: Annual environmental monitoring report condition requirements

EPL288 Condition #	Condition detail	Section
77	The Annual Environmental Monitoring Report must:	-
77.1	report on monitoring required under this licence;	This AEMR
77.2	include a tabulation in Microsoft ® Excel ® format, of all monitoring data required to be collected in accordance with this licence;	Provided to NT EPA separately
77.3	summarise performance of the authorised discharge to water, compared to the discharge limits specified in Table 3 in Appendix 2;	2.1

[2] As defined in EPL228-05

[3] Condition 76 reads: *The licensee must submit an Annual Environmental Monitoring Report to the NT EPA by 30 September for each year of this licence unless otherwise authorised, for the Scheduled Activity conducted during the preceding 12 month period from 1 July to 30 June.*

EPL288 Condition #	Condition detail	Section
77.4	summarise performance of the authorised emissions to air, compared to the emission limits and targets specified in Table 5 in Appendix 3, when the fuel burning or combustion facilities for the Scheduled Activity have operated under normal and maximum operating conditions for the annual period;	3
77.5	summarise operating conditions of each emission source and the resulting air emission quality;	3.2
77.6	provide total emissions to air in tonnes per year for the air quality parameters listed in Table 6 in Appendix 3;	3.1
77.7	assess the contribution of the authorised emissions on the Darwin region ambient air quality during periods not affected by bushfire smoke for Wet and Dry seasons;	3.3 and 3.5
77.8	report on outcomes of the REMP monitoring and assessment;	This AEMR
77.9	summarise measures taken to reduce waste;	6
77.10	consider the NT EPA Guideline for Reporting on Environmental Monitoring;	APPENDIX A:
77.11	be reviewed by Qualified Professional(s); and	APPENDIX B:
77.12	be provided to the NT EPA with the Qualified Professional(s) written, certified review(s) of the Annual Environmental Monitoring Report.	APPENDIX B:

1.3 Program objective

An overview of the environmental monitoring programs, their objectives, and cross-references to sections within the AEMR which provide more detail, are listed in Table 1-2. Monitoring was undertaken in accordance with the Onshore Operations Environmental Management Plan (OEMP) and EPL228 requirements.

Table 1-2: Monitoring program objectives

Program	Objective	Section
Commingled treated effluent (750-SC-003)	To ensure commingled treated effluent does not exceed discharge criteria specified in EPL228.	2.1
Harbour sediment	To detect changes in surficial sediment quality in the vicinity of the Jetty Outfall and determine if changes are attributable to Ichthys LNG operations.	2.2
Point source emissions to air	To determine if air emissions from stationary point sources are within acceptable limits	3.2
Dark-smoke events	To determine if air emissions from the flare systems are within acceptable limits.	3.4
Air toxic monitoring	To measure BTEX levels during periods when the acid gas incinerators (AGIs) are offline for 90% of more during any 30 day period.	3.5

Program	Objective	Section
Groundwater quality	To detect changes in groundwater quality and determine if these changes are attributable to Ichthys LNG operations.	4.1
Nearshore marine pests	To assess the presence/absence of invasive marine pest at the Ichthys LNG product loading jetties, through a coordinated approach with the Northern Territory (NT) Biosecurity Unit.	5.2
Introduced terrestrial fauna	To determine the presence, location and methods used to control nuisance species.	5.3
Weed survey	To identify the abundance and spatial distribution of known and new emergent weed populations, especially in areas susceptible to weed invasion, to inform weed management control activities.	5.4
Weed management	To manage invasive weeds onsite.	5.5
Vegetation rehabilitation monitoring	To determine if vegetation recovery through natural processes has occurred.	5.6
Cultural heritage	To determine if there has been any interference to cultural heritage sites.	5.7

1.4 Site information

1.4.1 Ichthys LNG operational milestones

Table 1-3 provides an overview of the Ichthys LNG key milestones for the reporting period. A general Ichthys LNG site layout is shown in Figure 1-1.

Table 1-3: Ichthys LNG key milestones during the reporting period

Date	Report
July 2024	Site Inspection with Northern Territory Environment Protection Authority (NT EPA) Officers, focused on air emissions and acid gas incinerator performance and reliability.
September 2024	• NT EPA approved the Ichthys LNG statutory audit terms of reference in accordance with Condition 33 of EPL 228-05. • INPEX notified NT EPA of Train 2 shutdown and gas export pipeline (GEP) pigging campaign which resulted in increased flaring activities at onshore Ichthys LNG plant. • INPEX issued AEMR 2023-2024 to NT EPA with independent qualified professional review completed.
October 2024	Qualified Auditor completed the onshore statutory audit of the EPL228-05, Onshore Environment Management Plan and Addendum 1 Firefighting Training Addendum.
December 2024	INPEX issued annual reports to NT EPA: • Annual Return as per condition 78 of EPL 228-05 • Annual Flaring Records as per condition 71 of EPL 228-05.

Date	Report
January 2025	INPEX finalised and issued the statutory audit report to NT EPA in accordance with condition 34 of EPL 228-05.
February 2025	NT EPA completed an audit of INPEX's AEMR vs national pollutant inventory (NPI) data for financial year 2023-2024.
March 2025	• INPEX -issued Rev 2 of the AEMR 2023-2024, following NT EPA's audit of AEMR vs NPI. • INPEX notified NT EPA of planned flaring activities associated with planned maintenance activities.
April 2025	NT EPA Site Inspection of Ichthys ILNG Facility focused on wastewater discharges; AGI operations and maintenance, equipment and sample points; air emissions; and flaring.
June 2025	NT EPA compliance assessment letter for EPL 228-05 (2024-2025) issued to INPEX.

Figure 1-1: Ichthys LNG layout

1.4.2 Environmental context

Ichthys LNG is located on Bladin Point, on the northern side of Middle Arm Peninsula in Darwin Harbour (Figure 1-2). Bladin Point is a low-lying peninsula in Darwin Harbour, which is separated from the mainland by a mudflat. Ichthys LNG is approximately 4 km from Palmerston (the nearest residential zone) and approximately 10 km south-east of the Darwin central business district, across Darwin Harbour.

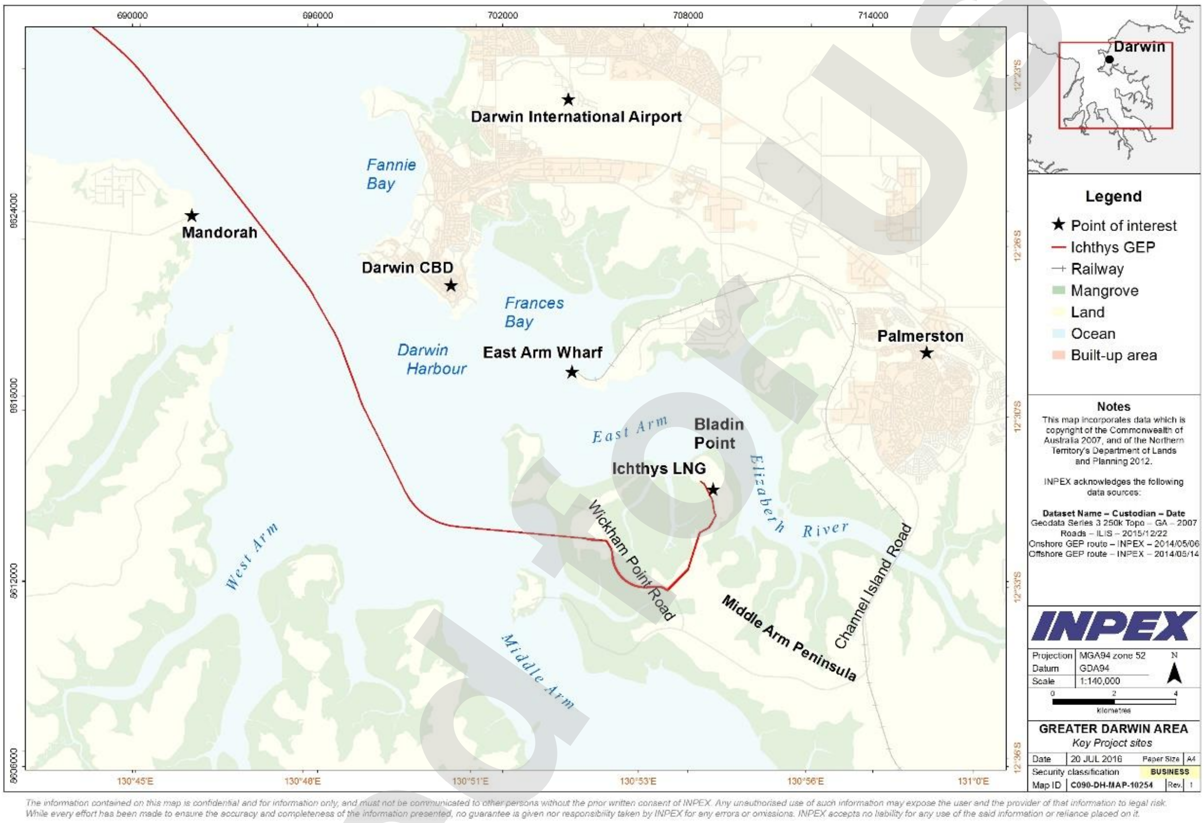


Figure 1-2: Location of Ichthys LNG

Ichthys LNG lies in the monsoonal tropics of northern Australia, which has two distinct seasons: a hot wet season from November to April and a warm dry season from May to October. April and October are transitional months between the wet and dry seasons. Darwin experiences an overall mean annual rainfall of ~1516.2 mm, the majority of which occurs during the wet season. The 2024/2025 wet season recorded 1113.2 mm of rainfall (Table 1-4 and Figure 1-3).

Table 1-4: Bladin Point wet season and transitional months rainfall (mm)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
Darwin average	**70.6**	**141.7**	**250.8**	**426.3**	**374.6**	**319.0**	**102.2**	**1,610.1**
2012/2013	36.8	199.8	232.4	282.8	291.2	415.2	141.6	1,599.8
2013/2014	134.8	352	268	780	335	14.4	111	1,995.2
2014/2015	13	226.4	175.4	630	492.2	233.8	54.2	1,825.0
2015/2016	12.6	140.6	709.4	243.2	213.4	231.8	63.8	1,614.8
2016/2017	83.8	265.4	469.8	614.2	736	515.8	220.6	2,905.6
2017/2018	93	249.2	125.4	1,031.6	380.4	423.4	39	2,342.0
2018/2019	2.6	183.8	91.6	311.4	159.6	147.8	125.8	1,022.6
2019/2020	24.0	71.2	51.5	327.2	217.7	179.9	72.9	944.3
2020/2021	69.1	87.8	343.5	333.5	194.7	163.4	55.6	1,247.5
2021/2022	67.9	131.9	282.0	357.0	222.2	121.2	89.6	1,271.7
2022/2023	155.9	177.9	341.3	196.2	228.2	207.8	92.1	1,399.4
2023/2024	9.0	52.0	111.3	476.1	289.5	203.7	11.8	1153.4
2024/2025	20.8	119.6	99.6	299.1	256.0	205.9	112.2	1113.2

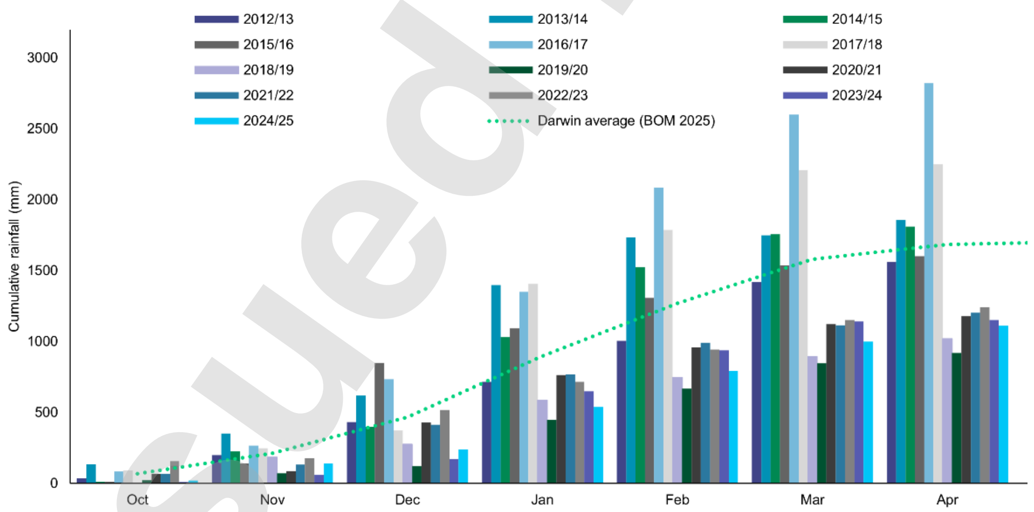


Figure 1-3: Bladin Point cumulative wet season rainfall

2 DISCHARGES TO WATER

This section describes the outcomes of the comingled treated effluent wastewater monitoring program.

2.1 Commingled treated effluent

The key objective of commingled treated effluent sampling (sampling point 750-SC-003) is to ensure discharge criteria specified in Table 3, Appendix 2 of EPL228 is not exceeded for wastewater discharged from Ichthys LNG.

The monitoring frequency, as specified in Table 3, Appendix 2 of EPL228 was implemented, with sampling occurring monthly (refer to Table 2-1).

Table 2-1: Commingled treated effluent sampling dates

Sample month	Sample collection date(s)
Jul-2024	10
Aug-2024	13
Sep-2024	10
Oct-2024	8
Nov-2024	12
Dec-2024	10
Jan-2025	14
Feb-2025	11
Mar-2025	11
Apr-2025	8
May-2025	13
Jun-2025	10

2.1.1 Method overview

All samples for the monitoring of the comingled effluent were taken from the nominated sampling point 750-SC-003 in accordance with INPEX's sample schedule (document number L290-A1-LIS-60006). All testing equipment passed QC requirements during the 2024-2025 reporting period with all calibration records maintained by INPEX's National Association of Testing Authorities, Australia (NATA) certified onsite laboratory. Records of calibration are referenced on the Certificate of Quality issued by the onsite laboratory for each sample. Applicable calibration records are verified during the statutory audit conducted every 18 months. The commingled treated effluent sampling point (750-SC-003) is located downstream of treated effluent observation basin and upstream of the Jetty Outfall. Samples collected from 750-SC-003 representing liquid effluent that is discharged to Darwin Harbour via the Jetty Outfall. The Jetty Outfall discharge is visually inspected daily by INPEX operations staff for any visible sheen caused by hydrocarbons. Sightings are recorded only by exception in the J5 logbook for reference. There was no visible hydrocarbon sheen observed during this reporting period. The sampling point consists of two valves, an isolation valve, and a sample needle valve, with the latter used to regulate flow for sample collection. Sampling from the commingled treated effluent sample point was conducted by trained laboratory analysts using NATA accredited analysis methods by both the INPEX onshore laboratory and external third-party laboratories.

The parameters, sampling methods, limit of reporting (LOR) and discharge limits for the commingled treated effluent monitoring program are provided in Table 2-2.

All results are reported through the INPEX onshore laboratory database systems (laboratory information management system; (LIMS) that produce sample Certificates of Analysis (COA) inclusive of the laboratory NATA accreditation number. To enable the identification of an exceedance, the discharge limits specified in Table 3, Appendix 2 of EPL228 (refer to Table 2-2) have been entered into the LIMS. Sample results are compared to their respective discharge limits in the COA. If a result exceeds the discharge limit, it is highlighted in the COA and the onshore laboratory generate an out of specification report. The external laboratory responsible for the micro analysis updated the reporting name for faecal coliforms in May 2024. These are now presented as thermotolerant coliforms as part of NATA accreditation requirements with testing, LOR and discharge limits remaining the same.

Table 2-2: Commingled treated effluent discharge monitoring, methods, and discharge limits

Parameter	Testing method*	Unit	LOR	Discharge limit
Volumetric flow rate	CFI	m^3/hr	n/a	180
pH	INPEX Lab	pH Unit	n/a	6.0 - 9.0
Electrical conductivity (EC)	INPEX Lab	µS/cm	10	n/a
Temperature	CFI	°C	-	35°C
Turbidity	INPEX Lab	NTU	0.5	n/a
Dissolved oxygen	CFI	%	-	n/a
TPH as oil and grease	INPEX Lab	mg/L	1.0	6
Total recoverable hydrocarbons (TRH; C10-C40)	External lab	µg/L	100	n/a
Total suspended solids (TSS)	INPEX Lab	mg/L	5	10

Parameter	Testing method*	Unit	LOR	Discharge limit
Biochemical oxygen demand (BOD)	External lab	mg/L	2	20
Chemical oxygen demand (COD)	INPEX Lab	mg O_2/L	3	125
Free Chlorine	INPEX Lab	mg/L	0.02	2
Ammonia	INPEX Lab	mg N/L	2	n/a
Total nitrogen (TN)†	Calculation	mg N/L	2	10
Total phosphorus (TP)	INPEX Lab	mg P/L	0.5	2
Reactive phosphorus (FRP)	INPEX Lab	mg P/L	0.5	n/a
Cadmium (dissolved)	External lab	µg/L	0.1	n/a
Chromium (dissolved)	External lab	µg/L	1	n/a
Copper (dissolved)	External lab	µg/L	1	n/a
Lead (dissolved)	External lab	µg/L	1	n/a
Mercury (dissolved)	External lab	µg/L	0.1	n/a
Nickel (dissolved)	External lab	µg/L	1	n/a
Silver (dissolved)	External lab	µg/L	1	n/a
Zinc (dissolved)	External lab	µg/L	5	n/a
Enterococci	External lab	cfu/100mL	1	n/a
Escherichia coli	External lab	cfu/100mL	1	100
Faecal coliforms (Thermotolerant coliforms)	External lab	cfu/100mL	1	400
Anionic surfactants	External lab	mg/L	0.1	n/a
Activated methyl diethanolamine (aMDEA)	External lab/INPEX lab	mg/L	0.001 and 5	n/a
Glycol	External lab/INPEX lab	mg/L	2 and 5	n/a

* CFI = calibrated field instrument

† Total nitrogen is a sum of nitrite, nitrate and total Kjeldahl nitrogen (TKN). TKN analysis was completed by both INPEX onshore laboratory and external laboratory interchangeable, depending on INPEX onshore laboratory equipment availability. Nitrate and nitrite were measured by INPEX onshore laboratory.

2.1.2 Results and discussion

Routine monitoring results

The results for 750-SC-003 sampling for the reporting period are presented in APPENDIX C:.

During the reporting period, there were six occurrences where wastewater quality was above discharge limits, these are further discussed in Section 2.1.3. Following an initial exceedance, further sampling at 750-SC-003 was undertaken to confirm the results as part of an investigation. Any elevated results during the investigation sampling process are considered part of an ongoing original event.

Overall, there was little variability of the wastewater quality during the 2024/2025 reporting period in comparison to previous reporting timeframes (refer to Table 2-3). The main sampling considerations for this reporting period were total nitrogen exceedances (two events) and thermotolerant coliforms exceedances (four events). These will be discussed further in Table 2-4.

Table 2-3: Yearly discharge exceedance comparison at 750-SC-003

Reporting Period	Total Number of Exceedances at 750-SC-003
2018-2019	4
2019-2020	4
2020-2021	2
2021-2022	3
2022-2023	10
2023-2024	2
2024-2025	6

In general, INPEX's main wastewater discharge exceedances during the 2024-2025 reporting period were related to total nitrogen and thermotolerant coliforms at the Jetty Outfall discharge location 750-SC-003. The current Onshore Operations Environmental Management *Plan* (L060-AH-PLN-6005 Rev 8) states that the onsite Sewage Treatment Plant (STP) is a potential source of E.coli, as it includes Membrane Bioreactor (MBR) treatment followed by UV/chlorine disinfection to reduce coliform levels. The investigations relating to the thermotolerant coliforms exceedances in July 2024 and June 2025 were able to eliminate E. coli as the source of exceedance via sampling of the wastewater treatment plant. Corrective actions have been focused on improving disinfection of waste water originating from the STP to mitigate any potential E.coli event. Elevated total nitrogen levels from the jetty outfall have been attributed to faulty pH analysers associated with the combined cycle power plant (CCPP). The faulty analysers contributed to the increase and overdose of Ammonia and subsequent increase in concentration of total nitrogen in the CCPP wastewater discharging via the jetty outfall. Corrective actions have been implemented to mitigate repeat events of this nature.

Volumetric flow rate data for the reporting period is shown in Figure 2-1. The data confirms that the volumetric flowrate throughout the period remained well below the 180 m^3/h discharge limit.

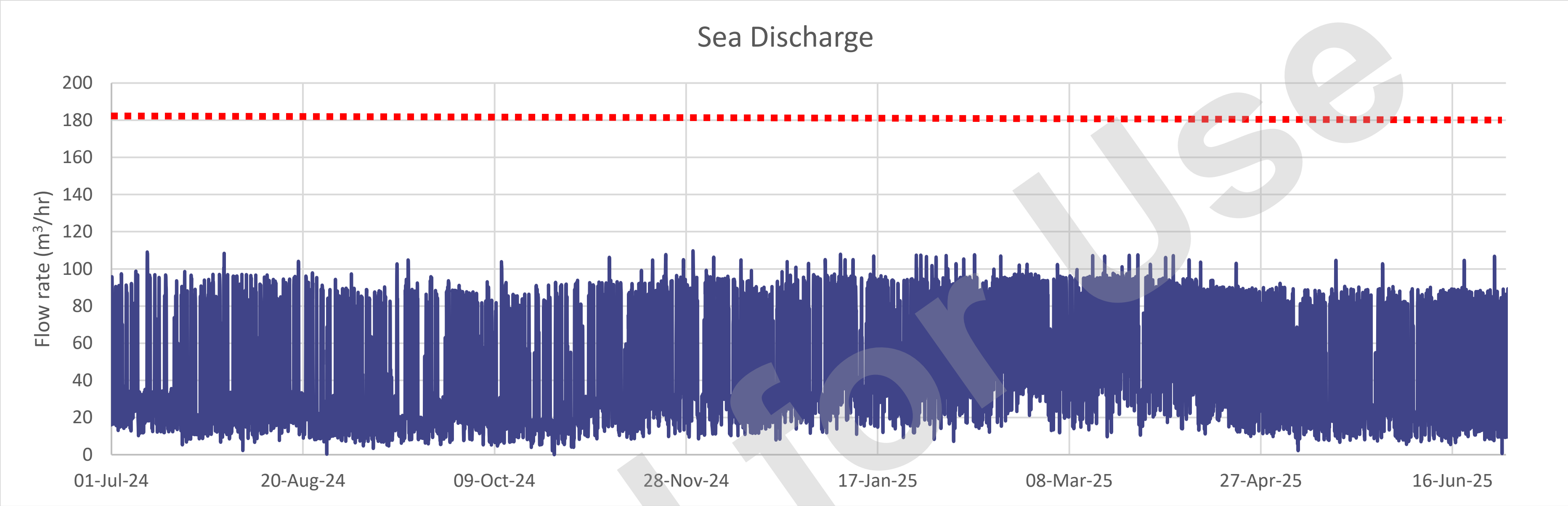


Figure 2-1: Flow rate measured at L-750-FI-0002 flow meter (m^3/h)

Quality assurance/quality control

The quality assurance/quality control (QA/QC) procedures specific to the collection and analysis of samples from sample location 750-SC-003 included:

NATA accredited analytical laboratories were used for all analysis, or a test method managed under a NATA accredited quality management system

laboratory designated sample holding times met chain of custody forms was completed and accompanied the samples

INPEX laboratory QA/QC procedures were completed as follows:

- laboratory blanks
- replicates/duplicate
- spikes
- calibration against standard reference materials
- INPEX laboratory review of external laboratory QA/QC analysis reports
- annual sampling verification, which involves the collection of two samples and trip blanks
- calibration of all field-testing equipment using the INPEX standard method(s) was undertaken.

2.1.3 Assessment of limit exceedances and investigation outcomes

Throughout the reporting period and displayed on the COA, there were six discharge limit exceedances (refer to APPENDIX C:). A summary table of all discharge limit exceedances, including contributing factors and corrective actions is provided in Table 2-4.

Table 2-4: Summary of commingled treated effluent sample point exceedance events

Date sampled	Exceedance reported	Parameter	Result	Limit	Contributing factors	Corrective actions
10 July 2024	18 July 2024	Thermotolerant coliforms	1000 CFU/100ml	400 CFU/100ml	The sample was taken at 09:00 am on Wednesday 10 July 2024 from the combined Jetty Outfall discharge line, sampling location 750-SC-003. The Onshore Laboratory issued the NATA accredited testing results to the Ichthys Onshore Environmental Advisor at 08:56 am on Wednesday 17 July 2024; confirming a thermotolerant coliforms result of 1000 CFU/100mL, which exceeded the discharge limit of 400 CFU/100mL. INPEX notified NT EPA of the exceedance at 14:47 on Thursday 18 July, which was about five hours outside of the 24 hour reporting timeframe. An internal non-conformance report was raised against Condition 74 of EPL228-05. During the investigation, another two thermotolerant coliform exceedances were detected (in August and September) from the combined Jetty Outfall discharge location 750-SC-003 during routine monthly sampling, and were included within this investigation report. Sampling results from the investigation indicated that E. Coli and Enterococci results were significantly lower than the Thermotolerant Coliform results, and therefore it was unlikely that the Thermotolerant Coliform exceedances were solely from a faecal source. Following the exceedance in July 2024, INPEX conducted a site investigation of the WWTP between 23-24 July 2024 and confirmed that the C/D/E/F membrane bioreactors (MBR) were still performing well. However, MBR membranes A and B at L-750-SU-004 were in poor condition (high turbidity permeate). The low performance of MBR membranes A/B at L-750-SU-004 appeared to be masked because membranes C/D/E/F were producing excellent quality permeate and the WWTP was running within specification and below design capacity3. Therefore, it was recommended that MBR membranes A/B at L-750-SU-004 be replaced to maintain excellent quality permeate.	The following actions were taken to improve performance of the WWTP: • replacement of two electronic ballast, UV lamps in the WWTP occurred since the last exceedance in September 2024, • replacement of four yellow induction LED's for electronic ballast functionality replaced on control panel in the WWTP, • verification that all UV lamps in the WWTP were in working order, and • confirmation that the irradiance value on UV meter LCD within the WWTP is 90%. • draining of the irrigation tank, on two occasions, to remove sludge by vacuum truck (and dispose offsite), to reduce residual sludge that may contribute to the out of specification (OOS) results, and • utilisation of the irrigation tank to circulate stagnant water from SU-404 observation basin), to reduce residual sludge that may contribute to the out of specification (OOS) results. The below MOC's were focused on ensuring wastewater originating from the WWTP onsite were within specifications to assure the source of the thermotolerant coliform exceedances were not faecal in nature: • implementation of MOC #200016721 to replace WWTP Inlet screen by Q1 2025, and • implementation of MOC #200016981 to replace two of the six MBR membrane cassettes (A and B) which had performance issues in July 2024 between June to December 2025.
13 August 2024	23 August 2024	Thermotolerant coliforms	870 CFU/100ml	400 CFU/100ml		
10 September 2024	13 September 2024	Thermotolerant coliforms	750 CFU/100ml	400 CFU/100ml		
8 April 2025	9 April 2025	Total nitrogen	20mg/L	10mg/L	During the routine monthly sampling event on 08 April 2025, the following wastewater streams were flowing into the combined jetty discharge outfall line (L750-SC-003): • CCPP Neutralisation Package • Demin Package • Treated Water from Irrigation tank As part of the investigation process, a total of 8 additional samples were carried out the following sample locations assisting formulated the subsequent corrective actions: • Observation Basin (L-750-SU-404) • Open Ground Flare COC Pit1 (L-750-SU-051) • Filtered Water Package (L-750-SC-002) • Jetty Outfall comingled (L-750-SC-003) CCPP contributions to the TN exceedance and the observation basin pumps (404-A/B) were offline when the sample was taken.	Through the incident investigation process, the following actions were identified to understand the issue, prevent reoccurrence and better manage future exceedances: 1. Environment to check the basis of design for sampling procedure of the Jetty Outfall, to see whether it requires streams and pumps to be flowing, or whether it restricts the pumps to be turned off prior to sampling. 2. Subject to action 1; Onshore Laboratory to review current sampling procedure.

Date sampled	Exceedance reported	Parameter	Result	Limit	Contributing factors	Corrective actions
10 June 2025	11 June 2025	Total nitrogen	15mg/L	10mg/L	The investigation confirmed that the TN exceedance was caused by elevated ammonia levels in the combined cycle power production (CCPP) package. The cause for the elevated ammonia in the CCPP was associated with a faulty conductivity analyser which is designed to calculate pH of the CCPP blowdown wastewater INPEX engineering confirmed that the faulty conductivity analyser used to analyse pH in the CCPP ammonia dosing skid[1], incorrectly calculated pH to be lower. Consequently, the ammonia pumps automatically increased stroke to 100% to rectify/increase the incorrectly calculated pH, causing the system to overdose ammonia. The overdose in ammonia resulted in an increased concentration of TN, causing the exceedance at Jetty Outfall L750-SC-003 The root cause of the event was attributed to faulty equipment within the CCPP ammonia dosing skid.	• Raise a notification #10186637 and work order #2100120205 (priority 1) to frontline engineering and maintenance to rectify the pH analyser issue • Instruct CCPP package operators to switch ammonia dosing from AUTO to MANUAL control to manage pH levels
10 June 2025	19 June 2025	Thermotolerant coliforms	660 CFU/100ml	400 CFU/100ml	Based on the investigation results, the exact cause or source of the thermotolerant coliform exceedance is unknown because elevated results of thermotolerant coliforms were observed in the following systems: • the Jetty Outfall (750-SC-003) had the highest level of thermotolerant coliform on 19 June at 2000 CFU/100mL; however this reduced to 260 CFU/100mL on 8 July 2025; • the observation basin (750-SU-404) had an elevated level of thermotolerant coliforms on 19 June 2025 at 800 CFU/100mL; however this reduced to 620 CFU/100mL on 2 July 2025; • the filtered water ex 750-T-550 (750-SC-002) with 380 CFU/100mL on 2 July 2025; and • the AOC holding basin inlet (750-SU-403) with 250 CFU/100mL on 2 July 2025. The other systems investigated, had low levels of thermotolerant coliforms detected, and were therefore not considered further in the investigation. Furthermore, sample results taken on 19 June 2025 at 750-SC-004 (Irrigation Water ex 750-T-550) and 750-SC-009 (Irrigation Tank) confirmed that cause of the event was not faecal in nature with low E.Coli levels.	• chemical dosing advice was issued on 5 July 2025, to treat the following sumps 750-SU-402; 750-SU-404 and 750-SU-406 with sodium hypochlorite and sump 750-SU-403 with calcium hypochlorite, to reduce thermotolerant coliform levels • investigation of UV unit identified that it was operating below specification • Maintenance Notification (#10186637) was raised rectify the UV unit on 23 June 2025. • Routine monthly sampling at Jetty Outfall (L-750-SC-003) on 8 July 2025 (LIMS Sample ID L2503364001) confirmed that the thermotolerant coliform levels were back within specification • No further actions will be undertaken, other than routine monthly sampling at Jetty Outfall location L-750-SC-003 (next sample due early August 2025). Should another exceedance occur, additional hypochlorite dosing may be considered to the Irrigation Tank and Observation Basin.

2.1.4 Program rationalisation

Sampling is to remain as per EPL228 requirements, no changes are proposed to the sampling process.

2.2 Harbour sediment

The purpose of the harbour sediment quality monitoring program is to provide an early warning of potential accumulation of contaminants from Ichthys LNG wastewater discharges, in surficial sediments surrounding the jetty outfall.

In accordance with the OEMP (L060-AH-PLN-60005), harbour sediment monitoring occurs biennially (every two years). Harbour sediment monitoring was within the reporting period in July 2024 associated reporting is summarised in Table 2-5.

The key objective of the harbour sediment quality program is to detect changes in surficial sediment quality in the vicinity of the Jetty Outfall and determine if changes are attributable to Ichthys LNG operations.

Table 2-5: Harbour sediment quality survey details

Survey	Date	Report	INPEX Dox #
5	04 July 2024	Harbour Sediment Quality Monitoring – Interpretative Report No. 5	L290-AH-REP-70082

2.2.1 Method overview

The harbour sediment quality survey was performed in accordance with the Harbour Sediment Quality Monitoring Plan (L290-AH-PLN-70003). Surficial sediment samples were collected using a grab sampler from 16 potential impact sites radiating away from the jetty outfall and two control sites in East Arm (Figure 2 2). The sediment grab sampler and QA/QC procedures followed were in accordance with the Harbour Sediment Quality Monitoring Plan, which was developed in consideration of the National Assessment Guidelines for Dredging (NAGD; Commonwealth of Australia 2009). The use of NAGD ensures consistency in sediment characterisation programs and is largely adopted for use in the Northern Territory (NT EPA 2013).

Following collection, surficial sediment samples were sent to a NATA accredited laboratory for analysis of parameters listed in Table 2-6. Laboratory results were then compared to benchmark levels to ascertain whether a trigger exceedance had occurred.

Exceedance of a benchmark level is defined as a measured analyte exceeding its relevant sediment quality guideline value (SQGV; also referred to as guideline value) as per ANZG (2018) and the same analyte also exceeding the background level for Darwin Harbour sediment. Background levels were calculated based on results presented in 2012 Darwin Harbour baseline sediment survey (Munksgaard et al. 2013). Note, where measured metal or metalloids exceeded SQGVs, results where possible are normalised for aluminium concentrations based on methods described in Munksgaard (2013) and Munksgaard et al. (2013) and compared to background levels (i.e. baseline or reference levels).

