Notice

Environmental Protection Act 1994

Assessment level decision

This notice is issued by the administering authority pursuant to section 229 of the Environmental Protection Act 1994 *to advise whether a proposed amendment to an environmental authority is a major or minor amendment.*

To: SANTOS QNT PTY. LTD.
Ground Floor, Santos Centre
60 Flinders Street
ADELAIDE SA 5000

cc: Australia Pacific LNG Pty Limited
Level 4
139 Coronation Drive
MILTON QLD 4064

Email: Envapprovals@upstream.originenergy.com.au

ATTN: sch4p4(6) Per

Our reference: EPPG00872113

Assessment level decision for an application to amend an environmental authority

1. Application details

The application to amend the environmental authority EPPG00872113 was received by the administering authority on **18/02/2020**. The application reference number is: APP0049581

Land description: PL450, ATP337, PL1012, PL451, ATP1191, PL457

2. Decision

The assessment level decision for this application is that the proposed amendment to the environmental authority is a **major** amendment.

3. Reasons for the decision

As per section 223 of the *Environmental Protection Act 1994*, a major amendment for an environmental authority is defined as an amendment that is not a minor amendment. With reference to the definition of a minor amendment (threshold) in section 223 of the *Environmental Protection Act 1994*, specifically parts (b), (d), (e) and (f) a minor amendment (threshold) does not significantly increase the level of environmental harm caused by the relevant activity; does not significantly increase the scale or intensity of the relevant activity; relate to a new tenure that is a petroleum lease; or involve an addition to the surface area for the relevant activity of no more than 10% of the existing area.

It is considered that the proposed amendment will:

b) significantly increase the level of environmental harm caused by the relevant activity due to the additional petroleum activities and associated disturbance;

d) significantly increase the scale or intensity of the relevant activity as the proposed amendment seeks to add two petroleum leases and an additional 190 wells;

e) seeks to add two new petroleum lease tenures;

f) seeks to authorise 190 wells which will result in more than a 10% increase in addition to the surface area for the relevant activity.

As such, the proposal is determined to be a major amendment.

4. Assessment fee

The administering authority has determined that the proposed amendment to the environmental authority is a major amendment therefore further fees for the assessment of this application are required to be paid to the administering authority.

The assessment fee for a major amendment is 30% of the annual fee for the environmental authority that is the subject of the application prescribed under Schedule 15, Part 2, Item 8 of the Environmental Protection Regulation 2019.

The assessment fee to be paid is $31,336.20.

If applying through Connect, you can pay the assessment fee by credit card. Alternatively, the assessment fee can be paid by cheque or money order to the Department of Environment and Science.

Under section 229(2)(b) of the EP Act, the assessment of the amendment application will not proceed until the assessment fee is paid.

5. Review and appeal rights

You may apply to the administering authority for a review of this decision within 10 business days after receiving this notice. You may also appeal against this internal review decision to the Land Court. Information about your review and appeal rights is attached to this notice. This information is guidance only and you may have other legal rights and obligations.

Should you have any questions in relation to this notice, please contact the department using the contact details provided below.

sch4p4(6) Personal inf

Signature

3/03/2020

Rachel Copp
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
Energy and Extractive Resources
Department of Environment and Science
GPO Box 2454, Brisbane QLD 4001
Phone (07) 3330 5715
Email: energyandextractive@des.qld.gov.au

Attachments

Information sheet: Internal review and appeals (ESR/2015/1742)

Part A – Administrative details

Date of request: 14/05/2020	**Due date of request: 28/05/2020**

Section 1: Notes for the requesting officer
This work request form is used to request advice and assistance from Technical Support in accordance with the guideline Technical and scientific support for officers. Further information is available on the Technical Support SharePoint site. The completed work request form should be **approved by your Manager** sent to the DES Technical Support inbox technicalsupport@des.qld.gov.au . Please attach relevant files to request and/or state EDOCS items number(s) in this form. If you require **advice on water quality, release to water or MEDLI then that is provided by DES Water Sciences**. Please CC these requests to water.workrequests@des.qld.gov.au . Standard response time is 10bds. If a response needed in less than 10bds from receipt of work request, you must telephone the Manager of Technical Support on 3330 5713, prior to sending the request. Every effort will be made to accommodate your request but precedence will be given to statutory timeframes and environmental issues of an urgent nature. Some negotiation of timeframes may be required in circumstances of high workloads. Feedback is needed on your completed work request (except 'meeting/call or 'other' category). This can be provided by accessing and completing the form at: Feedback Form and click on "Save" when you are finished.

