

# Annual Compliance Report Ichthys LNG Project (EPBC 2008/4208): 2020–2021

Report

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## Correction Notice

The following correction notice applies to the Annual Compliance Report Ichthys LNG Project (EPBC 2008/4208): 2020–2021 (Rev 0, 0000-AH-REP-70041), herein referred to as the ACR.

### 1 REASON FOR CORRECTION

A review of contractor data and quality assurance processes determined that an error had resulted, which led to the mis-reporting of results for total petroleum hydrocarbons (TPH) in intertidal sediments. Original TPH C10-C36 (sum of TPH) results were reported based on a non-national association of testing authorities (NATA)-accredited method, which is not suitable for assessment of compliance against environment protection licence (EPL) 228-04. The NATA-accredited TPH C10-C36 (sum of TPH) results (used for assessing compliance against EPL228-04) were mis-labelled in the ACR as TPH C10-C36 (sum of total after silica gel clean-up) results.

The error in TPH reporting occurred because of a data manipulation/transcription error between the analytical laboratory and the contractor report. The laboratory provided the contractor with the incorrect coding for results, which resulted in contractor data analysis software apportioning data to the wrong analysis in the report.

To ensure this error is not repeated in future monitoring, the contractor will complete quality assurance and quality control checks on all laboratory provided data to ensure the results match the requested analysis, prior to the data being entered into the contractor's data analysis software. Contractor reports to INPEX have also been updated to reflect this amendment.

### 2 CORRECTIONS

#### 2.1 Correction 1

Page 43, Section A.5.2, *Organics* is retracted and replaced with the following:

##### *Organics*

*A summary of intertidal sediment chemistry for inorganics is provided in Table A-10. Exceedances of the benchmark levels were recorded at one control site (CSMC01) for hydrocarbons. The exceedance is likely to indicate the presence of biogenic, naturally occurring hydrocarbons (e.g. lipids, plant oils, tannins, animal fats, proteins, humic acids and fatty acids). Previous positive detections of TPH at monitoring sites have subsequently been below laboratory limits of reporting post silica gel clean-up and there are no known sources of petrogenic hydrocarbons into the environment from Ichthys LNG. As the exceedance occurred at a control site, further investigation, including silica gel clean-up, was not completed.*

#### 2.2 Correction 2

Page 43, Section A.5.2, *Organics*, Table A-10 is retracted and replaced with the following:

**Table A-10: Summary of organic mangrove sediment chemistry (mg/kg)**

<b>Site</b>	<b>TPH C10-C36 (sum of total)*</b>
<i>Guideline value</i>	280
<i>Background level</i>	n/a
<i>BPMC09</i>	33
<i>BPMC10</i>	76.4
<i>BPMC11</i>	<3.7
<i>BPMC16</i>	103.3
<i>BPMC17</i>	236.6
<i>BPMC25</i>	52.2
<i>BPMC26</i>	141.2
<i>CSMC01-HM</i>	<b>335.5</b>
<i>CSMC01-TF</i>	171.4
<i>CSMC01-TC</i>	51.4
<i>CSMC03-HM</i>	194
<i>CSMC03-TF</i>	147.1
<i>CSMC03-TC</i>	215.3

*\*Bold values indicates trigger exceedances*

### **3 IMPACTS TO ENVIRONMENTAL COMPLIANCE**

There are no impacts to environment compliance reported in the ACR as the reported TPH C10-C36 (sum of total after silica gel clean-up) results were used to assess compliance. There are no reportable environmental trigger exceedances as a result of this correction.

**RECORD OF AMENDMENT**

Revision	Section	Amendment

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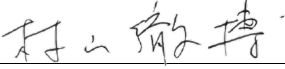
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**Declaration of accuracy**

In making this declaration, I am aware that sections 490 and 491 of the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or documents. The offence is punishable on conviction by imprisonment or a fine, or both. I declare that all the information and documentation supporting this compliance report is true and correct in every particular. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this authorisation.

<b>Signed</b>	
<b>Full name</b>	Tetsuhiro Murayama
<b>Position</b>	Director
<b>Organisation</b>	INPEX Operations Australia Pty Ltd, ABN 48 150 217 262
<b>Date</b>	12/10/2021

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**Abbreviations, terms and acronyms**

<b>Abbreviation, term or acronym</b>	<b>Meaning</b>
2020/2021 Compliance Report	Annual Compliance Report Ichthys LNG Project (EPBC 2008/4208): 2020-2021 (0000-AH-REP-70041)
AOC	accidentally oil contaminated
BOD	biological oxygen demand
BTEX	benzene, toluene, ethylbenzene and xylene
CCR	central control room
cfu/100 mL	colony forming units per 100 millilitres
COD	chemical oxygen demand
COS	Coastal Offset Strategy (X075-AH-STR-0001)
COVID-19	disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)
CPF	central processing facility
CCPP	combined cycle power plant
DAWE	Department of Agriculture, Water and the Environment (Commonwealth)
EC	electrical conductivity
DO	dissolved oxygen
EPBC 2008/4208	the Ichthys LNG Project Commonwealth approval
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
EPL228 (as varied)	The Ichthys LNG environment protection licence issued by the NT EPA to operate the Ichthys LNG facility.
FPSO	floating production, storage and offloading (facility)
GEP	gas export pipeline
IMT	incident management team
INPEX	INPEX Operations Australia Pty Ltd
LDMP	Ichthys Onshore LNG Facilities: Liquid Discharge Management Plan: Operations (L060-AH-PLN-60050)
LDMP Addendum	Onshore Operations Environmental Plan and Liquid Discharge Management Plan: Addendum 1 Firefighting training (L790-AH-PLN-70000)
LNG	liquefied natural gas
LPG	liquefied petroleum gas
Maintenance DSDMP	Maintenance Dredging and Spoil Disposal Management Plan (L060-AH-PLN-60010)
mg/kg	milligram per kilogram
mg/L	milligrams per litre
MLSS	mixed liquor suspended solid
mpn/100 mL	most probably number (bacteria) per 100 millilitres

NATA	National Association of Testing Authorities
Nearshore OPEP	Nearshore Oil Pollution Emergency Plan (X060-AH-PLN-60003)
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
NTU	nominal turbidity units
OSMP	operational and scientific monitoring program
PSD	particle size distribution
SWL	standing water level
the Project	Ichthys LNG Project
TN	total nitrogen
TPH	total petroleum hydrocarbons
TRC	total recoverable hydrocarbons
TSS	total suspended solids
µg/L	micrograms per litre
µg N/L	micrograms of nitrogen per litre
µg P/L	micrograms of phosphorous per litre
µS/cm	microSiemens per centimetre
QA/QC	quality assurance and quality control
°C	degrees Celsius
%	percent

## 1 INTRODUCTION

INPEX Operations Australia Pty Ltd (INPEX) as proponent for the Ichthys LNG Project, was issued with an approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act; approval EPBC 2008/4208) on 27 June 2011. The EPBC 2008/4208 approval was subsequently amended by variations to conditions 1, 3, 4, 5, 7, 8, 9, 11, 13, 15, 16 and 19 made pursuant to Section 143 of the EPBC Act.

Condition 13 of EPBC 2008/4208 requires INPEX to submit a Compliance Report to the Department of Agriculture, Water and the Environment (DAWE) within 15 months from commencement of operation<sup>1</sup>, with each subsequent report submitted within 12 months from the date of the previous report. This is the third Compliance Report to be submitted following commencement of operations on 27 July 2018.

Specific Project details are provided in Table 1-1, with an overview and status of activities described in Section 2.

**Table 1-1: Ichthys LNG Project details**

Item	Project details
EPBC number	EPBC 2008/4208
Project name	Ichthys LNG Project
Approval holder	INPEX Operations Australia Pty Ltd
Approval holder ABN	ABN 48 150 217 262
Approved Action	To develop the Ichthys Field in the Browse Basin to produce liquefied natural gas, liquefied petroleum gas and condensate and including the installation and operation of offshore extraction facilities in Ichthys Field, onshore processing facilities at Bladin Point and 850-935km pipeline from Ichthys Field to Bladin Point, Northern Territory, as described in the referral (EPBC 2008/4208) and the variation to the action dated 11 May 2011.

### 1.1 Purpose and scope

The purpose of this Compliance Report is to meet the requirements of EPBC 2008/4208 Condition 13 (as varied 27 May 2015), which states:

*The person taking the action must submit a Compliance Report detailing compliance with any plan, report, strategy, or program (however described) referred to in relation to this approval. The date of the first Compliance Report must be submitted to the Minister within 15 months from the commencement of operation with each subsequent report submitted within 12 months from the date of the previous report. The Compliance Report must be made publicly available on the person taking the action's Australian website for the operational life of the action.*

*The Compliance Report is not required to include activities conducted within the Commonwealth Marine Area.*

*The person taking the action may cease complying with condition 13 if they have written agreement from the Minister.*

<sup>1</sup> The Ichthys LNG Project approval (EPBC 2008/4208) defines operations as "the commencement of gas extraction and transfer from subsea wells to the floating liquefied natural gas facility and liquefied natural gas facility and liquefied natural gas tankers". The date reflected is the date the wells were first opened offshore. Onshore operations did not commence until 14 September 2018.

DAWE representatives have advised<sup>2</sup> that the scope of the Compliance Report is limited to the demonstration of compliance with the following EPBC 2008/4208 conditions (as varied) and their associated plans, programs or strategies:

- Condition 1 - Oil Spill Contingency Plan (as varied on 03 February 2015)
- Condition 2 - Operational and Scientific Monitoring Program
- Condition 5 - Decommissioning Management Plan (as varied on 27 May 2015)
- Condition 8 - Liquid Discharge Management Plan (as varied on 03 February 2015)
- Condition 9 - Noise Management Plan (as varied on 06 March 2014)
- Condition 10 - Dredging and Spoil Disposal Management Plan (as varied on 05 April 2013)
- Condition 11 - Offsets (Coastal Offset Strategy) (as varied on 23 June 2021, refer to Table 1-2).

This Compliance Report addresses compliance with above conditions and associated plans, programs or strategies during the 27 July 2020 to 26 July 2021 reporting period.

As per EPBC 2008/4208 Condition 13, this report does not address activities occurring in the Commonwealth Marine Area. These activities are regulated by the National Offshore Petroleum Safety and Environment Authority under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and associated regulations.

### 1.1.1 Variations to EPBC 2008/4208 approval conditions

Two variations to EPBC 2008/4208 approval conditions have been approved by DAWE during the reporting period. Both variations related to Condition 11 and are outlined in Table 1-2.

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<sup>2</sup> Email correspondence received from the DAWE Compliance Monitoring Team on 30 July 2019.

**Table 1-2: Variations to EPBC 2008/4208 approval conditions**

Variation date	Condition (changes to condition denoted in <i>italics</i> )	Description of variation
21 August 2020	<p>Condition 11a:</p> <p>High level details on the implementation of the following offsets outlined in the Northern Territory Government's letter to the Acting Secretary of the Department of Sustainability, Environment, Water, Population and Communities dated 23 May 2011, including a commitment and indicative schedule for the development of detailed sub-plans for each offset program</p> <ul style="list-style-type: none"> <li>• Publication of data collected for the Browse Basin and Kimberley coastline;</li> <li>• an integrated monitoring and research program for Darwin Harbour;</li> <li>• habitat mapping for Darwin Harbour Region (including Bynoe Harbour);</li> <li>• funding of Australian Research Council Linkage projects;</li> <li>• <i>conservation management of dugongs, cetaceans and threatened marine matters of national environmental significance in the Top End; and</i></li> <li>• research on the conservation status, distribution and habitat use of coastal dolphins.</li> </ul>	<p>This variation addressed:</p> <ul style="list-style-type: none"> <li>• broadening the eligible species to include threatened marine species</li> <li>• broadening the geographical extent to include the entire Top End.</li> </ul> <p>As a direct result, the varied program is expected to deliver greater conservation outcomes, while also delivering cultural and social benefits.</p> <p>The Program status and compliance is further described in Table 3-3.</p>
23 June 2021	<p>Condition 11b and 11c:</p> <p>11 b. <i>Provision for the protection and management, for the life of the project, of approximately 2000 ha of terrestrial vegetation and mangroves, or of an area as otherwise agreed by the Minister;</i></p> <p>Note 1: Protection can include the acquisition and inclusion of an area in the conservation estate, covenanting arrangements on private land, other formal agreements with private landholders, or permanent changes to management regimes on Crown or Aboriginal land.</p> <p>Note 2: This condition does not limit the provision of these offsets in synergy with any conditions of any other approving party.</p>	<p>This variation defined the protection, management and funding commitment for the life of project (40 years). This is consistent with Step 9 of Section 4.5 of the Coastal Offset Strategy, to establish a legally binding agreement between 1 July 2023 and 1 July 2063 (40 years).</p> <p>Condition 11 b and c status and compliance is further described in Table 3-3.</p>

	<p>11c. <i>Provision for the protection and management, for the life of the project, of marine habitat for inshore dolphins, marine turtles and Dugong that is preferably, but not necessarily, adjacent to the protected mangrove vegetation.</i></p> <p>Note 1: Protection can include the acquisition and inclusion of an area in the conservation estate, covenanting arrangements on private land, other formal agreements with private landholders, or changes to management regimes on Crown or Aboriginal land.</p> <p>Note 2: This condition does not limit the provision of these offsets in synergy with any conditions of any other approving party.</p> <p><i>Life of the project means 40 years.</i></p>	
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### 1.1.2 DAWE approved plans or strategies

Table 1-3 provides an overview of relevant DAWE approved plans or strategies, which were in effect during the 27 July 2020 to 26 July 2021 reporting period.