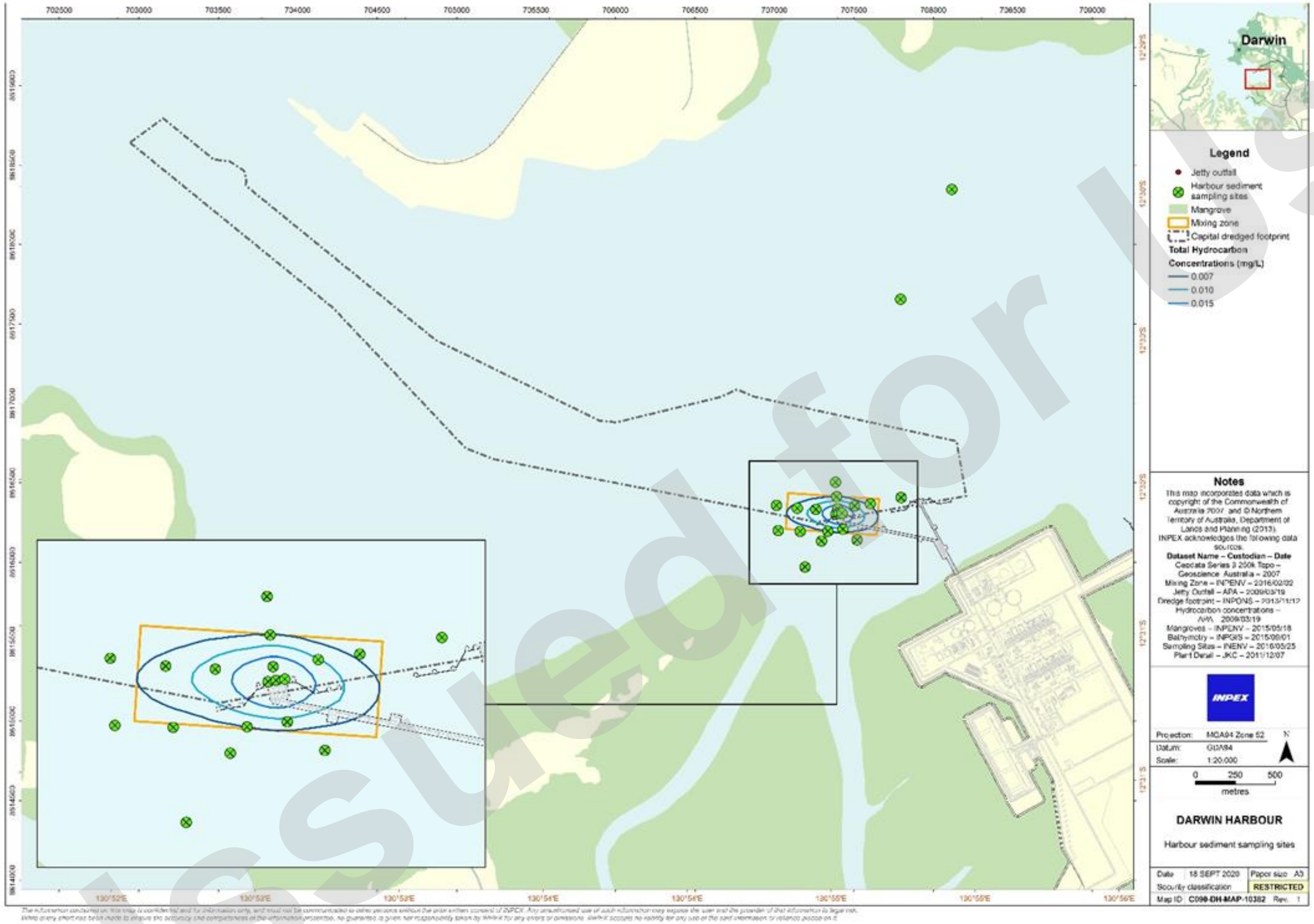


Figure 2-2: Harbour sediment quality sampling locations

Table 2-6: Harbour sediment quality monitoring parameters, trigger, and background values

Parameter	Unit	Trigger value*	Background value†
Total organic carbon (TOC)	%	n/a	n/a
TPH / TRH	mg/kg	280	n/a
Benzene, toluene, ethylbenzene, and xylene (BTEX)	mg/kg	n/a	n/a
Aluminium	mg/kg	n/a	n/a
Antimony	mg/kg	2	n/a
Arsenic	mg/kg	20	16.0
Cadmium	mg/kg	1.5	0.07
Chromium	mg/kg	80	17.5
Copper	mg/kg	65	4.7
Lead	mg/kg	50	8.8
Mercury	mg/kg	0.15	n/a
Nickel	mg/kg	21	8.7
Zinc	mg/kg	200	21.4
Particle size distribution (PSD)	µm	n/a	n/a

* ANZG (2018) sediment quality guideline value.

† Background levels are from Munksgaard et al. (2013), using the average of non-normalised sediment samples collected from intertidal (n=247) areas within the Darwin Harbour.

2.2.2 Quality control assessment

All samples arrived at laboratories within the required holding times for all analytes.

Laboratory QA/QC

The following matrix spike recoveries were outside control limits and may affect data interpretation:

Aluminium: Recovery % 68; Lower control limit % 75; Upper control limit % 125.

The low recovery rates suggest that the actual concentrations of aluminium in samples have the potential to be biased low by up to 32% and should be taken into consideration when using results quantitatively. However, as there is no established trigger value for aluminium, interpretation of the results remains unaffected. No other analytes were outside of the recommended acceptance range.

Sediment blanks

Analyte concentrations measured in blank samples were all below laboratory LORs.

Replicate samples

Analysis of field split samples revealed that the relative percentage differences (RPD) achieved the performance criteria of <35%%, with the following exceptions:

I02 and QA01

- Total organic carbon (TOC) (RPD = 78%).

I02 and QA02

- Aluminium (RPD = 91%)
- Chromium (RPD = 51%)
- Nickel (RPD = 43%)
- TOC (RPD = 96%)

Analysis of the triplicate samples revealed that the relative percentage differences were within the performance criteria of <50%, with the following exceptions:

I15 and QA03

- Mercury (RPD = 120%)
- TOC (RPD = 195%)

I15 and QA04

- Aluminium (RPD = 97%)
- Chromium (RPD = 58%)
- Nickel (RPD = 52%)
- TOC (RPD = 143%)

I16 and QA05

- Mercury (RPD = 86%)
- TOC (RPD = 96%)

I16 and QA06

- Aluminium (RPD = 87%)
- Nickel (RPD = 50%)

As all analytes reported were below the established trigger values, elevated RPD's are not considered to affect the interpretation of results.

Sample QA02 QA04 and QA06 were analysed by the secondary laboratory

2.2.3 Results and discussion

Metal and metalloid results for harbour sediment quality are presented in Table 2-7. These results are compared to trigger values and background levels. Trigger values have been derived from ANZG (2018) while background levels are from Munksgaard et al. (2013).

All samples tested for hydrocarbons (total recoverable hydrocarbons (TRHs), total petroleum hydrocarbons (TPHs) and benzene, toluene, ethylbenzene and xylene (BTEX)) recorded concentrations below the limit of reporting (LOR), with the exception of TPH detected within the fraction range of C10-C36 and C10-C40 at sites I04, I05 and I06. Following these detections, sediment samples were subjected to silica gel clean-up. The subsequent results for TRH (>C10-C40 fraction) and TPH (>C10-C36 fraction) reported below the LOR (100 mg/kg and 50mg/kg respectively).

No trigger exceedances were recorded for any analyte at either control or impact sites during the July 2024 harbour sediment monitoring event. Metal concentrations in 2024 were generally lower than results recorded in 2021 and 2022 and were comparable with results recorded in 2019. Overall, there were no changes to harbour sediment quality associated with Ichthys LNG activities. As such, discharges have not adversely affected the declared beneficial users or harbour sediment objectives for Darwin Harbour.

Table 2-7: Harbour sediment quality survey metal and metalloid results (mg/kg)

Site*	**Aluminium**	**Antimony**	**Arsenic †**	**Cadmium**	**Chromium**	**Copper**	**Lead**	**Mercury**	**Nickel**	**Zinc**
Trigger values	**n/a**	**2**	**20**	**1.5**	**80**	**65**	**50**	**0.15**	**21**	**200**
Background level	**n/a**	**n/a**	**16.0**	**0.071**	**17.5**	**4.7**	**8.8**	**n/a**	**8.7**	**21.4**
I1	7700	<1	12	<0.1	27	6.2	11	<0.02	8.6	24
I2	6100	<1	12	<0.1	22	4.8	9.9	<0.02	7.1	21
I3	5500	<1	12	<0.1	21	4.4	9.5	<0.02	6.5	19
I4	4200	<1	9.2	<0.1	15	3.7	7.3	<0.02	5	16
I5	4900	<1	7.9	<0.1	18	4.4	8.6	<0.02	5.8	19
I6	6100	<1	7.1	<0.1	19	4	7.2	<0.02	5.7	17
I7	5100	<1	10	<0.1	18	7	7.8	<0.02	6	17
I8	5800	1.1	11	<0.1	20	5	8.6	<0.02	6.5	19
I9	6200	<1	9.8	<0.1	20	4.7	8.6	<0.02	6.4	19
I10	6000	<1	10	<0.1	21	4.9	9.6	<0.02	6.6	20
I11	5500	<1	12	<0.1	19	4.4	9.2	<0.02	6	18
I12	5100	<1	9.6	<0.1	18	4.2	8.2	<0.02	5.6	17
I13	3900	<1	9.5	<0.1	17	4.5	7.1	<0.02	4.9	14
I14	4100	<1	15	<0.1	33	3.2	10	<0.02	3.4	12
I15	4500	<1	11	<0.1	17	4.1	8	<0.02	5.3	16
I16	1600	<1	12	<0.1	7.1	1.4	3.6	<0.02	1.8	6.8
C1	2000	<1	13	<0.1	11	2	3.9	<0.02	2.4	7.2
C2	4700	<1	19	<0.1	20	4.5	8.5	<0.02	5.6	18

* C = Control Site, I = Impact site.

† Bold values indicate trigger exceedance and results in brackets have been normalised for aluminium concentrations as per Munksgaard (2013)

Table 2-8: Harbour sediment quality survey organic results

Site*	TOC (mg/kg)	TPH (mg/kg)	TPH (mg/kg) Post silica gel clean-up	BTEX (mg/kg)
Trigger values	**n/a**	**280**	**280**	**n/a**
Background level	**n/a**	**n/a**	**n/a**	**n/a**
I1	11,000	<50	-	<0.1
I2	34,000	<50	-	<0.1
I3	<1000	<50	-	<0.1
I4	35,000	**340**	50	<0.1
I5	<1000	176	-	<0.1
I6	12,000	155	-	<0.1
I7	18,000	<50	-	<0.1
I8	15,000	<50	-	<0.1
I9	5000	<50	-	<0.1
I10	34,000	<50	-	<0.1
I11	5000	<50	-	<0.1
I12	3000	<50	-	<0.1
I13	10,000	<50	-	<0.1
I14	15,000	<50	-	<0.1
I15	85,000	<50	-	<0.1
I16	20,000	<50	-	<0.1
C1	16,000	<50	-	<0.1
C2	48,000	<50	-	<0.1

* C = Control Site, I = Impact site

2.2.4 Trigger assessment outcomes

There were no exceedances of trigger values for the reporting period.

2.2.5 Program rationalisation

No program rationalisation was proposed for harbour sediment monitoring from the 2024 harbour sediment monitoring. Results of the 2024 harbour sediment monitoring event are consistent with results of the 2022 monitoring event, recommendation for monitoring to continue to be undertaken biennially. The next proposed survey is planned for 2026 and will be included in the associated reporting period.

3 EMISSIONS TO AIR

This section includes the outcomes of the following monitoring programs:

point source emissions (Section 3.2)

dark smoke events (Section 3.4).

This section also summarises the operating condition of each emission source and the resulting air emission quality (Section 3.3) and provides a summary of total emissions to air in tonnes per year for the main parameters outlined in EPL228 (Section 3.1).

3.1 Total emissions to air

INPEX is required to provide total stationary emissions to air (tonnes/year) for air quality parameters (Condition 77.6 of EPL228-05 listed in Table 6, Appendix 3 of EPL228). Estimated total stationary emissions to air for the reporting period are provided in Table 3-1, which are based on INPEX's similar data sources used for Commonwealth emission reporting requirements for National Pollutant Inventory (NPI) and National Greenhouse and Energy Reporting Scheme (NGERS).

Table 3-1 has also been updated to include total volatile organic compounds (total VOCs), sulphur dioxide (SO_2) and particulate matter (PM; specifically PM_{10} and $PM_{2.5}$) as recommended by NT EPA's NPI audit (5 February 2025[4]) and annual compliance assessment of EPL228-05 (19 June 2025).

Table 3-1: Estimated total emissions to air for the reporting period

Parameter	Emissions (t/yr) [1,2]	
	EPL-228 stationary emissions for AEMR	**NPI emissions onshore**
NO_x as nitrogen dioxide (NO_2)	1,900.990	1,953.057
Mercury (Hg)	0.032	0.032
Benzene	540.978	541.740
Toluene	468.782	469.686
Ethylbenzene	0.924	1.143
Xylenes	60.771	61.653
Hydrogen sulphide (H_2S)	150.868	150.868
Carbon monoxide (CO)	3,115.966	3,123.659
Particulate matter 10 (PM_{10})	100.882	105.337
Particulate matter 2.5 ($PM_{2.5}$)	100.882	105.159
Total volatile organic compounds (VOCs)	NA	4,324.438

[4] NT EPA recommended *that all substantial emissions of toxic air pollutants such as VOCs, sulfur dioxide and particulates should be included in your AEMR* (NTEPA letter 33-D25-1853 received 5 February 2025).

Parameter	Emissions (t/yr) [1,2]	
	EPL-228 stationary emissions for AEMR	NPI emissions onshore
Sulphur dioxide (SO_2)	NA	273.137

Note:

1. Differences between EPL228 stationary emissions for AEMR vs NPI emissions are due to the differences in the scope of emissions reported. For example, NPI requires the inclusion of stationary and fugitive emissions while the EPL 228-05 only requires reporting of emissions from particular stationary sources (Table 6 of Appendix 3 of EPL 228-05 lists these sources).
2. An increase in FY 25 reported emissions compared to FY 24 reported emissions has occurred due to a correction in the calculation method, to better reflect Ichthys LNG operating conditions.

3.2 Point source emissions to air

The key objective of point source emission monitoring (commonly referred to as stack sampling) is to ensure air emissions do not exceed the concentration limit criteria specified in Table 5, Appendix 3 of EPL228. The frequency of monitoring is outlined in EPL228, which requires annual monitoring of most emission points, monthly monitoring of hot venting, and hydrocarbons monitoring for all flare events.

Annual monitoring is undertaken in accordance with the requirements of EPL228.

Table 3-2 provides a summary of the point source emission monitoring conducted for the reporting period.

Table 3-2: Point source emissions survey dates

Survey	Start date	End Date
Ektimo Report #R017503-1 tested: - LNG Refrigerant Compressor Driver Gas Turbines Train 1 West (A1) - LNG Refrigerant Compressor Driver Gas Turbines Train 1 East (A3)	13 August 2024	14 August 2024
Ektimo Report #R017503-2a tested: - LNG Refrigerant Compressor Driver Gas Turbines Train 2 West (A2) - LNG Refrigerant Compressor Driver Gas Turbines Train 2 East (A4)	13 August 2024	14 August 2024
Ektimo Report #R017503-3 & 3a, tested: - Heating Medium Furnace A (A15) - Heating Medium Furnace B (A16)	16 August 2024	16 August 2024
Ektimo Report #R017503-4a tested: - AGRU Incinerator - LNG Train 1 (A13-1)	14 August 2024	14 August 2024
Ektimo Report #R018379-3a tested - AGRU Incinerator - LNG Train 1 (A13-1)	19 February 2025	19 February 2025
Ektimo Report #R018379-2a tested:	20 February 2025	22 February 2025

Survey	Start date	End Date
- CCPP Heat Recovery Steam Generator (HRSG) 1 (A5-2) - CCPP Heat Recovery Steam Generator (HRSG) 2 (A6-2) - CCPP Gas Turbine Generator 3 (GE Frame 6; A7-1) - CCPP Heat Recovery Steam Generator (HRSG) 4 (A8-2) - CCPP Heat Recovery Steam Generator (HRSG) 5 (A9-2)		

3.2.1 Method overview

Stationary source emissions monitoring was completed at 12 point sources (out of a total of 18 stacks) on the Frame 7 compression turbines (4), CCPP Frame 6 heat recovery system generator (HRSG) stacks (5), heating medium furnaces (2) and AGRU incinerator 1 (2).

For the CCPP Frame 6 turbines, each turbine has two stacks, one which allows for normal operation of the turbine (with exhaust emissions directed to a conventional stack) and a separate stack with an associated HRSG, allowing for steam to be generated through the duct burning of fuel. The two stacks cannot be operated together so stack monitoring is dependent on which stack is in use at the time of sampling.

Table 3-3 and Table 3-4 show the EPL228 air emission target and limits plus the constituents that are required to be monitored at the point source locations as per Appendix 3, Table 5 and Table 6 respectively, of EPL228-05. Figure 3-1 shows the locations of the stationary source emissions monitoring locations at Ichthys LNG.

The following locations are inline gas sampling points (not ports) and as such are exempt from the standard methods for point source emissions sampling:

- 551-SC-003 (release point number A13-2)
- 552-SC-003 (release point number A14-2)
- 541-SC-001 (release point number A13-3) and
- 542-SC-001 (release point number A14-3).

INPEX conducts inhouse gas sampling and analysis from these locations for benzene, toluene, ethylbenzene and xylene (BTEX), hydrogen sulphide (H_2S) and mercury (Hg) using conventional industry methods. The analysis of these substances is conducted on a monthly basis using test methods that are managed under a NATA-accredited Quality Management System. It is noted that in-house accreditation scope does not specifically cover the individual analytical methods.

Stationary source and gas samples are either collected by INPEX laboratory technicians and tested in the on-site NATA accredited laboratory or are collected by an external NATA-accredited contractor and analysed in the field or by external laboratories.

All stack sampling ports have been installed in accordance with AS4323.1-1995 Stationary Source Emissions - Selection of Sampling Positions.

All stack sampling, where applicable, is undertaken in accordance with:

- New South Wales (NSW) Environment Protection Authority (formerly the Department of Environment and Conservation) Approved Methods for the Sampling and Analysis of Air Pollutants in NSW; or

- United States Environmental Protection Agency (USEPA) Method 30B (Mercury Sorbent Trap Procedure) for mercury emissions.

For the sampling and analysis of nitrogen oxides (NO_x), INPEX and the stack emission monitoring Contractor, have followed the procedures as listed in NSW Test Method 11, which cross references to USEPA Method 7E *Determination of Nitrogen Oxide Emission from Stationary Sources (Instrumental Analyser Procedure)*. This lists comprehensive quality control and calibration procedures that must be followed to ensure accurate and reliable results. The analysis of nitrous oxide is also managed under a NATA accredited Quality Management System.

Table 3-3: Contaminant release limits to air at authorised stationary emission release points

Release point number	**Source**	**Pollutant**	**Concentration target**		**Concentration limit**	
			mg/Nm^3	ppmv	mg/Nm^3	ppmv
A1, A2, A3, A4	LNG Refrigerant Compressor Driver Gas Turbines (GE Frame 7s)	NO_x as NO_2	50 @ 15% O_2 dry	25 @ 15% O_2 dry	70@ 15% O_2 dry	35 @ 15% O_2 dry
A5-1, A6-1, A7-1, A8-1, A9-1	CCPP Gas Turbine Generators (GE Frame 6s, 38 MW)	NO_x as NO_2	50 @ 15% O_2 dry	25 @ 15% O_2 dry	70@ 15% O_2 dry	35 @ 15% O_2 dry
A5-2, A6-2, A7-2, A8-2, A9-2	CCPP Gas Turbine Generators (GE Frame 6s, 38 MW) also burning vaporised iso-pentane in duct burners	NO_x as NO_2	150 @ 15% O_2 dry	75 @ 15% O_2 dry	350@ 15% O_2 dry	175 @ 15% O_2 dry
A13-1, A14-1	AGRU Incinerators	NO_x	320 @ 3% O_2 dry	160 @ 3% O_2 dry	350@ 3% O_2 dry	175 @ 3% O_2 dry
A15, A16	Heating Medium Furnaces	NO_x	160 @ 3% O_2 dry	80 @ 3% O_2 dry	350@ 3% O_2 dry	175 @ 3% O_2 dry

Table 3-4: Air emission monitoring program

Release Point Number	Sampling Location Number	Source	Monitoring Frequency	Parameter
A1	L-641-A-001	LNG Train 1 Refrigerant Compressor Driver Gas Turbine (GE Frame 7)	Annual	NO_x as NO_2, CO, temperature, efflux velocity, volumetric flow rate
A2	L-642-A-001	LNG Train 2 Refrigerant Compressor Driver Gas Turbine (GE Frame 7)		
A3	L-641-A-002	LNG Train 1 Refrigerant Compressor Driver Gas Turbine (GE Frame 7)		
A4	L-642-A-002	LNG Train 2 Refrigerant Compressor Driver Gas Turbine (GE Frame 7)		
A5-1	L-780-GT-001	CCPP Gas Turbine Generator #1 (GE Frame 6) – conventional stack	Annual	NO_x as NO_2, CO, temperature, efflux velocity, volumetric flow rate
A6-1	L-780-GT-002	CCPP Gas Turbine Generator #2 (GE Frame 6) – conventional stack		
A7-1	L-780-GT-003	CCPP Gas Turbine Generator #3 (GE Frame 6) – conventional stack		
A8-1	L-780-GT-004	CCPP Gas Turbine Generator #4 (GE Frame 6) – conventional stack		
A9-1	L-780-GT-005	CCPP Gas Turbine Generator #5 (GE Frame 6) – conventional stack		
A5-2	L-630-F-001	CCPP Gas Turbine Generator #1 (GE Frame 6) – HRSG stack		
A6-2	L-630-F-002	CCPP Gas Turbine Generator #2 (GE Frame 6) – HRSG stack		
A7-2	L-630-F-003	CCPP Gas Turbine Generator #3 (GE Frame 6) – HRSG stack		
A8-2	L-630-F-004	CCPP Gas Turbine Generator #4 (GE Frame 6) – HRSG stack		
A9-2	L-630-F-005	CCPP Gas Turbine Generator #5 (GE Frame 6) – HRSG stack	Annual	NO_x as NO_2, CO, temperature, efflux velocity, volumetric flow rate
A13-1	L-551-FT-031	AGRU Incinerator – LNG Train 1	Annual	NO_x as NO_2, CO, temperature, efflux velocity, volumetric flow rate
A13-2	551-SC-003	AGRU Hot Vent – LNG Train 1, prior to release at A3	Monthly	BTEX, H_2S, volumetric flow rate
A13-3	541-SC-001	Feed gas to AGRU – LNG Train 1 – prior to release at A3	Monthly	Hg
A14-1	L-552-FT-031	AGRU Incinerator – LNG Train 2	Annual	NO_x as NO_2, CO, temperature, efflux velocity, volumetric flow rate
A14-2	552-SC-003	AGRU Hot Vent – LNG Train 2, prior to release at A4	Monthly	BTEX, H_2S, volumetric flow rate
A14-3	542-SC-001	Feed gas to AGRU – LNG Train 2 – prior to release at A4	Monthly	Hg
A15	L-640-A-001-A	Heating Medium Furnaces	Annual	NO_x as NO_2, CO, temperature, efflux velocity, volumetric flow rate
A16	L-640-A-001-B	Heating Medium Furnaces	Annual	NO_x as NO_2, CO, temperature, efflux velocity, volumetric flow rate
A17	L-700-F-002	Ground flare #5 warm	All flare events	Mass of hydrocarbons flared
A18	L-700-F-001-A/B	Ground flare #2 cold		
A19	L-700-F-003	Ground flare #1 spare		
A20	L-700-F-005-A/B	Tank flare #1 LNG		
A21	L-700-F-006-A/B	Tank flare #2 LPG		
A22	L-700-F-007	Tank flare #3 LNG/LPG		
A23	L-700-F-004	Liquid flare		

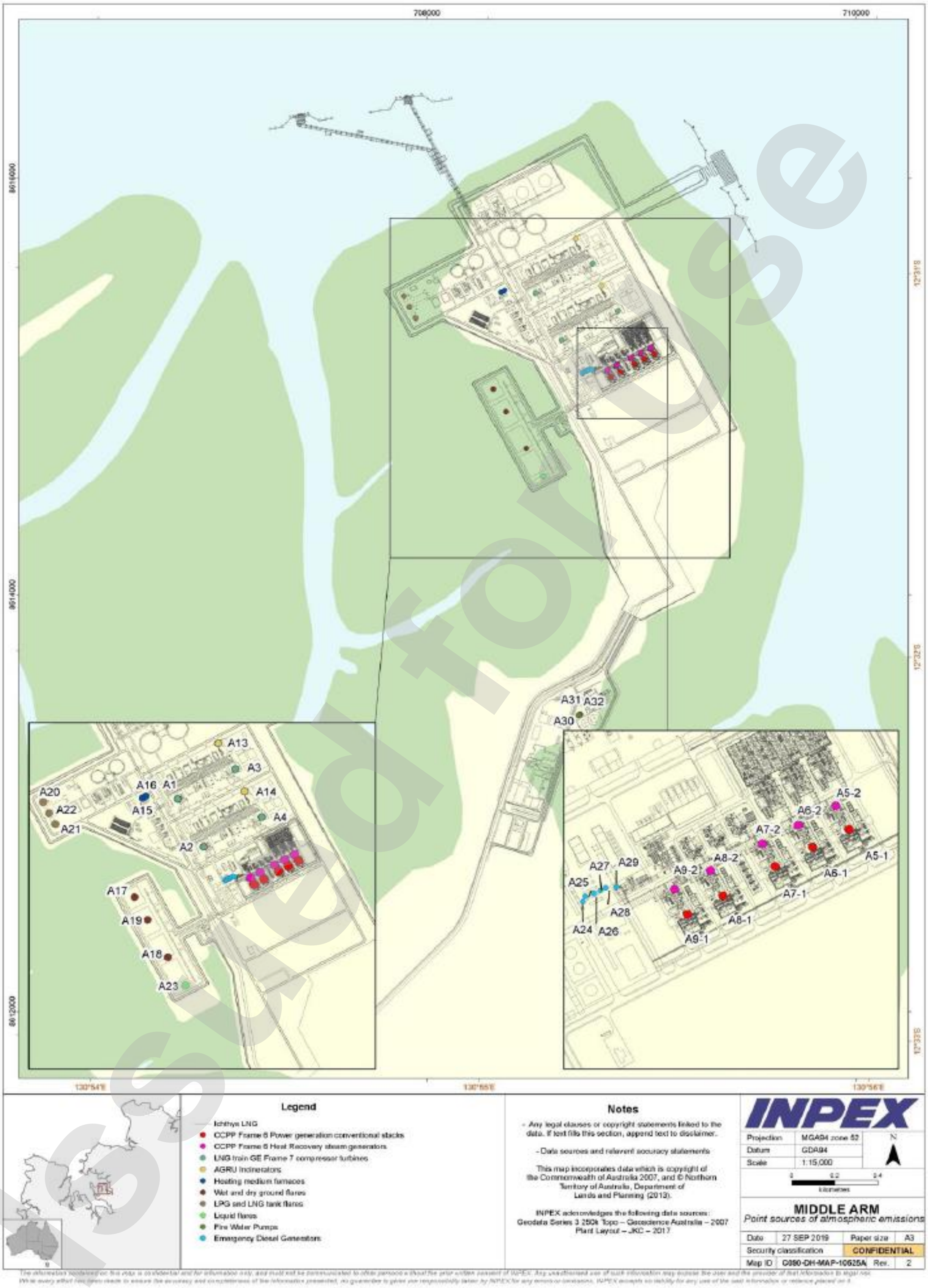


Figure 3-1: Location of authorised stationary emission release points

3.2.2 Quality control assessment

Stationary source emissions testing undertaken in August 2024 - February 2025, were carried out as per the nominated test method within EPL228-05 license condition 58.2 following the NSW Department of Environment and Conservation Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales or USEPA Method 30B for mercury emissions. This was completed in conjunction with Appendix 3, Table 6 of EPL228. All samples were collected and sampled as per above conditions. NATA accredited environmental consultants Ektimo were engaged to carry out onsite stationary source testing as INPEX's NATA accreditation is still pending.

3.2.3 Results and discussion

All results for the permanent plant were below limit criteria provided in Appendix 3, Table 5 of EPL228 (Table 3-3). The stationary source emission monitoring results are provided in APPENDIX D:

Due to equipment being offline for planned maintenance and extended unplanned equipment fault outages; release point number A5-1 (L-780-GT-001), A6-1 (L-780-GT-002), A7-2 (L-630-F-003), A8-1 (L-780-GT-004) and A9-1 (L-780-GT-00 5) were unable to be tested. As previously mentioned in section 3.2.1, CCPP frame 6 turbines have two stacks with only one of the two stacks running at a time. As such, release port numbers A5-1, A6-1, A8-1 and A9-1 (conventional stack series) were not tested in this reporting period as they were not online while the "HRSG stack series" frame 6 sampling locations (A5-2 (L-630-F-001), A6-2 (L-630-F-002), A8-2 (L-630-F-004) and A9-2 (L-630-F-005), were online and utilised in this survey.

The mass of hydrocarbons flared for the reporting period for each flare source is presented in Table 3-5.

Table 3-5: Mass of hydrocarbons flared during the reporting period

Release Point number	Location Number	Source	Mass of hydrocarbons flared (tonnes)
A17 / A19	L-700-F-002 / L-700-F-003	Ground flare #5 warm/ Ground flare #1 spare	42,611
A18 / A19	L-700-F-001-A/B / L-700-F-003	Ground flare #2 cold / Ground flare #1 spare	24,767
A20 / A22	L-700-F-005-A/B / L-700-F-007	Tank flare #1 LNG / Tank flare #3 LNG/LPG (spare)	5,017
A21 / A22	L-700-F-006-A/B / L-700-F-007	Tank flare #2 LPG / Tank flare #3 LNG/LPG (spare)	6,996
A23	L-700-F-004	Liquid flare	0

Figure 3-2 and Figure 3-3 show the vented acid gas flow rates in standard cubic metre per hour (Sm^3/h) for Train 1 and Train 2 respectively. During the time the acid gas incinerators (AGIs) were offline, the acid gas was hot vented when the LNG trains were online. Figure 3-4 and Figure 3-5 provide the flow rate of acid gas to the Train 1 and Train 2 AGIs, while the incinerator was in service.

While the AGIs were offline and venting was occurring, gas sampling was undertaken in accordance with EPL228-05 condition 58.1. Throughout the reporting period, INPEX experienced a number of performance issues with Train 1 and Train 2 AGIs resulting in periods of outages for both AGIs. They were taken offline for a full review and Management of Change process before being re-started. The NT EPA was notified of the AGI performance issues in accordance with EPL228-05 condition 70.

Section 3.5 contains more information about air quality monitoring results undertaken in the Darwin airshed.

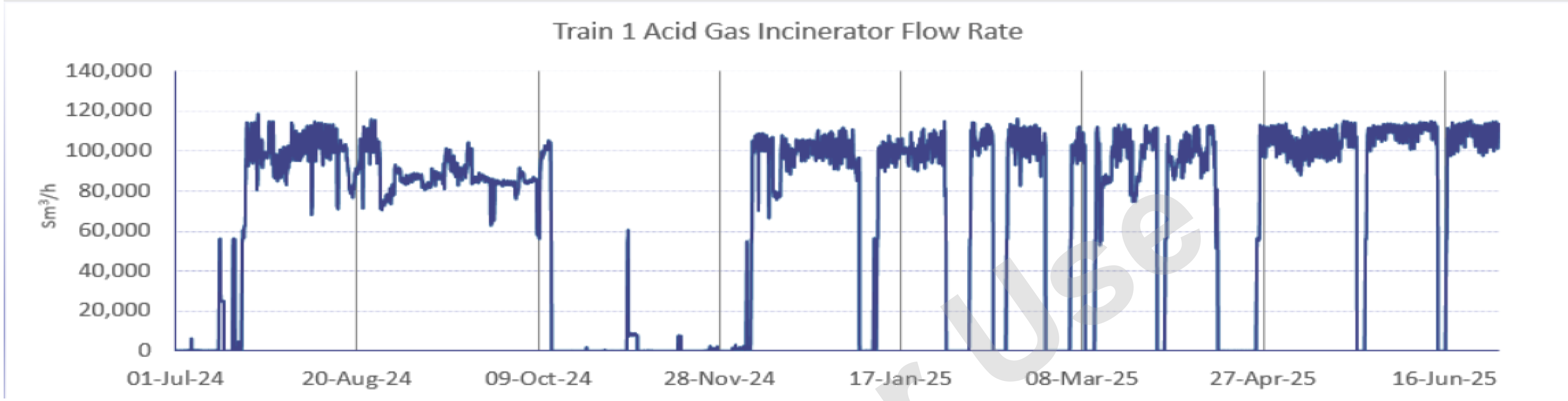


Figure 3-2: Train 1 acid gas incineration rates (Sm^3/h)

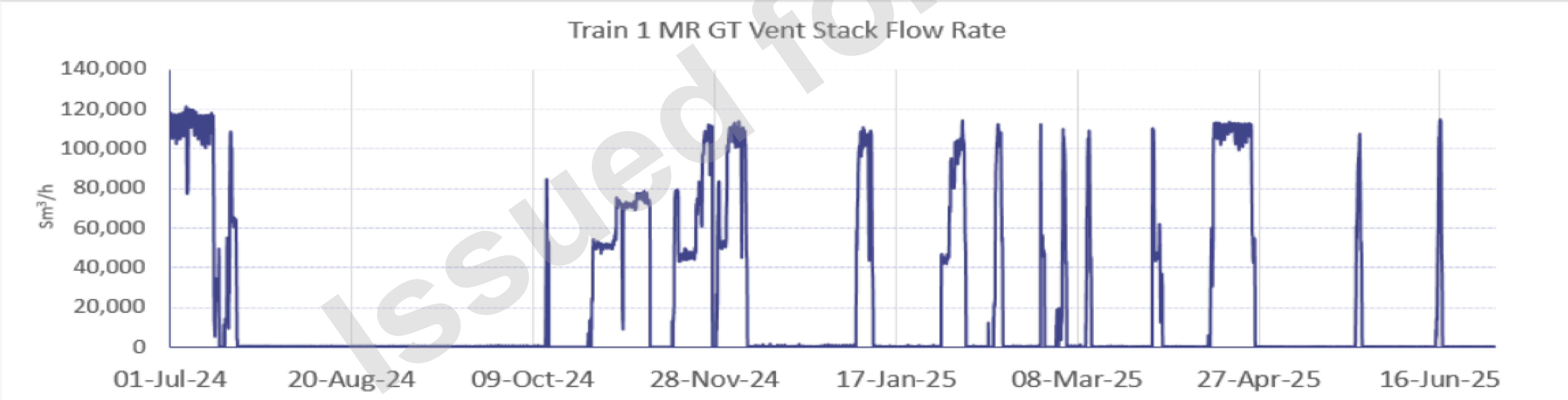


Figure 3-3: Train 1 acid gas venting flow rates (Sm^3/h)

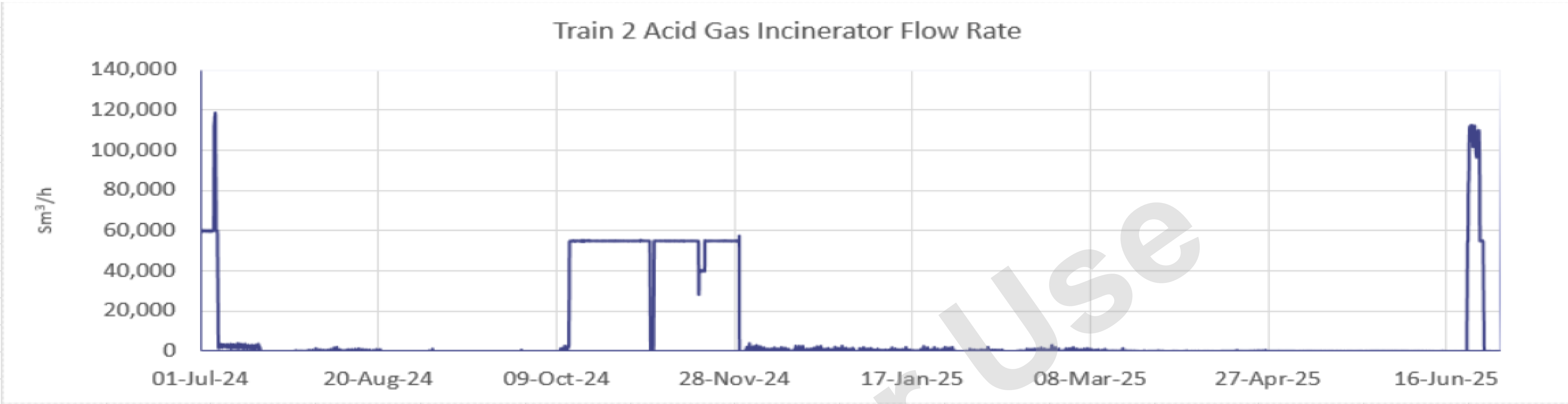


Figure 3-4: Train 2 acid gas incineration rates (Sm³/h)

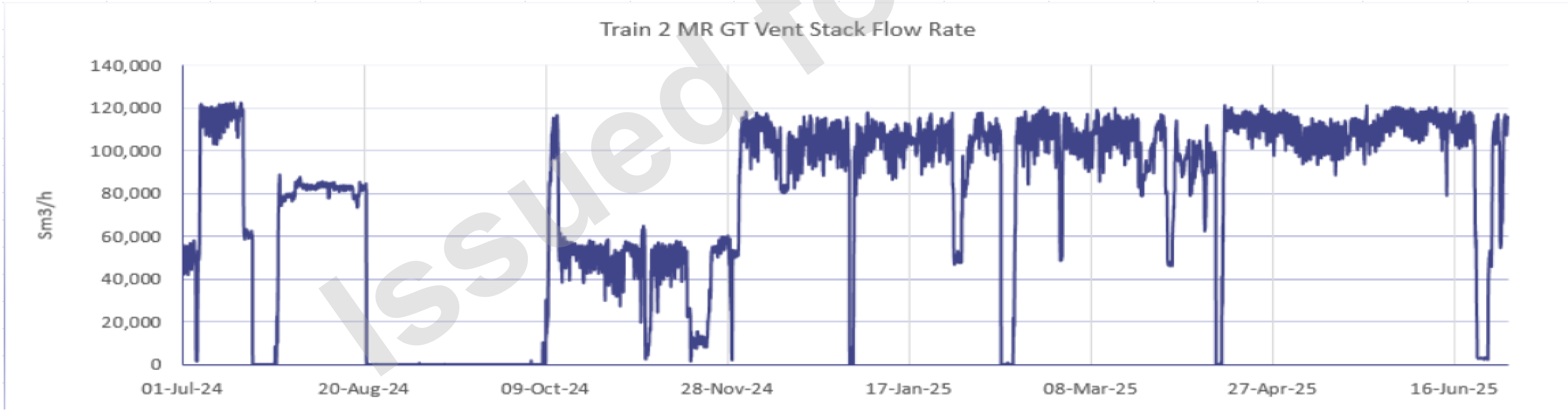


Figure 3-5: Train 2 acid gas venting flow rates (Sm³/h)

3.2.4 Program rationalisation

No rationalisation is currently proposed for monitoring stationary emissions sources; therefore, monitoring will be conducted as per the EPL228 requirements.

However, due to the poor performance of the AGRU incinerators during the reporting period, INPEX has implemented an air toxic monitoring program in the Darwin airshed to measure BTEX on a monthly basis at four locations[5]. While this air toxic monitoring is additional to the EPL228 requirements, INPEX has included the air toxic monitoring program into a revised version (to be issued to NT EPA) of the Onshore Operations Environment Management Plan (OEMP; L060-AH-PLN-60005), and continues to provide the NT EPA with copies of monthly air toxic monitoring reports. Air toxic monitoring results are covered further in Section 3.5 of this AEMR.

3.3 Overall summary of performance of stationary emission sources

The status of the stationary point source emissions at Ichthys LNG is provided in Table 3-6 based on information presented in Sections 3.1 and 3.2. As stated above, the Train 1 and LNG Train 2 AGIs were both offline for periods of time during the reporting period. While the AGIs were offline, sampling of the vented gas occurred as per EPL228 condition 58.

Table 3-6: Stack emission status and air quality

Release point number	Emission source	Status	Air emissions
A1	Compressor turbine WHRU West 1 (Frame 7)	Operational	Acceptable
A2	Compressor turbine WHRU West 2 (Frame 7)	Operational	Acceptable
A3	Compressor turbine WHRU East 1 (Frame 7)	Operational	Acceptable
A4	Compressor turbine WHRU East 2 (Frame 7)	Operational	Acceptable
A5-1	Power generation turbine 1 (Frame 6)	Intermittent use, when HRSG offline	Not tested in this survey
A6-1	Power generation turbine 2 (Frame 6)	Intermittent use, when HRSG offline	Not tested in this survey
A7-1	Power generation turbine 3 (Frame 6)	Operational	Acceptable
A8-1	Power generation turbine 4 (Frame 6)	Intermittent use, when HRSG offline	Not tested in this survey
A9-1	Power generation turbine 5 (Frame 6)	Intermittent use, when HRSG offline	Not tested in this survey
A5-2	Power generation turbine 1 HRSG (Frame 6)	Operational	Acceptable
A6-2	Power generation turbine 2 HRSG (Frame 6)	Operational	Acceptable

[5] ILNG fence boundary, Frances Bay, Palmerston and Winnellie

Release point number	Emission source	Status	Air emissions
A7-2	Power generation turbine 3 HRSG (Frame 6)	Off-line during survey	Not tested in this survey
A8-2	Power generation turbine 4 HRSG (Frame 6)	Operational	Acceptable
A9-2	Power generation turbine 5 HRSG (Frame 6)	Operational	Acceptable
A13-1	AGRU Incinerator – LNG Train 1	Operational	Acceptable
A13-2	AGRU Hot Vent – LNG Train 1, prior to release at A3	Operational	Acceptable
A14-1	AGRU Incinerator – LNG Train 2	Off-line during survey	Not tested in this survey
A14-2	AGRU Hot Vent – LNG Train 2, prior to release at A4	Operational	Acceptable
A15	Heating medium furnace 1	Operational	Acceptable
A16	Heating medium furnace 2	Operational	Acceptable

3.4 Dark smoke events

Ichthys LNG has been designed to minimise dark-smoke events; however, dark smoke can result during flaring due to incomplete combustion of hydrocarbons. The environmental impacts from smoke are considered negligible but may cause visual amenity impact and community concern.

3.4.1 Method overview

Visual monitoring and closed-circuit television monitoring of flares is undertaken to detect possible dark smoke events in accordance with the Onshore LNG Dark Smoke Management Guideline. If dark smoke is produced during operations, the shade (or darkness) of the smoke is estimated using the Australian Miniature Smoke Chart (AS 3543:2014), which uses Ringelmann shades. The shade and duration of the dark-smoke event is recorded. Dark smoke monitoring targets and limits for all the flare systems are provided in Table 3-7. Any dark smoke events (above Ringelmann 1) are recorded and investigated as an incident and reported to the NT EPA in the annual record of flaring (Condition 71 of EPL228-05).

Table 3-7: Dark smoke monitoring targets and limits

Emission source	Pollutant	Target	Limit
Flares	Smoke	<Ringelmann 1	Visible smoke emissions darker than Ringelmann shade 1

Flaring and other data are stored in the site's Process Control System (PCS). The PCS serves as the primary means to control and monitor Ichthys LNG and automatically maintains operating pressures, temperatures, liquid levels, and flow rates within the normal operating envelope with minimal intervention from operator consoles in the central control room (CCR). The system has built-in redundancy in communication, control, and human interface. Information from the PCS is displayed on visual display units in the CCR. During process upset conditions, the system has detailed alarm handling and interrogation functions to minimise operator overload. The PCS is also equipped with a database function that permits operations personnel to investigate a historical sequence of events. In addition, volatile organic compound emissions are estimated by use of the NPI and NGERS reporting tools.

3.4.2 Results and discussion

No dark smoke events (above Ringelmann 1) occurred during the 2024/2025 reporting period.

3.4.3 Program rationalisation

No program rationalisation is proposed.

3.5 Air toxics monitoring

Following the OEMP adaptive management framework, air toxic sampling was reinstated in July 2024 due to operational performance issues of the acid gas incinerators (AGIs). The AGI performance issues have resulted in periods of hot venting, and emissions of VOCs such as BTEX.

The objective of the air toxics monitoring program is to ensure that during periods where AGIs are hot venting, air toxicants specified in *National Environment Protection (Air Toxics) Measure* (Air Toxics NEPM) remain within safe levels.

Table 3-8Table 3-8 provides a summary of the air toxics monitoring completed during the reporting period.

Table 3-8: Ambient air quality and ambient air toxics survey dates

Date	Report
30 July 2024	Eurofins COA Report #1123305-TO (L060-AH-REP-70075)
29 August 2024	Eurofins COA Report #1134628-TO (L060-AH-REP-70073)
26 September 2024	GHD Air Toxic Report - September 2024 (L060-AH-REP-70083)
28 October 2024	GHD Air Toxic Report - October 2024 (L060-AH-REP-70077)
28 November 2024	GHD Air Toxic Report - November 2024 (L060-AH-REP-70078)
17 December 2024	GHD Air Toxic Report - December 2024 (L060-AH-REP-70080)
30 January 2025	GHD Air Toxic Report - January 2025 (L060-AH-REP-70079)
27 February 2025	GHD Air Toxic Report - February 2025 (L060-AH-REP-70081)

Date	Report
27 March 2025	GHD Air Toxic Report - March 2025 (L060-AH-REP-70082)
29 April 2025	GHD Air Toxic Report - April 2025 (L060-AH-REP-70084)
26 May 2025	GHD Air Toxic Report – May 2025 (L060-AH-REP-70076)
26 June 2025	GHD Air Toxic Report – June 2025 (L060-AH-REP-70085)

3.5.1 Method overview

INPEX reinstated air toxics ground level monitoring in July 2024 as the AGIs continue to experience performance issues. The receptor locations, when considered in conjunction with prevailing winds and peak dispersion modelling predictions, indicate that the NT EPA air quality network monitoring stations Francis Bay and Palmerston were appropriately located within the Darwin Airshed, in order to be used for the assessment of air toxics from Ichthys LNG. During the reporting periods, additional monitoring was also undertaken at the Winnellie NT EPA air quality network monitoring station and adjacent to Ichthys LNG. The locations of the air toxics monitoring locations are shown in Figure 3-6.

Monthly air toxics monitoring is completed using evacuated canisters for sample capture (24-hour regulator), with subsequent analysis for Benzene, Toluene and Xylene (BTX) using gas chromatography - mass spectrometry techniques. Consistent with the Air Toxics NEPM monitoring framework, this monitoring is conducted using the United States Environmental Protection Authority (USEPA) TO-15 analytical methodology (USEPA 1995) using a NATA accredited laboratory. The frequency of monitoring is monthly while one or both AGIs are offline due to performance issues, data is then compared against the standards for pollutants specified in the Air Toxics NEPM, at all monitoring locations.

The review criteria for the monitoring program, as per Air Toxics NEPM monitoring framework, are provided in Table 3-9.

Table 3-9: Air Toxics NEPM data review criteria

Parameter	Averaging Period	Review Criteria (Air Toxics NEPM)*	Units
Benzene	Annual	0.003	ppm
Toluene	24 hour	1	
	Annual	0.1	
Xylenes	24 hour	0.25	
	Annual	0.2	

* Air toxics review criteria excludes allowance for background. Upon review, potential project increment (above background) is to be addressed through consideration of spatial variability of sample results.

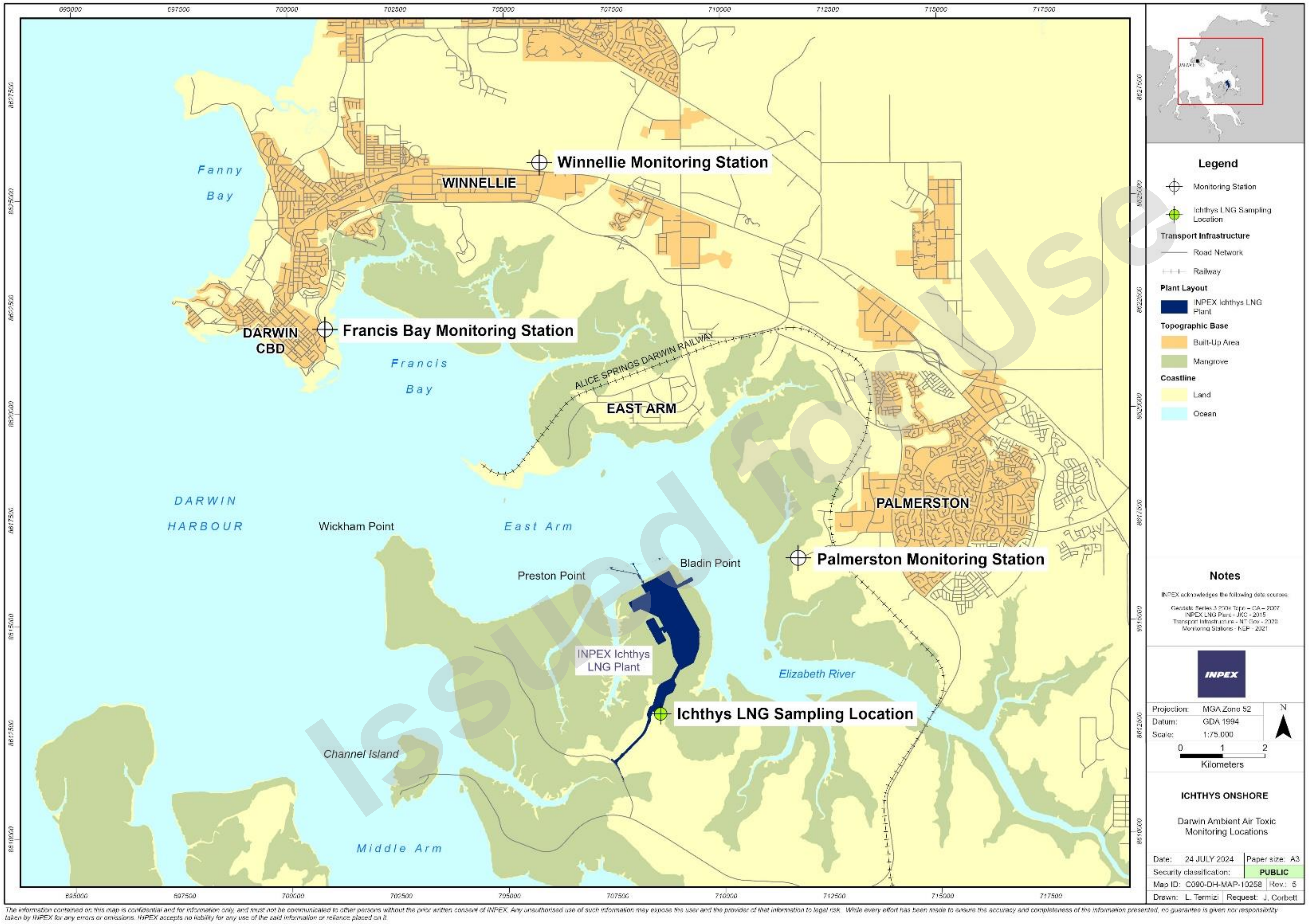


Figure 3-6: Air toxics monitoring station locations

3.5.2 Results and discussion

A summary table of monthly air toxics monitoring results are provided in Table 3-10. Limits of reporting (LOR) for Benzene, Toluene and Xylenes are 0.0005, 0.0020 and 0.0015 ppm, respectively.

Table 3-11Table 3-11 shows that measured concentrations were all well below Air Toxics NEPM 24-hour and annual criteria for the reporting period. This indicates that air toxics were not detectable during sampling periods, when the AGIs were offline and hot venting.

Table 3-10: Air toxic results (in ppm) for the reporting period

Period	Sampling point	Benzene	Toluene	Xylenes
Jul-24	Palmerston	0.0009	0.0030	0.0030
	Frances Bay	0.0006	0.0029	0.0030
	Winnellie	0.0006	0.0040	0.0030
	ILNG	0.0009	0.0030	0.0030
Aug-24	Palmerston	0.0006	0.0029	0.0023
	Frances Bay	0.0006	0.0029	0.0023
	Winnellie	0.0009	0.0032	0.0025
	ILNG	0.0009	0.0037	0.0028
Sep-24	Palmerston	0.0006	0.0029	0.0023
	Frances Bay	0.0009	0.0032	0.0025
	Winnellie	0.0009	0.0032	0.0025
	ILNG	0.0009	0.0032	0.0025
Oct-24	Palmerston	0.0009	0.0032	0.0025
	Frances Bay	0.0009	0.0032	0.0094
	Winnellie	0.0009	0.0032	0.0025
	ILNG	0.0009	0.0032	0.0025
Nov-24	Palmerston	0.0009	0.0032	0.0025
	Frances Bay	0.0009	0.0032	0.0025
	Winnellie	0.0009	0.0034	0.0025
	ILNG	0.0009	0.0034	0.0025
Dec-24	Palmerston	0.0009	0.0037	0.0028
	Frances Bay	0.0009	0.0034	0.0025
	Winnellie	0.0009	0.0037	0.0028
	ILNG	0.0009	0.0034	0.0025
Jan-25	Palmerston	0.0009	0.0037	0.0028

Period	Sampling point	Benzene	Toluene	Xylenes
	Frances Bay	0.0009	0.0032	0.0028
	Winnellie	0.0009	0.0034	0.0028
	ILNG	0.0009	0.0034	0.0025
Feb-25	Palmerston	0.0009	0.0048	0.0025
	Frances Bay	0.0009	0.0032	0.0025
	Winnellie	0.0006	0.0029	0.0023
	ILNG	0.0009	0.0032	0.0025
Mar-25	Palmerston	0.0006	0.0027	0.0021
	Frances Bay	0.0009	0.0037	0.0028
	Winnellie	0.0006	0.0029	0.0023
	ILNG	0.0009	0.0037	0.0028
Apr-25	Palmerston	0.0009	0.0037	0.0028
	Frances Bay	0.0013	0.0042	0.0035
	Winnellie	0.0009	0.0040	0.0030
	ILNG	0.0009	0.0042	0.0032
May-25	Palmerston	0.0006	0.0029	0.0032
	Frances Bay	0.0006	0.0029	0.0032
	Winnellie	0.0006	0.0029	0.0032
	ILNG	0.0006	0.0029	0.0032
June-25	Palmerston	0.0009	0.0037	0.0028
	Frances Bay	0.0009	0.0037	0.0028
	Winnellie	0.0009	0.0032	0.0025
	ILNG	0.0009	0.0037	0.0028

Table 3-11: Air toxics results (in ppm) for reporting period

Parameter	Averaging period	Criteria (Air Toxic NEPM)	Sample pollutant concentration			
			Palmerston	Francis Bay	Winnellie	ILNG
Benzene	24-hour#	N/A	0.0009	0.0013	0.0009	0.0009
	Annual*	0.003	0.0008	0.0009	0.0008	0.0009
Toluene	24-hour#	1	0.0048	0.0042	0.0040	0.0042
	Annual*	0.1	0.0034	0.0034	0.0033	0.0034
Xylene	24-hour#	0.25	0.0032	0.0094	0.0032	0.0032
	Annual*	0.2	0.0026	0.0033	0.0027	0.0027

*The annual average is calculated as the maximum 12-month average within the data set (full LOR value used where relevant in this calculation).

#The 24-hour value shown is the maximum value within the 12-month data set.

† For the purposes of reporting against the NEPM standard, the laboratory data is converted from micrograms per cubic meter ($\mu g/m^3$) to parts per million (ppm), this calculation assumes a standard temperature and pressure of 25°C and 1 atmosphere.

3.5.3 Program rationalisation

Although the above monthly air toxic sampling program is termed adaptive management, the draft OEMP Rev 9 has been updated to include air toxics and criteria for when monitoring is required *'in the event where one or more acid gas incinerator(s) (AGIs) are offline for 90% or more during any 30-day period'*.

4 UNPLANNED DISCHARGES TO LAND

4.1 Groundwater quality

The key objective of the groundwater monitoring program is to detect changes in groundwater quality and determine if these changes are attributable to Ichthys LNG operations. Note there are no planned discharges directly to groundwater, other than rainfall and non-contaminated water (NCW); however, there is potential for groundwater to become contaminated as a result of an accidental spill, leak, or rupture during Ichthys LNG operations.

As per the OEMP, groundwater quality is required to be monitored biannually (e.g. twice yearly at 15 sites). Table 4-1 provides a summary of the groundwater quality surveys completed during the reporting period.

Table 4-1: Groundwater quality monitoring survey details

Survey	Sampling period	Report	INPEX Doc #
14	1 - 3 October 2024	Groundwater Quality Interpretive Report No 14	L290-AH-REP-70077
15	31 March - 29 April 2025	Groundwater Quality Interpretive Report No 15	L290-AH-REP-70076

4.1.1 Method overview

The groundwater quality monitoring surveys were undertaken in accordance with the Groundwater Quality Monitoring Plan (L290-AH-PLN-70000). The Groundwater Quality Monitoring Plan was developed in consideration of Australian, State and Territory groundwater sampling standards and guidelines. A high-level summary of methods is provided below.

Prior to sampling, groundwater wells were gauged with an interface probe to determine the standing water level (SWL). Following gauging, groundwater wells were purged using a low flow micro purge pump with SWL and in situ parameters being measured every three to five minutes. Once the well had been purged and in-situ parameters had stabilised over three consecutive readings, groundwater samples were then collected for analysis.

Following collection, groundwater samples were sent to NATA accredited laboratories for analysis of parameters listed in Table 4-2. Results were then compared to benchmark levels to ascertain whether a trigger exceedance had occurred.

Exceedance of a benchmark level is defined as a measured analyte exceeding its relevant trigger value (see Table 4-2) and the same analyte also exceeding the background level for each groundwater well. An exceedance is considered a technical exceedance when the limit of reporting (LOR) exceeds the benchmark level for a parameter. Specific background level trigger values were calculated using the approach described in ANZG (2018). The 80th and/or 20th percentile value for each parameter was determined using the monthly groundwater data collected during the construction phase of Ichthys LNG between 2013 and 2018.

Table 4-2: Groundwater quality monitoring parameters, methods, and trigger values

Parameter	Unit	Sampling method*	Trigger value	Trigger value reference
pH	pH units	CFI	Outside 6.0 and 8.5	NRETAS 2010
EC	µS/cm	CFI	n/a	n/a
Dissolved oxygen	%	CFI	n/a	
Oxygen reduction potential	mV	CFI	n/a	
Temperature	°C	CFI	n/a	
Total dissolved solids	mg/L	SFLA	n/a	
Oxides of nitrogen	µg N/L	SFLA	20	NRETAS 2010
Ammonia	µg N/L	SFLA	20	
TN	µg N/L	SFLA	300	
TP	µg P/L	SFLA	30	
FRP	µg/L	SFLA	10	
Phenols	µg/L	SFLA	n/a	n/a
TRH[‡]	µg/L	SFLA	600	Ministry of Infrastructure and the Environment (2009)
Benzene	µg/L	SFLA	500	ANZG 2018
Toluene	µg/L	SFLA	180	
Ethylbenzene	µg/L	SFLA	5	
Xylenes	µg/L	SFLA	75	
Aluminium	µg/L	SFLA	24	Golding et al. 2015
Arsenic	µg/L	SFLA	2.3	ANZG 2018
Cadmium	µg/L	SFLA	0.7	
Chromium III	µg/L	SFLA	10	
Chromium VI	µg/L	SFLA	4.4	
Cobalt	µg/L	SFLA	1	
Copper	µg/L	SFLA	1.3	
Lead	µg/L	SFLA	4.4	
Manganese	µg/L	SFLA	390	J. Stauber and R. Van Dam Pers.Com. 23 March 2015 cited in Greencap (2016)
Mercury	µg/L	SFLA	0.1	ANZG 2018
Nickel	µg/L	SFLA	7	

Parameter	Unit	Sampling method*	Trigger value	Trigger value reference
Silver	µg/L	SFLA	1.4	
Vanadium	µg/L	SFLA	100	
Zinc	µg/L	SFLA	15	
Biological oxygen demand (BOD)†	mg/L	SFLA	n/a	n/a
Faecal coliform†	cfu-100mL	SFLA	n/a	
Escherichia coli†	cfu-100mL	SFLA	n/a	

* SFLA = sample for laboratory analysis, CFI = calibrated field instrument

† Only at BPGW19A and BPGW27A

‡ Where TRH is detected over the prescribed limits a silica gel clean-up will be undertaken and reanalysed to remove false positive natural oil results

Figure 4-1: Groundwater quality sampling locations

4.1.2 Quality Control Assessment

Laboratory holding times

All samples arrived at the laboratories within the required holding times for all analytes and chemical compounds with trigger values, for both survey 14 and 15.

Blank samples

Analyte concentrations measured in rinsate and field blank samples reported below the laboratory LORs for survey 14. Rinsate blanks samples taken during survey 15 on 29 April 2025 recorded concentrations of arsenic and manganese above the laboratory LORs. Primary groundwater samples collected on the same day reported manganese concentrations of 168 μg/L and 367 μg/L, both of which are below the trigger value. It is therefore unlikely that the sampling procedure caused a measurable increase in contaminant concentrations during groundwater sampling. The arsenic concentration (0.3 ug/L) in the rinsate blank is significantly lower than the primary sample results, which reported arsenic concentrations of 7.4 ug/L and 596 μg/L — both of which exceed the trigger value of 2.3 ug/L. Given the substantial difference between blank levels and primary sample concentrations, the arsenic detection in the rinsate blank is considered inconsequential to the overall data quality and interpretation of the results.

Duplicate and triplicate samples

Analyses of duplicate samples revealed that the relative percentage differences (RPD) achieved the performance criteria of <30 % for all analytes for survey 15 and most for survey 14, with the following exceptions:

Survey 14

- Total phosphorus (RPD = 33)

Analyses of triplicate samples revealed that the RPD achieved the performance criteria of <30 % for the majority of analytes, with the following exceptions:

Survey 14

- Total nitrogen (RPD = 58)

Survey 15

- Total nitrogen (RPD = 50)
- Phosphate total (RPD = 90)

Survey 14: The phosphorus concentration of the primary sample (14 μg/L) and the duplicate sample (10 μg/L) were both below the trigger value of 30 μg/L. The nitrogen concentration of the primary sample (550 μg/L) and the triplicate sample (1,000 μg/L) were both above the trigger value of 300 μg/L and the background level of 468 μg/L. This elevated RPD therefore places some uncertainty on the accuracy of nitrogen concentrations recorded in the primary sample from BPGW26, this has been treated as an exceedance and investigated in Sections 4.1.3 and 4.1.4.

Survey 15: The phosphorus concentration of the primary sample (19 μg/L) was below the trigger value of 30 μg/L. The nitrogen concentration of the primary sample (240 μg/L) was below the trigger level, whilst the triplicate sample (400 μg/L) was above the trigger value of 300 μg/L but below the background level of 468 μg/L.

Limit of reporting (LOR)

The number of raised LORs during groundwater monitoring survey 14 and 15 is less than what was recorded for previous monitoring rounds. This was achieved following discussion with ALS to develop an improved COC that details the laboratory methods required to attain the LORs outlined in the Ichthys LNG Groundwater Monitoring Plan (INPEX 2020b).

Survey 14

The following observations were made regarding the limit of reporting (LOR) for analytes measured at ALS:

- Hexavalent chromium was analysed to an LOR of 100 µg/L in one primary sample and analysed to an LOR of 10 µg/L in one primary sample. Both these results are higher than the LOR of 1 µg/L, and higher than the trigger value of 4.4 µg/L required for the groundwater monitoring program. These results therefore impact the trigger assessment and represent technical exceedances.
- Trivalent chromium was analysed to an LOR of 100 µg/L in one primary sample, which is higher than the LOR of 1 µg/L, and higher than the trigger value of 10 µg/L required for the groundwater monitoring program. This result impacts the trigger assessment and represents a technical exceedance.
- Trivalent chromium was analysed to an LOR of 10 µg/L in one primary sample, which is higher than the LOR of 1 µg/L required for the groundwater monitoring program and equal to the trigger value of 10 µg/L. This result does not impact the trigger assessment.
- Cadmium was analysed to an LOR of 0.2 µg/L in in five primary samples. This is higher than the LOR of 0.05 µg/L required for the groundwater monitoring program but less than the trigger value of 0.7 µg/L. This result does not impact the trigger assessment.
- Nickel was analysed to an LOR of 0.5 µg/L in in four primary samples. This is higher than the LOR of 0.1 µg/L required for the groundwater monitoring program but less than the trigger value of 7 µg/L; therefore, this result does not impact the trigger assessment.
- Vanadium was analysed to an LOR of 0.2 µg/L in five primary samples and an LOR of 0.5 µg/L in three primary samples. This is higher than the LOR of 0.1 µg/L required for the groundwater monitoring program, but less than the trigger value of 100 µg/L; therefore, this result does not impact the trigger assessment.

The elevated LORs for hexavalent chromium and trivalent chromium have resulted in three technical exceedances.

Survey 15

The following observations were made regarding the LOR for analytes measured at the primary laboratory (ALS):

- Trivalent chromium was analysed to an LOR of 10 µg/L in two primary samples. This is higher than the LOR of 0.2 µg/L required for the groundwater monitoring program and equal to the trigger value. This results therefore does not impact the trigger assessment.
- Nitrate and nitrite were analysed to an LOR of 20 µg/L in 10 primary samples. This is higher than the LOR of 10 µg/L required for the groundwater monitoring program and equal to the trigger value. This results therefore does not impact the trigger assessment.

None of the raised LORs were higher than the trigger values, therefore the integrity of this round of groundwater monitoring has not been impacted.

4.1.3 Results and discussion

A high-level summary of groundwater results, discussion and trends is provided in the following sections, with detailed results and data collected during the reporting period provided in APPENDIX E:. Note, presentation of groundwater data trends include data collected during the construction phase. Groundwater surveys undertaken during the reporting period are specified in Table 4-1. To date, groundwater monitoring during the operations phase of Ichthys LNG shows that there has been no change in groundwater quality.

Survey 14: October 2024

Forty-one exceedances against benchmark levels and three technical exceedances were recorded in groundwater monitoring survey 14 in October 2024. Exceedances include 21 for nutrients, 19 for dissolved metals and one for pH. No exceedances were recorded for hydrocarbons, mercury or physicochemical parameters. This is an increase from the 37 exceedances recorded during the tenth groundwater monitoring survey undertaken during October 2024.

All exceedances have been compared to data recorded during the dry season months of May to October between May 2016 and October 2024.

Visual assessment of time plotted data indicates that several of the nutrient analyte exceedances represent short-term spikes, potentially related to seasonal environmental variables, rather than increasing trends. Visual assessment of time plotted data has indicated the following trends for nutrient exceedances:

Ammonia: Increasing trends at VWP341, BPGW40, BPGW41 and BPGW26.

- Total nitrogen: Increasing trends, albeit fluctuating at BPGW40.
- Filterable reactive phosphorus (FRP): Increasing trend at BPGW40.

Visual assessment of time plotted data for metal exceedances has indicated the following trends:

- Cobalt: Increasing trend at VWP341 and BPGW41
- Copper: Increasing trend at BPGW41
- Zinc: Increasing trend at VWP341.

The following historical maximum values were recorded during the October 2024 monitoring survey:

- Ammonia at BPGW26 (374 µg/L)
- FRP at BPGW40 (32 µg/L)
- Cobalt at BPGW41 (1.7 µg/L)
- Copper at BPGW41 (3.0 µg/L)

Results of the investigation into each of the exceedances are described in Section 4.1.4.

Survey 15: April 2025

Thirty-eight exceedances against both the trigger and background concentrations were recorded in the fifteenth groundwater monitoring survey in April 2025. Exceedances include 14 for nutrients, 21 for dissolved metals and 3 for pH. No exceedances were recorded for hydrocarbons, mercury or physicochemical parameters.

Exceedances were plotted on time series graph to compare to pre-construction and construction data and discern trends in the data.

A review of the 14 nutrient exceedances from April 2025 monitoring survey found that nine of the exceedances were consecutive for at least three surveys. Trend analysis completed by the monitoring contractor indicates:

Ammonia:

- Increasing trends for ammonia at BPGW40
- Increasing trends for ammonia has stabilised at BPGW41 and VWP341
- Fluctuating trends for ammonia at BPGW18, BPGW20, and BPGW28
- Nitrogen: Fluctuating long-term trend for total nitrogen at BPGW40, BPGW41 and VWP341
- Oxides of nitrogen: Consistent fluctuating trend of oxides of nitrogen, with concentrations increasing in the wet season and decreasing in the dry season at BPGW38A.
- FRP: Slightly increasing trend at BPGW07 has stabilised.

A review of the 21 metal exceedances from April 2025 monitoring survey found that eight of the exceedances were consecutive for at least three surveys. Trend analysis of the 21 metals exceedances completed by the monitoring contractor indicates that:

- Arsenic: Increasing albeit fluctuating long-term trend at BPGW09 and VWP328.
- Cobalt: Stable but fluctuating at BPGW08A; and increasing trend at BPGW09, VWP328, BPGW40 and VWP341.
- Zinc: Increasing trend at VWP341.
- Copper: Fluctuating trend at BPGW07.
- Manganese: Fluctuating and increasing trend at VWP341 and BPGW09.
- Nickel: Stable overall but fluctuating at VWP341.
- Zinc: Fluctuations at BPGW07, fluctuating and increasing VWP341.

The following historical maximum values were recorded during the April 2025 monitoring survey:

- Aluminium at BPGW20 (774 µg/L)
- Aluminium at BPGW28 (336 µg/L)
- Ammonia at BPGW41(807 µg/L)
- Cobalt at BPGW40 (2.3 µg/L) and at VWP341 (185 µg/L)
- Manganese at BPGW07 (1560 µg/L), BPGW09 (763 µg/L) and VWP341 (3520 µg/L)
- Zinc at VWP341(176 µg/L)

Results of the investigation into each of the exceedances are described in Section 4.1.4.

4.1.4 Trend analysis and trigger exceedance investigation outcomes

Trend analysis

Increasing trends were determined across groundwater surveys 14 and 15, ammonia ((BPGW18, BPGW27A, BPGW28, BPGW40, BPGW41 and VWP341), total nitrogen (VWP341), arsenic (BPGW09 and VWP328), cobalt (VWP341, VWP328 and BPGW40), manganese (VWP341), and zinc (VWP341). Note analytes with an increasing trend in survey 14 but not survey 15 have not been included in this analysis. Trend graphs represented below are based on sites experiencing exceedances for at least 3 successive monitoring sampling campaigns.

Further to the investigations undertaken for Survey 14 and 15, during the latest reporting period the monitoring contractor was commissioned to complete an independent report to assess and interpret any groundwater data trends of metals and nutrients around the Ichthys LNG facility. Findings from this assessment have been incorporated into this section and Section 4.1.5.

pH

Analysis of pH at the sampling sites over time shown in Figure 4-2 indicate that the overall pH trend remained stabilised across the sites from earlier reporting periods. Of the pH exceedances observed no exceedance trend was detected, with values fluctuating and within historic ranges.