**Table 1-3: DAWE approved plans/strategies**

Title	Description
<p>Ichthys Onshore LNG Facilities: Liquid Discharge Management Plan: Operations (LDMP; L060-AH-PLN-60050)</p> <p>Onshore Operations Environmental Plan and Liquid Discharge Management Plan: Addendum 1 Firefighting Training (LDMP Addendum; L790-AH-PLN-70000)</p>	<p>The LDMP describes the measures in place to mitigate the potential environmental effect of liquid discharges associated with onshore Ichthys LNG operations activities.</p> <p>During the reporting period, two revisions to the LDMP were approved by DAWE, in accordance with EPBC 2008/4208 Condition 8. One of these revisions was in the form of an Addendum, and its approval forms part of the approved LDMP. The LDMP (Rev 3) was approved by DAWE on 15 March 2021. Changes incorporated into Revision 3 included the following:</p> <ul style="list-style-type: none"> <li>Amend typographical errors and changes to the names of government departments</li> <li>Address changes to the monitoring program following a review of annual monitoring data.</li> </ul> <p>The LDMP Addendum (Rev 1) was approved by DAWE on 23 June 2021. The LDMP Addendum was prepared, in lieu of a full revision to the LDMP, to address the requirement to undertake portable/mobile firefighting training utilising PFAS-free training foam at Ichthys LNG. The Addendum includes a description of the activity and controls and monitoring that will be undertaken. The LDMP Addendum forms part of the approved LDMP.</p>
<p>Nearshore Oil Pollution Emergency Plan (Nearshore OPEP; X060-AH-PLN-60003)</p>	<p>The Nearshore OPEP describes the activities, arrangements, and framework for response to oil spills, which may occur within Northern Territory waters as a result of Ichthys LNG activities (EPBC 2008/4208, Condition 1) and the operational scientific monitoring program (EPBC 2008/4208, Condition 2), which would be implemented in the event of a spill.</p> <p>The Nearshore OPEP (Rev 1) was submitted in accordance with EPBC 2008/4208 Conditions 1 and 2 and was approved by DAWE on 23 February 2017. Subsequent to this, the Nearshore OPEP was updated in October 2018 (Rev 2) to incorporate administrative amendments. These amendments did not result in a new or increased risk, and as such was submitted to DAWE for information only in accordance with Condition 15.</p> <p>No updates to the Nearshore OPEP occurred during the 2020 - 2021 reporting period.</p>
<p>Maintenance Dredging and Spoil Disposal Management Plan (Maintenance DSDMP; L060-AH-PLN-60010)</p>	<p>The Maintenance DSDMP describes the measures in place to mitigate impacts associated with maintenance dredging. It allows for a maximum volume of 1.5 Mm<sup>3</sup> to be dredged within an approved 5-year period.</p> <p>The Maintenance DSDMP (Rev 1) was submitted in accordance with EPBC 2008/4208 Condition 10 and was approved by DAWE on 21 June 2018.</p> <p>No updates to the Maintenance DSDMP occurred during the 2020-2021 reporting period.</p>
<p>Coastal Offset Strategy (COS; X075-AH-STR-0001)</p>	<p>The COS provides high-level details of INPEX's environmental offset programs.</p>

	<p>During the reporting period, two revisions to the COS were approved by DAWE, in accordance with EPBC 2008/4208 Condition 15C.</p> <p>The COS (Rev 7) was approved by DAWE on 20 October 2020. Changes incorporated into Revision 7 included the following:</p> <ul style="list-style-type: none"><li>• Ichthys LNG Project status update</li><li>• Offset program/s status update</li><li>• Amendment of Condition 11a (following variation approval on 21 August 2020)</li><li>• Condition 11b and 11c program description and timelines.</li></ul> <p>The COS (Rev 8) was approved by DAWE on 22 July 2021. Changes incorporated into Revision 8 included updates on the following:</p> <ul style="list-style-type: none"><li>• Amendment to Condition 11b and 11c wording (following variation approval on 23 June 2021).</li></ul>
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## 2 DESCRIPTION OF ACTIVITIES

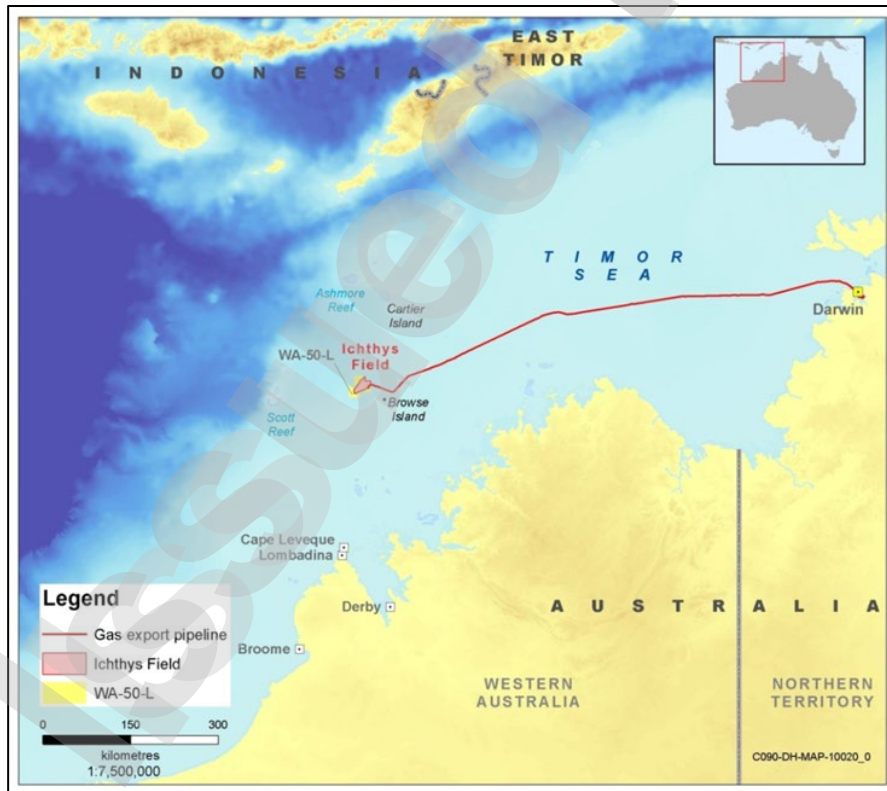
### 2.1 Ichthys Project overview

The Ichthys LNG Project (the Project) is a joint venture between INPEX group companies (the Operator), major partner TotalEnergies, and the Australian subsidiaries of CPC Corporation Taiwan, Tokyo Gas, Osaka Gas, Kansai Electric Power, JERA and Toho Gas. Drawing on the hydrocarbon resources of the Ichthys gas and condensate field in the Browse Basin at the western edge of the Timor Sea offshore Western Australia, the Project is expected to produce 8.9 Mt of liquefied natural gas (LNG) and 1.6 Mt of liquefied petroleum gases (LPGs) per annum, along with approximately 100 000 barrels of condensate per day at peak.). The Project has an expected operational life of at least 40 years.

The Ichthys Field covers an area of around 800 km<sup>2</sup> and drilling studies suggest that its hydrocarbon resources are 12.8 trillion cubic feet of sales gas and around 527 million barrels of condensate.

The extraction of natural gas and condensate is carried out via a floating semisubmersible central processing facility (CPF) at the Ichthys Field. This removes water and most of the condensate from the reservoir fluids and the separated condensate is transferred to a floating production, storage and offloading (FPSO) facility moored approximately 3.5 km from the CPF. After further processing on the FPSO, the condensate is exported directly from the field at an average rate of up to 85 000 barrels per day.

The dehydrated gas and the remainder of the condensate is compressed and exported through an approximately 890 km long gas export pipeline (GEP) to the Project's onshore processing plant at Bladin Point in Darwin Harbour in the Northern Territory (NT; see Figure 2-1)



**Figure 2-1: Project location**

## 2.2 Current status of activities

Key operations activities undertaken at Ichthys LNG onshore plant during the reporting period were as follows:

- activities associated with the product (LNG, LPG and condensate) processing, storage, loading and offtake.
- activities associated with routine and shutdown maintenance of the onshore facilities.
- environment monitoring activities.

The COVID-19 pandemic had an impact on operations and scheduled training activities and exercises. Impacts occurred throughout the reporting period. Border travel restrictions and lockdowns were imposed by the NT Government and INPEX's Pandemic Plan remained active, resulting in several access restrictions for non-essential personnel working at Ichthys LNG.

### 3 COMPLIANCE WITH EPBC 2008/4208 APPROVAL CONDITIONS

As per the requirements of DoE (2014) the terms and definitions provided in Table 3-1 have been used to indicate the status of compliance with relevant EPBC 2008/4208 approval conditions.

A summary of the compliance status with relevant EPBC 2008/4208 approval conditions (Section 1.1), applicable timeframes and reference to evidence supporting the compliance status (as applicable) is provided in Table 3-3.

**Table 3-1: Compliance status terms, acronyms and definitions**

Term	Acronym	Definition
Compliant	C	"Compliance" is achieved when all the requirements of a condition have been met, including the implementation of management plans or other measures required by those conditions.
Non-compliant	NC	A designation of "non-compliance" should be given where the requirements of a condition or elements of a condition, including the implementation of management plans and other measures, have not been met.
Not applicable	NA	A designation of "not applicable" should be given where the requirements of a condition or elements of a condition fall outside of the scope of the current reporting period. For example, a condition which applies to activity that has not yet commenced.

#### 3.1 Audit, reviews and exercises

A summary of the audits, reviews and exercises, as relevant to EPBC 2008/4208 conditions, undertaken during the reporting period is provided in Table 3-2. Outcomes of audits as applicable to EPBC 2008/4208 conditions are presented in Table 3-3.

**Table 3-2: Summary of audits, reviews and exercises**

Audit/review/exercise title	Scope	Date
Annual Onshore Operations Environmental Compliance Audit (External third-party audit – ERM on behalf of Northern Territory Environment Protection Authority (NT EPA))	The audit assessed compliance with the Onshore Operations Environmental Management Plan (OEMP; inclusive of liquid discharge management) and NT EPA issued operations environmental protection licence (EPL228).	12-15 October 2020
Annual Onshore Operations Environmental Compliance Audit (Internal audit)	The audit assessed compliance with the LDMP, OEMP and the NT EPA issued operations licence (EPL228).	19-30 July 2021
Annual review of Nearshore OPEP (internal)	Review to ensure the Nearshore OPEP remained current and suitable for Ichthys LNG activities occurring in Darwin Harbour.	15 December 2020

First strike response training	Oil spill training exercise, involving the land based deployment of zoom boom, marine configuration of boom to a "J" sweep. Followed by land based training on the skimmer system and towable waste storage tanks	21 January 2021
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Table 3-3: EPBC 2008/4208 approval conditions compliance table