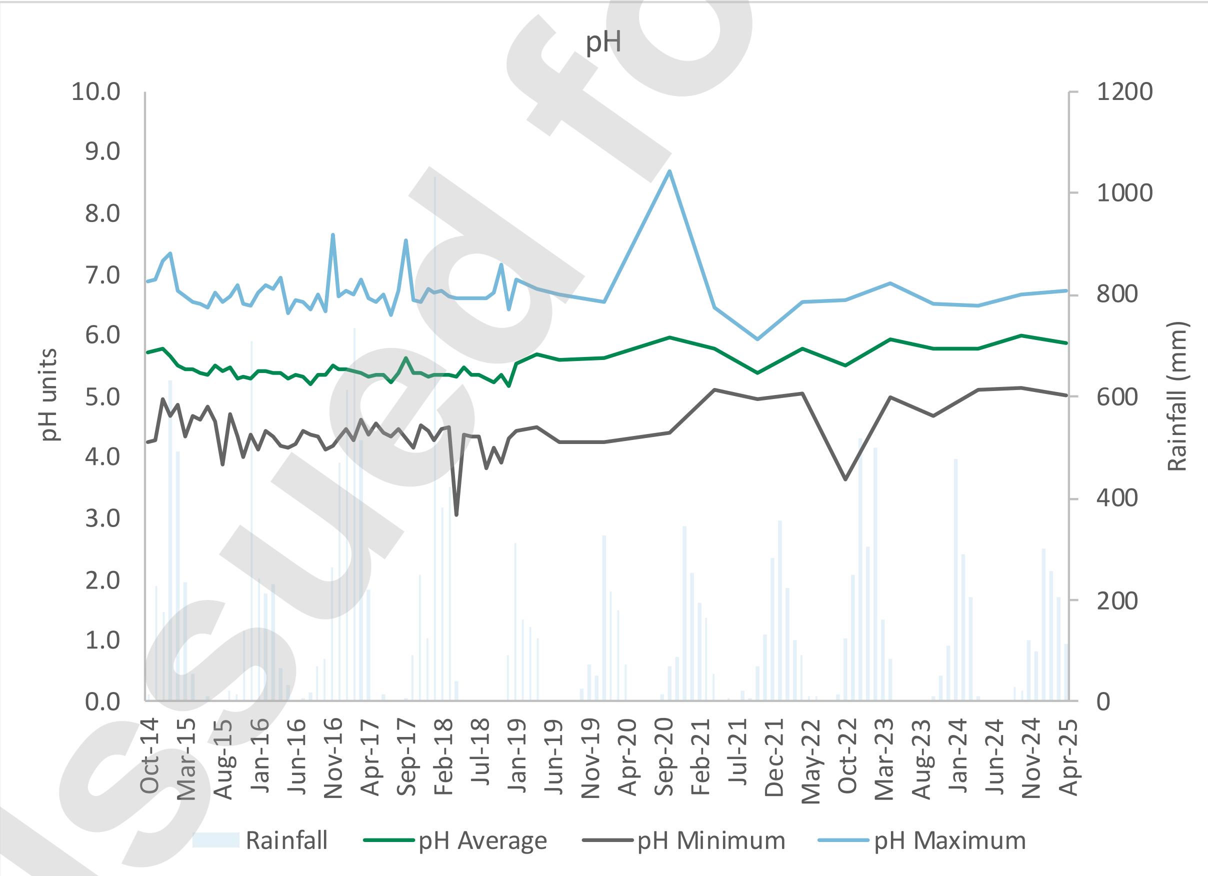


Figure 4-2: Average, minimum and maximum pH of all operational monitoring wells from October 2014 to April 2025

Ammonia

Ammonia exceedances were recorded at nine and seven monitoring bores respectively during the fourteenth and fifteenth groundwater monitoring survey (BPGW18, BPGW20, BPGW27A, BPGW28, BPGW40, BPGW41 and VWP341 for both surveys and BPGW19A, BPGW26 for Survey 14). This is an increase of one exceedance recorded per survey during the previous dry and wet season surveys undertaken in October 2023 and April 2024. Trend analysis indicates that while the ammonia concentrations at BPGW27A and BPGW28 are higher than background, they are fluctuating within stable ranges. BPGW20 is only just above the background level of 96.8mg/L (Figure 4-4).

Trend analysis indicates that ammonia concentrations at VWP341 have increased since 2018 and have stabilised. BPGW41 has been increasing since 2014 and appears to be following an increasing trend. VWP341 and BPGW40 have decreased in concentration since survey 14; however, they both remain above background concentrations (Figure 4-3). This increase at BPGW40, BPGW41 and VWP341 is likely due to a reduction in recharge of groundwater, low aquifer permeability and lower rates of dispersion (AECOM, 2024b).

It is noted that monitoring during the construction stage of the project (2012-2015) identified that ammonia concentrations were regularly recorded above the trigger value of 20 µg/L across the site (AEC Environmental 2015). Investigations into the ammonia trigger exceedances did not determine any potential sources of ammonia on site, no pathway from sources of ammonia on site to groundwater. Coastal areas often have high levels of organic matter, both from marine sources (like seaweed and marine life) and terrestrial sources (like plant litter). As organic matter decomposes, it releases ammonia into the groundwater through processes such as ammonification, where organic nitrogen is converted into ammonium. Coastal sediments, which are often rich in clays and organic materials, can retain and release ammonia through ion exchange processes. This ammonia can then migrate into the groundwater (AECOM, 2024). Therefore, the increasing trends are considered to be as a result of natural variation.

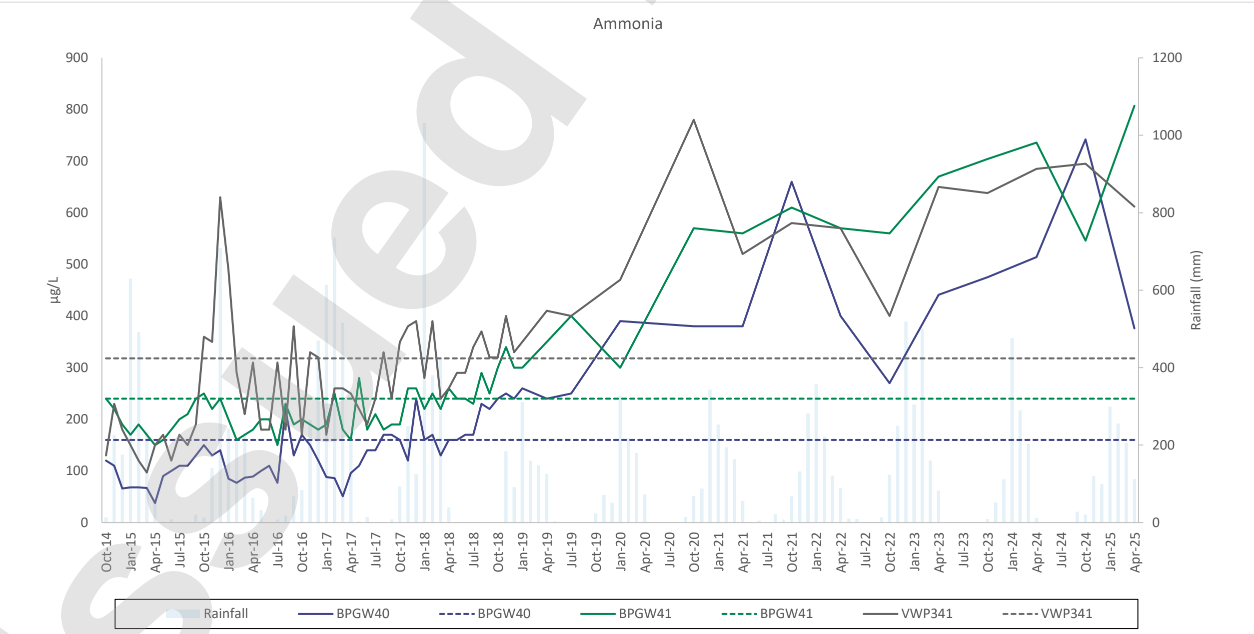


Figure 4-3: Ammonia concentrations at BPGW40, BPGW41 and VWP341 from October 2014 to April 2025 and respective background levels (dashed lines)

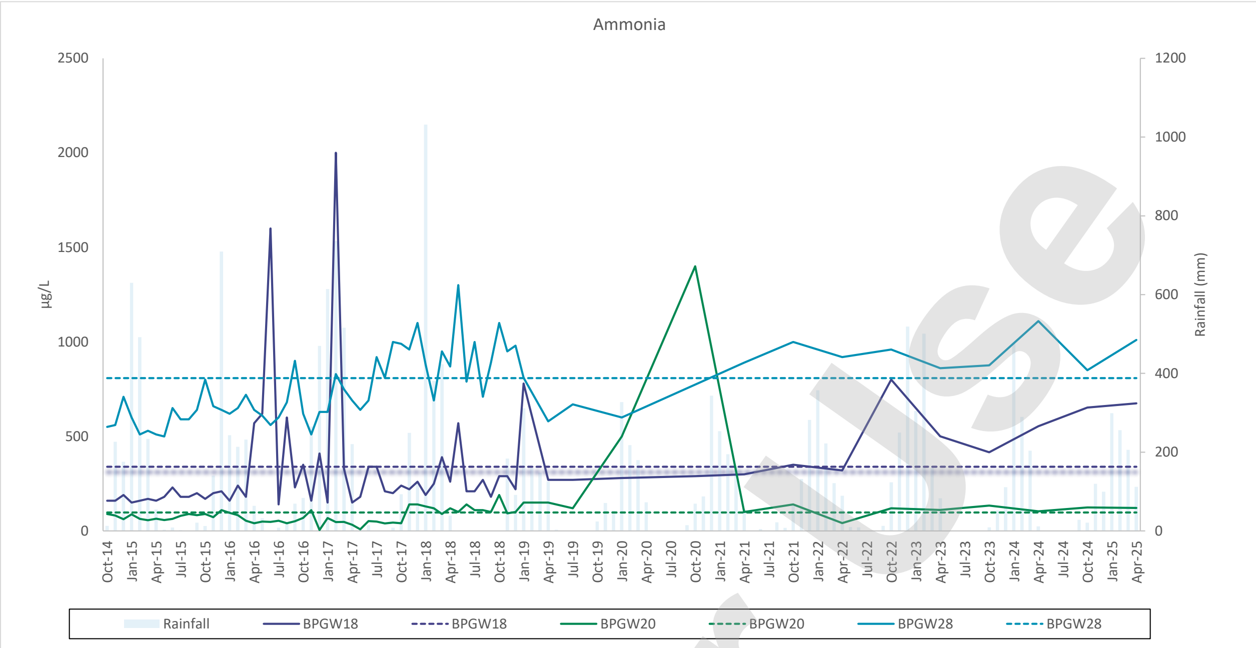


Figure 4-4: Ammonia concentrations at BPGW18, BPGW20 and BPGW28 from October 2014 to April 2025 and respective background levels (dashed lines)

Total nitrogen

Four and five trigger exceedances for total nitrogen were recorded respectively during the fourteenth and fifteenth groundwater monitoring survey, at bores BPGW19A, BPGW26, BPGW28, BPGW40 and BPGW41 and VWP341.

Trend analysis as indicates as shown in Figure 4-5 that total nitrogen concentrations recorded at BPGW40, BPGW41 and VWP341 fluctuate each year. Concentrations at BPGW40 and BPGW41 have remained above the background since October 2021 and have been above the background at VWP341 since April 2023. The April 2025 exceedances for nitrogen are the first at BPGW19A and BPGW28 since 2019. Coastal areas are prone to saline water intrusion, which can create anoxic (low oxygen) conditions in groundwater. These conditions can inhibit the denitrification process (which would otherwise remove oxides of nitrogen), leading to an accumulation of nitrogen oxides in the groundwater (AECOM, 2024).

A review of Ichthys LNG activities indicates that there have been no activities that may have impacted total nitrogen at these locations. Therefore, total nitrogen trigger exceedances are not considered to be a result of Ichthys LNG operations, however they will continue to be monitored in future surveys.

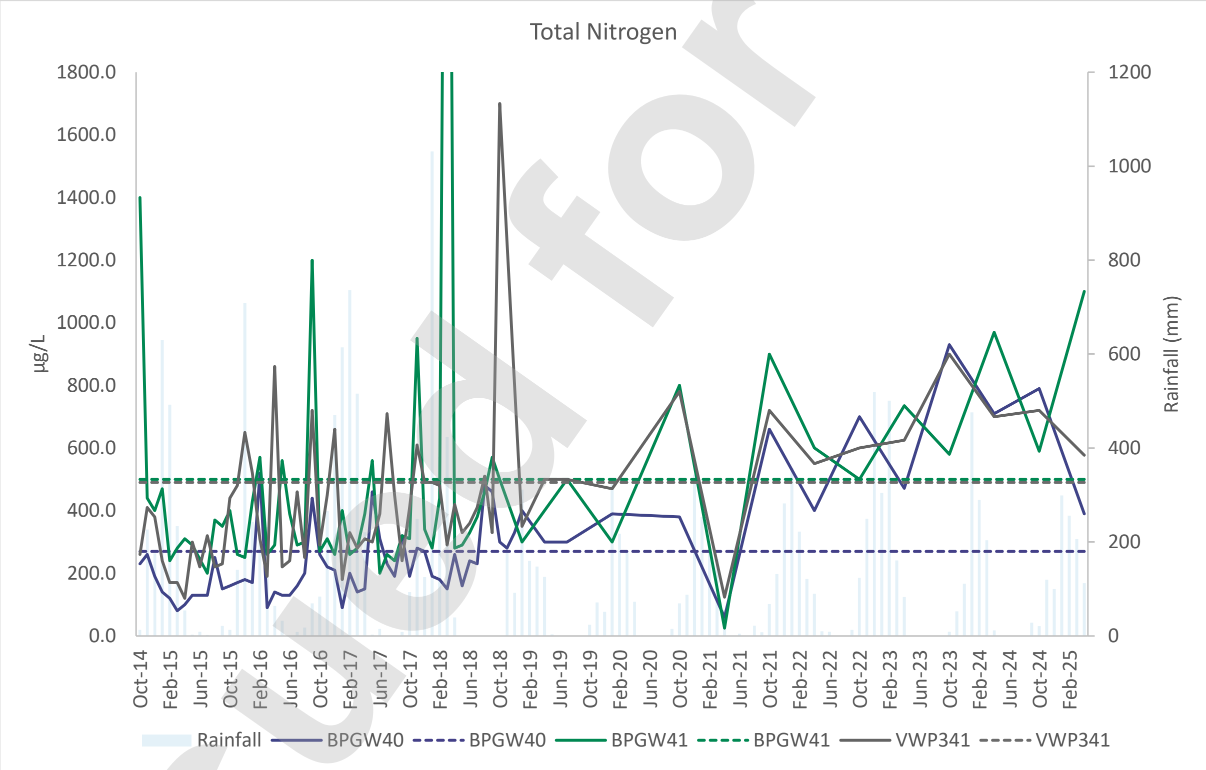


Figure 4-5: Total nitrogen concentrations recorded at BPGW40, BPGW41 and VWP341 from October 2014 to April 2025 (dashed lines represent respective background levels)

Filterable reactive phosphorus (FRP)

Seven FRP exceedances were recorded during the fourteenth groundwater monitoring survey at bores BPGW01, BPGW07, BPGW08A, BPGW19A, BPGW28, BPGW40, and BPGW41. Of these only one monitoring bore, BPGW07, recorded an exceedance during the fifteenth groundwater survey. Trend analysis indicates FRP concentrations regularly fluctuate with concentrations generally increasing in the dry season and decreasing in the wet season. Concentrations of FRP at BPGW07 have been above background levels since 2023, trend analysis does not indicate that FRP levels are increasing (Figure 4-6).

Phosphorite, a sedimentary rock containing high concentrations of phosphate minerals, and apatite are a significant natural source of phosphorus. These deposits often form in marine environments, which is why coastal areas may have naturally elevated levels of phosphorous in their groundwater. In shallow groundwater, redox conditions often influence phosphorus solubility. Under anoxic conditions, iron oxides that typically bind phosphorus can dissolve, releasing phosphorus into the water. Phosphorus can adsorb onto soil particles, particularly iron and aluminium oxides. However, changes in pH or redox potential can cause desorption, enriching groundwater with phosphorus (AECOM, 2024).

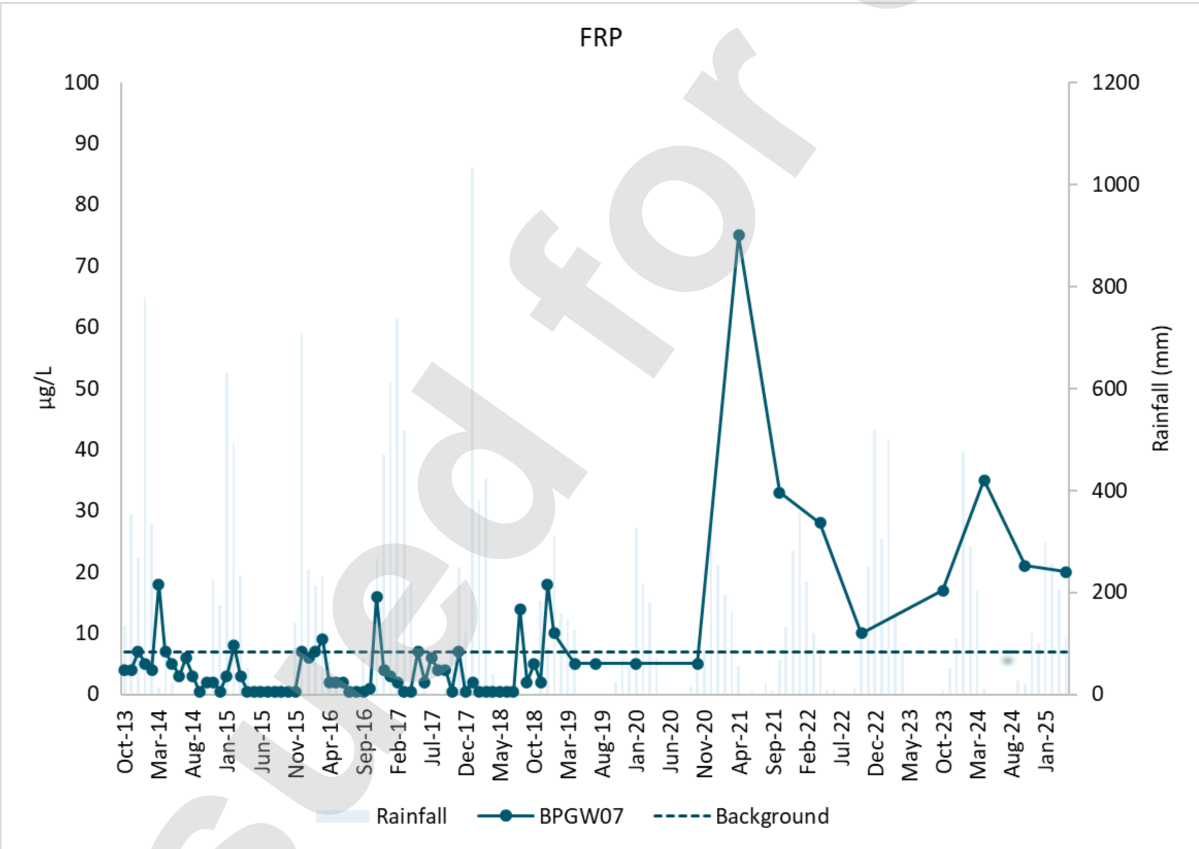


Figure 4-6: Filterable reactive phosphorus (FRP) concentrations recorded at BPGW07 from October 2014 to April 2025

Aluminium

One and three exceedances for aluminium were recorded respectively during fourteenth and fifteenth groundwater monitoring survey at BPGW19A (both surveys), BPGW20, and BPGW28. Aluminium concentrations at BPGW19A fluctuate with higher concentrations generally in the dry season and lower concentrations in the wet season, with the exceedances from this reporting period within the historical range. Aluminium concentrations ay BPGW20 and BPGW28 are usually below the LOR and have spiked during the April 2025 monitoring survey. The April 2025 exceedance represents new historical maximum concentrations at both bores. There is no indication of an increasing trend at any of the bores.

Arsenic

Three and six exceedances for arsenic were recorded respectively during fourteenth and fifteenth groundwater monitoring survey. Of these monitoring bores VWP328 and VWP341 have recorded exceedances on three or more successive surveys, refer to Figure 4-7 and Figure 4-8. Arsenic concentrations at VWP328 and VWP341 are higher than the early background period (2014-2016), they have been fluctuating within a stable range since 2017.

High concentrations of arsenic are known to occur within the coastal strata of Darwin Harbour and are likely a reflection of local geology rather than anthropogenic sources (Padovan 2003). Arsenic is pH dependent. In soil, AsH3 and As0 occur only under highly reducing conditions, except for when the pH is extremely low. Under moderately reducing conditions and a pH between 4 and 10, and an ambient redox potential of around 0 V, such as may occur in anoxic subsurface waters and sediments, arsenite As(III), e.g., H3AsO3, As2O3 and arsenate As(V), e.g., H3AsO4 occur. Both arsenite and arsenate forms are soluble in water. Arsenic mobilisation may be a result of desorption/dissolution due to a change to a reducing chemical environment, and dissolution of host oxyhydroxide due to decrease in pH or shift from oxidizing to reducing conditions (AECOM, 2024).

The exceedances observed in this reporting period are likely due to seasonal factors with further investigation not suggested to be currently required by monitoring contractor.

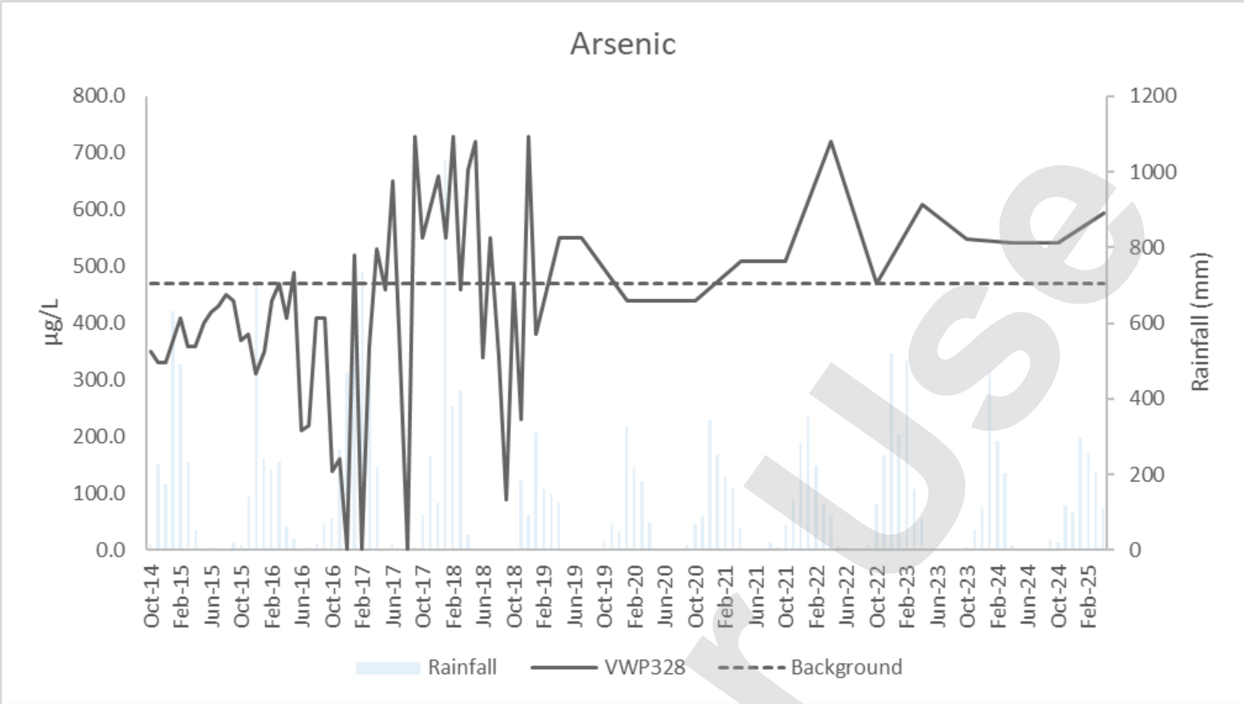


Figure 4-7: Arsenic concentrations recorded at VWP328 from October 2014 to April 2025

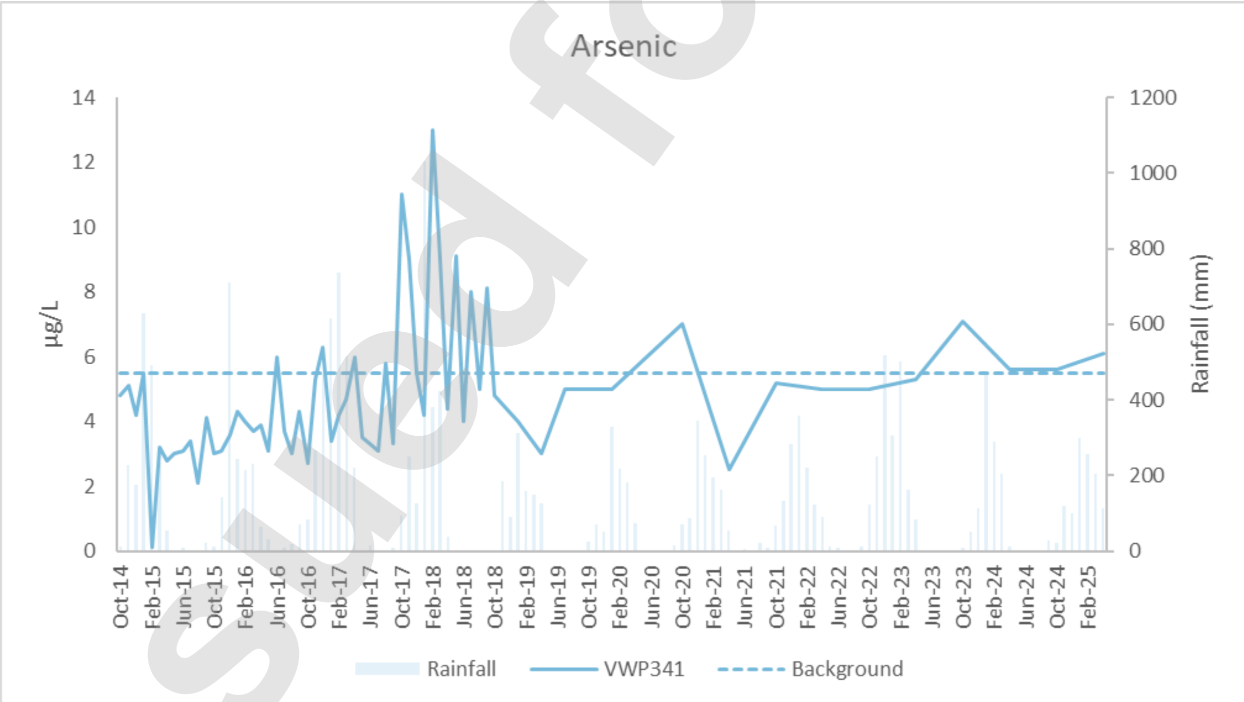


Figure 4-8: Arsenic concentrations recorded at VWP341 from October 2014 to April 2025

Cobalt

Cobalt concentrations have fluctuated above or near the trigger and background levels at BPGW40 since April 2021, with the concentration spiking in April 2025 (Figure 4-9). The concentration of 2.3 µg/L is the new historical maximum for the bore. Exceedances at BPGW40 appear to be fluctuating seasonally at or just above the trigger value (1 µg/L), with higher trends potentially linked to an increasing rainfall, and therefore are likely a result of natural variation. Cobalt concentrations at VWP328 appear to be stable with slight seasonal fluctuations over the last two years. The April 2025 exceedance represents the fifth exceedance in six monitoring rounds (Figure 4-10).

Error! Reference source not found. demonstrates that VWP341 cobalt concentrations appears to be rising steadily and have consistently trended at the top of cobalt concentrations across operational groundwater bores. The April 2025 exceedance represents the historical maximum for the bore.

The weathering of cobalt-bearing rocks (such as ultramafic and sulfide ores) releases cobalt into the soil and groundwater. In coastal areas, shallow groundwater often experiences fluctuating redox conditions. Under reducing conditions, cobalt can be mobilised from sediments into groundwater. The mixing of freshwater with saline saltwater can alter the geochemistry of groundwater, leading to the desorption of cobalt from mineral surfaces and its subsequent enrichment in groundwater. Additionally, coastal environments often have high organic content, which can form complexes with cobalt, enhancing its mobility and concentration in groundwater (AECOM, 2024).

Investigations into trigger exceedances did not determine any potential sources of cobalt on site (refer Section 4.1.5); therefore, the increasing trends are considered to be likely as a result of natural variation. These increases are likely due to a reduction in recharge of groundwater, low aquifer permeability and lower rates of dispersion (AECOM 2024b).

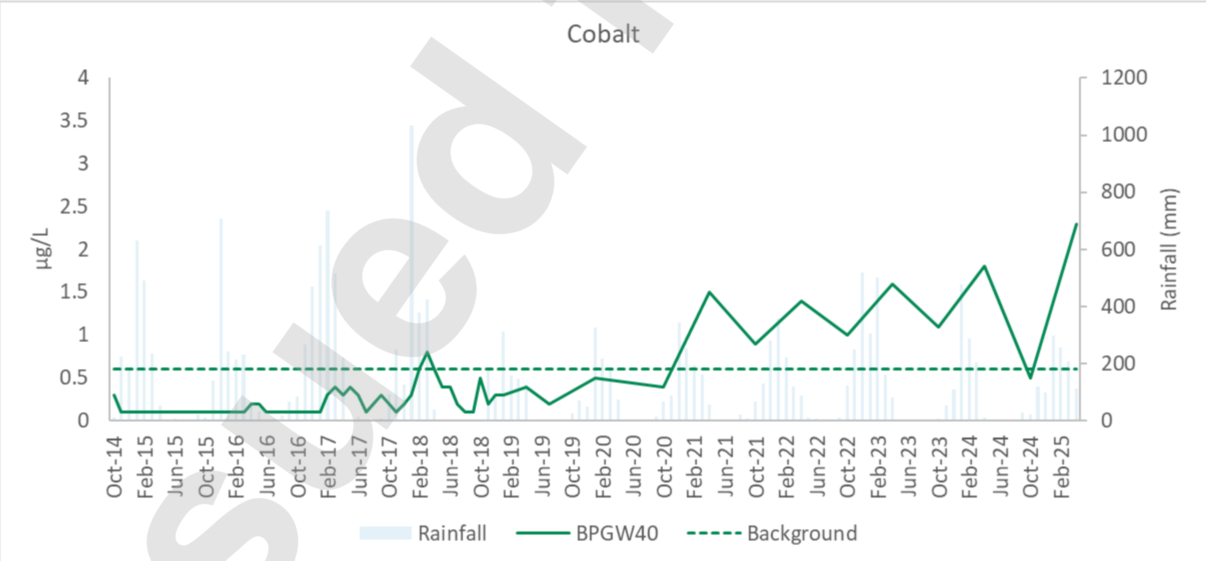


Figure 4-9: Cobalt concentrations recorded at BPGW40 from October 2014 to April 2025

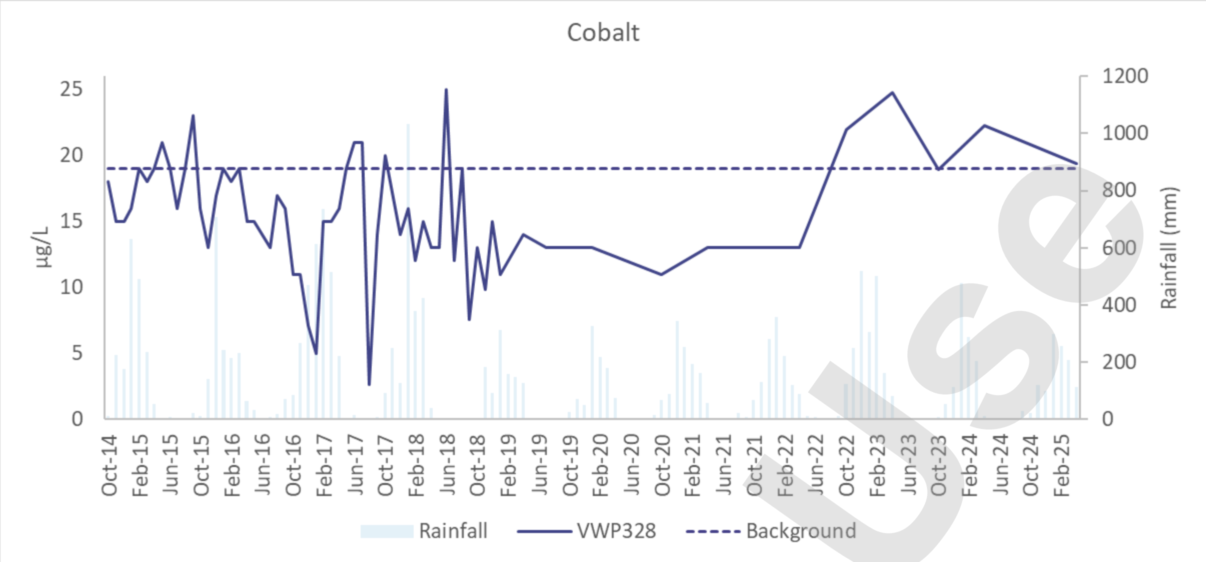


Figure 4-10 Cobalt concentrations recorded at VWP328 from October 2014 to April 2025

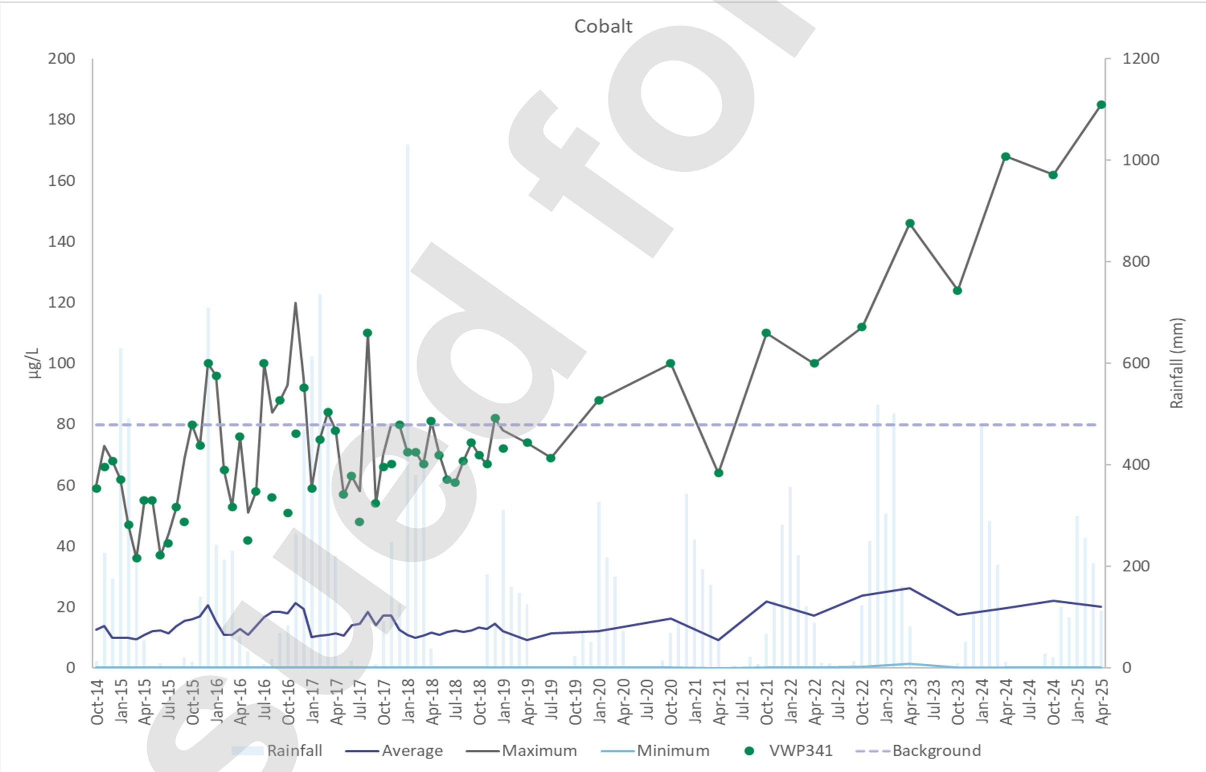


Figure 4-11: Cobalt concentrations recorded at VWP341 with respective background level (dashed line) and the average, minimum and maximum cobalt of all operational monitoring wells from October 2014 to April 2025

Manganese

Figure 4-12 indicates that manganese concentrations at BPGW09 and VWP341, reaching historical maximums in April 2025. The bores appear to fluctuate seasonally, with lower concentrations in the dry season and higher concentrations in the wet season. Trend analysis indicates that manganese concentrations at VWP341 appear to be trending upwards. Manganese concentrations at BPGW09 are potentially increasing due an increase in concentration of groundwater discharge upgradient (AECOM, 2024). Manganese is a major constituent of soils, and its solubility is controlled by pH and oxidation-reduction reactions. Anaerobic conditions can drive the reduction of manganese leading to its dissolution into groundwater. This often happens in soils where oxygen is depleted. Coastal areas often have complex groundwater recharge and discharge dynamics, influenced by tides, precipitation, and human activities. Variations in these dynamics can cause fluctuations in redox conditions, influencing manganese mobility. Manganese concentrations in soil solution are increased under reducing conditions and at low soil pH values (AECOM, 2024).

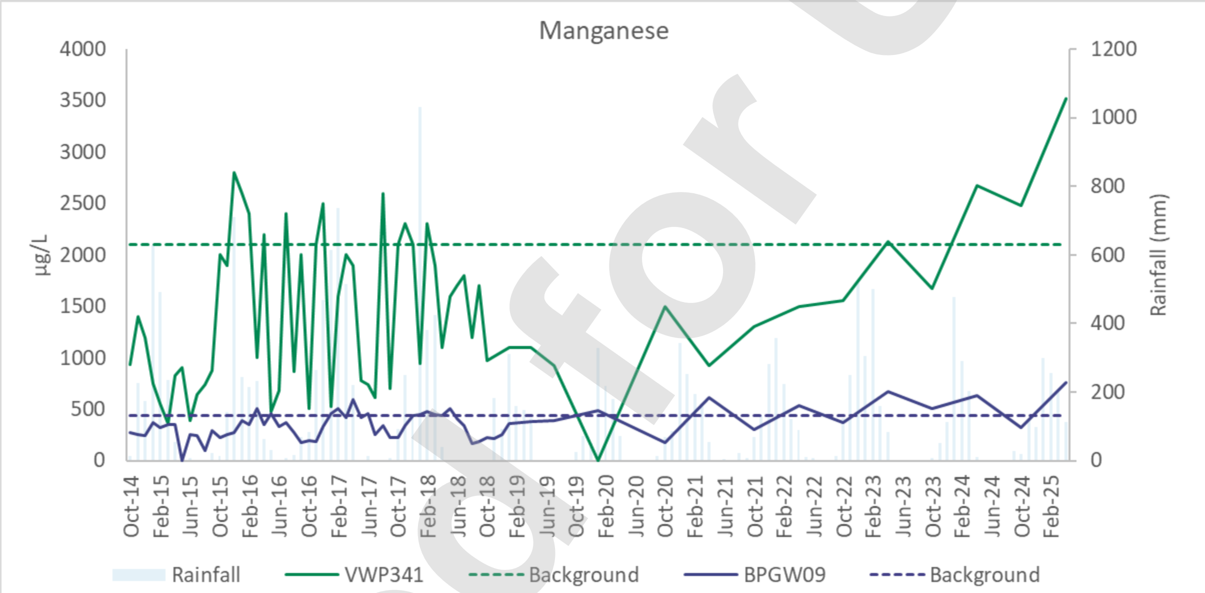


Figure 4-12: Manganese concentrations recorded at BPGW09 and VWP341 from October 2014 to April 2025

Nickel

A nickel exceedance was recorded at VWP341 during the fourteenth and fifteenth groundwater monitoring survey, with BPGW07 recording an exceedance for survey 14 only. Trend analysis indicates that nickel concentrations fluctuate within a stable range at VWP341 (Figure 4-12). The April 2025 exceedance is consistent with recordings from the last year and monitoring contractor has not recommended further investigation. Nickel is one of the most mobile of the heavy metals in the aquatic environment. The mobility of nickel in the aquatic environment is controlled largely by competition between various sorbents to scavenge it from solution and ligands to form non-sorptive complexes. In reducing environments, insoluble nickel sulfide may form. Nickel chloride is water-soluble and would be expected to release divalent nickel into the water. Acidic conditions, manganese, and iron-reducing conditions increase the mobilisation of nickel (AECOM, 2024).

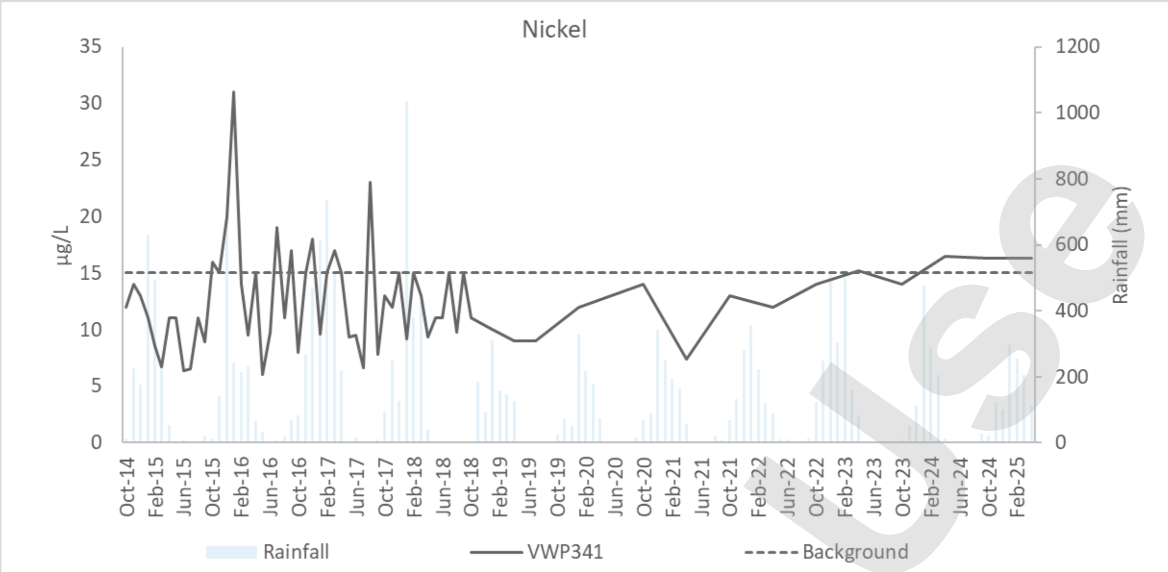


Figure 4-13: Nickel concentrations recorded at VWP341 from October 2014 to April 2025

Zinc

Trend analysis shows that the zinc concentrations frequently fluctuate at BPGW07 but remain within a stable range (Figure 4-13). Zinc concentrations appear to have steadily increased at VWP341 since 2016, and the April 2025 result (176 µg/L) represents the historical maximum zinc concentration for the bore. Seasonal fluctuations are evident with higher concentrations observed during the wet season. Investigations into trigger exceedances did not determine any potential sources of zinc on site (refer Section 4.1.4), therefore the increasing trends are considered to be likely as a result of natural variation. The mobility and solubility of zinc in groundwater are influenced by pH and redox conditions. In acidic conditions, zinc is more soluble and can be more readily mobilized into the groundwater (AECOM, 2024).

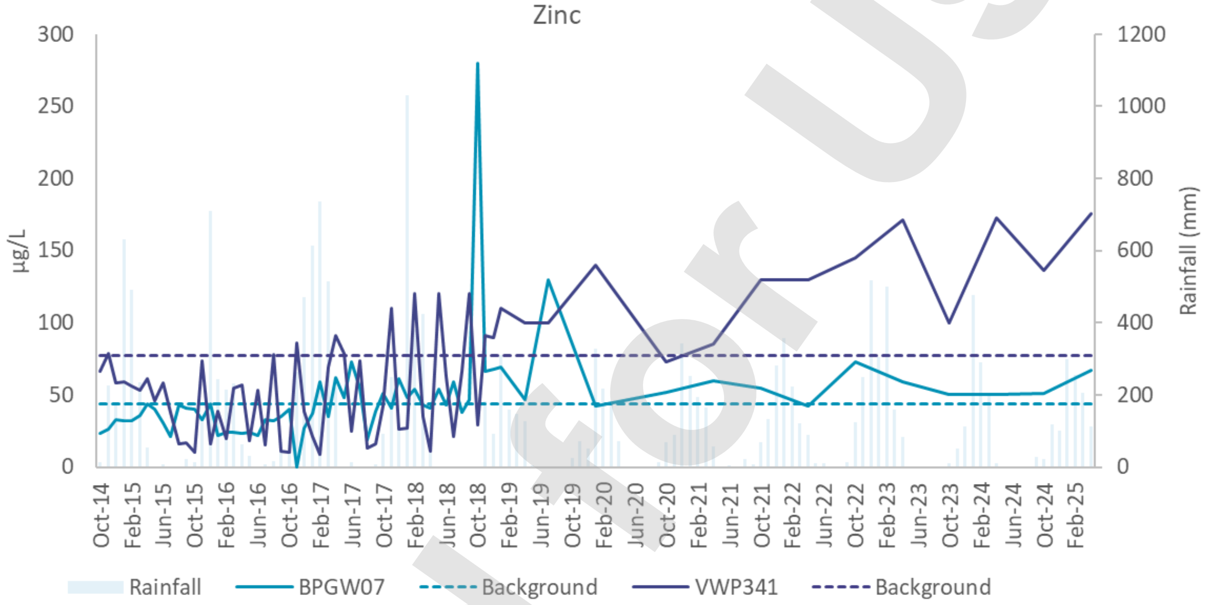


Figure 4-14: Zinc concentrations recorded at VWP341 and BPGW07 from October 2014 to April 2025

4.1.5 Trigger exceedance investigations

In accordance with the receiving environment adaptive management process outlined in Section 7.5 of the OEMP, groundwater trigger exceedances were investigated (i.e. results that exceeded benchmark levels, see Section 4.1.1). A summary of the number of trigger exceedances by survey is provided in Table 4-3 with corresponding investigation reports listed below:

- Groundwater Survey 14 – Trigger Investigation Report (L290-AH-REP-70131)
- Groundwater Survey 15 – Trigger Investigation Report (L290-AH-REP-70146)

Investigations were completed for all trigger exceedances. Investigations considered multiple lines of evidence, such as rainfall, seasonal factors, Ichthys LNG operational activities and any spill events, to determine if increasing trends in groundwater analytes were likely to be as a result of Ichthys LNG.

Investigations completed following the October 2024 and April 2025 monitoring surveys concluded that the reported trigger exceedances were not as a result of Ichthys LNG operations and were likely natural (e.g. represent seasonal trends and natural variability). Therefore, no further evaluation or management response was required.

Table 4-3: Summary of groundwater trigger exceedances

Date	Month	Physio-chemical	Nutrients	Metals
Survey 14	October	1	21	19
Survey 15	April	3	14	21

Further to the investigations above the independent groundwater assessment report was developed, analysing the potential causes for increasing concentrations of analytes at specific bores to interpret the impacts of these increasing trends to the surrounding environment. These results will determine whether the OEMP needs modifying to better monitor ILNG impacts to groundwater in a meaningful way. This report was delivered late-2024 and summarised that:

- Trace metals vs. nutrients
  - Analysis of the time plots indicates trace metals and nutrients (ammonia) are accumulating in groundwater at all sites presented in this report.
  - Trace metal concentrations fluctuated over broad ranges during the construction phase because the site was disturbed, and recharge was mobilising the metals from the unsaturated fill materials. Once construction was completed, the fluctuations decreased because the recharge flux was reduced by the finished (sealed) surface across the site. Trace metals continue to be mobilised (with higher concentrations) each wet season. Concentrations decrease in the dry season because either the solute flux is dispersed, or the metals/ metalloids are altered to insoluble forms.
  - Ammonia concentrations fluctuate seasonally, but they are higher in the dry season than during the wet season. Concentrations are increasing at locations testing as anoxic (reducing) and oxic (oxidising) and at sites that have mangrove mud (the organic material being a common source) and non-organic sand, gravel and clay deposits. Increasing dry season concentrations suggest ammonia is accumulating when flow groundwater rates are low. Decreasing concentrations during the wet season suggest a dispersal mechanism is present.
- Groundwater stratification
  - Analysis of the background monitoring data suggest the groundwater at VWP341 and BPGW40 is stratified with respect to the salinity. Bore BPGW41 is apparently less stratified. Stratification is the result of mechanisms such as aquifer permeability (preferred flowpaths), local vs. dispersed recharge, and differences in the density due to salinity. More stratification at bores VWP341 and BPGW40 may be the result of one of more of these mechanisms because they were / are on the coastal fringe where terrestrial groundwater discharges into a hypersaline marine setting. Bore BPGW41 was further away from (and less influenced by) the coastal discharge zone.
  - Stratification is likely to be significant because vertical and/or lateral movements in the profile will lead to changes in the quality of groundwater being sampled at fixed depths. Changes to the degree of stratification resulting from broad-scaled alterations to the hydrogeological conditions can be masked by local influences causing the profile to migrate up or down. Broad-scaled and local mechanisms for such change have been identified.
- Changes at the Combined Operations Complex

  - Manganese concentrations at bore BPGW08A are likely increasing because of a combination of the reduced rate of recharge and fluctuating water table within the fill materials. While the increasing manganese concentrations trends are clear, they do not appear to be the result of a point source such as a leak of spill. Rather, the source appears to be local materials i.e., fill and/or weathered siltstone.
  - Manganese concentrations at bore PBGW09 are likely increasing because the concentration in groundwater in the upgradient area (to the south) that discharges at this location is increasing. The source and mechanisms for those increases are described for bore BPGW08A above. Being in a discharge zone, concentrations are likely to fluctuate more because of overlapping influences from the terrestrial and marine environments. The proportions of each will vary depending on climatic, tidal and sea level fluctuations.
- Changes at the LNG facility (VWP341, BPGW40 and BPGW41)
  - Concentrations of manganese, cobalt, zinc, and ammonia at the three bore sites along the eastern side of the LNG facility (noted in the regular monitoring data reviews) are likely increasing because of a combination of reduced recharge (less water in), lower aquifer permeability (less water flowing), and lower rates of dispersion (more accumulation of solutes).
  - The accumulation mechanisms are the result of long-term and permanent changes to the local hydrogeology and presence of source materials i.e., fill and/or mangrove mud. They do not appear to be the result of a point source such as a leak of spill within the LNG facility.

The construction and ongoing presence of compacted foundation soils, bitumen and concrete has resulted in a reduction in permeability of surficial natural soils due to the compaction and possibly the geotechnical pre-loading of soft soils e.g., mangrove mud while the foundations were being constructed. This has resulted in an increase in the hydraulic gradient during the dry season. AEC Environmental (2015) estimated the seasonal recharge would be reduced by up to 30 to 40% at some sites because of the compacted fill for the facility foundations and sealed surfaces. The investigation concluded that compaction of soil post-construction, in 2014, may have caused changes to groundwater chemistry. Aquifer recharge is reduced in the dry season due to compacted fill and layered bitumen/concrete, allowing analytes to accumulate in the dry season and then be flushed in the wet season.

Deliberation and assessment will be given to appropriateness and timing of re-baselining background values once parameters and monitoring sites have stabilised.

4.1.6 Program rationalisation

No changes to groundwater monitoring at Ichthys LNG are currently proposed, as the current biannual monitoring is appropriate to capture seasonal impacts from unplanned discharges to ground.

5 FLORA, FAUNA, AND HERITAGE

5.1 Mangrove health and intertidal sediment

Mangrove health and intertidal sediments are monitored to detect potential adverse changes in mangrove community health as an indirect result of Ichthys LNG operations. The objectives of biennial mangrove health and intertidal sediment surveys are to:

- informatively monitor mangroves adjacent to Ichthys LNG
- detect changes in intertidal sediment quality attributable to Ichthys LNG.

As per the OEMP (L060-AH-PLN-60005), mangrove health and intertidal sediments are monitored biennially. Mangrove health and intertidal sediments were previously monitored during April 2024 and in turn not monitored during this reporting period.

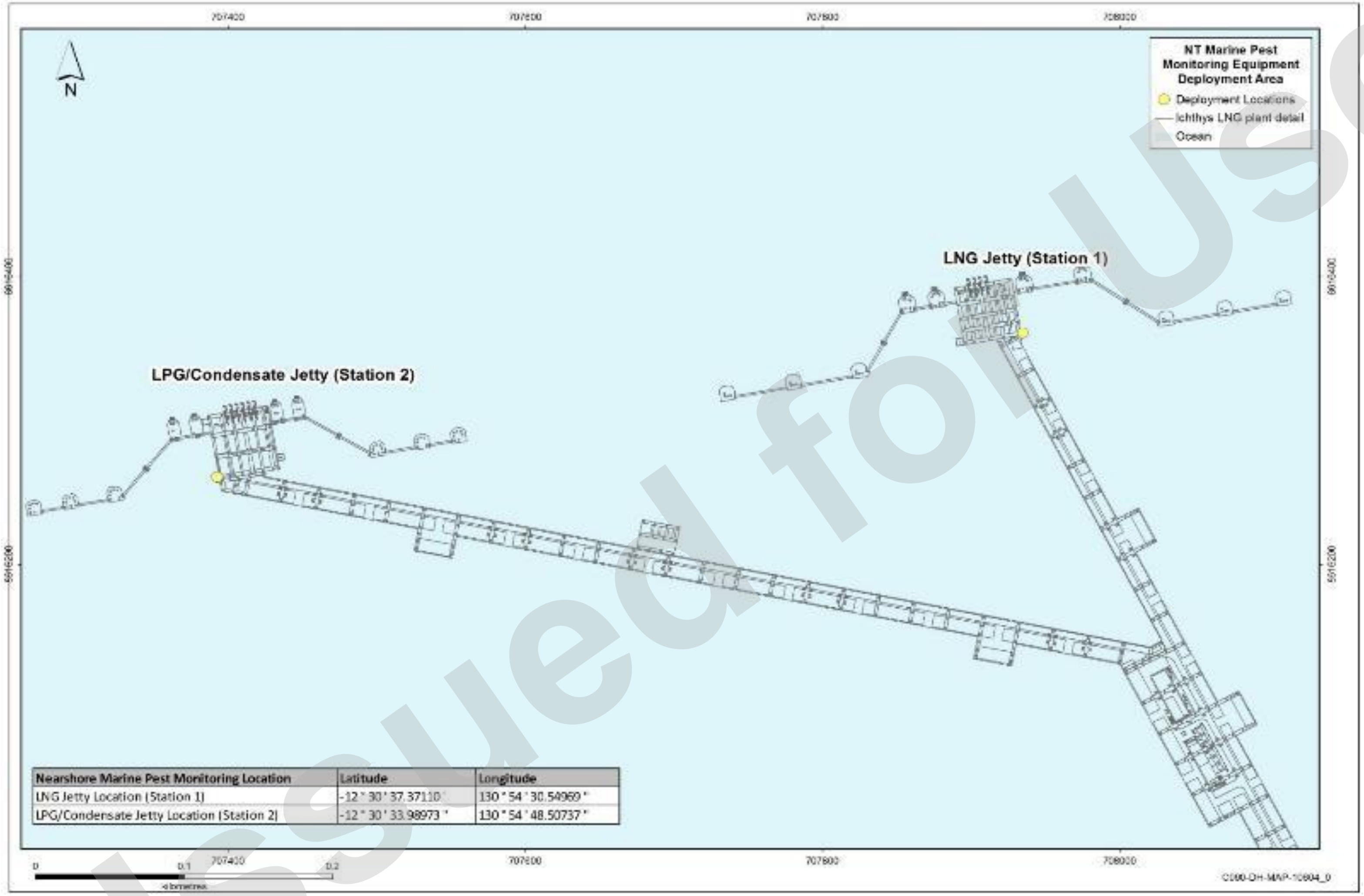
5.2 Nearshore marine pests

5.2.1 Method overview

Nearshore marine pest monitoring is undertaken to assess the presence/absence of invasive marine species at the Ichthys LNG and LPG/condensate product loading jetties (Figure 5-1). The two sites located on the product loading jetties have been incorporated in the wider Darwin Harbour program, managed by NT Aquatic Biosecurity Unit, within the Northern Territory Department of Agriculture and Fisheries (DAF) who provide the artificial settlement units (ASUs; Figure 5-2)) for INPEX to deploy at the jetties. Each ASU consists of four settlement plates (back-to-back) and two rope mops.

Photo-monitoring of ASUs is undertaken monthly with ASUs collected and replaced every fourth month (an example of monitoring photographs is shown in Figure 5-3). Collected ASUs and monthly photos of the traps are sent to NT DAF for species identification.

The ASUs were installed in September 2018 with monthly monitoring commencing in October 2018. During the reporting period monthly photo inspections occurred and the traps were collected and provided to NT DAF every four months for identification of species.



Nearshore Marine Pest Monitoring Location	Latitude	Longitude
LNG Jetty Location (Station 1)	-12 ° 30 ' 37.37110 "	130 ° 54 ' 30.54969 "
LPG/Condensate Jetty Location (Station 2)	-12 ° 30 ' 33.98973 "	130 ° 54 ' 48.50737 "

Figure 5-1: Nearshore marine pest monitoring locations

Figure 5-2: Nearshore marine pest ASU

Figure 5-3: Example of monitoring photographs taken during monthly inspection a) rope mop, b) inside the plates and c) plates surface biofouling conditions

5.2.2 Results and discussion

NT DAF examined plates and rope mops on submission every four months, and photos submitted after monthly inspections. NT DAF did not identify any invasive marine species on settlement devices deployed as part of the Darwin Harbour marine pest monitoring program.

5.2.3 Program rationalisation

No change proposed to the marine pest monitoring.

5.3 Introduced terrestrial fauna

Introduced terrestrial fauna may be monitored to determine the presence, location and methods used to control nuisance species.

5.3.1 Method overview

In the event introduced terrestrial fauna are deemed to be a nuisance at Ichthys LNG, INPEX will undertake an annual survey using a third-party licenced pest management contractor.

5.3.2 Results and discussion

During the reporting period there were no reports of introduced terrestrial fauna being deemed a nuisance onsite, as such, no annual survey was undertaken. The routine and ad-hoc pest management programs including baiting and trapping adequately managed introduced terrestrial fauna at Ichthys LNG.

5.3.3 Program rationalisation

No change to the current program is proposed.

5.4 Weed mapping

The key objectives of the weed mapping program are to:

- identify the abundance and spatial distribution of known and new emergent weed populations; and
- inform weed management and control activities.

Weed surveys are undertaken annually at the end of the wet season (nominally in April). Table 5-2Table 5-1 provides a summary of surveys completed during the reporting period.

Table 5-1: Weed survey details

Survey	Date	Report	INPEX Doc #
Survey 10	April 2025	Weed Management Report No. 10	L290-AH-REP-250603

5.4.1 Method overview

Weed surveys were performed in accordance with the INPEX LNG Weed Mapping and Vegetation Surveillance Monitoring Plan (L290-AH-PLN-70001). The area surveyed is shown in Figure 5-4. Parameters monitored during the weed surveys are listed in Table 5-2. Where identification of a species was not possible in the field, a voucher sample, together with photographs were taken to facilitate post survey identification.

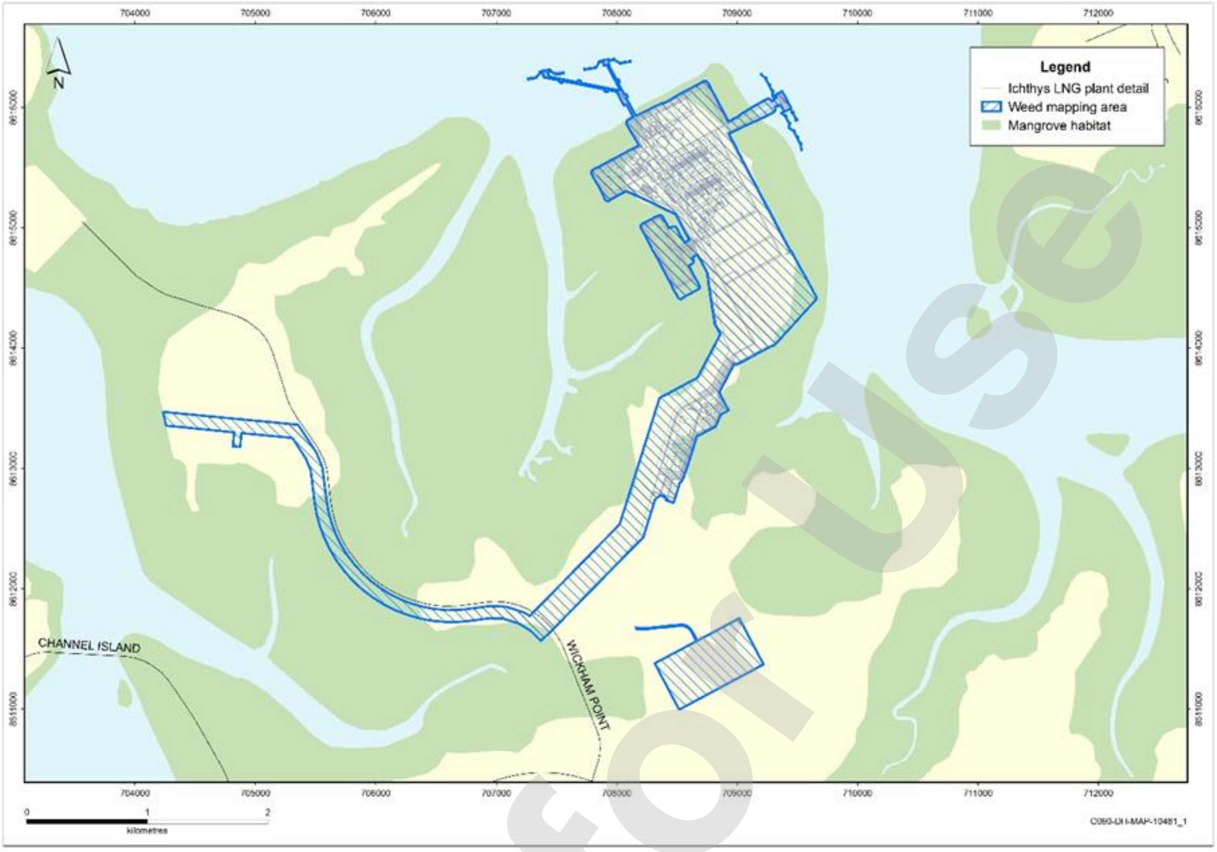


Figure 5-4: Weed survey area

Table 5-2: Weed survey parameters

Key Parameter	Descriptor
Weed names	Scientific and common names
Physical locations	Coordinates of localised outbreaks, polygons for larger occurrences
Abundance	Individual numbers and/or percentage cover, enabling comparison with previous and historic monitoring events
Date	Date of data collection for future and historic comparison

5.4.2 Results and discussion

Survey 10: May 2025

Six declared weed species were recorded during the 2025 survey, compared to five declared weed species recorded during the previous survey in April 2024. The results of the 2025 weed survey show a small decrease in the density and distribution of gamba grass across the site since the 2024 survey. The monoculture infestation patch surrounding Section 1949 was reduced from 22,900m^2 to 18,925m^2. There has been a significant reduction of hyptis populations within the GEP corridor, a total of 30 hyptis patches were recorded during the survey.

Weed species observed during the survey include:

- gamba grass

- hyptis
- neem tree
- flannel weed
- sicklepod
- latana.

No other new declared weed species were recorded at Ichthys LNG during the reporting period. Declared weed species previously identified during weed surveys include:

perennial mission grass (not detected in 2024 and 2025).

Two non-declared weeds of note were observed during the survey:

- annual mission grass
- stylo.

Weeds identified during the weed mapping surveys were communicated to the weed management contractor and managed accordingly (see Section 5.5).

Declared weed infestation trend analysis

A trend analysis for weed results from all surveys was completed (Figure 5-5). Gamba grass infestations recorded during 2025 have decreased slightly from 2024 but remain much higher compared to the period of 2021–2023. This reduction is due to a significant decrease in single plant infestations. Hyptis populations recorded in 2025 have decreased from 2024 to levels comparable to 2022 and 2023.

Notably, no perennial mission grass was recorded in Survey 10. Patches of this species are a very high priority for control.

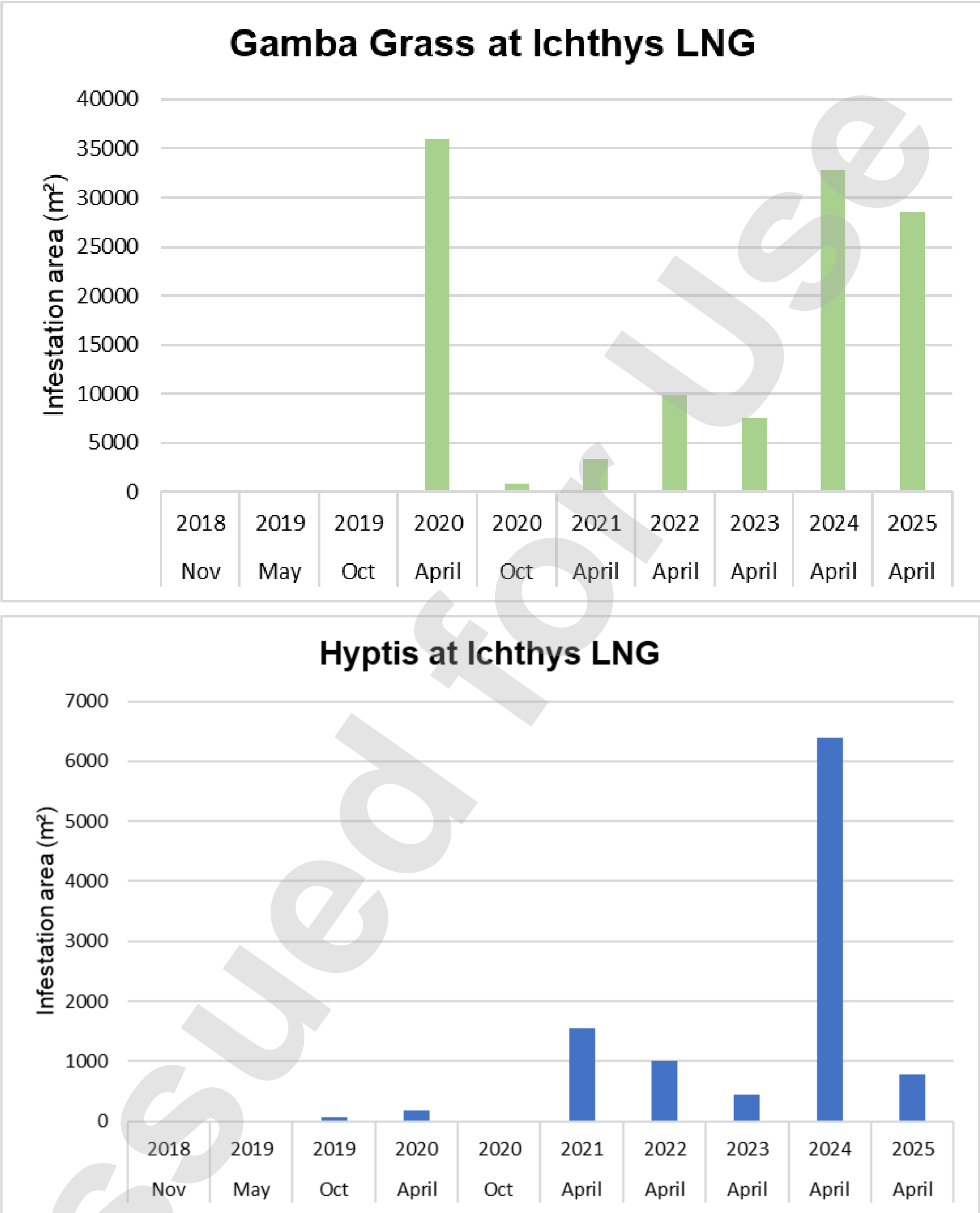


Figure 5-5: Comparison of declared weed infestations between AEMR reporting periods

5.4.3 Program rationalisation

No changes to weed surveys is proposed. The current annual weed surveys will still allow INPEX to fulfil its commitments under the OEMP and *Weeds Management Act* (NT).

5.5 Weed management

5.5.1 Method overview

Weed control at the site was undertaken and managed by a weed management contractor during the reporting period. Vegetation control at the site occurred along the fence lines, drains, inside the facility and along the GEP corridor, including the Section 1949 laydown yard. Weed control is carried out at set intervals of December, February and April during the reporting period. Methods of control include back-burning in early dry season, slashing, and spray application of herbicides, boom spray, and backpacks for the 2024/2025 reporting period.

5.5.2 Results and discussion

Overall weed management measures undertaken did result in a slight reduction in weed load, particularly in Section 1949. Therefore, it is recommended that a gamba grass treatment program is implemented in Section 1949 and along the GEP corridor, the operations area and the production area immediately following each wet season until it has been sufficiently controlled. This may take several years of concentrated controlled effort to see a reduced population of gamba grass across the entire site. Control methods will be directed by the NT Government guidelines (https://nt.gov.au/environment/weeds/weeds-in-the-nt/A-Z-list-of-weeds-in-the-NT/gamba-grass/control).

A weed maintenance strategy has been developed for onshore, guided by maintenance work instructions that are divided into three separate work orders to balance the required resources to execute the proposed weed control measures. Weed management resources are initiated in the months of February, April and December to action the recommended control measures.

5.5.3 Program rationalisation

No changes are proposed to weed management at Ichthys LNG.

5.6 Vegetation rehabilitation monitoring

The key objectives of the vegetation rehabilitation monitoring are to:

- monitor native vegetation recovery; and
- provide management advice to ensure the establishment of stable, self-sustaining vegetation communities.

In accordance with the OEMP, vegetation rehabilitation is now biennial (every two years). Vegetation rehabilitation monitoring (also known as vegetation surveillance) for the reporting period is detailed in Section 5.6.2. Table 5-3 provides a summary of surveys completed during the reporting period.

Table 5-3: Vegetation rehabilitation survey details

Survey	Date	Report	INPEX Doc #
Survey 5	9-15 April 2025	Vegetation Surveillance Report No. 5	L290-AH-REP-70058

5.6.1 Method overview

A vegetation surveillance survey (Survey 5) was performed in accordance with the Northern Territory guidelines and field methodology for vegetation survey and mapping (Brocklehurst et al. 2007). Key parameters assessed during the surveillance survey are shown in Table 5-4. Rehabilitation categories (discussed in Section 5.6.2) are provided in Table 5-5. The area surveyed is shown in Figure 5-6.

Table 5-4: Vegetation surveillance parameters

Key Parameter	Descriptor
Vegetation community description	Describing remnant vegetation communities immediately adjacent to the GEP corridor
Physical locations	Mapping the distribution of vegetation communities within the GEP corridor
Rehabilitation progress	Assessing and classifying rehabilitation progress of areas within the GEP corridor
Soil erosion	Recording any areas of active soil erosion in rehabilitation areas
Vegetation on rehabilitated areas (VS01 – VS05 and VS10)	Observations recorded at each site included: • Plant species composition, cover, and abundance (including weeds) • Vegetation structure • Recruitment of perennial species • Soil and land surface characteristics • Disturbances such as grazing, erosion and fire.