Condition no.	Condition	Timing	Status	Evidence/Comments
1.	<p>Oil Spill Contingency Plan</p> <p>The person taking the action must develop and submit to the Minister for approval, an Oil Spill Contingency Plan that demonstrates the response preparedness of the person taking the action for any hydrocarbon spills, including the capacity to respond to a spill and mitigate the environmental impacts on the Commonwealth marine area and listed species habitat within offshore areas and Darwin Harbour. The Plan must include, but is not limited to:</p> <ol style="list-style-type: none"> <li>Oil spill trajectory modelling for potential spills from the action. This should include consideration of a well blow out or uncontrolled release. The modelling should be specific to the characteristics of the hydrocarbons contained in the Ichthys gas field, the likely volumes released in a worst case scenario spill, and the potential time over which the oil may be released in a worst case scenario spill, including a scenario of a minimum eleven (11) week uncontained spill;</li> <li>A description of resources available for use in containing and minimising impacts in the event of a spill and arrangements for accessing them;</li> <li>A demonstrated capacity to respond to a spill at the site, including application of dispersants, if required and appropriate, and measures that can feasibly be applied within the first 12 hours of a spill occurring;</li> <li>Identification of sensitive areas that may be impacted by a potential spill, in particular, Browse Island, specific response measures for those areas and prioritisation of those areas during a response;</li> <li>Details of the insurance arrangements that have been made in respect of paying the costs associated with operational and scientific monitoring, as outlined in the Operational and Scientific Monitoring Program required under condition 2 and repairing any environmental damage arising from potential oil spills, as determined necessary from the results of the Operational and Scientific Monitoring Program;</li> <li>Training of staff in spill response measures and identifying roles and responsibilities of personnel during a spill response; and</li> <li>Procedures for reporting oil spill incidents to the Department.</li> </ol> <p>The person taking the action must not commence drilling activities until the Oil Spill Contingency Plan is approved. The approved Oil Spill Contingency Plan must be implemented.</p>	Ongoing	Compliant	<p>During the reporting period there were no spill events which required activation of the Nearshore OPEP.</p> <p>An annual review of the Nearshore OPEP was undertaken in late-2020. The review did not result in any changes or updates to the plan, and the content remains current.</p> <p>As reported, in the 2019/2020 Annual Compliance Report (X00-AH-REP-70001) first strike response training for personnel was undertaken in August 2020. Please refer the 2019/2020 Annual Compliance Report for further details on the training provided and the outcomes/learnings of the training.</p> <p>Further oil spill training was undertaken on 21 January 2021, through the deployment of the zoom boom to configure a "J" sweep in Darwin Harbour, which was followed by land based training on the skimmer system and towable tanks.</p> <p>Darwin Incident Management Team (IMT) Competency Based Training was undertaken in February 2021. This involved the training of new Darwin IMT members and acted as refresher training for existing personnel on the Darwin IMT roster.</p> <p>A GEP rupture exercise is scheduled to be undertaken in September 2021. The exercise is based on a GEP rupture scenario in Darwin Harbour, and will utilise modelling based on real-time weather patterns.</p> <p>The exercise will involve members from the INPEX Darwin IMT and support elements from the Perth IMT, as well as the Crisis Management Team (Perth based). In addition to INPEX personnel, Darwin Port Authority personnel will also participate in the exercise.</p> <p>The purpose of the exercise is to:</p> <ul style="list-style-type: none"> <li>test the Ichthys LNG Incident Management Guide 013 Loss of Containment Onshore Pipeline (GEP)</li> <li>test the ability for the Darwin IMT to enact a response for this incident. Escalate this response to the correct level, being Level 3 and involve the Crisis Management Team</li> <li>enact the correct plume modelling with RPS</li> <li>test communications from the Ichthys LNG Central Control Room (CCR) to the CPF CCR</li> <li>test the ability to liaise with Darwin Port Authority regarding the spill.</li> </ul> <p>The outcomes/learnings of the GEP rupture exercise will be reported on in the 2021/2022 reporting period.</p> <p>Insurance arrangements were maintained in accordance with the Insurance Plan described in the Nearshore OPEP during the reporting period.</p>
2.	<p>Operational and Scientific Monitoring Program</p> <p>The person taking the action must develop and submit to the Minister for approval, an Operational and Scientific Monitoring Program that will be implemented in the event of an oil spill to determine the potential extent and ecosystem consequences of such a spill, including, but not limited to:</p> <ol style="list-style-type: none"> <li>Triggers for the initiation and termination of the Operational and Scientific Monitoring Program, including, but not limited to, spill volume, composition, extent, duration and detection of impacts;</li> <li>A description of the studies that will be undertaken to determine the operational response, potential extent of impacts, ecosystem consequences and potential environmental reparations required as a result of the oil spill;</li> </ol>	Ongoing	Compliant	<p>The Operational and Scientific Monitoring Program (OSMP) is incorporated into the Nearshore OPEP, which address the requirements of EPBC 2008/4208 Conditions 1 and 2 – refer above.</p> <p>During the reporting period there were no spill events which required activation of the OSMP. INPEX continues to maintain a contract with an external contractor to ensure OSMP readiness, in the event this is required to be implemented.</p>

Condition no.	Condition	Timing	Status	Evidence/Comments
	<p>c. Details of the insurance arrangements that have been made in respect of paying the costs associated with operational and scientific monitoring, as outlined in the Operational and Scientific Monitoring Program, and repairing any environmental damage arising from potential oil spills, as determined necessary from the results of the Operational and Scientific Monitoring Program;</p> <p>d. Inclusion of sufficient baseline information on the biota and the environment that may be impacted by a potential hydrocarbon spill, to enable an assessment of the impacts of such a spill;</p> <p>e. A strategy to implement the Operational and Scientific Monitoring Program, including timelines for delivery of results and mechanisms for the timely peer review of studies;</p> <p>f. In the event of an oil spill the person taking the action must pay all costs associated with all operational and scientific monitoring undertaken in response to the spill, as outlined in the approved Operational and Scientific Monitoring Program and any environmental remediation determined necessary by the results of the approved Operational and Scientific Monitoring Program; and</p> <p>g. Provision for periodic review of the program.</p> <p>The Operational and Scientific Monitoring Program must be submitted at least three months prior to the commencement of drilling activities. The person taking the action must not commence drilling activities until the Operational and Scientific Monitoring Program is approved. The approved Operational and Scientific Monitoring Program must be implemented.</p>			
5.	<p>Decommissioning Management Plan The person taking the action must submit for the Minister's approval a Decommissioning Management Plan to mitigate the environmental effects of decommissioning the proposal within the Commonwealth marine area. The Decommissioning Management Plan must include a detailed risk assessment to justify leaving any infrastructure on the seafloor of the Commonwealth marine area and must be consistent with any published Commonwealth Government policy or legislation prevailing at the time. Decommissioning cannot commence until the plan is approved. The approved plan must be implemented.</p>	Prior to decommissioning activities	Not applicable	This condition was not applicable during the reporting period.

Condition no.	Condition	Timing	Status	Evidence/Comments
8.	<p>Liquid Discharge Management Plan</p> <p>The person taking the action must submit for the Minister's approval a Liquid Discharge Management Plan or plans to mitigate the environmental effects of any liquid discharge from the proposal, including sewerage and surface water runoff. The Liquid Discharge Management Plan(s) must be for the protection of the Commonwealth marine area and habitat for listed species in Darwin Harbour and must:</p> <ol style="list-style-type: none"> <li>identify all sources of liquid discharge;</li> <li>describe any impacts associated with the discharge of liquids, including the cumulative impacts associated with the discharge of sewerage;</li> <li>clearly articulate the objectives of the plan and set measurable targets to demonstrate achievement of these;</li> <li>outline measures to avoid impacts;</li> <li>where impacts are unavoidable describe why they are unavoidable and measures to minimise impacts;</li> <li>demonstrate how any discharges into Darwin Harbour are consistent with the guidelines for discharges, and the water quality objectives for Darwin Harbour, developed under the National Water Quality Management Strategy;</li> <li>identify all regulatory requirements relating to the discharge of liquids and how these will be met;</li> <li>include a monitoring regime to determine achievement of objectives and success of measures used;</li> <li>outline reporting and auditing arrangements; and</li> <li>describe how the plan will apply the principles of adaptive management.</li> </ol> <p>The plan(s) must be submitted prior to the commencement of the relevant activity to which they apply. The relevant activity may not commence until the plan is approved. Separate Liquid Discharge Management plans can be submitted for the management of liquid discharges in the Commonwealth Marine Area and Darwin Harbour. The approved plan(s) must be implemented.</p>	Ongoing	Compliant	<p>During the reporting period, the following compliance monitoring activities were undertaken:</p> <ul style="list-style-type: none"> <li>monthly commingled treated effluent (in-pipe) monitoring (August 2020 to July 2021)</li> <li>quarterly jetty outfall monitoring (October 2020, January 2021, April 2021)</li> <li>annual harbour sediment monitoring (May 2021)</li> <li>biannual groundwater quality monitoring (October/November 2020 and April 2021)</li> <li>mangrove health and intertidal sediment monitoring (April 2021).</li> </ul> <p>Results of monitoring programs demonstrate that liquid discharges associated with Ichthys LNG activities have not adversely affected the declared beneficial uses or objectives for Darwin Harbour. A description of the monitoring programs and locations is described in Section 7 of the LDMP, with a summary of the outcomes of each of these monitoring programs provided in Appendix A.</p> <p>There were no changes to the frequency of the monitoring programs during the reporting period. Changes to monitoring programs for the 2020/2021 reporting period were as follows:</p> <ul style="list-style-type: none"> <li>Harbour sediments – ceased particle size distribution (PSD) analysis, removed two monitoring sites.</li> <li>Groundwater – reduced the number of wells monitored from 20 to 15; analysis of dissolved metals only at all wells (including cessation of inorganic mercury analysis); ceased analysis of phenols at all wells.</li> <li>Mangroves – ceased monitoring at two sites (BPMC24 and CSMC04); ceased collection of a secondary sample of sediment adjacent to each mangrove quadrat; ceased collection of mud whelks for analysis; ceased PSD analysis of mangrove sediments.</li> </ul> <p>To assess compliance with the LDMP both an external audit conducted by a third-party (ERM on behalf of the NT EPA) and an internal audit were undertaken during the reporting period (refer to Table 3-2). In both audits, a non-conformance was recorded where specified commingled treated effluent (in-pipe) discharge limits had been exceeded during the reporting period. Note, in all cases discharge limit exceedances were investigated and corrective actions implemented at the time of the event, in accordance with the LDMP. All exceedances were minor in nature, and did not result in any environmental harm or impact. Appendix A provides a summary of these exceedances.</p> <p>There were no events during the reporting period, which resulted in a material non-compliance with the LDMP or a significant impact to matters of national environmental significance.</p> <p>No portable/mobile firefighting training activities (the subject of the LDMP Addendum) were undertaken during the reporting period.</p>
9.	<p>Noise Management Plan</p> <p>The person taking the action must submit for the Minister's approval a Noise Management Plan (or multiple plans) to avoid and mitigate the noise impacts on marine fauna associated with construction activities in Darwin Harbour or the Commonwealth marine area. The Noise Management Plan/s must be for the protection of listed species in Darwin Harbour or the Commonwealth marine area (whichever area the construction activities are to be undertaken) and must:</p> <ol style="list-style-type: none"> <li>identify all sources of noise that may adversely impact fauna in Darwin Harbour or the Commonwealth marine area;</li> </ol>	Construction phase	Not applicable	No construction activities requiring a noise management plan occurred during the reporting period.

Condition no.	Condition	Timing	Status	Evidence/Comments
	<ul style="list-style-type: none"> <li>b. describe any impacts associated with noise generated by pile driving and blasting;</li> <li>c. provide a schedule of expected pile driving and blasting activities;</li> <li>d. clearly articulate the objectives of the plan and set measurable targets to demonstrate achievement of these;</li> <li>e. outline measures to avoid impacts;</li> <li>f. where impacts are unavoidable describe why they are unavoidable and measures to minimise impacts;</li> <li>g. include a monitoring regime to determine achievement of objectives and success of measures used;</li> <li>h. provide for the involvement of an expert panel in the development of the plan and monitoring program required to detect and manage impacts;</li> <li>i. outline reporting and auditing arrangements; and</li> <li>j. describe how the plan will apply the principles of adaptive management.</li> </ul> <p>In addition, the person taking the action is not permitted to undertake any blasting unless it can be demonstrated that all prudent and feasible alternatives have been ruled out and the Minister has given specific permission to allow blasting. If permission is granted the person taking the action must not undertake blasting activities for more than 28 days in total, without written approval from the Minister, and must not undertake blasting before sunrise or after sunset on any of these days.</p> <p>The plan/s must be submitted at least three months prior to the commencement of any pile driving or blasting activities to which the plan applies. Pile driving or blasting activities may not commence until the plan is approved. The approved plan must be implemented.</p>			
10.	<p>Dredging and Spoil Disposal Management Plan</p> <p>The person taking the action must submit for the Minister's approval a Dredging and Spoil Disposal Management Plan (DSDMP) for the protection of inshore dolphins, marine turtles and Dugong occupying Darwin Harbour. The DSDMP must include, but is not limited to, the following:</p> <ul style="list-style-type: none"> <li>a. final methodologies for dredging including the method and timing of dredging activities;</li> <li>b. a schedule for dredging activities;</li> <li>c. a comparison of dredging methodologies proposed based on potential impacts on dolphins, turtles and Dugongs associated with individual methods, including noise and sediment plumes;</li> <li>d. justification of the dredging option/s chosen based on best practice at the time;</li> <li>e. mitigation measures, including measures for each type of dredge to avoid entrapment of marine turtles;</li> <li>f. methods to prevent, detect and respond to impacts on any number of marine turtles;</li> <li>g. measures that allow the alteration of dredging activities and/or implement mitigation methods in an adaptive management framework to ensure the protection of turtles, Dugongs and dolphins;</li> <li>h. the outcomes of hydrodynamic and sediment transport modelling required to predict impacts and finalise the design of the dredging campaign;</li> <li>i. contingencies to manage dredging if there is a significant departure from predicted impacts;</li> <li>j. an ecological monitoring program, which must exist either in full within the DSDMP, or as a standalone document (see Note 1 below) that is appropriately referenced in the DSDMP;</li> <li>k. the involvement of an expert panel in the development of the plan and monitoring program required to detect and manage impacts; and</li> <li>l. reporting and auditing arrangements.</li> </ul> <p>The DSDMP must be submitted at least three months prior to the commencement of dredging. Dredging for which the DSDMP has been prepared must not commence until the DSDMP is approved. The approved DSDMP must be implemented.</p>	Ongoing	Compliant	The approved Maintenance DSDMP is not yet activated, as there has been no requirement for a maintenance dredging campaign since the approval of the plan.