Table 5-5: Rehabilitation categories – assessment criteria

Vegetation Community	Category 1	Category 2	Category 3
Low Eucalypt woodland	• Annual grassland / herb land • Total vegetation cover less than 30% (post wet season, with large bare areas) • Tree or shrub seedlings or juveniles absent	• *Acacia* spp. low sparse shrubland • Scattered individuals or small patches of juveniles and seedings of Acacia and other native shrub species	• Mixed Acacia shrubland • Several life forms presenting including shrubs, woody forbs, annual and perennial grasses

Vegetation Community	**Category 1**	**Category 2**	**Category 3**
	• Large continuous areas of bare ground • Low litter levels • Surface structures very sparse or absent • Evidence of accelerated surface run-off	• Evidence of more than one shrub recruitment event i.e., mixed age stands • Moderate litter levels • Stable soil surface	• Evidence of several recruitment events of perennial species i.e., a range of cohorts • Continuous litter cover • No evidence of accelerated surface water run-off
Low mangrove closed forest	• Seedlings or juvenile mangroves absent or present as very scattered individuals of single age cohort	• Seedlings and juvenile mangroves widespread with canopy cover > 5% • Usually, evidence of more than one recruitment event, as shown by multiple age-classes	• Moderately dense stands of mangrove juvenile and seedlings with canopy cover >20% • Evidence of several mangrove recruitment events i.e., a range of age cohorts are present
Low *Melaleuca* sp. open woodland / sedgeland	• Sparse patchy cover of sedges • Melaleuca sp. seedlings or juveniles absent or present as very scattered individuals of single age cohort • Evidence of accelerated surface water run-off	• Open sedgeland with < 50% cover with small discontinuous bare patches. • Scattered individuals or sparse patches of Melaleuca sp. and other native perennials on slightly elevated ground (*Note establishment of native perennial tree and shrub species were not observed during Survey No. 2) • Moderate litter levels	• Elevated areas with Melaleuca shrubland • Evidence of several recruitment events of perennial species i.e., a range of age cohorts • Extensive litter cover • Stable soil surface with no accelerated surface run-off
Low Monsoon vine forest	• Annual grassland/herbland • Total vegetation cover less than 30% (post wet season, with large bare areas) • Tree or shrub seedlings or juveniles absent • Large continuous areas of bare ground • Low litter levels	• *Acacia* spp. and *Melaleuca* spp. Low sparse shrubland • Scattered individuals or small patches of juveniles and seedings of native shrub species • Evidence of more than one shrub recruitment event i.e., mixed age stands • Moderate litter levels	• Mixed *Acacia* spp./*Melaleuca spp*. • shrubland • Several life forms presenting including shrubs, woody forbs, annual grasses, and herbs • Evidence of several recruitment events of perennial species i.e., a range of cohorts

Vegetation Community	Category 1	Category 2	Category 3
	• Surface structures very sparse or absent • Evidence of accelerated surface run-off	• Stable soil surface	• Continuous litter cover • No evidence of accelerated surface water run-off

Figure 5-6 Vegetation surveillance survey area

5.6.2 Results and discussion

The results of Survey 4 indicate that regeneration rates of vegetation within the GEP corridor differs for each of the vegetation communities, as follows:

- *Low eucalyptus woodland (LEW)*: When previous survey results were compared with Survey no 4, a decrease in area allocated for category 3 was recorded. Total LEW area category 3 has decreased from 5.40 ha (70%) to 2.86 ha (37%), while LEW category 1 and 2 increased from 0.04 ha (1%) and 2.3 ha (29%) to 1.02 ha (13%) and 3.85 ha (50%) since the 2023 monitoring round. However, LEW area category 3 has increased since the first monitoring round in 2019 by 1.31 ha. Some successional development is evident within the LEW rehabilitation sites (VS01, VS0-2 and VS05). However, Acacia species (*Acacia holosericea and A. auriculiformis*) make up most of the recruited species, with no Eucalyptus species recruitment recorded. An overall decrease in LEW establishment was recorded along the GEP Corridor, with the area allocated to rehabilitation categories 2 and 3 falling from 99.4% to 86.8% since Survey No. 4 in 2023.
- *Low mangrove closed forest (LMCF):* LMCF rehabilitated communities demonstrated an overall improvement from the previous survey, with a decrease in rehabilitation category 1 from 1.10 ha (18%) to 0.56 ha (9 %). This is slightly offset by a decrease in rehabilitation category 3 from 1.86 ha (31%) to 0.67 ha (11.2%). Most of this vegetation community was assessed as rehabilitation category 2 (4.75 ha, 79%). This result indicates that the LMCF communities within the rehabilitation zone remain in the intermediate stage of ecological succession. Evidence of recruitment can be seen at LMCF sites with *Ceriops australis* plants within the rehabilitation zone approximately 1 m shorter than fully developed adult plants in the adjacent area. The areas cleared will remain suitable for *Ceriops australis* to re-establish. This is because the environmental conditions, including salinity, drainage, nutrient and oxygen levels will remain largely unchanged (Lee 2003).
- *Low Melaleuca sp. open woodland/sedgeland*: Results from 2025 monitoring indicate that low Melaleuca open woodland / sedgeland communities have declined in health, with rehabilitation category 1 increasing from 0.39 ha (32%) to 1.11 ha (92%), and rehabilitation category 3 decreasing from 0.12 ha (10%) to 0 ha (0%). This result may be due to the different subjective judgement of the personnel undertaking the assessment. It should also be noted that a relatively small portion of the GEP rehabilitation area is attributed to this vegetation community (1.11 ha, 7% of the GEP), therefore a change in rehabilitation scores within this community across surveys will cause a relatively large % change in results. Evidence of recruitment of *Melaleuca viridiflora* can be seen adjacent to the GEP rehabilitation zone, as displayed in Plate 3. However, minimal recruitment is evident within the GEP of this community type, and most of the vegetation comprises sedges such as *Fimbristylis macassarensis*.

- *Low monsoon vine forest:* Results from the 2025 monitoring round indicate that Low Monsoon vine forest areas have improved since 2023, with 100% of the 2.82 ha of this community being allocated as rehabilitation category 3. This represents an increase from the 1.50 ha (59%) assessed as rehabilitation category 3 in 2023. Acacia spp. were the dominant revegetation species recorded within the Low Monsoon vine forest, with recruitment of *Melaleuca viridiflora* also evident. Acacia sp. regenerate from long lived dormant soil seed banks and require natural triggers, such high temperature, to break seed dormancy for germination and seedlings recruitment. A review of aerial imagery from 2019 to 2025 reveals that vegetation cover has increased significantly within the GEP area classified as Low Monsoon vine forest, particularly along the beach valve, as displayed in Figure 5-7 and Figure 5-8 (Aecom 2025)

Figure 5-7: Aerial imagery of GEP along the Beach Valve in 2019

Figure 5-8: Aerial imagery of GEP along the Beach Valve in 2025

The results of Survey No. 5 show that natural regeneration is occurring within GEP corridor and the majority of the GEP corridor is progressing toward a self-sustaining native vegetation community. A slight decrease from 86.3% to 84.8% in the area within the GEP corridor categorised within either rehabilitation category 2 or 3 has occurred since the previous monitoring event in 2023. This indicates that progression toward a self-sustaining native vegetation community is occurring slowly.

Annual mission grass and gamba grass are present throughout the GEP corridor. Targeted and, timely ongoing weed control measures are required to ensure this does not likely to prevent regeneration of native seedlings and impacts to surrounding remnant native vegetation communities. Recommendations on the timing of weed control are provided in Section 5.5.2, as well as recommendations to minimise the risk of herbicide spray drift impacting native rehabilitation communities.

It should be noted that data was collected by different personnel across the surveys, so some of the difference in results may be due to the subjective judgements of the assessors. Weed species were recorded within LEW rehabilitation sites, these weeds may negatively impact recruitment of native species. Gamba grass, one of the recorded weeds, grows in tall dense stands, and can outcompete native species for sunlight, water and nutrients, and leads to a reduction in the diversity and abundance of native plant species (TNRM, 2025).

5.6.3 Program rationalisation

No program rationalisation is proposed for vegetation rehabilitation surveillance from the latest conducted vegetation surveillance Survey 5. The next proposed survey will occur in 2026.

5.7 Cultural heritage

The objective of cultural heritage surveys is to determine if there has been any interference to cultural heritage sites as a result of Ichthys LNG operations.

5.7.1 Method overview

Visually inspections of cultural heritage sites will be undertaken when required at a frequency determined by the Larrakia Advisory Committee.

5.7.2 Results and discussion

No inspections of heritage site were required during the reporting period. No heritage breaches occurred within the reporting period.

6 WASTE REDUCTION MEASURES

Waste is managed in accordance with the INPEX waste management processes and the waste control hierarchy (Figure 6-1).

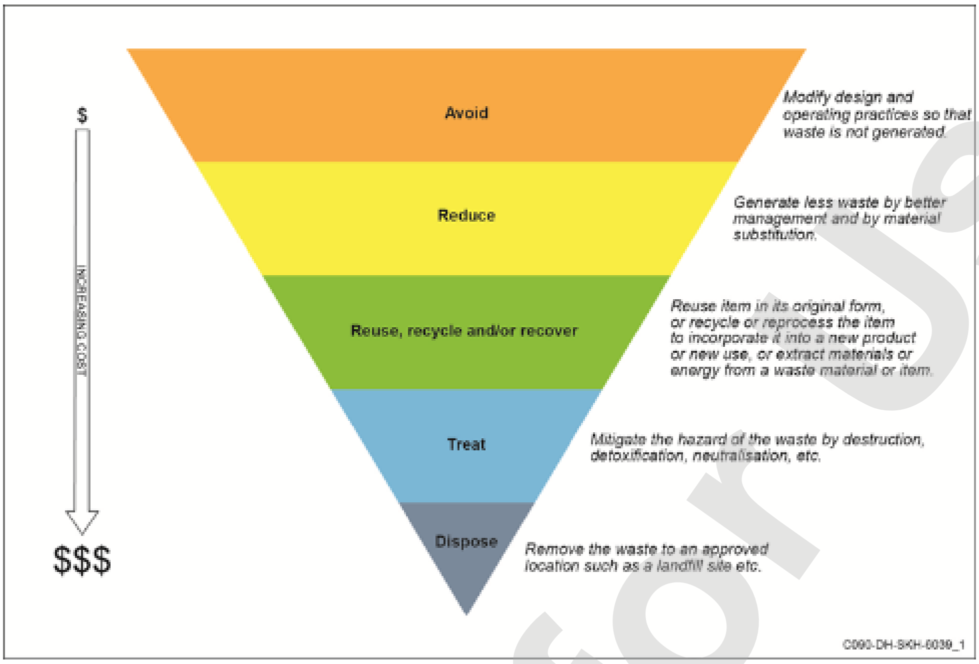


Figure 6-1: INPEX waste control hierarchy

Waste streams at the site are categorised into four broad classes (which include both liquid and solid waste, as outlined in section 3.8.7 of the OEMP):

- recyclable (non-hazardous) waste
- non-recyclable (non-hazardous) waste
- recyclable (hazardous) waste
- non-recyclable (hazardous) waste.

Note, the onsite treatment of wastewater and disposal via the onsite evaporation basin are excluded from reportable waste data (refer to Table 6-1), and only records from licenced waste contractors are used for this waste section.

Solid waste segregation measures involved the placement of various recyclable and non-recyclable waste receptacles around Ichthys LNG, while liquid wastes were segregated into recyclable and non-recyclable streams and then disposed of offsite to suitable treatment and disposal facilities following classification by waste contractors. The expected waste generated by onsite activities and subsequent control measures are detailed further and in INPEX's Onshore Environmental Management Plan L060-AH-PLN-60005 section 3.8.7

Table 6-1 presents a comparison of the waste streams from the 2021/2022, 2022/2023 and 2023/2024 reporting periods against the current reporting period (2024/2025).

Table 6-1: Waste stream data comparison

Waste Stream	2021-2022 (tonnes)	2022-2023 (tonnes)	2023-2024 (tonnes)	2024-2025 (tonnes)
Recyclable / non-hazardous	1126.4	459.7	181.9	844.8
Recyclable / hazardous	10.4	15.7	3.9	343.02
Non-recyclable / non-hazardous	2090.5	4328.3	2395.6	1498.64
Non-recyclable / hazardous	626.0	1196.1	363.9	81.06
Total	**3853.3**	**5999.8**	**2945.3**	**2767.52**

The reporting period 2024/2025 saw an overall reduction in total waste during (2767.52 tonnes) compared to the 2023/2024 reporting period (2945.3 tonnes). Despite a slight decrease in overall waste, there was an increase in recycling of non-hazardous and hazardous waste streams and a reduction in non-recyclable (non-hazardous and hazardous) waste streams in 2024/2025 compared to previous years.

Site wide waste reduction initiatives are implemented via the Waste Management Standard (0000-AH-STD-600047) which applies to all waste streams onsite. Waste management activities or initiatives for the reporting period included:

- a transition to GRI 306 waste classification and reporting;
- unplanned shutdown due to maintenance required on the heat exchanger and associated pigging campaign of the gas export pipeline;
- improvement in the Waste Contractor’s processing of carbon waste;
- capture and storage of chemical waste streams to avoid the mixture of waste streams and rainwater runoff from Ichthys LNG. This prevents the generation of large volumes of wastewater predominately in the AGRU of each LNG train, where amine is used as a solvent to extract acid gases (including carbon dioxide); and
- improvement in the Waste Contractor’s treatment methods to reduce/divert hazardous and non-hazardous wastes from going to landfill; and an increased focus on recycling, re-using, and incineration with energy recovery for non-hazardous and hazardous wastes.

Although not directly related to solid and liquid waste, energy recovery occurs through the use of the waste heat recovery systems. Heat recovery units are located on the GE Frame 7 gas turbine stacks, which capture the heat of the turbine exhaust and then transfer the energy to the site heating medium system. A similar heat transfer method is also used in the CCPP, where the exhaust heat from the GE Frame 6 turbine stacks used to generate steam, which is then transferred into energy in the steam turbines. Use of the waste heat recovery systems reduce the overall fuel consumption and air emissions.

7 PROGRAM RATIONALISATION AND FUTURE SURVEYS SUMMARY

There were no proposed recommendations for changes to monitoring programs and future monitoring will be undertaken in accordance with the current OEMP and EPL228. The proposed next survey dates are outlined below in Table 7-1.

Table 7-1: Survey forecast for future monitoring periods

Survey/Data Collection Scope	Frequency	Previous Survey	Next Survey
Commingled treated effluent	Monthly	July 2024 – June 2025	July 2025 – June 2026
Harbour sediment	Biennial	July 2024	June 2026
Total emissions to air	Annual	July 2024 – June 2025	July 2025 – June 2026
Point source emissions to air	Annual	August 2024, February 2025	Q4 2025, Q1 2026
Dark smoke events	Ad-hoc	n/a	n/a
Air toxic monitoring	Monthly (while AGIs offline)	July 2024 – June 2025	July 2025 – June 2026
Groundwater quality	Bi-annual	October 2024 April 2025	October 2025 April 2026
Mangrove health and intertidal sediments	Biennial	April 2024	April 2026
Nearshore marine pests	Monthly	July 2024 – June 2025	July 2025 – June 2026
Introduced terrestrial fauna	Annual	July 2024 – June 2025	July 2025 – June 2026
Weed mapping	Annual	April 2025	April 2026
Weed management	Annual – as required	Dec 2024, Feb & April 2025	Dec 2025, Feb & April 2026
Vegetation rehabilitation monitoring	Biennial	June 2025	June 2027
Cultural heritage	Ad-hoc	n/a	n/a

8 REFERENCES

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ANZG—*see* Australian and New Zealand Governments and Australian State and Territory Governments

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APPENDIX A: NT GUIDELINE FOR ENVIRONMENTAL REPORTING

NT Guideline for Environmental Reporting	NT Guideline Information	AEMR Reference
Title page	The title page should include: • report name • reporting period (e.g., October 2014–October 2015) • date of submission • version number • where relevant, licence/approval number, or reference to other document the report is being submitted in relation to (e.g., environmental impact statement, pollution abatement notice) • details of report author, including company details.	Title page and Section 1.
Executive summary	The executive summary should succinctly summarise each section of the report, and in particular, the findings of the report.	Executive summary.
Monitoring objective	The monitoring objective(s) should be clearly stated in order to enable the results of monitoring to be assessed in the context of the objectives. Note, where monitoring is linked to a licence or approval, the objectives of monitoring: • may already be specified in an approved monitoring plan, or • may simply be the specific conditions on monitoring included in the • licence/approval that state monitoring point locations, analytes, analysis type, frequency, and limits/trigger values.	Each section includes a subsection with monitoring objectives for each monitoring program.
Monitoring method	*Where there is an approved monitoring plan* Provide details of the approved plan (title, version number, date of submission). *Where there is not an approved monitoring plan* Provide details including: • current map showing sampling locations (including control/reference sites), discharge/emission points, major infrastructure, sensitive environmental receptors, key, scale bar and north arrow • a description of the receiving environment, including environmentally sensitive receptors and significant features • a description of sampling and analysis methods, including detail on reasons for selection of sampling locations (e.g., random stratified), assumptions and deviations from standard sampling/analysis methods1	Each section includes a subsection with monitoring methods for each monitoring program.

NT Guideline for Environmental Reporting	**NT Guideline Information**	**AEMR Reference**
	• factors that may affect variability in monitoring results (e.g., tidal movement, climate, fauna migration, peak production months).	

Monitoring results–presentation	The clear and concise presentation of monitoring results is a critical component of a monitoring report.
	When presenting results, it is important to ensure that:
	• current results are presented in a table and graph
	• results are presented along with:
	  • units
	  • assessment criteria (e.g., limits/trigger values specified in licences/approvals, or in relevant standards or guidelines)
	  • analysis type (e.g., for filtered/unfiltered with filter pore size, five-day or
	  • three-day biological oxygen demand, wet or dry weights)
	  • analytical methods
	  • limit of reporting (LOR), or level of precision for results obtained from
	  • field instruments
	  • measures of uncertainty
	• necessary calculations have been made, to compare data with assessment
	• criteria (e.g., calculation of medians, means, running averages and loads)
	• modification calculations (such as for hardness) have been made using the modifying parameter recorded at the time of sampling
	• all results that exceed the assessment criteria are clearly highlighted
	• summary of previous results (sufficient to highlight trends – usually a minimum of 2–5 years data) is included.
		Each section includes a subsection with monitoring results and discussion for each monitoring program.

Monitoring results–quality assurance/ quality control (QA/QC) evaluation	Results presented in the monitoring report should be reviewed for data completeness, accuracy, and precision. Some typical QA/QC questions include: • for completeness – were all samples taken at the correct location and frequency? • for quality control – _ were all samples collected, preserved in accordance with the specified sampling method or standard sampling methods? • were calibration checks made and were results within an acceptable range? • was analysis undertaken in accordance with relevant national standards (such as accredited under the National Association of Testing Authorities)?	Monitoring plans (referenced in the method overview section) include QA/QC processes.

NT Guideline for Environmental Reporting	**NT Guideline Information**	**AEMR Reference**
Discussion and interpretation of results	This section should include: • discussion of results in context with the monitoring objective(s) • discussion of results where assessment criteria were exceeded, including likely cause of exceedances and likelihood of further exceedances • discussion of trends (consideration of spatial and temporal trends in comparison to previous monitoring data) • discussion of anomalous results, including likely cause • statistical analysis where appropriate • a table of non-conformances with monitoring method.	Each section includes a subsection with monitoring results and discussion for each monitoring program
Conclusion and proposed actions	In this section the submitter of an environmental monitoring report must confirm that the report is true and accurate. Where the report relates to a licence/approval, confirmation must be provided by a person(s) authorised to legally represent the holder of the licence/approval. The wording for this section should be: *I [NAME AND POSITION], have reviewed this report and I confirm that to the best of my knowledge and ability all the information provided in the report is true and accurate.* Note: significant penalties may apply where it is demonstrated that false or misleading information has been supplied to the NT EPA.	APPENDIX B:
Abbreviations	Use of abbreviation should be minimised. However, if they are used to improve readability, this section should specify all abbreviations used in the report.	Throughout AEMR
References	If information (facts, findings etc.) from external documents is to be included in the report, the information must be referenced. If references are from documents that are not freely available (e.g., internal reports, mine management plans) then such documents will need to be provided to the NT EPA on request.	Throughout AEMR
Appendices	Appendices should be used for information that is too detailed or distracting to be included in the main body of the report (such as raw data tables, laboratory reports, QA/QC data).	Appendices

APPENDIX B: EPL228 AEMR 2024-2025 CERTIFICATION

B.1 INPEX

INPEX	I, Takuya Sugawara (Alternate Director, Ichthys LNG Pty Ltd, Australia) confirm that to the best of my knowledge and ability all the information provided in the *EPL228 Annual Environmental Monitoring Report 2024-2025* (L060-AH-REP-70087) is true and accurate.
Name	Takuya Sugawara
Position	Alternate Director, Ichthys LNG Pty Ltd
Signature	
Date	21 October 2025

B.2 Qualified Professional

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INPEX Operations Australia Pty Ltd
Jamie Carle
Ichthys Environment Team Lead
Onshore Operations
144 Wickham Road
Wickham NT 0822

DATE
21 October 2025

SUBJECT
2024-2025 AEMR Review and certification report

REFERENCE
0775533

Dear Jamie

Subject: 2024-2025 AEMR Review and certification report

Environmental Resources Management Australia Pty. Ltd (ERM) was engaged by INPEX Operations Australia Pty Ltd (INPEX) to undertake an independent review of the Ichthys LNG Plant's Annual Environmental Monitoring Report (AEMR) by Qualified Professionals[1]. This report documents the review process and identifies the issues raised and their resolution, resulting in a statement of verification and Statutory Declaration as required by the Northern Territory EPA (NT EPA).

The scope of the review is pursuant to Condition 77 of the Environmental Protection Licence (EPL) 228-05 (EPL228-05 came into effect on 13.12.2022). Condition 77 requires the submission of an Annual Environmental Monitoring Report as follows:

77 The Annual Environmental Monitoring Report must:

77.1 report on monitoring required under this licence;

77.2 include a tabulation in Microsoft® Excel® format, of all monitoring data required to be collected in accordance with this licence;

77.3 summarise performance of the authorised discharge to water, compared to the discharge limits specified in Table 3 in Appendix 2;

77.4 summarise performance of the authorised emissions to air, compared to the emission limits and targets specified in Table 5 in Appendix 3, when the fuel burning or combustion facilities for the Scheduled Activity have operated under normal and maximum operating conditions for the annual period;

77.5 summarise operating conditions of each emission source and the resulting air emission quality;

77.6 provide total emissions to air in tonnes per year for the air quality parameters listed in Table 6 in Appendix 3;

77.7 assess the contribution of the authorised emissions on the Darwin region ambient air quality during periods not affected by bushfire smoke for Wet and Dry seasons;

77.8 report on outcomes of the REMP monitoring and assessment;

77.9 summarise measures taken to reduce waste;

[1] A '*qualified professional'* as described by the EPL228-05 is a person who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature.

77.10 consider the NT EPA Guideline for Reporting on Environmental Monitoring;

77.11 be reviewed by Qualified Professional(s); and

77.12 be provided to the NT EPA with the Qualified Professional(s) written, certified review(s) of the Annual Environmental Monitoring Report.

The purpose of the qualified professional review of the AEMR is to provide an independent assessment verifying that the AEMR is compliant with the conditions of EPL228-05. The review was undertaken by two qualified professionals as deemed appropriate for the content of the AEMR. The qualified professionals are listed in **Table 1**.

TABLE 1 QUALIFIED PROFESSIONALS

Area of expertise	Qualified professional
Discharges to Water	Ken Kiefer
Air Quality	James Grieve

Each of the qualified professionals individually reviewed the Draft AEMR (Revision B) dated 23 August 2024 with respect to the Condition 76 EPL228-05 (as stated above) and the relevant corresponding area of expertise.

The comments raised were recorded in a comments register which is appended to this report in **Annex A**. The register was provided to INPEX seeking comment on how the identified issues will be closed out. INPEX resubmitted the revised AEMR (Revision 0) dated 03 October 2025 to ERM for review, which incorporated the agreed changes and the comments register cross-referenced with the revised sections of the AEMR.

ERM was satisfied that each of the responses had been appropriately incorporated into the updated revision and the comments were closed out. Therefore, the following statement of verification has been made and signed by each of the qualified professionals who undertook the review.

Statement of verification: Based on the review as outlined in this report, ERM confirms that INPEX responded to all comments raised. ERM has reviewed INPEX responses to the comments provided and is satisfied that the content of the AEMR comply with Condition 76 of the EPL228-05 for the 2023-2024 period.

Area of expertise	Qualified professional	Signatures
Discharges to Water	Ken Kiefer	
Air Quality	James Grieve	

Yours sincerely,

For Environmental Resources Management Australia Pty. Ltd.

Paul Fridell
Partner

ANNEX A COMMENTS REGISTER

COMMENTS REGISTER - QUALIFIED PROFESSIONALS REVIEW: AEMR 2024-2025

Contract Number	INPEX PO 565508 / 4500135825
Reviewer	ERM
Document Name	EPL228-05 Annual Environmental Monitoring Report 2024-2025
Company Document No#	L060-AH_REP_70087
Document Revision No# / Date	Revision B / 27 August 2025

ERM's comments from Rev B have been amended in Rev 0 of the AEMR.

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
Discharges to Water				
1	Table 2-4 Thermotolerant coliforms exceedances for July-Sept	For the Thermotolerant coliforms exceedances for July-Sept, were there any samples taken as part of the investigation (other than the planned monthly monitoring samples) that were used to guide and validate the corrective actions?	Yes, non-routine request (NRR) for additional sampling of thermotolerant coliforms, E.Coli and Enterococci between July-Sept 2024 were conducted to support the investigation and guide corrective actions to mitigate environmental harm. These sampling results were included in Section 6 of the investigation report (L060-AH-REP-70062) provided to NT EPA. A total of nine sampling events were conducted across the following three streams (included in the incident report): • Jetty Outfall (L750-SC-003) • Observation Basin (L750-SU-404) • Miscellaneous (L-750-Miscellaneous) A routine monthly sampling event on 15 Oct 2024 confirmed thermotolerant	Closed

COMMENTS REGISTER - QUALIFIED PROFESSIONALS REVIEW: AEMR 2024-2025

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
			coliforms levels were back within specification, validating that the corrective actions were effective and the investigation was considered closed.	
2	Table 2-4 Thermotolerant coliforms exceedances for July-Sept	The Corrective Actions includes a statement : "*The below MOC's were focused on ensuring wastewater originating from the WWTP onsite were within specifications to assure the source of the thermotolerant coliform exceedances are not faecal in nature.*" Are the exceedances from July-Sept considered to be not faecal in nature? If so, what actions and sampling were undertaken to confirm this? IS there potential the source is from the AOC as was suspected with the 2022-2023 exceedances?	AEMR has been amended to reflect wording from Section 5 of the incident investigation report (issued to NT EPA) stating that '*sampling results from the investigation indicated that E. Coli and Enterococci results were significantly lower than the Thermotolerant Coliform results, and therefore it was unlikely that the Thermotolerant Coliform exceedances were solely from a faecal source.'* The actions to mitigate the AOC source are identified (circulation of stagnant water).	Closed
3	Table 2-4 Thermotolerant coliforms exceedances for July-Sept	Further if the MOCs noted in the above comment are intended to that the thermotolerant coliform exceedances are not faecal in nature, did INPEX consider some of the management actions done post similar exceedances from 2022-2023? This included a temporary six-month sampling a six-month program of monthly sampling from locations upstream of the	No, the corrective actions outlined above were considered to be effective. Routine monthly sampling on 8 October 2024 of the jetty outfall (750-SC-003) confirmed thermotolerant coliforms 150 CFU/100ml was within specification of 400 CFU/100ml. Therefore, no further NRR sampling program was undertaken following the investigation report as origin of the no longer existed	Closed

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
		combined discharge, 750-SC-009 and 750-SU-403 Inlet, with testing for Faecal Coliforms. Were there learnings from that for the future MOC?		
4	Table2-4 TN Exceedance April	Were there any samples taken as part of the investigation that was used to guide and validate the corrective actions?	Yes, additional NRR samples were undertaken to support the incident investigation report and guide corrective actions to mitigate environmental harm. A total of eight sampling events were conducted across the following four streams (included in the incident report): • Observation Basin (L-750-SU-404) • Open Ground Flare COC Pit 1 (L-750-SU-051) • Filtered Water Package (L-750-SC-002) • Jetty Outfall comingled (L-750-SC-003)	Closed
5	Table2-4 TN Exceedance June	Were there any samples taken as part of the investigation that was used to guide and validate the corrective actions?	No additional NRR samples were undertaken to support the incident investigation because the corrective actions to rectify a faulty conductivity pH analyser, and manual dosing of ammonia levels in the CCPP package were considered effective; confirmed by routine monthly sampling of the Jetty Outfall (L-750-SC-003) sampled on 8 July 2025 which returned a TN result of 10mg/l. This was	Closed

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
			communicated to NT EPA on 21 July 2025 with a copy of the incident investigation report.	
6	Table 2-4 Thermotolerant coliforms exceedances for June	Is the source of the thermotolerant coliforms exceedances considered be non-faecal?	It is unlikely that the cause of the thermotolerant exceedance was faecal in nature because the significantly low E. coli sample results from both L-750-SC-009 & L-750-SC-004 on 19/6/2025 confirmed that the TC exceedance did not originate from the WWTP, which is the only identified source of e.coli in the OEMP. This was communicated to NT EPA in the investigation report. AEMR amended with *Furthermore, sample results taken on 19 June 2025 at 750-SC-004 (Irrigation Water ex 750-T-550) and 750-SC-009 (Irrigation Tank) confirmed that cause of the event was not faecal in nature with low E.Coli levels.*	Closed
7	Table 2-4 Thermotolerant coliforms exceedances for June	The corrective actions identified for future exceedances is to treat the following sumps 750-SU-402; 750-SU-404 and 750-SU-406 with sodium hypochlorite and sump 750-SU-403 with calcium hypochlorite, to reduce thermotolerant coliform levels. While the sampling done does indicate these areas all have concentrations	No, a temporary monitoring program was not undertaken at these locations following the incident investigation. During the incident investigation report we undertook a total of 12 sampling events across the following seven streams to analyse thermotolerant coliforms, E. Coli and Enterococci: • 750-SC-009 (Irrigation Tank)	Closed

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
		thermotolerant coliforms, with 750-SU-404 having the highest. Given the overall conclusion was that the "the exact cause or source of the thermotolerant coliform exceedance is unknown," is a temporary monitoring program warranted for these locations.	• 750-SU-404 (Observation Basin) • 750-SC-402 (Filter Package ex 750-A-402) • 750-SC-404 (Irrigation water ex 750-T-550) • 750-SU-403 (AOC Holding Basin Inlet) • 720-SC-018 (RO B Pass 1 reject water to 720-T) • 720-SC-020 (RO C Pass 1 reject water to 720-T) Routine monthly sampling completed on 12 August 2025 confirmed that thermotolerant coliforms were back within specification, and the corrective actions were considered to be effective. INPEX communicated the lab results to NT EPA on 2 September 2025.	
Unplanned Discharges to Land				
1	Appendix E Table	The data present for some parameters, mainly metals appear to be presented in separate units. There is a 1000-fold difference in the LORs between the two events based on the 100-fold difference it appears the data in Survey 14 are results in ug/L units and Survey 15 are result in mg/L. Please review and make consistent. They are	Noted – This has been amended to ug/L throughout. Lab and contractor reports contain both mg/L and ug/L, though agree that unit used should be consistent within the section of the AMER and have updated accordingly.	Closed

COMMENTS REGISTER - QUALIFIED PROFESSIONALS REVIEW: AEMR 2024-2025

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
		all in ug/L units, so using that for the table would make review and comparison easier		
2	Appendix E Table	Highlighting exceedance in the table would be helpful for review for NT EPA.	Updated groundwater Table 8-1 in the AEMR to indicate the exceedances bolded and in red font.	Closed
3	Section 4.1.2 Blank Samples	In addition to manganese, add comment on potential impact of the arsenic sample results on that day.	Updated to include wording around the arsenic detention in the rinsate blank. Arsenic detection in the rinsate blank was not considered to impact the overall data quality and interpretation of the results given the low level.	Closed
4	Section 4.1.4	Consistent with other parameters with exceedances add graphs for Filterable reactive phosphorus and aluminium to support the report conclusions.	Amended – Graph for FRP has been added and cross referenced to BPG07 (Figure 4-6). Graph for Aluminium has not been added as exceedances were one off for the sites and not trending upwards. Text at the start of section 4.1.4 of AMER describes this: "*Trend graphs represented below are based on sites experiencing exceedances for at least 3 successive monitoring sampling campaigns*." Additional graph has been developed and added for Ammonia for sites BPGW18, BPGW20, BPGW28.	Closed
5	Section 4.1.5	There is a reference to "*compaction of soil*" as an influence on groundwater	Section 4.1.5 has been expanded around the compaction and lower permeability of	Closed

COMMENTS REGISTER - QUALIFIED PROFESSIONALS REVIEW: AEMR 2024-2025

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
		quality. More context needs to be added on the actual timing of compaction may not be across the general construction timing indicated in the report.	materials during the construction of the site. Along with wording on the reduced recharge to groundwater.	
Air Quality				
1	Abbreviations and definitions	Should include carbon monoxide. General comment – sentence case required for descriptors of abbreviation (leading capital) "*NOX*" should be "*NO_x*" and the definition should be Nitrogen oxides (as the sum of NO and NO_2)	INPEX style guide is not to capitalise unless it's a name, place, or title. Noted – CO added to abbreviations; and NO_x corrected.	Closed
2	3.1	Change: "*and specifically includes total volatile organic compounds (total VOCs), sulphur dioxide and particulate matters (PM 10 and 2.5)*" to: "*and specifically includes total volatile organic compounds (total VOCs), sulphur dioxide (SO_2) and particulate matter (PM_{10} and $PM_{2.5}$).*" Optional: can include a footnote describing PM_{10} and $PM_{2.5}$.	Amended. Footnote not added (as abbreviation clear in text and definitions provided in the abbreviations and definitions table for the document) – abbreviations have been updated in the text / table (see also comment in line item No.5 of this comments table - addressed).	Closed

COMMENTS REGISTER - QUALIFIED PROFESSIONALS REVIEW: AEMR 2024-2025

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
3	3.1 Table 3-1	Benzene, Toluene and Xylenes to be populated once ERM has done the NPI review.	Amended.	Closed
4	3.1 Table 3-1	Header "*HOParameter*" should read "*Parameter*".	Amended.	Closed
5	3.1 Table 3-1	Carbon monoxide should include the formula ie. Carbon monoxide (CO) as this is the first use of the term. Similar comment for PM_{10} and $PM_{2.5}$.	Amended.	Closed
6	3.1 Table 3-1	Change "*NOx*" to "NO_x". Ensure significant figures are applied on a consistent basis that aligns with the accuracy of the data inputs. Suggest 3 significant figures as a reasonable approach.	NO_x Amended	Closed
7	Table 3-2	Optional: the "*End date*" column should be consistent, across the table, even if the end is the same start date. Optional: Increase the width of the first column to improve readability.	Amended. Amended table.	Closed
8	Table 3-2	Query: Has A13-1 been tested twice? 14 August 2024 and 19 February 2025. If so then the comment should read "*Stationary source emissions monitoring was completed at 12 point sources*" and not 13 point sources.	Yes, A13-1 was tested twice; no of point sources amended to 12. The stack test in February 2025 (R01839-3a) included operating AGI 1 at different temperatures to evaluate BTEX destruction efficiency.	Closed

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
9	Table 3-2	Change "*AGRU Incinerator – LNG Train 1 (A13-1)*" to "*AGRU Incinerator LNG Train 1 (A13-1)*" for consistency. Change "*Ektimo Report R018379-2a tested*" to "Ektimo Report #R018379-2a tested" for consistency. Change "*Ektimo Report #R018379-3a tested*" to "*Ektimo Report #R018379-3a tested:*" for consistency.	Amended	Closed
10	3.2.1	Remove the statement: "*However, currently there are no approved NSW test methods for the sampling and analysis of nitrous oxide, nor any approved Australian Standard or USEPA methods.*" Nitrous oxide (i.e N_2O) is not a required monitoring parameter for reporting of air emissions.	Amended. Noted.	Closed
11	3.2.1	Change "*For the sampling and analysis of nitrous oxide*" to "*For the sampling and analysis of nitrogen oxides (NO_x)*" Nitrous oxide is N_2O	Amended.	Closed
12	3.2.1	Change: "*INPEX conducts inhouse gas sampling and analysis from these locations for benzene, toluene, ethylbenzene and*	Amended.	Closed

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
		xylene (BTEX), hydrogen sulphide (H_2S) and mercury (Hg) using conventional industry methods which are not NATA accredited. The analysis of these gases is conducted on a monthly basis using test methods that are managed under a NATA accredited Quality Management System." to (reviewing for accuracy): *"INPEX conducts inhouse gas sampling and analysis from these locations for benzene, toluene, ethylbenzene and xylene (BTEX), hydrogen sulphide (H_2S) and mercury (Hg) using conventional industry methods. The analysis of these <u>substances</u> is conducted on a monthly basis using test methods that are managed under a NATA-accredited Quality Management System. It is noted that in-house accreditation scope does not specifically cover the individual analytical methods."*		
13	Table 3-3	Row 2, column 3. Change "*NOx*" to "*NO_x*".	Amended.	Closed
14	Table 3-4	Column "*Monitoring Frequency*" – all words or sentences should be in	Amended.	Closed

COMMENTS REGISTER - QUALIFIED PROFESSIONALS REVIEW: AEMR 2024-2025

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
		sentence case format (i.e. leading capital letters).		
15	3.2.2	Change "*Stationary source emissions testing undertaken in October-November 2023*" to "*Stationary source emissions testing undertaken in August 2024 – February 2025*".	Amended.	Closed
16	3.2.3	Change "*APPENDIX D*:" to "*APPENDIX D*". Change "Darwin air shed" to "Darwin airshed".	INPEX inbuilt template format default (Appendix D:). Not amended Airshed Amended.	Closed
17	Table 3-5	Optional: Consider amending title from "*Mass of hydrocarbons flared*" to "*Mass of hydrocarbons flared during the reporting period*".	Amended.	Closed
18	Figure 3-2 and 3-3	x-axis font should be same size as the x-axis for Figure 3-2. Consider adding vertical grid lines to assist interpretation of data.	Amended.	Closed
19	Figure 3-4	Caption should be in bold font.	Amended.	Closed
20	Figures 3-2 till 3-5	Optional for figures, 3-2 till 3-5: 1. The y-axis should have a thousand separator to make the numbers more readable, for example 10000 should read 10,000.	1. Amended 2. Not applicable – too many operations variables to display a "standard operating" parameter clearly.	Closed

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
		2. Standard conditions should be defined (in terms of temperature and pressure).		
21	3.4.1	Change: *"Flaring and other data is stored in the sites Process Control System (PCS)".* to: *"Flaring and other data are stored in the site's Process Control System (PCS)."*	Amended.	Closed
22	3.5.1	Figure 3-5 font should be corrected.	Amended size to A3.	Closed
23	3.5.2	Suggest retaining LOR's in reporting of data as this provided important context.	Amended to include LOR for Benzene, Toluene and Xylenes are 0.0005, 0.0020 and 0.0015 ppm, respectively.	Closed
24	Table 3-11	In table header, change "*Air Toxic NEMP*" to "*Air Toxics NEPM*". The footnote regarding conversions is not needed, as both the criteria and sampling data are both presented in ppm. Commentary around LORs (from earlier in this section) should be used here if LOR values have been used to calculate averages. Equivalent text should be included in the first footnote. ERM would recommend using half of the LOR, however the full LOR is also	Amended. Footnote remains for transparency. Amended footnote.	Closed

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
		reasonable given it has been stated transparently and is more conservative.		
25	Appendix D1	All instances of O_2 should have the "2" as a subscript. Optional: Make pollutant columns similar width.	O_2 Amended. D1 table not amended.	Closed
26	Appendix D2	For sample 10/02/2025 L2500680001 and 12/03/2025 L2501113001. Query if m/p Xylene is a positive detection or supposed to be "<30"? Optional: the format for D.2 caption is capitalisation for every word, which is different to the caption format for D.1	Amended to <30 ppmV. Amended.	Closed
27	Table 3.1	Footnotes 1 and 2 can be applied to the "*Emissions (t/yr)*" header in place of each of the individual column headers below.	Amended.	Closed
28	Table 3.1	Consider revised text for Footnote 2: *"Reported emission quantities for some VOCs have changed significantly relative to the previous reporting year. This is due to a change in the calculation methods to incorporate detailed process monitoring data. For accuracy purposes, total air emissions presented in previous reporting periods will be revised based on the change in*	Partially amended.	Closed

No.	Report Section	Reviewer Comment/Recommendation	INPEX Response (Rev 0 amended)	ERM response
		methodology and reports re-issued in due course."		