Condition no.	Condition	Timing	Status	Evidence/Comments
	Note 1: Regarding condition 10(j); if the person taking the action wishes to prepare the ecological monitoring program as a standalone document, then the ecological monitoring program must be approved in writing by the Minister. The approved ecological program must be implemented.			
11.	<p><b>Offsets</b></p> <p>The person taking the action must submit for the Minister's approval a Coastal Offset Strategy for the protection of listed threatened species and listed migratory species impacted by the proposal in Darwin Harbour. The Coastal Offset Strategy must include:</p> <p>a. High level details on the implementation of the following offsets outlined in the Northern Territory Government's letter to the Acting Secretary of the Department of Sustainability, Environment, Water, Population and Communities dated 23 May 2011, including a commitment and indicative schedule for the development of detailed sub-plans for each offset program</p> <ul style="list-style-type: none"> <li>• Publication of data collected for the Browse Basin and Kimberley coastline;</li> <li>• an integrated monitoring and research program for Darwin Harbour;</li> <li>• habitat mapping for Darwin Harbour Region (including Bynoe Harbour);</li> <li>• funding of Australian Research Council Linkage projects;</li> <li>• conservation management of dugongs, cetaceans and threatened marine matters of national environmental significance in the Top End; and</li> <li>• research on the conservation status, distribution and habitat use of coastal dolphins.</li> </ul> <p>b. Provision for the permanent protection of approximately 2000 ha of terrestrial vegetation and mangroves, or of an area as otherwise agreed by the Minister and provision for the management of the protected area(s) for the life of the project;</p> <p>Note 1: Permanent protection can include the acquisition and inclusion of an area in the conservation estate, covenanting arrangements on private land, other formal agreements with private landholders, or permanent changes to management regimes on Crown or Aboriginal land. Note 2: This condition does not limit the provision of these offsets in synergy with any conditions of any other approving party.</p> <p>c. Provision for the permanent protection of marine habitat for inshore dolphins, marine turtles and Dugong that is preferably, but not necessarily, adjacent to the protected mangrove vegetation and provision for the management of the protected area(s) for the life of the project.</p> <p>Note 1: Permanent protection can include the acquisition and inclusion of an area in the conservation estate, covenanting arrangements on private land, other formal agreements with private landholders, or permanent changes to management regimes on Crown or Aboriginal land. Note 2: This condition does not limit the provision of these offsets in synergy with any conditions of any other approving party</p> <p>The Coastal Offset Strategy must include commitments to timeframes and funding arrangements and be made available on the proponent's website. The strategy must be submitted for approval at least three months before construction activities commence in Darwin Harbour. No construction activities may commence in Darwin Harbour until the Coastal Offset Strategy is approved.</p>	Ongoing	Compliant	<p>Scientific reports, data and maps, which have been produced as result of execution of programs required under Condition 11, are available at <a href="https://www.inpex.com.au/projects/ichthys-lng/our-commitments/">https://www.inpex.com.au/projects/ichthys-lng/our-commitments/</a>.</p> <p><b>Condition 11a</b></p> <p>Condition 11a offset programs which have been completed and were reported on in previous Compliance Reports have been excluded from the current 2020/2021 Compliance Report. The following Condition 11a programs remain ongoing during the 2020/2021 reporting period:</p> <ul style="list-style-type: none"> <li>• Darwin Harbour integrated marine monitoring and research program</li> <li>• Conservation management of dugongs, cetaceans and threatened marine matters of national environmental significance in the Top End.</li> </ul> <p><u>Darwin Harbour integrated marine monitoring and research program</u></p> <p>During the reporting period a number of field activities and reports were completed, including:</p> <ul style="list-style-type: none"> <li>• Sediment Monitoring: <ul style="list-style-type: none"> <li>• Completion of benthic sampling survey in Middle Arm and West Arm between 13 July to 17 September 2020.</li> <li>• Completion of annual rod surface-elevation table sediment measurements in November 2020.</li> <li>• A final report that described the 2019/20 field campaigns to Outer Darwin Harbour and provides the data and metadata completed.</li> <li>• A field and data report that described the 2019/20 field campaigns to West Arm and Middle Arm and delivery of underpinning datasets.</li> <li>• Preparation of a draft report that evaluates the utility of the sampling designs to detect indicator concentrations that are above the background concentrations, and that maps normalised concentrations of these indicators.</li> </ul> </li> <li>• Pressure Monitoring: <ul style="list-style-type: none"> <li>• Pressure monitoring has commenced in accordance with the pressure monitoring plan.</li> <li>• Population density datasets have been purchased.</li> <li>• Pressure monitoring data analysis was undertaken to explore mechanisms for eventual web-based dissemination through Microsoft Power BI.</li> <li>• Development of a draft pressure monitoring report.</li> </ul> </li> <li>• Mangrove Monitoring: <ul style="list-style-type: none"> <li>• Completion of a Long-term Mangrove Monitoring Plan for Darwin Harbour</li> <li>• Satellite analysis complete, looking at mangrove extent mapping and change analysis.</li> <li>• Completion of photovoltaic time series, field methodology and field data collection.</li> </ul> </li> <li>• Darwin Harbour Integrated Monitoring and Research Coordination Committee:</li> </ul>

Condition no.	Condition	Timing	Status	Evidence/Comments
				<ul style="list-style-type: none"> <li>Department Environment, Parks and Water Security organised/chaired meetings with stakeholders (including INPEX) to foster collaboration, and report to Darwin Harbour Advisory Committee. An overview of the committee is available at &lt;<a href="https://depws.nt.gov.au/water/water-management/darwin-harbour/darwin-harbour-integrated-marine-monitoring-and-research-program">https://depws.nt.gov.au/water/water-management/darwin-harbour/darwin-harbour-integrated-marine-monitoring-and-research-program</a>&gt;.</li> <li>Contribution towards the development of an integrated report card for Darwin Harbour. More detail on the integrated report card can be found at &lt;<a href="https://nt.gov.au/_data/assets/pdf_file/0010/689023/vision-report-card-darwin-harbour-prospectus.pdf">https://nt.gov.au/_data/assets/pdf_file/0010/689023/vision-report-card-darwin-harbour-prospectus.pdf</a>&gt;.</li> </ul> <p>Conservation management of marine megafauna in the western Top End The offsets program has been integrated into the NTG Aboriginal Ranger Grants Program. The first calls for funding under the NTG Aboriginal Ranger Grants Program commenced in late-July 2021 and will run until 10 September 2021. The Aboriginal Ranger Grants Guideline includes specific criteria pertaining to Condition 11a, this can be found at &lt;<a href="https://depws.nt.gov.au/_data/assets/pdf_file/0003/1027578/aboriginal-ranger-grants-program-guidelines-2021-2022.pdf">https://depws.nt.gov.au/_data/assets/pdf_file/0003/1027578/aboriginal-ranger-grants-program-guidelines-2021-2022.pdf</a>&gt;</p> <p>An overview of the projects funded through this Project will be reported on in the next annual reporting period.</p> <p><b>Condition 11b and 11c</b></p> <p>During the reporting period, Steps 2 to 4 were completed in accordance with Section 4.3 and 4.5 (Table 4-1) of the approved COS. Specifically:</p> <ul style="list-style-type: none"> <li><i>Step 2: Determine mechanisms for protection</i> - The option most likely to succeed for meeting the requirements of Conditions 11b and 11c was completed on 7 September 2020.</li> <li><i>Step 3: Develop regional screening criteria and Step 4: Screen NT for suitable land and marine areas</i> - The land areas for further progression were identified on 7 September 2021. This identification led into a select expression of interest process, which concluded on 2 August 2021.</li> </ul> <p>Outside of the reporting period, a Letter of Intent was executed between INPEX and an Aboriginal Corporation on 19 August 2021. The Letter of Intent completes <i>Step 5: Engage with Relevant Land Owners</i> in the approved COS. Additionally, a project Execution Plan was finalised on 13 September 2021, closing out <i>Step 6: Develop Execution Plan</i> in the approved COS.</p> <p>Project information related to this offset condition is available at &lt;<a href="https://www.inpex.com.au/projects/ichthys-lng/our-commitments/">https://www.inpex.com.au/projects/ichthys-lng/our-commitments/</a>&gt;.</p>

## 4 REFERENCES

Department of the Environment. 2014. *Annual Compliance Report Guidelines*. Commonwealth of Australia, Canberra, ACT.

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Greencap. 2016. *Environmental Impact Monitoring Program*. Report prepared for JKC Australia LNG Pty Ltd by Greencap Ltd, Winnellie, NT.

Padovan, A.V. 2003. *Darwin Harbour water and sediment quality*. Marine and Estuarine Environments of Darwin Harbour. Proceeding of the Darwin Harbour Public Presentations, February 2003.

## **APPENDIX A: SUMMARY OF OPERATIONS MONITORING PROGRAM RESULTS**

### **A.1 Commingled treated effluent (in-pipe) monitoring**

Commingled treated effluent (in-pipe) sampling was undertaken on a monthly basis throughout the reporting period. Where an exceedance was detected additional sampling was undertaken where this was determined to be required. In addition to routine monthly sampling, ad hoc sampling was undertaken as part of the onsite laboratory National Association of Testing Authorities (NATA) Australia accreditation Quality Assurance and Quality Control (QA/QC) processes.

The results for in-pipe monitoring at sample location 750-SC-003 for the reporting period are presented in Table A-1. Results that exceeded discharge limits are shown in bold text.

During the reporting period, there were four occurrences where wastewater quality was above discharge limits, which are further discussed in Section A.1.1.

Overall, there was generally little variability of the wastewater quality, with the majority of results below discharge limits described in the LDMP. This demonstrates the wastewater treatment systems were operating effectively.

#### **A.1.1 Limit exceedance assessment outcomes**

Throughout the reporting period there were four discharge limit exceedances. A summary table of all discharge limit exceedances including corrective actions is provided in Table A-2.

**Table A-1: Monthly sampling results for 750-SC-003 (bolded values indicate an exceedance)**

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	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	µg N/L	µg P/L	µg P/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	cfu/100m L	cfu/100m L	cfu/100m L	mg/L	mg/L	mg/L	mg/L	
Discharge limit			6 to 9	n/a	35	n/a	n/a	6	n/a	n/a	10	20	125	2	n/a	10000	2000	n/a	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
14-Jul-20	6:55 AM	L2003397001	7.9	266	24.4	1.0	80	<1	<20	<100	<5	<2	12	<0.02	<2000	<2000	<500	<500	<0.1	<1	7	<1	<0.1	4	<1	204	<1	<1	<1	<0.1	<5	<5	<5	
11-Aug-20	7:57 AM	L2003900001	8.3	311	27.3	1.0	84	<1	<20	<100	<5	2	8	<0.02	<2000	2000	<500	<500	<0.1	<1	4	<1	<0.1	4	<1	148	13	<b>3800</b>	<b>5700</b>	<0.1	<5	<5	<5	
20-Aug-20	8:28 AM	L2004299001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	-	-	-	-		
01-Sep-20	7:10 AM	L2004299001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	6	-	-	-	-		
07-Sep-20	8:10 AM	L2004410001	7.8	277	29.6	1.0	82	<1	<20	<100	<5	5	12	0.02	<2000	3000	<500	<500	<0.1	<1	3	<1	<0.1	<1	<1	73	85	10	10	<0.1	<5	<5	<5	
15-Sep-20	7:46 AM	L2004523001	-	-	-	-	<1	-	-	-	<5	-	12	<0.02	7000	7000	<500	<500	-	-	-	-	-	-	-	-	-	-	-	<5	<5	<5		
13-Oct-20	10:20 AM	L2005058001	8.1	404	32.7	0.5	90	<1	<20	<100	<5	2	-	<0.02	5000	6000	<500	<500	<0.1	<1	5	<1	<0.1	<1	<1	28	<1	<1	<1	0.3	<5	<5	<5	
10-Nov-20	09:02 AM	L2005539001	8.1	310	32.5	2.0	83	<1	<20	<100	<5	13	17	0.02	4000	5000	<500	<500	<0.1	<1	4	<1	<0.1	<1	<1	116	<1	1	1	<0.1	<5	<5	<5	
08-Dec-20	08:00 AM	L2006055001	7.9	257	31.0	1.0	83	<1	<20	<100	<5	2	12	<0.02	<2000	3000	<500	<500	<0.1	<1	2	<1	<0.1	2	<1	368	11	5	5	<0.1	<5	<5	<5	
19-Jan-21	09:20 AM	L2100186001	7.9	286	27.9	5.0	87	<1	<20	<100	<5	<2	11	<0.02	<2000	9000	<500	<500	<0.1	<1	2	<1	<0.1	1	<1	140	3	<1	<1	<0.1	<5	<5	<5	
9-Feb-21	09:13 AM	L2100662001	8.1	257	27.8	1.0	94	<1	<20	<100	<5	<2	7	0.025	<2000	<2000	<500	<500	<0.1	<1	1	<1	<0.1	<1	<1	122	3	2	2	<0.1	<5	<5	<5	
9-Mar-21	09:25 AM	L2101075001	7.8	301	30.0	1.0	92	<1	<20	<100	<5	<2	13	<0.02	<2000	2000	<500	<500	<0.1	<1	<1	<1	<0.1	<1	<1	116	17	<1	<1	<0.1	<5	<5	<5	
13-Apr-21	08:15 AM	L2101588001	8.0	590	31.3	0.5	78	<1	<20	<100	<5	<2	11	<0.02	3000	5000	<500	<500	<0.1	<1	2	<1	<0.1	<1	<1	52	1	2	2	<0.1	<5	<5	<5	
22-Apr-21	11:54 AM	L2101743001	-	-	-	-	-	-	-	-	-	-	-	-	2000	3000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
25-Apr-21	12:07 PM	L2101776001	-	-	-	-	-	-	-	-	-	-	-	-	2000	6000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
28-Apr-21	08:05 AM	L2101861001	-	-	-	-	-	-	-	-	-	-	-	-	<2000	3000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
30-Apr-21	08:15 AM	L2101884001	-	-	-	-	-	-	-	-	-	-	-	-	<2000	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
05-May-21	10:58 AM	L2101949001	-	-	-	-	-	-	-	-	-	-	-	-	2000	3000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
08-May-21	08:23 AM	L2101974001	-	-	-	-	-	-	-	-	-	-	-	-	<2000	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
11-May-21	09:45 AM	L2102049001	8.4	307	32.7	1.0	99	<1	<20	<100	<5	<2	15	<0.02	4000	4000	<500	<500	<0.1	<1	2	<1	<0.1	1	<1	302	190	2	2	<0.1	<5	<5	<5	
08-Jun-21	08:35 AM	L2102440001	8.2	366	28.6	1.0	97	<1	<20	<100	<5	<b>23</b>	21	<0.02	<2000	4000	1400	1400	<0.1	<1	5	<1	<0.1	<1	<1	62	1	<1	<1	<0.1	<5	<5	<5	
17-Jun-21	01:00 PM	L2102581001	7.9	637	32.0	3.0	96	<1	<20	<100	<5	<2	11	-	3000	1000	2000	2000	<0.1	<1	9	<1	<0.1	2	<1	54	13	<1	<1	<0.1	<5	<5	<5	
17-Jun-21	01:00 PM	L2102582001	7.9	655	32.8	2.0	95	<1	<20	<100	<5	<2	12	-	<2000	1000	2000	2100	<0.1	<1	8	<1	<0.1	1	<1	53	3	<1	<1	<0.1	<5	<5	<5	
17-Jun-21	01:15 PM	L2102583001	-	-	-	-	<1	-	-	-	-	-	-	-	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
17-Jun-21	01:00 PM	L2102603001	7.8	-	32.7	-	95	<1	-	-	-	<2	11	-	-	<b>11000</b>	2000	2400	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

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	Faecal coliforms	Anionic surfactants	aMDEA	Glycol (MEG)	Glycol (TEG)
21-Jun-21	09:10 AM	L2102622001	7.5	-	26.5	-	84	-	-	-	-	-	< 3	-	-	3000	<500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
06-Jul-21	09:05 AM	L2102932001	-	-	-	-	-	-	-	-	-	-	-	-	-	4000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20-Jul-21	07:45 AM	L2103198001	9.0	670	27.2	1.0	91	<1	<20	<100	<5	<2	12	<0.02	19000	19000	<500	<500	<0.1	<1	6	<1	<0.1	<1	<1	40	<1	<1	<1	<0.1	<5	<5	<5
20-Jul	14:47 PM	L2103219001	-	-	-	-	-	-	-	-	-	-	-	-	43000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23-Jul-21	09:50 AM	L2103273001	8.1	-	-	-	-	-	-	-	-	-	-	-	<2000	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25-Jul-21	09:40 AM	L2103306001	8.1	-	-	-	-	-	-	-	-	-	-	-	<2000	<2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Issued for Use

**Table A-2: Summary of commingled treated effluent sample point exceedance results**

Date sampled	Parameter	Result	Limit	Cause and/or contributing factors	Corrective actions
11 August 2020	<i>Escherichia coli</i>	3,800 cfu/100 mL	100 cfu/100 mL	Through follow up sampling at various locations in the wastewater treatment systems, the original sample result was unable to be replicated to confirm the presence of <i>E. coli</i> and Faecal Coliforms and identify a potential source in the wastewater streams at the site.	INPEX was unable to replicate the original sample results, taken on 11 August and identify a source of contamination. As a precaution the following occurred between 21 and 28 August 2020:
	Faecal Coliforms	5,700 cfu/100 mL	400 cfu/100 mL	Following the initial exceedance being reported on 20 August 2020, sampling occurred at the sewage treatment plant (post treatment and chlorine and ultra-violet disinfection, sampling locations 750-SC-004 and 750-SC-009) and at the jetty outfall discharge line (sample location 750-SC-003). All results from sampling conducted on 20 August 2020, reported <i>E. coli</i> and Faecal Coliforms at <1 cfu/100mL. Further sampling conducted on 1 September 2020 at location 750-SC-003 reported <i>E. coli</i> and Faecal Coliforms at <1 cfu/100mL and 6 cfu/100mL.  There is potential that cross contamination may have occurred in the sampling and laboratory analysis program. The sample was collected by an INPEX Qualified Sampler, following a detailed sampling procedure and the analysis was conducted by an external NATA accredited laboratory. The investigation was unable to confirm that cross-contamination of the sample occurred. The external laboratory conducted a duplicate test of the original sample, collected on 11 August 2020, which reported similar levels to that of the original sample.	<ul style="list-style-type: none"> <li>manual chlorine dosing of the accidentally oil contaminated (AOC) treatment system and holding basins, and increased chlorine dosing in the sewage treatment plant;</li> <li>cleaning of the ultraviolet disinfection system, located in the sewage treatment plant;</li> <li>installation of floating chlorine dispensers in the AOC treatment system; and</li> <li>treated sewage and AOC wastewaters were held up from discharging to the jetty outfall between the period 19 to 28 August 2020, which allowed for chlorine dosing in the AOC holding basin.</li> </ul>
8 June 2021 & 17 June 2021	Biological Oxygen Demand (BOD)	23 mg/L	20 mg/L	Periodic monthly sampling occurred at location 750-SC-003 on 8 June 2021, this identified a BOD exceedance event, which was reported on 17 June 2021. Additional sampling was undertaken on 17 June 2021, to investigate the initial exceedance, which identified an exceedance of TN. Due to the follow up sampling detecting an additional analyte exceedance, the two exceedances were combined into one investigation.	INPEX identified that the main source of the elevated BOD and TN was from the sewage system operating in an upset condition, and the following actions occurred:
	Total Nitrogen (TN)	11 mg/L	10 mg/L	During the sampling events on 8 and 17 June 2021, only two of the four wastewater streams were flowing into the combine jetty discharge outfall line, being the demineralised reject brine and treated sewage.  Sampling undertaken on 17 June 2021 upstream of location 750-SC-003, of the individual stream of treated sewage (sample location 750-SC-009), as part of the BOD exceedance investigation, identified that the sewage treatment plant was in an upset condition associated with changed conditions for the additional manning levels at the site associated with the shutdown. The BOD levels at the sewage treatment plant were <2 mg/L; however, the TN values reported were 9 mg/L.  Sampling conducted on 21 June 2021 at sampling location 750-SC-003 with just the demineralisation plant reject brine flowing and no other streams, reported TN and chemical oxygen demand (COD) levels of 3 mg/L and <3 mg/L, respectively. These results demonstrate that the source of the exceedances was not from the demineralisation plant.  Prior to the shutdown the mixed liquor suspended solid (MLSS) mass (as part of the activated sludge process in the sewage treatment plant) was significantly increased to deal with the predicted escalation in sewage waste at the site, due to the manning levels increasing from 500 to ~1500 people.  In addition, as part of the shutdown a number of standalone ablution blocks were mobilised to the site and located adjacent to work areas, with the wastewater from the ablution blocks being taken offsite for disposal by a licenced contractor, as the chemicals required in the tanks to prevent odour issues meant the sewage was unable to be treated onsite at the permanent sewage plant.  Due to the use of the standalone ablution blocks by the shutdown workforce, the predicted increase in wastewater volume to be treated at the permanent sewage plant did not eventuate, and the increase in MLSS mass resulted in upset conditions in the process of the sewage treatment plant.	<ul style="list-style-type: none"> <li>Diversion of the treated sewage to the AOC holding basin chambers, and then batch discharging from the holding basin, to allow for mixing and reduction of the TN concentration to below discharge limits. This was undertaken from 17 to 27 June 2021, after which the sewage plant returned to stable operations.</li> <li>Reduction in the MLSS biomass, to match the influent flow rates.</li> <li>Manual sugar dosing was undertaken to reduce the TN levels until stable operations in the sewage treatment plant were achieved, following the reduction in MLSS, coupled with maintenance on the sugar dosing pumps.</li> <li>The BOD concentration was reported below EPL228 limit, for sampling conducted 17 June 2021 at location 750-SC-003, while sampling of the treated sewage at location 750-SC-009 on 23 June 2021 reported the TN at 4 mg/L.</li> </ul> <p>Through the incident investigation the following action was identified to prevent reoccurrence:</p> <ul style="list-style-type: none"> <li>Prior to a significant manning level rise at the site, the MLSS levels will not be pre-emptively increased at the sewage plant. The MLSS levels and overall sewage system is to be managed based on the inflows coming into the plant.</li> </ul>

Date sampled	Parameter	Result	Limit	Cause and/or contributing factors	Corrective actions
				<p>By increasing the MLSS to a larger volume and having the same wastewater inflows to the sewage treatment plant for standard manning levels (~500 people), the biomass was unable to function effectively and consume appropriately the organic pollutants in the input wastewater stream. Essentially the food to microorganism ratio was placed out of balance and the activated sludge process was not effectively removing (and treating) BOD and TN. This is the considered the main cause of both the BOD and TN exceedance.</p> <p>At the time of sampling on 17 June 2021, the MLSS mass was proactively being reduced (by wasting to biosolid removal) in the sewage treatment plant to ensure the correct volume was re-established to match the input wastewater volumes. The results of the investigation sampling conducted on 17 June 2021 at location 750-SC-003 reported a BOD concentration of &lt;2 mg/L, which indicated that MLSS reduction was effectively removing the BOD at that time; however, the nutrient levels were still elevated due to the plant still being in an upset condition.</p> <p>In addition, through the daily inspection rounds, on 19 June 2021 the sugar dosing pump was identified not to be working properly and a work request was raised to undertake maintenance. The pump was replaced on 20 June 2021. During the period the pump was offline, manual sugar dosing was undertaken (noting that sugar dosing continued for several days after the pump was replaced to ensure the MLSS biomass was in a healthy condition). The sugar dosing system may have potentially been faulty for 24 hours prior to being identified as faulty (18 to 19 June 2021), and this may have contributed to an increase of TN at this time.</p>	
20 July 2021	TN	19 mg/L	10 mg/L	<p>During the sampling events on 20 July 2021, only three of the four wastewater streams were flowing into the combined jetty discharge outfall line, being treated steam blowdown, demineralised reject brine and treated sewage.</p> <p>Previous routine sampling undertaken on 19 July 2021 upstream at the treated sewage (sample location 750-SC-009), reported that the sewage treatment plant was working effectively with nitrate results of 1.3 mg/L and it was not the source of the elevated TN. Further sampling on 23 Jul 2021 confirmed the sewage plant was operating in a stable condition.</p> <p>The investigation considered whether the elevated TN was originating from the steam plant within the combined cycle power plant (CCPP), due to the TN comprising mostly of ammonia. A low flow sampling event at location 750-SC-003 (with only the treated steam blowdown and demineralised reject brine) was undertaken, and sampling upstream in the steam plant of the CCPP confirmed the off-specification waste water was originating from the steam plant.</p> <p>It was subsequently identified in the early evening of 20 July 2021, that the ammonia dosing pump (which injects ammonia into the steam header) was faulty and overdosing ammonia into the steam system, with the pump still operational with a zero percentage stroke rate (at a zero percent stroke rate no dosing should be occurring). The pump was taken offline for repair, and dosing was switched across to an alternative pump.</p>	<p>Through the incident investigation the following action were identified to prevent reoccurrence:</p> <ul style="list-style-type: none"> <li>• The faulty ammonia dosing pump is to be repaired and recalibrated.</li> <li>• The reliability of the ammonia dosing pumps will be reviewed.</li> </ul>



## A.2 Jetty outfall monitoring

Quarterly jetty outfall monitoring was completed during the reporting period as follows:

- compliance survey 6 - 12 October 2020
- compliance survey 7 - 20 January 2021
- compliance survey 8 - 7 April 2021.

Impact and reference site results for the three surveys are summarised in Table A-3. Generally, results for all parameters in all three surveys show little variability between impact and reference sites, indicating the discharged commingled treated effluent had no discernible influence on samples collected at these locations. As such, it can be inferred that Ichthys LNG jetty outfall discharges have not adversely affected the declared beneficial uses or water quality objectives for Darwin Harbour.