ANNEX B STATUTORY DECLARATIONS

THE NORTHERN TERRITORY OF AUSTRALIA

STATUTORY DECLARATION

(1) Insert full name and address of person making declaration

I, Kenneth Kiefer of Environmental Resources Management Australia Pty Ltd located at Level 8/501 Swanston St, Melbourne VIC 3000.

(2) Here insert the matter declared to, either directly following the word "declare" or, if the matter is lengthy, insert the words "as follows" and thereafter set out the matter in numbered paragraphs

solemnly and sincerely declare that the results are accurate to the best of my knowledge or belief and that I have not included in the results information that I know or suspect to be false or misleading or failed to include in the report information that I know to be relevant.

This declaration is true and I know it is an offence to make a statutory declaration knowing it is false in a material particular.

Declared at Melbourne on the 10th day of October 2025.

(3) Signature of the person making the declaration

....

(4) Signature of the person before whom the declaration is made

Witnessed by:

(5) Here insert full name of person before whom the declaration is made, legibly written, typed or stamped

Tanya Kiefer ....Tanya Kiefer....

(6) Here insert contact address or telephone number of person before whom the declaration is made

+61 0421213439 ....

NOTE: This declaration may be witnessed by any person who is at least 18 (eighteen) years of age.

NOTE: This written statutory declaration must comply with Part 4 of the *Oaths Affidavits and Declarations Act*.

NOTE: Making a declaration knowing it is false in a material particular is an offence for which you may be fined or imprisoned.

THE NORTHERN TERRITORY OF AUSTRALIA

STATUTORY DECLARATION

(1) Insert full name and address of person making declaration

I, James Alexander Grieve of Environmental Resources Management Australia Pty Ltd located at Level 14, Kent St, Sydney, New South Wales 2000

(2) Here insert the matter declared to, either directly following the word "declare" or, if the matter is lengthy, insert the words "äs follows" and thereafter set out the matter in numbered paragraphs

solemnly and sincerely declare that the results are accurate to the best of my knowledge or belief and that I have not included in the results information that I know or suspect to be false or misleading or failed to include in the report information that I know to be relevant.

This declaration is true and I know it is an offence to make a statutory declaration knowing it is false in a material particular.

Declared at Sydney on the 21st day of October 2025.

(3) Signature of the person making the declaration

....

(4) Signature of the person before whom the declaration is made

(5) Here insert full name of person before whom the declaration is made, legibly written, typed or stamped

(6) Here insert contact address or telephone number of person before whom the declaration is made

Witnessed by:

....

Level 14, Kent St, Sydney, New South Wales 2000

NOTE: This declaration may be witnessed by any person who is at least 18 (eighteen) years of age.

NOTE: This written statutory declaration must comply with Part 4 of the *Oaths Affidavits and Declarations Act.*

NOTE: Making a declaration knowing it is false in a material particular is an offence for which you may be fined or imprisoned.

ANNEX C QUALIFIED PROFESSIONAL PROFILE AND CV

WATER

Ken Kiefer (Water Quality - Qualified Professional)

Ken has over 20 years of experience in the risk assessment and environmental toxicology. He is currently the ERM global risk assessment technical community leader. Ken has experience quantitative health risk assessments for the management of water discharges to the environment to meet a range of client and regulatory objectives in line with environmental policy frameworks within all Australian states, U.S., New Zealand, India, and other international jurisdictions.

Ken has provided human health and ecological risk assessment support for Oil and Gas clients of operational use chemicals in drilling or enhanced production of gas and oil. Ken has also recently provided the aquatic toxicology advice to INPEX supporting the INPEX submission to NT EPA seeking regulatory approval of modified licensed discharge limits of key chemicals likely to be found in discharge water from Ichthys project into Darwin Harbour.

AIR QUALITY

James Grieve (Air Quality – Qualified Professional)

James Grieve is an air quality engineer with 20 years of experience in the assessment and management of air quality and related environmental matters. His experience extends across a broad range of sectors including energy, waste management, transport, manufacturing, construction, mining, and remediation of contaminated land.

He has completed air quality investigations for a number of projects throughout Australia and Asia. This work has involved applying a range of technical skills, inclusive of atmospheric dispersion modelling, as well as working with regulatory authorities on planning, assessment and licensing issues. James also has a wide range of experience in the field air quality monitoring, having constructed air quality monitoring programs, and prepared monitoring methodologies.

James has provided air quality management support for a wide range of facilities in the oil and gas sector, including petroleum extraction, refining, distribution and export. Through this work he has developed an understanding of key emissions associated with these process, and associated mitigation and monitoring strategies.

Ken Kiefer

Technical Director –
Global Human Health and Ecological Risk Assessment Technical Community Director

Mr. Kiefer has over 20 years of experience in the risk assessment and environmental toxicology. He is currently the ERM global risk assessment technical community leader. Mr. Kiefer has experience quantitative health risk assessments for the management of contaminated sites to meet a range of client objectives in line with environmental policy frameworks within all Australian states, U.S., New Zealand, India, and other international jurisdictions.

Mr. Kiefer has provided human health and ecological risk assessment support for Oil and Gas clients of operational use chemicals in drilling or enhanced production of gas and oil. Mr. Kiefer has also provided aquatic toxicology support for regulatory approval of discharge of chemicals.

Experience: 20 years' experience in environmental consultancy, project management and research

LinkedIn: https://www.linkedin.com/in/ken-kiefer-79b07940/

Email: ken.kiefer@erm.com

Education

- M.S., Agricultural and Environmental Chemistry, University of California, Davis (1998)
- B.S., Environmental Toxicology, University of California, Davis (1993)

Professional Affiliations & Registrations

- Australasian College of Toxicology and Risk Assessment
- Australian Contaminated Land Consultants Association
- Australian Land and Groundwater Association (ALGA)

Key Industry Sectors

- Government
- Mining
- Oil and Gas
- Chemical
- Manufacturing
- Power

Languages

- English, native speaker

Fields of Competence

- PFAS
  - Design of investigations of PFAS impact in soil, groundwater, surface water, sediment and biota
  - Environmental fate and transport
  - Quantitative health and ecological risk assessment
  - Toxicological evaluations
- Quantitative health and ecological risk assessment
- Vapour intrusion evaluations
- Environmental fate and transport
- Probabilistic risk assessment
- Toxicological evaluations

Key Recent PFAS Conference Presentations

- Vida Maulina, Lisa Thomson, and **Ken Kiefer**. *(Abstract Accepted)* September 2019. *Derivation Of Water Quality Guideline Value For Marine Discharge Of Monoethylene Glycol*. CleanUp Conference, Adelaide, SA.
- Ron Arcuri, **Ken Kiefer**, Belinda Goldsworthy. October 2013. *Developing Surface Water Screening Levels For Compounds Associated With Aqueous Film Forming Foams*. CleanUp Conference, Melbourne, VIC.

Key Projects

- Aquatic toxicity assessment and derivation EPL discharge limits. The assessment provided a review of specific products that maybe discharged. The derivation of EPL limits also provided a review of the on-site laboratory analytical methodologies to meet the derived EPL criteria.
- Ecological risk assessment for Water Treatment Plant effluent as part of remediation of former gas works. Risk assessment successfully led to increases in discharge limits.
- Human health and ecological risk assessment for residual coal tar impacts to remain post-remediation due to the practical limits of the remediation. Successfully demonstrated isolated residual coal tar impacts do not pose a risk.
- Provided senior technical review and oversight over the delivery of over 30 quantitative human health and ecological risk assessments as part of the management of a large portfolio (>100 sites) of petroleum hydrocarbon sites. The completion of risk assessments include wide ranging complex sites including: site with impact groundwater seeping into car parks of multi-story residential buildings; shallow groundwater plumes affecting multiple residential properties; and emerging contaminants (e.g. PFAS and MTBE).
- PFAS human health and ecological risk assessment for Refinery Senior Technical Lead. Development of surface water Site-Specific Screening Levels (SSSL) for PFOS and PFOA for human health and ecological receptors. The methodology used to derive the ecological screening criteria was based on the NEPM (1999) and the ANZECC (2000) methods used to derive trigger values. The result was a set of surface water SSSLs for PFOS and PFOA protective of aquatic species present in the site area. Human health SSSLs were also developed to be protective of humans consuming fish caught within the site area. The outcomes of the risk assessment process were used to eliminate the need for remediation to mitigate potential risks and highlight areas of the site where management of LNAPL was warranted to meet regulatory requirements. The risk assessment was accepted by the EPA-appointed site Auditor
- PFAS human health and ecological risk assessment. Airport JUHI Facility. Senior Technical Lead. An off-site sediment and surface water sampling program was also undertaken to determine the extent of PFOS and PFOA impacts. Human health and ecological screening criteria were selected for PFOA and PFOS. PFOS and PFOA were not measured above Tier 1 criteria in media relevant to potential fish or ecologically sensitive benthic assemblages. No risks posed by PFOS and PFOA were identified on-site and off-site human or ecological receptors. ERM employed a proactive communication and consultation strategy throughout the life of the project, to assist in the acceptance of the risk assessment outcomes by the Federal Assessor.

PFAS Projects

- **Legacy AFFF and Non-AFFF Product Sampling for PFAS – Multiple Sites, Australia (Department of Defence).** ERM was commissioned to conduct product sampling of both Aqueous Film Forming Foam (AFFF) and non-AFFF (such as aviation hydraulic oils) in order to build an understanding of the type and variability of PFAS compounds in products used across the Defence estate. One of the key objectives was to provide inputs to ongoing investigations, and support management and remediation actions. Ken is providing technical expert support for this work developing sampling strategies and data interpretation.
- **Auditor Technical Expert Support – RAAF Edinburgh and RAAF Wagga, Australia (Department of Defence)** Ken is providing technical expert support to State accredited auditors of the site investigations and risk assessment of legacy PFAS impacts.
- **AFFF Loss of Containment– Brisbane International Airport, Australia (Qantas).** PFAS human health and ecological risk assessment Senior Technical Lead for an AFFF loss of containment to adjacent river and estuary. A multi-media sampling program of sediment, soil, groundwater, surface water, and biota was developed to support the site-specific

risk assessment. The risk assessment used multiple lines of evidence to separate the risks related to the loss of containment with residual baseline pre-existing PFAS impacts; included mass balance assessment; and detailed laboratory analysis as a method to differentiate the PFAS fingerprint of the loss of containment from other PFAS sources. The Federal Assessor accepted the risk assessment. Successfully working with Commonwealth and state (QLD) regulators to demonstrate residual impact post initial water containment treatment efforts did not pose further risk to human health and the environment including indirect exposures associated with bioaccumulation of PFAS in biota. The outcomes of the risk assessment process were used to eliminate the need for further remediation to mitigate potential risks.

- **PFAS human health and ecological risk assessment for a Refinery (Confidential Client).** PFAS human health and ecological risk assessment for a Refinery. Senior Technical Lead. Development of surface water Site-Specific Screening Levels (SSSL) for PFOS and PFOA for human health and ecological receptors. The methodology used to derive the ecological screening criteria was based on the NEPM (1999) and the ANZECC (2000) methods used to derive trigger values. The result was a set of surface water SSSLs for PFOS and PFOA protective of aquatic species present in the site area. Human health SSSLs were also developed to be protective of humans consuming fish caught within the site area. The outcomes of the risk assessment process were used to eliminate the need for remediation to mitigate potential risks and highlight areas of the site where management of LNAPL was warranted to meet regulatory requirements. The risk assessment was accepted by the EPA-appointed site Auditor
- **PFAS human health and ecological risk assessment for a Refinery (Confidential Client).** PFAS human health and ecological risk assessment. Airport JUHI Facility. Senior Technical Lead. An off-site sediment and surface water sampling program was also undertaken to determine the extent of PFOS and PFOA impacts. Human health and ecological screening criteria were selected for PFOA and PFOS. PFOS and PFOA were not measured above Tier 1 criteria in media relevant to potential fish or ecologically sensitive benthic assemblages. No risks posed by PFOS and PFOA were identified on-site and off-site human or ecological receptors. ERM employed a proactive communication and consultation strategy throughout the life of the project, to assist in the acceptance of the risk assessment outcomes by the Federal Assessor.
- **PFAS human health assessment. RAAF Amberley (Department of Defence).** PFAS human health assessment. RAAF Amberley. Senior Technical Lead. Reviewed the consolidation of over six years of soil and groundwater data (for both hydrocarbons and Perfluorinated Compounds (PFCs) to refine the site Conceptual Site Model and understand the risks of undertaking the redevelopment works. Developed Site Specific Target Levels (SSTLs) to inform the remedial requirements and ensure construction works and future use of the site do not have an adverse impact upon human health or the environment.

Risk Assessment Projects

- Mr. Kiefer has provided health and ecological risk assessments as well as senior technical and quality programmes management as part of the management of a large portfolio (>100 sites) of petroleum hydrocarbon sites (including complex major hazard facilities such as refineries and terminals) across Australia, New Zealand and southeast Asia.
- Indoor Air Risk Assessment. Carson, California. Completed a human health risk assessment for exposure to VOCs including TCE and PCE to current on-site commercial workers and off-site residents due vapor intrusion from groundwater plume. Developed site-specific soil vapor attenuation factors and soil vapor target levels. Delineated indoor air concentrations of VOCs related to ambient air from the sub-surface sources.

- Prepared a risk assessment for off-site receptors to supplement an existing on-site risk assessment for a Superfund site. Off-site exposures included indoor air impacts to homes above the chlorinated VOC ground water plume. A number of different approaches were used to evaluate indoor air risks including vapour intrusion modelling from ground water, measured indoor and crawlspace air concentrations. Incorporated the use of GIS to present and communicate the complex environmental and risk information to regulators and the public.
- Human Health Risk Assessment of Rocket Testing Facility - Ventura, CA. Development of site-specific vapour migration model and vapour migration model validation field study focused on vapour transport through fractured bedrock.
- Determination of Ambient Chloroform Indoor Air Concentrations. Hill Air Force Base, UT. Established chloroform indoor air screening concentrations due to chlorinated drinking water.
- Vapour Intrusion Modelling, Mather Air Force Base, CA. Conducted vapour intrusion modelling in support of closure at Castle Air Force Base. Human health risk assessments for potential future receptors at multiple sites. COPCs include TCE and PCE.
- Prospective, Deterministic Baseline Human Health Risk Assessment (Vapour Intrusion) at a Sacramento Brownfield Site. Chico, CA. Industrial Site Redeveloped to Multi-family Land-use. Vapour intrusion assessment for BTEX and 1,2-DCA.
- Area–Specific Risk Assessment. Industrial Complex, South Bend, Indiana. Performed an area-specific risk assessment and developed of risk-based cleanup levels (RBCLs) for COPCs including PCE. The assessment included modelling to evaluate the potential of site constituents in soil to migrate to on-site indoor air and off-site groundwater.
- Soil Vapor Characterization and Risk Assessment, Los Angeles, CA. Developed strategy to address concerns regarding potential risks due to exposure in on-site and off-site indoor air to site related VOCs, including TCE and PCE. Performed risk assessment for current and future indoor receptors.
- Human Health Risk Assessment, Superfund, Olathe, KS. Multi-media human health risk assessment at a former industrial chemical storage and recycling centre. Qualitative and quantitative risk assessment conducted on measured and modelled VOCs in indoor air.
- Focused Human Health Risk Assessment at a former chemical facility, West Sacramento, CA. Conducted exposure and human health risk assessment to volatized CVOCs in indoor and outdoor air under the future land use conditions of a professional sports stadium.
- Performed Human health risk assessment evaluated risks to receptors due to dermal contact or ingestion exposures related to the beneficial use of red and brown mud and phosphogypsum as levee construction materials. This evaluation used the results material specific physiochemistry and aquatic toxicology studies. The evaluation included metals and radionuclides. Radionuclides were evaluated using USEPA RESRAD risk assessment model.
- Development of surface water discharge target levels for groundwater remediation system for a former coal fired power plant. Evaluation considered short-term and long term ecological effects.
- Post-release assessments of material harm to harbour water of high ecological and tourist value. Included innovated multiple-lines of evidence including understanding the nature of the release, the short-lived nature of the contaminants and understand of the complex mixing processes between the release and harbour.
- Human Health Risk Assessment for Complex Industrial Site. Human Health Risk Assessment for the redevelopment of waste-water ponds of former industrial complex of over 2,000 acres. Conducted human health risk assessments for multiple sites. Evaluation includes radionuclide, asbestos, dioxins/furans, PCBs, TPH, metals, SVOCs, and VOCs.
- Conducted human health risk assessment on two proposed >30-acre rural residential development

that was a former orchard. Soils contained arsenic, lead, and organochlorine pesticides. Assessment included probabilistic exposure assessment methodologies; site-specific in-vitro bioaccessability assessment; and background assessment. California regulatory agency approved the risk assessment.

- Provided senior technical review and oversight over the delivery of over 30 quantitative human health and ecological risk assessments as part of the management of a large portfolio (>100 sites) of petroleum hydrocarbon sites.
- Development of surface water Site-Specific Screening Levels (SSSL) for aqueous film forming foam (AFFFs) chemicals perfluorooctane sulphonate (PFOS) and perfluorooctanoic acid (PFOA) for human health and ecological receptors.
- Developed risk-based cleanup levels for arsenic, copper, and hexavalent chromium at wood treating facility. Cleanup levels were developed for protection of current and future workers as well as ground water quality.
- Completed a prospective human health risk assessment for future hypothetical beneficial uses for impacted ground water beneath a former Naval facility slated for commercial redevelopment. Chemicals of concern included chlorinated hydrocarbons, and BTEX. The assessment included a qualitative screening of many future potential ground water uses to focus the quantitative portion of the risk assessment to the two or three scenarios of greatest concern. Measured ground water concentrations were kriged to estimate areal average concentrations of each constituent, and subsequently three scenarios were quantitatively assessed: two worker scenarios and a school scenario. All scenarios were shown to be below acceptable hazard indices and EPA's risk range.
- Developed site-specific site-specific vapour migration modelling to evaluate potential migration from soil, shallow ground water, and deep ground water, which accounted for potential transport through fractured bedrock.
- Developed site-wide risk assessment methodologies risk from soil, shallow ground water, and deep ground water at a complex rocket testing facility.
- Baseline human health and ecological risk assessment for nitroammonia plant in Mexico to aid in divestment for on-going use. Primarily focused on assessment of off-site risks to current water users and ecological receptors potentially impacted by site groundwater. Included fate and transport modelling for migration of nitrate and ammonia in groundwater.
- Human health and ecological risk assessment related to the sub-surface fraccing and development of coal seam gas wells. Included evaluation of chemical and radiological tracer composition of frac fluids and return; pathway assessment of the potential release scenarios of frac fluids to the environment; and modelling of potential exposures frac fluid due potential surface and sub-surface release scenarios.
- Human health risk assessment related to the sub-surface fraccing and development of shale gas wells. Included evaluation of chemical and naturally occurring radioactive material (NORM) composition of frac fluids and return; pathway assessment of the potential release scenarios of frac fluids to the environment; and modelling of frac fluid into ground water aquifers.
- Human Health and Ecological Risk Assessment of Superfund Site - Former Radionuclide Research Facility and University Landfills. Risk assessment for a former radionuclide research facility and university landfills. Evaluation included tiered ecological and human health evaluation. Evaluation includes metals, VOCs, and radionuclides.
- Ecological Screening Risk Assessment. Performed screening ecological risk assessment for abandoned petroleum storage facility. Evaluated risks terrestrial and aquatic receptors. Developed site-specific surface water and sediment benchmarks.
- Performed screening ecological risk assessment for chemical manufacturing facility including

development of surface water and sediment benchmarks for site-specific constituents.

- Performed screening ecological risk assessment for abandoned petroleum storage facility. Evaluated risks terrestrial and aquatic receptors. Developed site-specific surface water and sediment benchmarks.
- Performed supplemental cumulative ecological risk assessment for U.S. Air Force. Evaluated risks of far-ranging species due to cumulative exposure to multiple individual sites that is not accounted for in individual site assessments.
- Performed baseline human health and ecological risk assessment and development of risk-based corrective action levels at a solvent recycling centre as part of RCRA facility investigations. Implemented a fractionation risk assessment approach for TPH. Performed environmental fate assessment of chemical constituents from soil into ground water using the SESOIL and Summers environmental fate and transport models. Performed environmental fate assessment of chemical constituents from soil into indoor air using the Johnson and Ettinger environmental fate and transport models. Provided statistical characterization and distribution analysis of soil and ground water concentrations.
- Performed screening ecological risk assessment for chemical manufacturing facility including development of surface water and sediment benchmarks for site-specific constituents.
- Developed strategy address concerns regarding potential risks due to exposure in on-site and off-site indoor air to site related VOCs. Assisted in developing site characterization work plan to support future risk assessment.
- Performed an area-specific risk assessment and developed of risk-based cleanup levels (RBCLs). The assessment included modelling to evaluate the potential of site constituents in soil to migrate to on-site indoor air and off-site ground water. The evaluation included VOCs and PCBs.
- Prepared risk assessment in support of RCRA facility investigations. Developed site-wide risk assessment methodologies including site-specific vapour migration modelling to evaluate potential migration from soil, shallow ground water, and deep ground water, which accounted for potential transport through fractured bedrock.
- Conducted risk assessment for a former radionuclide research facility and university landfill. A tiered ecological and human health evaluation included metals, VOCs, and radionuclides.
- Conducted health risk assessment on estimated emissions from a proposed waste to energy facility in Hong Kong. Evaluation included metals, VOCs, and dioxins.
- Performed a preliminary endangerment assessment human health risk assessment for a proposed new school on former agricultural property.
- Performed human health risk assessment and geostatistical evaluation using GIS (ArcView) as part of an analysis of historically released DDT at a manufacturing facility.
- Assisted with exposure and human health risk assessment of volatile organic chemicals in ground water. Performed modelling to assess exposure and risk to volatized chemicals under the future land use conditions of a sports stadium.
- Assisted with exposure and human health risk assessment of inorganic and organic chemicals in soil and sediments. Developed sediment target concentrations for chemicals based on recreational fish ingestion. Modelled transfer from sediments to fish for bioconcentrating chemicals including PCBs, Dioxins, Furans, PARs, and chlorinated pesticides.
- Assisted with exposure and toxicity assessment of over 20 chemicals in soil and ground water. Performed environmental fate assessment in soil and ground water using the SESOIL and VHS environmental fate and transport models. Provided statistical characterization and distribution analysis of soil and ground water concentrations.
- Performed environmental fate assessment of chemical constituents from soil and ground water into indoor and outdoor air using the Johnson and Ettinger and Hannah environmental fate and transport models in support of multiple site-specific risk assessments and development of risk based clean-up levels.

- Performed environmental fate assessment of chemical constituents from domestic water use into indoor air using published air stripping methodologies in support of multiple site-specific risk assessments as well as litigation support.
- Performed air dispersion modelling based on the accidental release scenario using EPA's ALOHA model. Used model outputs to estimate probable exposure levels for comparison with toxicity information.
- Provided litigation support for testifying toxicology and risk assessment expert for plaintiff on a case involving alleged illegal disposal of hazardous waste by a furniture stripping company. Evaluated available data for ability to determine amounts material illegally disposed.
- Provided litigation support for testifying toxicology and risk assessment expert for the defense on a case involving environmental damages resulting from an accidental release of Cl-containing gases. Researched information and performed air dispersion modelling for expert report in support of a lawsuit regarding phytotoxic effects from an accidental release of chlorine gas. Reviewed phytoxicity studies of chlorine gas to develop toxicity threshold for pine trees and determine the long term effects from an acute exposure event. Performed air dispersion modelling based on the accidental release scenario using EPA's ALOHA model. Used model outputs to estimate probable exposure levels for comparison with toxicity information.
- Provided litigation support for testifying toxicology and risk assessment expert for the defense on a case involving migration of VOCs and methane from an adjacent landfill into a commercial building.
- Provided litigation support for testifying toxicology and risk assessment expert for the defense on a case involving alleged health effects in inmates in California's Tehachapi Prison associated with hazardous substances in ground water at the prison. Lawsuit regarding potential health effects from exposure to PCE, TCE and nitrate impacted ground water. Reviewed database of ground water analytical results for completeness and reliability. Evaluated exposure levels for toxicological significance, comparing water levels, length of exposure to known toxicology of substances.
- Prepared GIS for a property development at a former orchard site. The GIS was used to geographically integrate risk assessment results with sample locations, and future property planning. Risk-based cleanup decisions were based on the results of GIS geostatistical analyses. Subsequent remediation alternative decisions were also based on the GIS developed for the site.
- Assisted in development of a GIS to support air modelling conducted for several commercial facilities for Proposition 65 warning requirements. The GIS was used to develop a mailing list database for properties within the air emissions plume using GIS geocoding.
- Developed database of surface water and soil concentrations for cadmium, copper, lead, and zinc from available data. Database was designed for use in a GIS for the purpose of evaluating spatial relationships in metal background concentrations. Access and Arc View were used in the development of the GIS.
- Developed GIS database of soils characteristics for use in the exposure and risk assessment model CalTOX. Data from the USDA STATSGO database was used for the development of GIS database of CalTOX soil inputs. ArcINFO was used in the development of the GIS.

Publications

- Kenneth L. Kiefer, Chuck E. Schmidt, Mark K. Jones, Ranajit (Ron) Sahu. 2013. *Assessing Vapour Intrusion - How do assessment technologies compare?* Remediation Australasia. Issue 12. 2013
- Norbeck et al. 1998. *Evaluating Factors That Affect Diesel Exhaust Toxicity*. Center for Environmental Research and Technology, College of Engineering, University of California, Riverside. Final Report Contract No. 94-312.
- Hsieh D.P.H., McKone, T.E., Geng, S., Schwalen, E.T. and Kiefer, K.L., 1995. *The Distribution of Landscape Variables for CalTOX within California*,

Department of Toxic Substances Control, California Environmental Protection Agency, Sacramento, California.

- T.E. McKone, Kiefer, K.L., Currie, R.C., Geng, S. and Hsieh, D.P.H., 1995. *Representing Uncertainty in Risk Assessments; Task I a: Constructing Distributions*, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Berkeley, California.
- T.E. McKone, Currie, R.C., Chiao, F.F., Kiefer, K.L. and Hsieh, D.P.H., 1995. *Representing Uncertainty in Risk Assessments; Task I b: Representing Uncertainty in Intermedia Transfer Factors: Case Studies*, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Berkeley, California.

Invited Speaker

Presenter at the ALGA 2-Day Risk Assessment 101 training course. Auckland and Christchurch, NZ (2017) and Hobart (2018).

Presentations

- **Ken Kiefer** and Darren Reedy. ***PFAS** Health Risk Assessment*. EcoForum 2018 Conference, Sydney, NSW.
- **Ken Kiefer** Kylie Dodd and Darren Reedy. *The Distribution of **PFAS** Compounds in the Marine Environment and Implications for Ecological Risk*. EcoForum 2018 Conference, Sydney, NSW.
- Lisa Thomson, **Ken Kiefer**, Kylie Dodd and Darren Reedy *Bioaccumulation of **PFAS** Within Aquatic Trophic Levels in an Australian Estuarine Environment*. EcoForum 2018 Conference, Sydney, NSW.
- Gavin Powell, Rob MacIntosh, **Ken Kiefer**, Wijnand Gemson, and Peter Madden. ***PFAS** and Urban Stormwater: Use of Mass Discharge Assessment in the Interpretation of the Conceptual Site Model*. EcoForum 2018 Conference, Sydney, NSW.
- **Ken Kiefer**, Kylie Dodd, and Darren Reedy. *Using **TOPA** in Risk Assessment.* EcoForum 2018 Conference, Sydney, NSW.
- **Ken Kiefer**, Wijnand Germs, Nathan Seaver, Kylie Dodd, and Ed Dennis. *Differentiating Groundwater Sources Using Mass Flux*. CleanUp 2017 Conference, Melbourne, NSW.
- **Ken Kiefer**. Re-Assessing Remedial Targets Based on Changes in Total Recoverable Hydrocarbons Mixtures During Remediation. CleanUp 2017 Conference, Melbourne, NSW.
- **Ken Kiefer**. Reducing Uncertainty in Vapour Intrusion Risks and Conservatism in Chlorinated Hydrocarbon Site Decision Making. CleanUp 2017 Conference, Melbourne, NSW.
- Kathryn East, **Ken Kiefer**. Extended **PFAS** Suite: Future-Proofing, or Creating More *Uncertainty?* EcoForum 2016 Conference, Freemantle, WA.
- W. Germs, **K. Kiefer**, and A. Kohlrusch. You Can't Manage What You Don't Measure: 1,4–Dioxane as Co-Contaminant at Chlorinated Solvent Sites. EcoForum 2016 Conference, Freemantle, WA.
- Sophie Wood, Phillippa Biswell, **Ken Kiefer** and Warren Pump. *The Trouble with Environmental Management Plans….* EcoForum 2016 Conference, Freemantle, WA.
- **Ken Kiefer** and Thavone List. What Are Total Recoverable Hydrocarbons? Implications for Contaminated Site Management. EcoForum 2016 Conference, Freemantle, WA.
- **Ken Kiefer** and Kathleen Prohasky. Evaluation of Primary Industry Beneficial Water Use and Consideration of Non-Health and –Environmental Risk Endpoints. EcoForum 2016 Conference, Freemantle, WA.
- Joseph Ferring and **Ken Kiefer**. *Using D Data Analysis and Visualisation to Reduce Uncertainty.* EcoForum 2016 Conference, Freemantle, WA.
- **Kenneth Kiefer**, Kathleen Prohasky, Wijnand Germs, Neil Gray and Tamie Weaver. September 2015. A Comparison Of Passive Sampling And Low-Flow Or Bailed Sampling Results Across A Range Of Australian Hydrogeological Settings. Cleanup 2015, Melbourne, Vic.
- **Kenneth Kiefer** and Thavone Shaw. September 2015. *Using Mass Balance In Risk Assessment.* Cleanup 2015, Melbourne, Vic.
- Kathleen Prohasky and Kenneth Kiefer. September 2015. *Complications Of Ambient*

Sources In Assessing Vapour Intrusion Risks. Cleanup 2015, Melbourne, Vic.