**Table A-3: Median impact (Imp) and reference (Ref) site sample results for jetty outfall compliance surveys 6, 7 and 8**

Parameter	Unit	Compliance Survey 6		Compliance Survey 7		Compliance Survey 8	
		Imp	Ref	Imp	Ref	Imp	Ref
pH	pH units	8.04	8	7.99	8.00	7.1	7.86
Electrical conductivity (EC)	µS/cm	54.39	54.44	55.13	55.39	52.74	52.83
Temperature	°C	31.18	31.23	30.63	30.65	30.28	30.23
Turbidity	NTU	0.9	1.05	1.9	1.85	1.1	1.8
Dissolved Oxygen (DO)	%	114*	116*	96.9	95.8	99	99
Free chlorine	mg/L	0.01 (<0.02)	0.02 (<0.02)	<0.02	<0.02	<0.02	<0.02
Visual clarity and colour	n/a	No change	No change	No change	No change	No change	No change
Surface films	n/a	No	No	No	No	No	No
Silver	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Copper	µg/L	0.5	0.5	0.7	0.55	0.4	0.35
Mercury	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	µg/L	0.4	0.4	<0.3	<0.3	<0.3	<0.3
Lead	µg/L	<0.1	0.25	<0.1	<0.1	<0.1	<0.1
Zinc	µg/L	1	2	2	1	2	<1
Ammonia	µg N/L	<3	<3	7	6.5	<3	<3.5
Filterable reactive phosphorous (FRP)	µg P/L	4	3.5	6	5.5	4	4

Parameter	Unit	Compliance Survey 6		Compliance Survey 7		Compliance Survey 8	
		Imp	Ref	Imp	Ref	Imp	Ref
Total phosphorous	µg P/L	16	15	18	17.5	16	15.5
Total nitrogen	µg N/L	120	120	140	130	130	120
Total suspended solids (TSS)	mg/L	1	<1	3	2.5	2	3.5
Total petroleum hydrocarbons (TPH) as oil and grease	n/a	None	None	None	None	None	None
	mg/L	<5	<5	<5	<5	<5	<5
TPH (C6 - C36)	µg/L	<50	<50	<50	<50	<50	<50
Enterococci	MPN/100 mL	<10	<10	<10	<10	<10	<10

\*Indicates an exceedance of the reference site and trigger value.

Values in brackets have been analysed by INPEX at the Ichthys on-site laboratory

### A.2.1 Trigger assessment outcomes

There were no trigger exceedances for metals, nutrients, TSS, hydrocarbons or enterococci during the reporting period. Exceedances were noted at all three impact sites during Compliance Survey 6 for DO. As reference site Jetty West also exceeded the trigger value, the exceedance was determined not to be a true exceedance / related to liquid discharges from the jetty outfall. Therefore, a trigger investigation was not required.

During Compliance Survey 7 an exceedance occurred for turbidity whereby a reference site value (Jetty East; 1.6 NTU) was lower than the median value of the impact sites (1.9 NTU). However, the individual impact site values did not exceed the values for NTU at the upstream reference site (2.1 NTU). No further investigation was subsequently undertaken and this was not considered to be a true exceedance of turbidity. There were no other physico-chemical exceedances.

### A.3 Harbour sediment quality monitoring

An annual harbour sediment quality monitoring survey was completed in May 2021.

Metal and metalloid results for harbour sediment quality are presented in Table A-4. There was one exceedance for the reporting period at an impact site (I14), arsenic at 27 mg/kg (see Section A.3.1). All impact and control locations were below the laboratory limit of reporting (LOR) for benzene, toluene, ethylbenzene and xylene (BTEX) (Table A-5). Most sampling locations had at least one result above the LOR for TPH within the petroleum hydrocarbon fraction range of C15 – C36 (excluded I11, I16 and C1). However, none of the results exceeded the guideline value of (280 mg/kg). The presence of TPH in the majority of samples likely indicates the presence of non-petrogenic hydrocarbons of biological origin (e.g. vegetable/animal oils and greases, humic and fatty acids). Non-petrogenic hydrocarbons of biological origin are known to occur in Darwin Harbour with mangrove sediment samples analysed during the construction and operational phases returning positive results for TPH. Samples were reanalysed following silica gel clean-up, with the majority of samples subsequently returning a result below LOR, indicating the presence of non-petrogenic hydrocarbons.

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 A-4: Harbour sediment quality survey metal and metalloid results**

Site <sup>†</sup>	Aluminium	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	Mercury
Guideline values	n/a	2	20	1.5	80	65	50	21	200	0.15
Background level	n/a	n/a	16.0	0.071	17.5	4.7	8.8	8.7	21.4	n/a
I1	15000	<2	14	0.2	30	8.3	10	10	26	0.01
I2-a	15000	<2	14	0.1	32	8.3	11	10	28	0.01
I2-b	14000	<2	15	0.2	34	8.8	12	11	30	0.01
I2-c	14000	<2	14	0.1	33	8.6	12	11	29	0.02
I3	9580	-	10.6	-	25.8	5.6	8.2	7.8	23.4	0.0
I4	13000	<2	12	<0.1	29	8	9	10	26	0.01
I5-1	15000	<2	15	<0.1	31	9.4	11	10	30	0.01
I5-2	14000	<2	15	0.2	30	8.4	10	10	27	0.01
I5-3	14000	<2	14	0.1	30	8.5	10	11	27	0.01
I6	18000	<2	14	0.1	34	8.9	11	12	30	0.01
I7	17000	<2	13	0.2	35	11	11	13	32	0.01
I8	15000	<2	14	0.2	33	9.4	11	12	30	0.01
I9	13000	<2	14	0.1	30	8	11	10	26	0.01
I10-1	15000	<2	15	0.2	32	8.3	10	11	28	0.01
I10-2	16000	<2	17	<0.1	34	8.4	11	11	29	0.01
I10-3	17000	<2	17	<0.1	35	8.8	12	12	30	0.01
I11	15000	<2	16	<0.1	32	8.5	11	11	28	0.01
I12	16000	<2	16	0.1	34	8.5	11	11	29	0.01
I13	16000	<2	17	<0.1	34	8.4	11	11	29	0.01
I14	13000	<2	27*	0.1	59	7	12	8.8	22	0.01
I15	14000	<2	16	<0.1	30	7.6	10	11	26	0.01
I16	3300	<2	17	<0.1	10	1.9	4	2.9	7.3	<0.01
C1	5600	<2	19	<0.1	19	4	6	4.80	12	<0.01
C2	13000	<2	17	<0.1	30	7.8	10	9.2	27	<0.01

†C = Control Site, I = Impact Site

\*Indicates trigger exceedance

**Table A-5: Harbour sediment quality survey organic results**

Site <sup>†</sup>	TOC (%)	TPH (mg/kg)	BTEX (mg/kg)
Guideline values	n/a	280	n/a
Background level	n/a	n/a	n/a
I1	1.3	58	<0.2
I2-a	1.34	38	<0.2
I2-b	1.25	30	<0.2
I2-c	1.5	<250	<0.2
I3	0.9	18	<0.2
I4	0.76	10	<0.2
I5-1	1.02	48	<0.2
I5-2	1	22	<0.2
I5-3	0.93	28	<0.2
I6	1.09	23	<0.2
I7	1.06	16	<0.2
I8	0.89	15	<0.2
I9	0.97	10	<0.2
I10-1	1.04	11	<0.2
I10-2	1.23	51	<0.2
I10-3	1.23	64	<0.2
I11	0.93	<3	<0.2
I12	1.07	29	<0.2
I13	1.4	80	<0.2
I14	0.6	5	<0.2
I15	1.33	17	<0.2
I16	0.33	<3	<0.2
C1	0.92	<3	<0.2
C2	0.95	6	<0.2

† C = Control Site, I = Impact Site

### A.3.1 Trigger assessment outcomes

There was one exceedance for the reporting period at an impact site (I14), arsenic at 27 mg/kg. High levels of arsenic are known to naturally occur in Darwin Harbour and are considered a reflection of local geology rather than anthropogenic activities (Padovan 2003). Additionally, arsenic is not considered to be a contaminant of concern from the Jetty Outfall. No further investigation was undertaken.

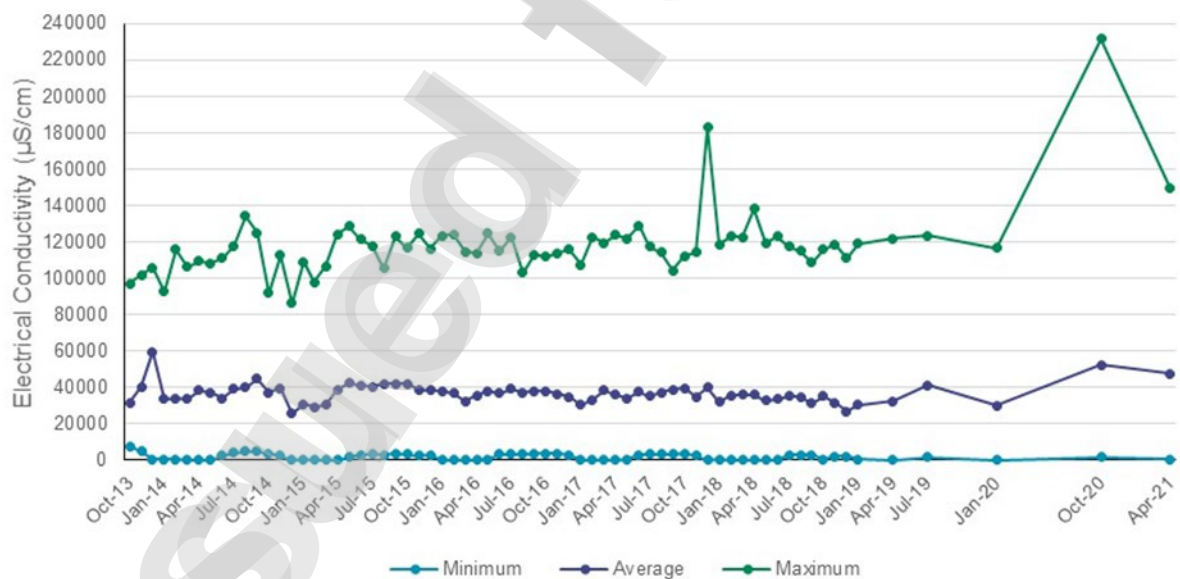
## A.4 Groundwater monitoring

Two groundwater surveys were completed in the reporting period, in October and November 2020 and April 2021. A high level summary of groundwater results and trends is provided below. Note that the presentation of groundwater data trends includes data collected during the construction phase.

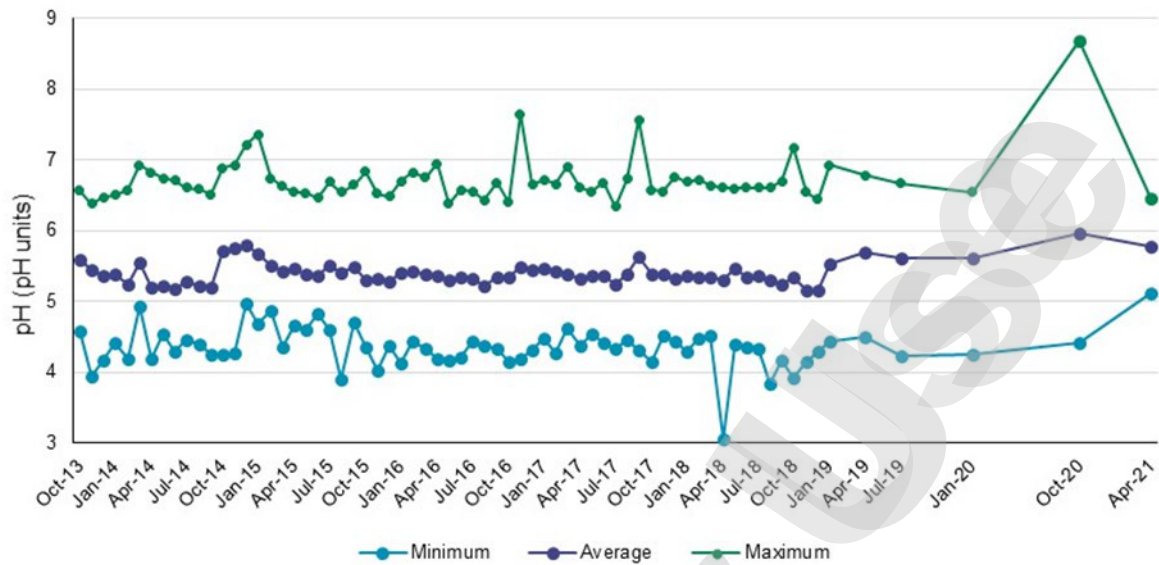
### A.4.1 Physio-chemical

Physio-chemical monitoring results measured during the reporting period are consistent with those from the construction period and the 2019/2020 reporting period. Ichthys LNG is located on low-lying peninsula connected to the mainland by a small isthmus. Most of the groundwater wells are located around the perimeter of Ichthys LNG and are saline with average electrical conductivity of 30,000 to 40,000  $\mu\text{S}/\text{cm}$  (Figure A-1). Groundwater is also acidic to neutral with average pH typically between 5.2 and 5.8 (Figure A-2).

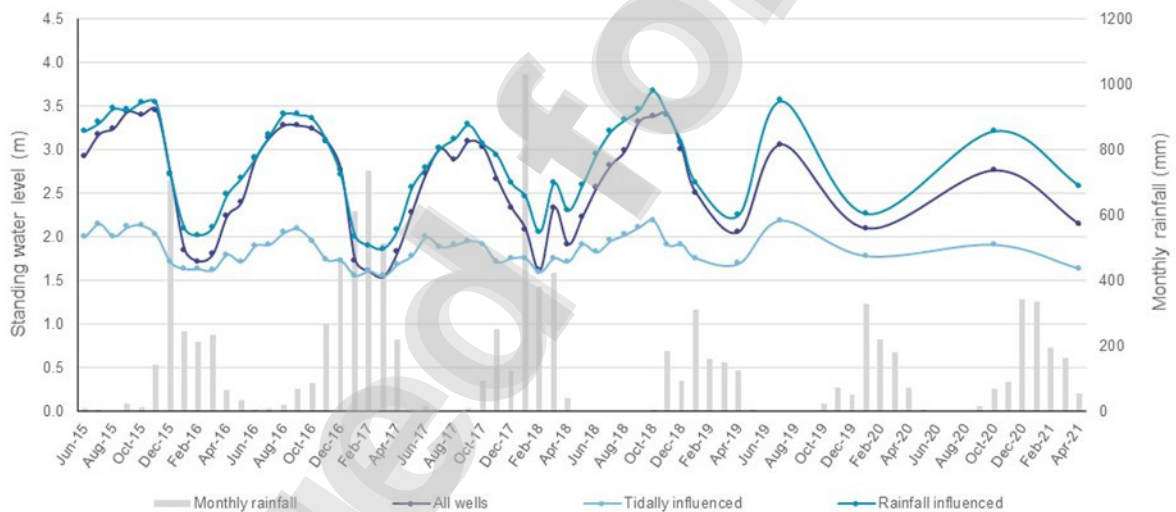
Similar to previous surveys, groundwater elevation was higher (e.g. water table was shallower) following the wet season and decreased during the dry season (Figure A-3). The standing water level (SWL) of groundwater at Ichthys LNG is influenced by rainfall recharge, although some bores are located slightly below the highest astronomical tide line and are tidally influenced. As such, these wells have less variability in their SWL. Note, the reduced SWL in the reporting period is likely to be associated with low rainfall over the 2018/2019, 2019/2020 and 2020/2021 wet seasons. An assessment of groundwater fluctuations during the construction phase of Ichthys LNG (2013 to 2019) concluded that construction of Ichthys LNG had not adversely impacted groundwater levels (Greencap 2019).



**Figure A-1: Mean, minimum and maximum electrical conductivity for Ichthys LNG groundwater wells**



**Figure A-2: Mean, minimum and maximum pH for Ichthys LNG groundwater wells**



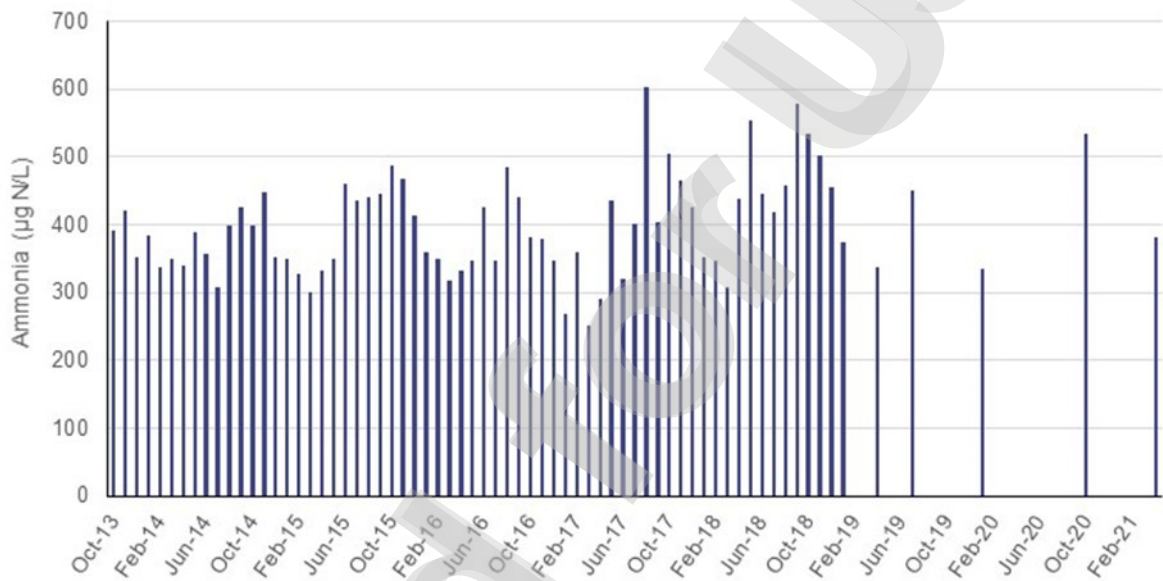
**Figure A-3: Mean SWL for Ichthys LNG groundwater wells**

**A.4.2 Nutrients**

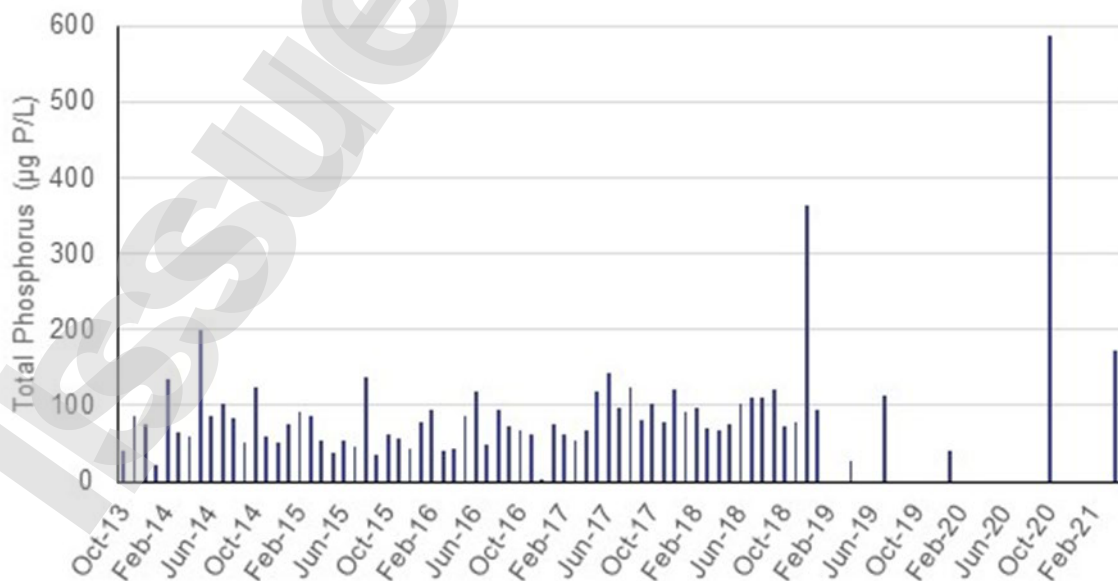
Nutrient monitoring results measured during the reporting period were generally consistent with those reported during the construction period and the 2019/2020 reporting period. Nutrient concentrations are known to vary inter-annually and seasonally (Figure A-4 and Figure A-5). Nutrients can also be highly variable between groundwater wells (as an example refer to Figure A-6).

During the reporting period, and similar to 2019/2020 reporting period, ammonia was the nutrient that had the greatest number of trigger exceedances (nine in Survey 6; Oct/Nov 2020 and six in Survey 7; April 2021). Ammonia also demonstrated a strong seasonal trend, with concentrations increasing during the dry season and decreasing in the wet season (Figure A-4). Inter-annual variability is likely to be associated with natural factors such as rainfall; both the total rainfall and timing of rain (e.g. early in the season or late in the season). The 2020/2021 wet season rainfall was below average and one of the driest wet seasons since construction of Ichthys LNG began. The dry 2020/2021 wet season has likely contributed the concentrations and subsequently the number of ammonia exceedances recorded during the reporting period.

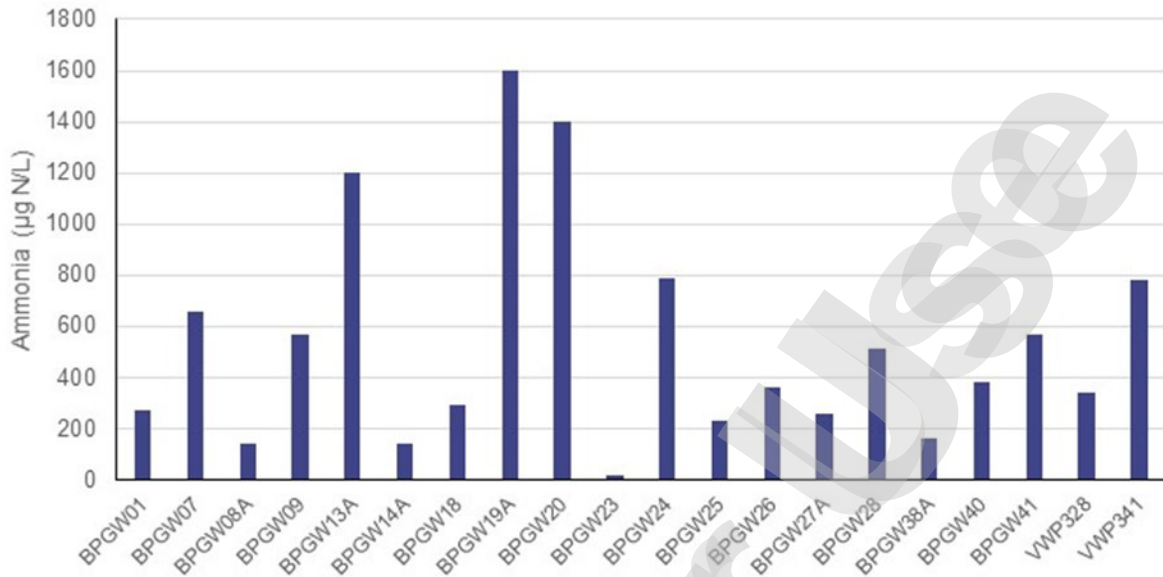
Overall, the variations in nutrient concentrations measured are considered to be the result of natural variations and not attributable to Ichthys LNG activities.



**Figure A-4: Mean ammonia concentrations for all groundwater wells**



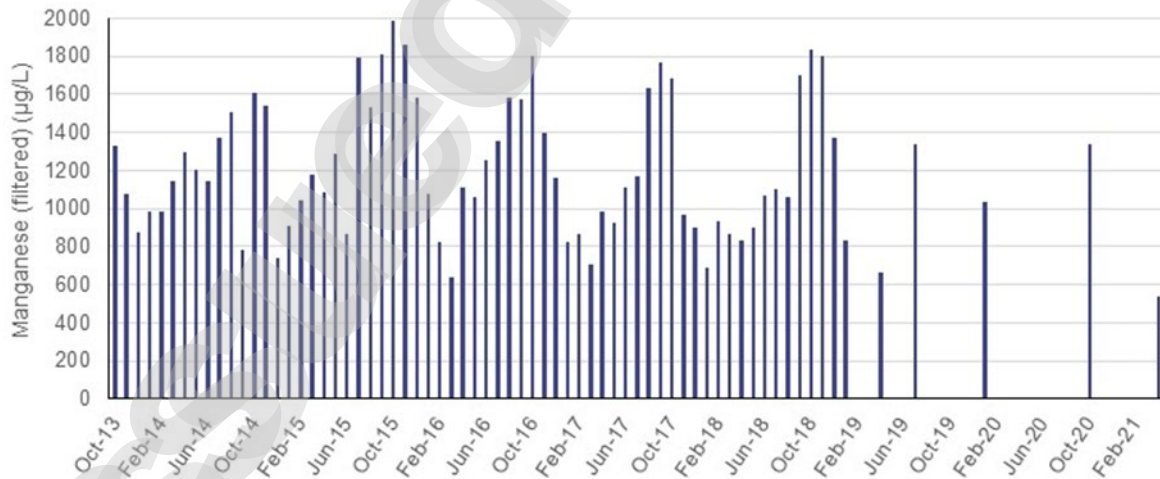
**Figure A-5: Mean total phosphorus concentrations for all groundwater wells**



**Figure A-6: Groundwater survey 6 ammonia concentrations**

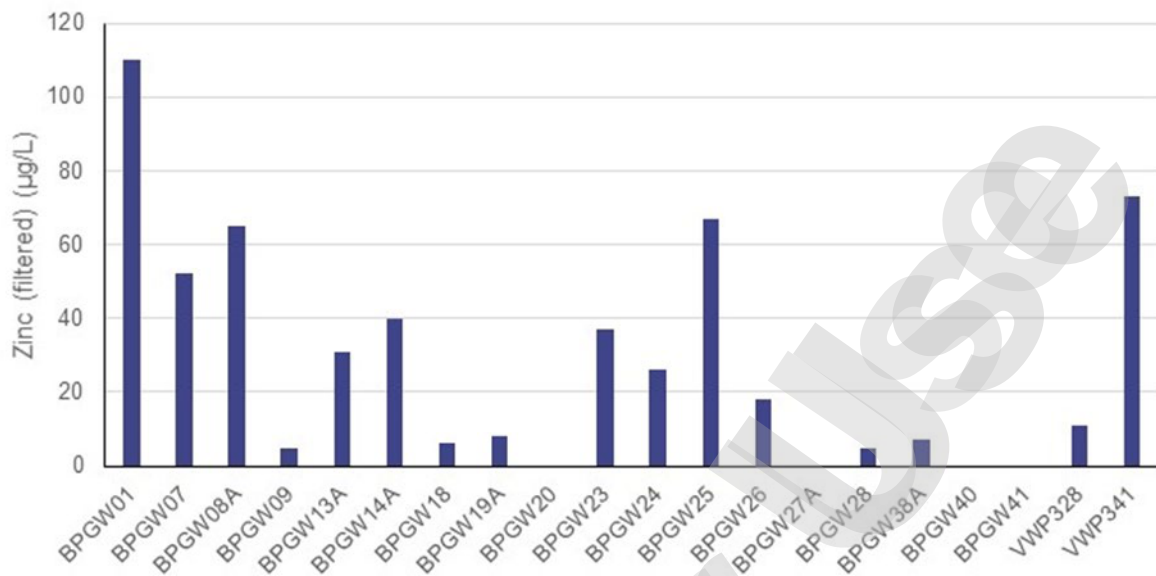
**A.4.3 Metals and metalloids**

Groundwater metal concentrations measured during the reporting period were generally consistent with those from the construction period and the 2019/2020 reporting period. Similar to nutrients, metal concentrations are known to vary inter-annually and seasonally (see Figure A-7 for an example). Metals can also be highly variable between groundwater wells (see Figure A-8 for an example).