- Kathleen Prohasky and Kenneth Kiefer. September 2015. Developing Groundwater Tier 1 Screening Criteria For Chronic And Acute Vapour Risks For Chlorinated Hydrocarbons. Cleanup 2015, Melbourne, Vic.
- **Ken Kiefer,** Joseph Ferring, & Will Ellis. October 2014. *Differentiating Between Soil and Groundwater Solvent Sources in Soil Vapour Risk Assessment.* EcoForum 2014 Conference, Gold Coast, QLD.
- Christine Lussier, Kathryn East & Ken Kiefer. October 2014. *Screening Levels for Polychlorinated Biphenyls in Water.* EcoForum 2014 Conference, Gold Coast, QLD.
- Jeremy Hogben, Steven Morrison & Kenneth Kiefer. October 2014. *Assessing Polar Compounds as Degradation Metabolites of Hydrocarbon Sources – The Need for Change.* EcoForum 2014 Conference, Gold Coast, QLD.
- Kathleen V. Prohasky and Kenneth L. Kiefer. October 2014. *Tier 1 Screening of Vapour Risks from Groundwater Data for Chlorinated Hydrocarbons*. ACTRA Conference. Coogee, NSW.
- **Kenneth L. Kiefer,** Alyson N. Macdonald, Kathleen Prohasky & Sophie Wood. October 2013. *Tier 1.5 Soil Vapour Screening For Non-Petroleum Volatile Organic Compounds.* CleanUp Conference, Melbourne, VIC.
- Kathleen V. Prohasky and Kenneth L. Kiefer. October 2013. Assessing Degradation Processes of Subsurface Vapours from a Petroleum Source in Fractured Basalt Using a Carbon Filter. CleanUp Conference, Melbourne, VIC.
- Ron Arcuri, Ken Kiefer, Belinda Goldsworthy. October 2013. Developing Surface Water Screening Levels For Compounds Associated With **Aqueous Film Forming Foams**. CleanUp Conference, Melbourne, VIC.
- **Kenneth Kiefer,** Alyson Macdonald, and Sophie Wood. October 2012. *Why do we need two different methods for screening vapour intrusion risks?* ACTRA. Adelaide SA.
- Dr. Sophie Wood, Ken Kiefer and Olivia Patterson. October 2012. *Health and Ecological Risk Assessment of Hydraulic Fracturing Fluids.* ACTRA. Adelaide SA.
- **Kenneth L. Kiefer**, Jonathan Lekawski, Valerie Phipps, Harrison Swift, and Sophie Wood. March 2012. *Case Studies of Implementing HSLs in Petroleum Hydrocarbon Sites*. EcoForum. Sydney. NSW.
- **Kenneth L. Kiefer**, Chuck E. Schmidt, Mark K. Jones, Ranajit (Ron) Sahu. September 2011. Comparison of Technologies for Assessing Vapour Intrusion In Future Structures from Subsurface Sources - Case Study with Side-by-Side Measured Flux and J&E Modelling. CleanUp Conference, Adelaide, SA.
- Kiefer, K.L., Jones, M., Shibata, M., Olsen, H., Steinmacher, S., and Case, J. April, 2005. *Dealing with Confounding Background Indoor Air Concentrations*. Air & Waste Management Association. Symposium on Air Quality Measurement Methods and Technology, San Francisco, CA
- Shull, L. and Kiefer, K. March 2005. *Those Pesky Emerging Contaminants: Will We Ever Be Done With Them?* Association for Environmental Health and Sciences: The 15th Annual AEHS Meeting & West Coast Conference on Soils, Sediments and Water, San Diego, CA.
- Kiefer, K.L., Shull, L., Bowland, M., and Jones, M. October 2003. Risk Based Decision Making Tools: Property Redevelopment and Arsenic Case Study, Brownfields 2003, Portland, Oregon.

James Grieve

Principal Consultant – Air Quality

James Grieve is an air quality engineer with 20 years of experience in the assessment and management of air quality and related environmental matters. His experience extends across a broad range of sectors including energy, waste management, transport, manufacturing, construction, mining, and remediation of contaminated land.

He has completed air quality investigations for a number of projects throughout Australia and Asia. This work has involved applying a range of technical skills, inclusive of atmospheric dispersion modelling, as well as interacting with regulatory authorities on planning, assessment and licensing issues. James also has a wide range of experience in the field air quality monitoring, having constructed air quality monitoring programs, and prepared monitoring methodologies.

James' engineering background provides him with a strong understanding of industrial processes, as required to assess pollutant formation potential and the effectiveness and feasibility of a broad range of air emission control technologies. This work has included options and feasibility studies, pilot trials, tender evaluation, design reviews, and Best Available Control Technology (BACT) analyses.

EXPERIENCE: 20 years' experience in air quality assessment and management

LINKEDIN: https://www.linkedin.com/in/james-grieve-3909a449/?originalSubdomain=au

EMAIL: james.grieve@erm.com

EDUCATION

Bachelor of Engineering (Mechanical, Honours), University of Sydney, 2005

PROFESSIONAL AFFILIATIONS AND REGISTRATIONS

- Member, Clean Air Society of Australia and New Zealand (CASANZ).

LANGUAGES

- English, native speaker

FIELDS OF COMPETENCE

- Air quality impact assessment.
- Air quality monitoring and management.
- Emission control system studies.
- Air quality compliance auditing.

KEY INDUSTRY SECTORS

- Oil & Gas
- Power
- Infrastructure
- Chemicals / Manufacturing
- Waste Management

KEY PROJECTS

Australian Energy Council Review of NPI Methodologies for Power Station Stack Emissions, 2022

Undertook review of national pollutant inventory methods for estimation of stack emissions from coal-fired power stations in Australia. Work included a survey of methods applied and corresponding accuracy, as well as a survey of regulatory preferences for emission estimation.

Confidential Client AGRU Venting Air Quality Impact Assessment, Victoria 2022

Conducted a review of Acid Gas Removal Unit (AGRU) process information and undertook emission estimation for VOC and acid gas emissions during bypass of the acid gas incinerator with subsequent atmospheric dispersion modelling and impact assessment in accordance with updated Victorian assessment guidelines.

Confidential Client LNG Facility Air Quality Monitoring Program, Asia 2024

Undertook ambient air quality monitoring program for LNG facility.

Confidential Client LNG Facility Air Quality Impact Assessment, Asia 2024

Prepared air quality impact assessment for gas processing with comparison against International Finance Corporation (IFC) ambient air quality standards.

INPEX Ichthys LNG Terminal Air Quality Monitoring Strategy, NT 2021

Prepared air quality monitoring plan for LNG processing, liquefaction, storage and export operations in Northern Territory. Work included emission review and station siting, and designation of monitoring criteria, methods, and compliance evaluation protocols. Program was successfully implemented to gather targeted datasets and provided a clear assessment of the environmental performance of the operations.

AGL Newcastle Gas-Fired Power Station Air Quality Impact, Greenhouse Gas and Aviation Impact Assessments, NSW 2021

Completed assessments for gas/distillate power station proposed at Tomago near to AGL's Newcastle Gas Storage Facility. Iterations of plant design include gas turbine and reciprocating gas engine options. Work included a detailed review of proposed emission controls, with subsequent atmospheric dispersion modelling of plant emissions in order to assess compliance with relevant ambient air quality standards.

Ampol Newcastle Terminal Air Quality Impact Assessment and Human Health Risk Assessment, NSW 2020-2022

Conducted independent air quality impact assessment and human health impact assessments to assist in planning consideration of rezoning adjacent to an existing petroleum import terminal.

AGL Newcastle Gas (LNG) Storage Facility: Tail Gas Processing, NSW 2017

Undertook air quality, greenhouse gas and plume rise assessments for LNG storage facility modifications including condensate flaring and a range of plant processes.

Qenos Altona Polyethylene Resin Manufacturing Facility, (VIC, 2016)

Undertook air quality impact assessment for polyethylene resin manufacturing operations. This work addressed emissions from solvent storage, resin polymerization, dehydration, and liquor distillation, as well as fugitive emissions from wastewater collection and treatment. Emissions were incorporated into atmospheric dispersion modelling, with assessment of model predictions against regulatory impact assessment criteria.

AGL 420 MW Barker Inlet Power Station Air Quality Impact Assessment, SA 2017

Conducted assessment for gas fired power station located adjacent to AGL's existing Torrens Island Power Plant. Iterations of plant design include gas turbine and LNG receiving functionalities.

Santos / Oil Search Ambient Air Quality Compliance Monitoring Program and Inventory, PNG 2016-Current

Developed and implemented air quality monitoring program for upstream oil and gas operations, covering separation, drying, compression, and condensate/crude refining.

Santos GLNG Air Quality and Plume Rise Assessments, QLD 2009

Conducted air quality and plume rise assessments for Gladstone LNG development.

Mobil Altona Oil Refinery Air Quality Impact Assessment, VIC 2016

Conducted air quality impact assessment for existing oil refinery. Assessment incorporated site-wide emissions from refinery plant, power generation, hydrocarbon storage, tanker transfer and wastewater treatment processes. Modelling was undertaken using the AERMOD in accordance with regulatory methodologies.

Mobil Yarraville Petroleum Storage Terminal Air Quality Assessment, 2013

Conducted air quality assessment for licencing for petroleum storage terminal.

Caltex Kurnell Terminal Conversion Air Quality Impact Assessment, 2013

Conducted air quality impact assessment for conversion of the facility from a refinery to a finished product import and storage terminal.

Shell Newport Terminal Air Quality Assessment, 2013

Conducted air quality assessment for licencing of petroleum hydrocarbon storage terminal.

Confidential Client Multi-Train LNG Liquefaction and Export Terminal, WA, 2010

Conducted atmospheric dispersion model for multi train LNG facility for application in human health risk assessment. Work included detailed VOC estimation across all plant emission sources and a range of operational scenarios.

APPENDIX C: COMMINGLED TREATED EFFLUENT (750-SC-003) LABORATORY RESULTS

C.1 Monthly sampling results for 750-SC-003

Shaded yellow cells with bold text indicate a trigger exceedance associated with subsequent discharge via Jetty Outfall. These are further described in Table 2-4.

Date	TIME	LIMS Sample ID	pH	Electrical conductivity	Temperature	Turbidity	Dissolved oxygen	TPH as oil & grease	TRH (C6-C10)	TRH (C10-C40)	TSS	BOD	COD	Free Chlorine	Ammonia	Total nitrogen	Total phosphorus	Filterable Reactive Phosphorus	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc	Enterococci	E coli	Thermotolerant/Faecal coliforms	Anionic surfactants	aMDEA	Glycol (MEG)	Glycol (TEG)
Unit			pH units	µS/cm	°C	NTU	%	mg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	µg N/L	mg N/L	mg P/L	mg P/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	cfu/ 100mL	cfu/ 100mL	cfu/ 100mL	mg/L	mg/L	mg/L	mg/L
Discharge limit			6-9	n/a	35	n/a	n/a	6	n/a	n/a	10	20	125	2	n/a	10	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100	400	n/a	n/a	n/a	n/a
10/07/2024	09:00	L2403330001	8.3	394	28.6	1.5	87	< 1	<20	<100	< 5	3	15	0.09	4	5	0.6	< 0.5	<0.1	<1	5	<1	<0.1	<1	<1	216	60	2	**1000**	<0.1	< 5	< 5	< 5
13/08/2024	08:15	L2403885001	8.3	219	26.7	1.5	80	< 1	<20	<100	< 5	3	12	0.02	6	9	1.3	1.1	<0.1	<1	1	<1	<0.1	<1	<1	117	47	100	**870***	<0.1	< 5	< 5	< 5
10/09/2024	08:04	L2404369001	8.0	217	29.0	1.5	78	< 1	<20	<100	< 5	5	14	0.02	6	6	1.0	1.0	<0.1	<1	<1	<1	<0.1	<1	<1	23	46	35	**750***	<0.1	< 5	< 5	< 5
08/10/2024	07:40	L2404898001	7.8	376	30.5	1.0	77	< 1	<20	<100	< 5	10	15	0.04	5	5	< 0.5	< 0.5	<0.1	<1	2	<1	<0.1	1	<1	197	12	1	150	0.2	< 5	< 5	< 5
12/11/2024	08:30	L2405502001	8.0	400	32.2	1.5	96	< 1	<20	<100	< 5	6	17	0.03	3	4	< 0.5	< 0.5	<0.1	<1	<1	<1	<0.1	2	<1	216	78	<1	330	<0.1	<5	<5	<5
10/12/2024	07:48	L2405995001	7.8	369	30.9	1.5	76	< 1	<20	<100	< 5	5	13	0.03	5	6	< 0.5	< 0.5	<0.1	<1	2	<1	<0.1	1	<1	140	67	<1	300	<0.1	<5	<5	<5
14/01/2025	07:35	L2500193001	7.8	298	31.0	1.5	89	< 1	<20	<100	< 5	2	18	0.03	2	2	1.0	< 0.5	<0.1	<1	2	<1	<0.1	1	<1	357	<1	<1	250	<0.1	<5	<5	<5
11/02/2025	08:20	L2500691001	8.1	314	29.8	1.5	86	< 1	<20	<100	< 5	3	11	0.02	6	6	< 0.5	< 0.5	<0.1	<1	2	<1	<0.1	1	<1	373	24	<1	110	<0.1	<5	<5	<5
11/03/2025	07:55	L2501135001	8.0	292	31.7	1.0	74	< 1	<20	<100	< 5	5	13	0.02	3	3	< 0.5	< 0.5	<0.1	<1	3	<1	<0.1	<1	<1	113	1	<1	28	<0.1	<5	<5	<5
08/04/2025	07:55	L2501630001	8.7	573	29.1	<0.5	78	< 1	<20	<100	< 5	<2	11	0.04	19	**19**	< 0.5	< 0.5	<0.1	<1	3	<1	<0.1	<1	<1	18	<1	<1	18	<0.1	<5	<5	<5
13/05/2025	09:25	L2502422001	8.1	335	29.8	0.5	88	< 1	<20	<100	< 5	10	11	0.02	9	9	< 0.5	< 0.5	<0.1	<1	9	1	<0.1	5	<1	176	<1	<1	110	<0.1	<5	<5	<5
10/06/2025	09:32	L2502889001	9.0	405	26.6	0.5	85	< 1	<20	<100	< 5	2	12	0.02	18	**15**	< 0.5	< 0.5	<0.1	<1	6	<1	<0.1	2	<1	147	2	3	**660**	<0.1	<5	<5	<5

* During the investigation, another two Thermotolerant Coliform exceedances were detected from the combined Jetty Outfall discharge line, sampling location 750-SC-003 and are included within the investigation report (L060-AH-REP-70062). These were detected at:

- 08:15 am Tuesday 13 August 2024. The NATA accredited testing results issued at 08:15 am on Friday 23 August 2024 confirmed a thermotolerant coliforms concentration of 870 CFU/100ml which exceeded the discharge limit of 400 CFU/100mL. INPEX notified NT EPA of the exceedance at 15:03 on Friday 23 August 2024.
- 08:04 am on Tuesday 10 September 2024. The interim NATA accredited testing result advised by the onshore laboratory on Friday 13 September 2024 at 17:53 confirmed a thermotolerant coliform concentration of 750 CFU/100ml which exceeded the discharge limit of 400 CFU/100mL. INPEX notified NT EPA of the exceedance at 20:51 on Friday 13 September 2024.

APPENDIX D: AUTHORISED STATIONARY SOURCE EMISSION RELEASE RESULTS

D.1 Stationary source emission test results by Ektimo

Sampling Point Number	Sampling Location Number	Date/Time	LIMS Number	NO_x as NO_2 - Concentration Target		NO_x as NO_2 - Concentration Limit		NO_x as NO_2 -Measured Concentration		CO Measured Concentration		Temperature	Efflux velocity	Volumetric flow rate
				mg/Nm³	ppm	mg/Nm³	ppm	mg/Nm³	ppmv	mg/m³	ppm	ºC	m/s	m³/min
LNG Refrigerant Compressor Driver Gas Turbines (GE Frame 7s)				**50 @ 15%O_2 dry**	**25 @ 15%O_2 dry**	**70**	**35 @ 15%O_2 dry**	**LNG Refrigerant Compressor Driver Gas Turbines (GE Frame 7s)**						
A1	L-641-A-001	18/02/2025 09:37	L2402740001					41	20	96	77	172	27	16000
A2	L-642-A-001	13/08/2024 10:39	L2402742001					43	21	2.3	1.9	165	26	16000
A3	L-641-A-002	14/08/2024 11:42	L2402741001					18	8.6	9.6	7.7	167	25	16000
A4	L-642-A-002	14/08/2024 08:44	L2402743001					15	7.5	11	8.9	170	26	16000
CCPP Gas Turbine Generators (GE Frame 6s, 38MW) - HRSG stack								**CCPP Gas Turbine Generators (GE Frame 6s, 38MW) - HRSG stack**						
A5-1	L-780-GT-001	-	-					-	-	-	-	-	-	-
A6-1	L-780-GT-002	-	-					-	-	-	-	-	-	-
A7-1	L-780-GT-003	21/02/2025 12:31	L2402746001					11	5.5	22	18	583	39	6800
A8-1	L-780-GT-004	-	-					-	-	-	-	-	-	-
A9-1	L-780-GT-005	-	-					-	-	-	-	-	-	-
A5-2	L-630-F-001	20/02/2025 10:42	L2402733001	**150 @15%O_2 dry**	**75 @15%O_2 dry**	**350**	**175 @15%O_2 dry**	16	8	<1	<1	203	22	7100
A6-2	L-630-F-002	20/02/2025 14:20	L2402734001					3.2	1.6	170	130	227	24	7200
A7-2	L-630-F-003	-	-					-	-	-	-	-	-	-
A8-2	L-630-F-004	21/02/2025 09:22	L2402736001					9.7	4.7	<1	<1	223	22	6800
A9-2	L-630-F-005	22/02/2025 09:12	L2402737001					8.3	4	32	25	236	23	6800
AGRU Incinerators				**320 @3%O_2 dry**	**160 @3%O_2 dry**	**350**	**175 @3%O_2 dry**	**AGRU Incinerators**						
A13-1	L-551-FT-031	14/08/2024 14:16	L2402731001					62	30	30	24	478	18	2500
		19/02/2025 10:22	L2502126001					9.3	4.5	2700	2200	400	18	2800
		19/02/2025 12:28	L2502127001					30	15	3300	2600	435	19	2700
		19/02/2025 14:38	L2502128001					45	22	1600	1300	462	20	2800
		19/02/2025 16:44	L2502129001					64	31	96	77	489	21	2900
A14-1	L-552-FT-031	-	-					-	-	-	-	-	-	-
Heating medium furnaces				**160 @3%O_2 dry**	**80 @3%O_2 dry**	**350**	**175 @3%O_2 dry**	**Heating medium furnaces**						
A15	L-640-A-001-A	16/08/2024 09:23	L2402738001					140	67	150	120	155	4.2	670
A16	L-640-A-001-B	16/08/2024 09:05	L2402739001					140	68	100	83	156	4.2	670

D.2 Monthly feed gas sampling test results reported by the INPEX Laboratory

Date	LIMS number	Hydrogen Sulphide (H_2S)	Benzene	Toluene	Ethylbenzene	m/p-Xylene	o-Xylene	Mercury
	Unit	ppmV	ppmV	ppmV	ppmV	ppmV	ppmV	µg/Nm³
A13-2 (L-551-SC-003) AGRU Hot Vent - LNG Train1, prior to release at A3								
21/07/2024 12:15	L2403317001	150	230	130	<30	<30	<30	NA
28/08/2024 10:49	L2403862001	140	380	300	<30	<30	<30	NA
10/09/2024 12:48	L2404337001	140	100	70	<30	<30	<30	NA
07/10/2024 15:05	L2404890001	140	190	150	<30	<30	<30	NA
27/11/2024 10:06	L2405478001	140	150	110	<30	<30	<30	NA
13/12/2024 10:00	L2405975001	140	250	190	<30	<30	<30	NA
13/01/2025 11:15	L2500167001	140	170	120	<30	<30	<30	NA
10/02/2025 12:53	L2500680001	140	250	220	<30	<30	<30	NA
19/02/2025 13:45	L2500831001	140	280	190	<30	<30	<30	NA
12/03/2025 10:25	L2501112001	140	250	190	<30	<30	<30	NA
26/04/2025 12:30	L2501738001	140	130	100	<30	<30	<30	NA
03/05/2025 14:40	L2502120001	140	160	120	<30	<30	<30	NA
09/06/2025 15:20	L2502875001	140	170	110	<30	<30	<30	NA
A13-3 (L-541-SC-001) Feed gas to AGRU – LNG Train 1 – prior to release at A3								
28/07/2024 14:30	L2403424001	NA	NA	NA	NA	NA	NA	< 0.005
20/08/2024 08:30	L2403995001	NA	NA	NA	NA	NA	NA	< 0.005
31/08/2024 08:00	L2404154001	NA	NA	NA	NA	NA	NA	< 0.005
14/09/2024 16:30	L2404432001	NA	NA	NA	NA	NA	NA	< 0.005
18/09/2024 16:00	L2404433001	NA	NA	NA	NA	NA	NA	< 0.005
26/09/2024 09:20	L2404463001	NA	NA	NA	NA	NA	NA	< 0.005
29/09/2024 08:30	L2404582001	NA	NA	NA	NA	NA	NA	< 0.005
24/02/2025 15:45	L2500811001	NA	NA	NA	NA	NA	NA	< 0.005
17/03/2025 07:45	L2501273001	NA	NA	NA	NA	NA	NA	< 0.005
19/04/2025 09:41	L2501609001	NA	NA	NA	NA	NA	NA	< 0.005
05/05/2025 08:30	L2502199001	NA	NA	NA	NA	NA	NA	< 0.005
26/06/2025 07:40	L2502744001	NA	NA	NA	NA	NA	NA	< 0.005
A14-2 (L-552-SC-003) AGRU hot Vent Train2, prior to release at A4								
08/07/2024 16:35	L2403318001	140	260	170	< 30	< 30	< 30	NA
No sample collected in August 2024								
No sample collected in September 2024								
25/10/2024 11:29	L2404989001	140	160	100	< 30	< 30	< 30	NA

Date	LIMS number	Hydrogen Sulphide (H_2S)	Benzene	Toluene	Ethylbenzene	m/p-Xylene	o-Xylene	Mercury
	Unit	ppmV	ppmV	ppmV	ppmV	ppmV	ppmV	µg/Nm³
12/11/2024 12:02	L2405479001	140	160	110	< 30	< 30	< 30	NA
13/12/2024 12:30	L2405976001	120	290	220	< 30	< 30	< 30	NA
13/01/2025 14:40	L2500168001	120	280	210	< 30	< 30	< 30	NA
10/02/2025 15:45	L2500681001	150	120	90	< 30	< 30	< 30	NA
12/03/2025 12:45	L2501113001	130	250	210	< 30	< 30	< 30	NA
26/04/2025 14:45	L2501739001	140	150	120	< 30	< 30	< 30	NA
05/05/2025 13:00	L2502121001	140	180	140	< 30	< 30	< 30	NA
10/06/2025 14:50	L2502876001	140	170	110	< 30	< 30	< 30	NA
A14-3 (L-542-SC-001) Feed gas to AGRU – LNG Train 2 – prior to release at A4								
16/07/2024 08:20	L2403423001	NA	NA	NA	NA	NA	NA	< 0.005
09/08/2024 10:40	L2403838001	NA	NA	NA	NA	NA	NA	< 0.005
21/10/2024 13:00	L2405092001	NA	NA	NA	NA	NA	NA	< 0.005
26/11/2024 12:00	L2405621001	NA	NA	NA	NA	NA	NA	< 0.005
26/12/2024 16:50	L2406104001	NA	NA	NA	NA	NA	NA	< 0.005
18/01/2025 13:38	L2500342001	NA	NA	NA	NA	NA	NA	< 0.005
16/02/2025 08:00	L2500810001	NA	NA	NA	NA	NA	NA	< 0.005
17/03/2025 09:09	L2501272001	NA	NA	NA	NA	NA	NA	< 0.005
20/04/2025 10:50	L2501608001	NA	NA	NA	NA	NA	NA	< 0.005
05/05/2025 08:00	L2502198001	10	120	110	<30	<30	<30	< 0.005
17/06/2025 11:09	L2502743001	NA	NA	NA	NA	NA	NA	< 0.005

APPENDIX E: GROUNDWATER QUALITY MONITORING DATA

Table 8-1: Groundwater sampling results for all sites, Groundwater Surveys 14 and 15

Monitoring Round	LocCode	Sampled Date-Time	Ammonia as N	Nitrogen (Total)	Oxides of Nitrogen	Phosphate total (P)	Reactive Phosphorus as P	TSS	TDS	Aluminium (Filtered)	Arsenic (Filtered)	Cadmium (Filtered)	Chromium (hexavalent) (Filtered)	Chromium (Trivalent) (Filtered)	Cobalt (Filtered)	Copper (Filtered)	Lead (Filtered)	Manganese (Filtered)	Mercury (Filtered)	Nickel (Filtered)	Silver (Filtered)	Vanadium (Filtered)	Zinc (Filtered)	Benzene	Ethylbenzene	Toluene	Xylene Total	TRH C6-C40	Biological oxygen demand	E. coli	Dissolved Oxygen (%)	EC (field)	pH (Field)	Redox	Temp
Units	n/a	n/a	ug/l	ug/l																										MPN/100 mL	% sat	uS/cm	pH_Units	mV	°C
Groundwater Survey 14	BPGW01	1/10/2024	29	230	91	40	18	-	2310	486	2.5	4.7	<1	<1	48	4.4	13.4	1200	<0.04	36.1	0.4	<0.2	228	<1	<2	<2	<2	<100	-	-	19.9	4,097	4.51	173.2	30.0
	BPGW07	1/10/2024	18	640	18	23	21	-	71,000	5	6.6	0.2	<1	<10	23	<1	1.4	976	<0.04	25	<0.1	<0.5	51	<1	<2	<2	<2	<100	-	-	23.2	86,440	5.83	82.5	31.2
	BPGW08A	1/10/2024	99	240	<20	26	27	-	10,600	92	9.8	0.6	<1	<1	58.2	<0.5	1.4	5090	<0.04	33.2	<0.1	0.4	53	<1	<2	<2	<2	<100	-	-	16.3	17,222	4.76	162.3	31.5
	BPGW09	1/10/2024	56	550	<20	6	3	-	91,300	<5	50.8	<0.2	<10	<10	3.1	<1	0.2	327	<0.04	1.9	<0.1	<0.5	6	<1	<2	<2	<2	<100	-	-	30.2	103,037	6.23	17.0	31.0
	BPGW18	3/10/2024	653	880	50	70	<10	-	55,600	<5	10.3	<0.2	<100	<100	<0.2	1	<0.2	74.2	<0.04	0.7	<0.1	0.8	<5	<1	<2	<2	<2	<100	-	-	28.3	81,127	6.04	-2.8	30.2
	BPGW19A	2/10/2024	1730	2350	<2	39	16	-	51,200	40	1.2	<0.2	<1	<10	<0.2	<1	<0.2	60.7	<0.04	<0.5	<0.1	3	5	<1	<2	<2	<2	<100	<1	<1	3.8	78,366	6.08	4.2	31.3
	BPGW20	3/10/2024	124	120	<20	8	7	-	644	<5	2.6	<0.05	<1	<1	2.1	<0.5	<0.1	35.9	<0.04	1.2	<0.1	<0.2	7	<1	<2	<2	<2	<100	-	-	14.8	1,472	5.41	42.5	33.2
	BPGW26	2/10/2024	374	550	<20	14	7	-	8050	<5	6.8	<0.05	<1	<1	9.7	<0.5	0.1	2880	<0.04	1.6	<0.1	<0.2	9	<1	<2	<2	<2	<100	-	-	4.3	20,516	5.66	85.4	31.2
	BPGW27A	2/10/2024	331	260	<20	<5	5	-	1440	<5	1.4	<0.05	<1	<1	2.2	<0.5	<0.1	28.7	<0.04	0.6	<0.1	<0.2	4	<1	<2	<2	<2	<100	<1	<1	5.3	2,878	5.39	94.1	33.6
	BPGW28	3/10/2024	850	1370	26	48	21	-	82,200	<5	2.8	<0.2	<1	<10	<0.2	<1	<0.2	166	<0.04	<0.5	<0.1	0.7	<5	<1	<2	<2	<2	<100	-	-	16.3	116,354	6.35	-29.5	30.9
	BPGW38A	2/10/2024	82	160	<2	16	8	-	994	<5	0.7	0.37	<1	<1	0.6	<0.5	<0.1	23.7	<0.04	1	<0.1	0.3	9	<1	<2	<2	<2	<100	-	-	8.1	1,711	6.01	87.5	33.1
	BPGW40	2/10/2024	742	790	<20	35	32	-	12,200	11	5.7	<0.05	<1	<1	<0.1	<0.5	<0.1	16.2	<0.04	<0.5	<0.1	0.4	7	<1	<2	<2	<2	<100	-	-	3.9	6,299	6.04	-26.4	31.4
	BPGW41	3/10/2024	546	590	<20	9	13	-	3210	<5	8	<0.05	<1	<1	1.7	3	0.2	185	<0.04	<0.5	<0.1	<0.2	7	<1	<2	<2	<2	<100	-	-	39.1	21,658	6.62	-1.6	30.5
	VWP328	3/10/2024	316	500	<20	<5	7	-	75,500	<5	580	<0.2	<1	<10	20.8	<1	0.4	350	<0.04	3.2	<0.1	<0.5	10	<1	<2	<2	<2	<100	-	-	49.6	108,800	5.65	13.9	30.6
	VWP341	2/10/2024	695	720	<20	55	8	-	2340	8	7.3	<0.05	<1	<1	162	<0.5	0.1	2480	<0.04	16.3	<0.1	0.3	136	<1	<2	<2	<2	<100	-	-	19.8	4,291	5.46	59.8	33.2
Groundwater Survey 15	BPGW01	31/03/2025	15	110	<2	8	1	-	60	48	3	<0.05	<1	<1	1.8	<0.5	0.2	138	<0.04	0.5	<0.1	<0.2	3	<1	<2	<2	<2	<100	-	-	2.6	193	5.02	-40.1	29.5
	BPGW07	15/04/2025	399	613	<2	28	20	-	92,600	8	5.8	0.5	<1	<01	30.6	<1	1.3	1560	<0.04	33.2	<0.1	1.1	67	<1	<2	<2	<2	<100	-	-	1.2	87,198	5.59	20.2	31.0
	BPGW08A	15/04/2025	33	156	<20	35	<1	-	2,830	6	26.7	<0.05	<1	<1	46.7	<0.5	<0.1	3360	<0.04	19.4	<0.1	<0.2	7	<1	<2	<2	<2	<100	-	-	2.2	4,439	5.70	-103.0	31.8
	BPGW09	15/04/2025	231	451	<20	<5	2	-	156,000	<5	73.2	<0.2	<1	<10	5.5	<1	0.9	763	<0.04	2	<0.1	0.6	<5	<1	<2	<2	<2	<100	-	-	0.6	124,438	5.97	-77.9	30.6
	BPGW18	16/04/2025	675	888	<20	45	<1	-	48,900	7	11.5	<0.2	<1	<1	<0.2	<1	<0.2	80.9	<0.1	0.7	<0.1	1.7	<5	<1	<2	<2	<2	<100	-	-	1.1	70,021	6.22	-99.8	30.3
	BPGW19A	16/04/2025	1660	2690	<20	33	<1	-	53,400	76	5.9	<0.2	<1	2	<0.2	<1	0.2	54.8	<0.1	<0.5	<0.1	4.9	<5	<1	<2	<2	<2	<100	3.9	<1	1.0	74,609	6.16	-125.1	30.7
	BPGW20	16/04/2025	122	223	<20	14	<1	-	604	774	2.7	<0.05	<1	<1	1.5	<0.5	0.5	25.6	<0.1	1.4	<0.1	3	7	<1	<2	<2	<2	<100	-	-	20.1	938	5.46	-10.0	33.4
	BPGW26	15/04/2025	167	240	<20	19	<1	-	3,670	<5	3.4	<0.05	<1	<1	6.7	<0.5	<0.1	1780	<0.04	1	<0.1	<0.2	3	<1	<2	<2	<2	<100	-	-	1.0	7,026	5.61	-81.7	32.2

Monitoring Round	LocCode	Sampled Date-Time	Ammonia as N	Nitrogen (Total)	Oxides of Nitrogen	Phosphate total (P)	Reactive Phosphorus as P	TSS	TDS	Aluminium (Filtered)	Arsenic (Filtered)	Cadmium (Filtered)	Chromium (hexavalent) (Filtered)	Chromium (Trivalent) (Filtered)	Cobalt (Filtered)	Copper (Filtered)	Lead (Filtered)
	BPGW27A	16/04/2025	**247**	254	<20	<5	<1	-	1,180	12	0.7	<0.05	<1	<1	1.7	<0.5	<0.1
	BPGW28	16/04/2025	**1010**	**1550**	<20	16	<1	-	77,600	**336**	2.8	<0.2	<1	<1	<0.2	<1	0.4
	BPGW38A	15/04/2025	<50	171	**0.213**	<5	<1	-	144	7	<0.2	<0.05	<1	<1	<0.1	<0.5	<0.1
	BPGW40	15/04/2025	**376**	**390**	<0.02	5	<1	-	2,830	<5	**7.8**	<0.05	<1	<1	2.3	<0.5	<0.1
	BPGW41	29/04/2025	**807**	**1100**	0.005	15	<10	-	13,900	<5	**7.4**	<0.05	<1	<1	<0.1	<0.5	0.001
	VWP328	29/04/2025	251	560	<0.02	<5	<1	-	81,100	<5	**5.94**	<0.2	<1	<10	**19.4**	<1	0.4
	VWP341	15/04/2025	**612**	**577**	<0.02	31	2	-	1,920	16	**6.1**	<0.05	<1	<1	**185**	<0.5	0.2

LocCode	Manganese (Filtered)	Mercury (Filtered)	Nickel (Filtered)	Silver (Filtered)	Vanadium (Filtered)	Zinc (Filtered)	Benzene	Ethylbenzene	Toluene	Xylene Total	TRH C6-C40	Biological oxygen demand	E. coli	Dissolved Oxygen (%)	EC (field)	pH (Field)	Redox	Temp
BPGW27A	23.3	<0.1	0.5	<0.1	<0.2	2	<1	<2	<2	<2	<100	1.5	2	0.5	2,106	5.14	24.6	33.5
BPGW28	176	<0.1	<0.5	<0.1	1.9	<5	<1	<2	<2	<2	<100	-	-	81.1	96,345	6.56	-115.6	30.8
BPGW38A	<0.5	<0.04	<0.5	<0.1	0.4	5	<1	<2	<2	<2	<100	-	-	3.5	268	6.69	23.9	31.8
BPGW40	188	<0.04	0.8	<0.1	<0.2	4	<1	<2	<2	<2	<100	-	-	1.2	5,271	6.04	-128.8	30.3
BPGW41	16.8	<0.04	<0.5	<0.1	0.5	14	<1	<2	<2	<2	<100	-	-	1.6	18,214	6.73	-173.2	29.6
VWP328	367	<0.04	2.4	<0.1	<0.5	<5	<1	<2	<2	<2	<100	-	-	4.9	84,402	5.99	-70.9	30.3
VWP341	**3520**	<0.04	**16.3**	<0.1	0.4	**176**	<1	<2	<2	<2	<100	-	-	3.5	3,074	**5.22**	-4.5	33.5

Document Endorsement and Approvals

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Document Identification

Document Number	Revision	Security Classification	Date
L060-AH-REP-70087	0	Public	22/10/25 08:00

Document Revision History

Revision	Date and Time	Issue Reason

Delegation of Authority

From Name	To Name	Date and Time	Action

Name	Title

Electronic Endorsement and Approval

Electronic approval of this document complies with the issued INPEX Electronic Approval Standard (0000-A9-STD-60011) and records evidence that the applicable person has either endorsed and/or approved the content contained within this document. The reviewers of this document are recorded in the CDS.

Name	Title	Date and Time	Action
Chris Serginson	Manager Environment	22/10/25 10:42	Endorser
Adrian Parody	Production Manager	22/10/25 10:47	Approver