**Figure A-7: Mean manganese concentrations for all groundwater wells**





**Figure A-8: Groundwater survey 6 zinc concentrations**

During the reporting period, and similar to the 2019/2020 reporting period, zinc was the metal that had the greatest number of trigger exceedances (five in October/November 2020 and two in April 2021) and showed a strong seasonal trend; concentrations typically increase during the dry season and typically decrease in the wet season following the onset of wet season rainfalls.

Interannual variability is likely to be associated with natural factors such as rainfall; both the total rainfall and timing of rain (e.g. early in the season or late in the season). The 2020/2021 wet season rainfall was below average and the driest wet season since construction of Ichthys LNG began. The dry 2020/2021 wet season has likely contributed the concentrations and subsequently the number of zinc exceedances recorded during the reporting period.

Overall the variations in metal and metalloid concentrations measured are considered to be the result of natural variations and not attributable to Ichthys LNG activities.

#### A.4.4 Organics

No TRH, BTEX or phenols were reported in any of the samples from any of the wells during the reporting period, there was also no detection of Light Non-Aqueous Phase Liquid at any well during the reporting period.

#### A.4.5 Microbiological

Faecal coliforms (total) and *E. coli* were not detected at BPGW19A during the reporting period; however, a LOR of 10 mpn/100 mL was used for Survey 7 instead of the normal 1 mpn/100 mL. Low concentrations of faecal coliforms and *E. coli* were detected during Survey 7 at BPGW27A (Table A-6).

There was one detection of BOD above the LOR, during the reporting period at BPGW19A in October 2020. Although concentrations were otherwise below the LOR, BOD was analysed to a LOR of 5 mg/L during Survey 7. Samples were also analysed outside of the sample holding times.

Faecal coliform and E.coli detections were at or just above the LOR. Detections occurred in the same sample, therefore are likely attributable to bacterial growth within the sample during transport, and are unlikely to be attributable to Ichthys LNG operations. The BOD result in Survey 6 was not repeated in Survey 7, and there is no trigger value for BOD.

**Table A-6: Microbiological results for the reporting period**

Well	Survey	<i>E. coli</i> (mpn*/100mL)	Faecal coliform (total) (mpn*/100mL)	BOD (mg/L)
BPGW19A	Survey 6	<1	<1	4.3
	Survey 7	<10 <sup>†</sup>	<10 <sup>†</sup>	<5 <sup>†</sup>
BPGW27A	Survey 6	<1	<1	<1
	Survey 7	1	2	<5 <sup>†</sup>

\*cfu/100 mL is equivalent to mpn/100 mL.

†Incorrect LOR applied to analyses. LOR required by monitoring program is 1 mpn/100 mL.

#### A.4.6 Trigger assessment outcomes

In accordance with the receiving environment adaptive management process outlined in the LDMP, groundwater trigger exceedances were investigated. A summary of the number of trigger exceedances by survey is provided in Table A-7.

Investigation for all trigger exceedances using multiple lines of evidence concluded that the reported trigger exceedances were likely natural (e.g. represent seasonal trends and natural variability) and no further evaluation or management response was required.

**Table A-7: Summary of groundwater trigger exceedances**

Survey	Month	Physico-chemical	Nutrients	Metals
Survey 6*	Oct/Nov	4	23	26
Survey 7 <sup>†</sup>	April	7	22	8

\* Includes 1 technical trigger exceedance, which occurred as a result of laboratory LOR not being achieved due to matrix interference.

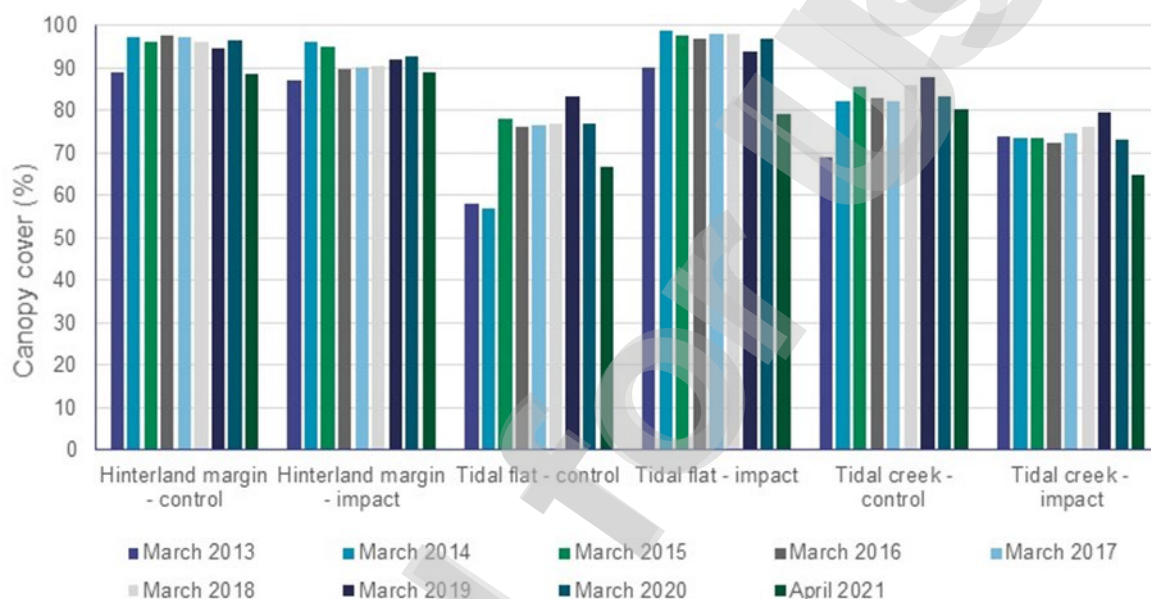
†Includes multiple technical trigger exceedances, which occurred as a result of samples being analysed to LORs higher than those required for the monitoring program, as well trigger exceedances resulting from the relative percentage difference (RPD) of QA/QC samples above the performance criteria of <30%.

#### A.5 Mangrove health and intertidal sediment monitoring

An annual mangrove health and intertidal sediment monitoring survey was undertaken in April 2021. To date, monitoring during the operations phase has shown there has been no demonstrable change in mangrove health, intertidal sediment or bio-indicator quality attributable to Ichthys LNG operations.

Canopy cover across all assemblages has remained relatively stable over time (Figure A-9). During compliance survey 3, canopy cover at sites BPMC09, BPMC25 and CSMC01-TF was lower than baseline values. Canopy cover was reduced by 18.2%, 19.9% and 20.5% respectively. Notably, the monitoring report (L290-AH-REP-70014) indicated that site BPMC25 was incorrectly identified and the appropriate location was not surveyed. No sites showed decreases in canopy cover near to levels considered to indicate ecologically significant change (a 30% decrease in canopy cover).

All sites were classified as healthy in 2021 with no signs of deterioration or abnormal stress based on indices of leaf colour, regeneration (i.e. seedlings and saplings), visible vertebrate fauna and infaunal bioturbation.



**Figure A-9: Mangrove canopy cover**

In-situ intertidal sediment measurements indicate that sediment at all sites range from being slightly alkaline to slightly acidic (pH values of 5.72–8.10). This range in pH is attributed to the conditions experienced by surface sediments, which are regularly flushed by tidal waters and well oxygenated. The surface sediments are subsequently oxidising, as indicated by the positive values in Table A-8.

**Table A-8: Average mangrove sediment in-situ monitoring results by assemblage**

Assemblage	pH		Redox potential (mV)	
	Impact	Control	Impact	Control
Hinterland margin	6.04	7.05	92.10	91.00
Tidal flat	7.72	6.77	47.2	114.20
Tidal creek	7.88	6.95	53.73	104.20

### A.5.1 Metal and metalloids

A summary of intertidal sediment chemistry for inorganics is provided in Table A-9. Two exceedances of arsenic were found at control sites but were not investigated further as no exceedances were found at impact sites.

**Table A-9: Summary of inorganic mangrove sediment chemistry (mg/kg)**

Site <sup>†</sup>	Aluminium	Antimony	Arsenic*	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	Mercury
Guideline values	n/a	2	20	1.5	80	65	50	21	200	0.15
Background level	n/a	n/a	16.0	0.071	17.5	4.7	8.8	8.7	21.4	n/a
BPMC09	5,500	<2	6	<0.1	14	1	4	4	16	0.05
BPMC10	5,200	<2	7	<0.1	12	3	4	4	18	<0.02
BPMC11	1,300	<2	<5	<0.1	6	<1.0	<1.0	<1.0	2	<0.02
BPMC16	1,400	<2	<5	<0.1	8	<1.0	<1.0	<1.0	<1.0	0.02
BPMC17	5,200	<2	18	<0.1	46	4	2	3	25	0.04
BPMC25	5,000	<2	13	<0.1	17	6	7	6	89	0.05
BPMC26	4,300	<2	9	<0.1	11	1	5	4	39	0.02
CSMC01-HM	3,600	<2	<5	<0.1	8	2	1	1	4	0.03
CSMC01-TC	13,000	<2	12	<0.1	33	1	10	8	33	0.03
CSMC01-TF	2,500	<2	6	<0.1	12	<1.0	2	1	10	<0.02
CSMC03-HM	7,500	<2	14	<0.1	37	11	11	6	24	0.07
CSMC03-TC	13,000	<2	<b>31</b>	<0.1	32	4	9	11	27	0.1
CSMC03-TF	16,000	<2	<b>36</b>	<0.1	40	5	13	11	32	0.1

† BPMC = impact site, CSMC = control site.

\* Bold values indicate trigger exceedance.

### A.5.2 Organics

A summary of intertidal sediment chemistry for inorganics is provided in Table A-10. Exceedances of the benchmark levels were recorded at one impact and two control sites for hydrocarbons. In accordance with recommendations made following the 2018/2019 reporting period, silica gel clean-up was performed on samples that exceeded the TPH trigger value to remove non-petrogenic hydrocarbons. Following silica gel clean-up, TPH results for the one impact and two control sites were below initial concentrations; and below the trigger value for the impact and one control site. This indicates the presence of naturally occurring hydrocarbons (e.g. lipids, plant oils, tannins, animal fats, proteins, humic acids and fatty acids).

**Table A-10: Summary of organic mangrove sediment chemistry (mg/kg)**

Site <sup>†</sup>	TPH C10-C36	Site <sup>†</sup>
Guideline values	280	280
Background level	n/a	n/a
BPMC09	45	33
BPMC10	88	76.4
BPMC11	3.5	<3.7
BPMC16	140	103.3
BPMC17	<b>310</b>	236.6
BPMC25	56	52.2
BPMC26	170	141.2
CSMC01-HM	<b>450</b>	335.5
CSMC01-TC	250	171.4
CSMC01-TF	89	51.4
CSMC03-HM	260	194
CSMC03-TC	200	147.1
CSMC03-TF	<b>300</b>	215.3

<sup>†</sup> BPMC = impact site, CSMC = control site.

\* Bold values indicate trigger exceedance.

### **A.5.3 Trigger assessment outcomes**

There were no trigger exceedances for the 2021 mangrove health and intertidal sediment survey. Two samples had elevated arsenic and one site had elevated TPH following silica gel clean-up for the intertidal sediment monitoring; however, these occurred at control sites and are not attributed to Ichthys LNG activities and no further investigation was undertaken.

Issued for Use

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Revision	Date and Time	Issue Reason
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### Delegation of Authority

From Name	To Name	Date and Time	Action

Name	Title

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