Section 2: Requesting Officer's contact details	
Your name	Amelia Sellars
Your contact phone number	3330 5591
Your unit	Energy and Extractive Resources
Your Manager's name	Clancy Mackaway
Your Director's name	Kerynne Birch
Email Address(es) for response	Amelia.sellars@des.qld.gov.au

Section 3: Request type (Tick the relevant request type below.)	
EIS / High risk assessment	☒
Compliance	☐
Policy advice	☐

Section 4: Statutory requests (Priority to be given to statutory requests.)	
Is there a statutory deadline? Yes	
If yes, type of statutory request? Other	If other request type, please specify below: EA amendment application – decision due 4/06/2020

Section 5: Technical Support expertise (Tick the relevant issues below)			
Air	☐	Regulated structures	☐
Contaminated land	☐	Rehabilitation	☐
Contaminated land – auditor's report (CLID)	☐	Surface water discharge	☐
Groundwater	☒	Waste	☐
Noise / vibration	☐	Waste water	☐
PFAS	☐	Other (If other, provide details below)	☐
Does the request relate to mining / petroleum and gas? Yes/No			

Part B – Site details

Section 6: Site location and company / person's name	
Name of Project (if relevant)	Denison Mahalo
Company / Person's name (if relevant)	Australia Pacific LNG Pty Limited
Street Address / and Property description (if relevant)	N/A
Tenures (if relevant)	PL1082, PL1083
EMR/CLR number (if relevant)	N/A

Section 7: DES References	
Environmental authority number (if relevant)	EPPG00872113
eDOCS reference number(s) (if relevant)	101/0032521
Community response number. (if relevant)	

Section 8: Background and issue(s) (Provide below a brief background and describe the issue(s).)

Origin Energy Resources Limited, as the upstream operator of Australia Pacific LNG Pty Ltd (APLNG) and Santos QNT Pty Ltd (Santos), as joint holders and operators of the Denison Trough/Mahalo tenures, applied to amend Environmental Authority (EA) EPPG00872113 on 18 February 2020. The EA amendment application seeks the authorisation to conduct petroleum activities on new petroleum lease (PL) tenures PL1082 and PL1083, with 190 petroleum wells proposed. No stimulation has been proposed. The current EA authorises 193 wells.

PL1082 and PL1083 are approximately 470 km^2 in size, located 30km north east of Rolleston and are situated within the Central Highlands Council. The Mahalo Development Area is adjacent to other resource tenures including conventional gasfields to the west of the project, Rolleston open cut coal mine ~28km southwest, and Blackwater Mine ~8km north. The target gas producing formation for the Mahalo Development Area is the Bandanna Formation, of the Permo-Triassic Bowen Basin.

The ALD was deemed to be major on 3 March 2020. This is due to the amendment proposing:

- to significantly increase the level of environmental harm;
- to increase the scale and intensity;
- a disturbance area greater than 10%; and
- an application for two new petroleum leases.

Public notification was not required for the application. An information request was issued on 29 April 2020. An initial assessment of the application supporting documents found that there was not enough detail provided in relation to the spatial and temporal extent of groundwater impacts and whether these extended beyond the project area, potential impacts to groundwater ecosystem dependency, and how the extraction of groundwater may affect the land and its land use. In particular, this required the applicant to address how potential ecological impacts such as subsidence or changes to overland flow that may occur due to the decline in water level and/or pressure when extracting groundwater and whether this changes the environmental value of the land and its use for irrigation, cropping and agriculture. Furthermore, further detail was requested to demonstrate the validity of the data provided in the water assessment report. APLNG has provided a response to the information request A decision on the application is currently due by 4 June 2020.

Section 9: Nature of assistance requested (Describe below what advice is needed and/or what question(s) do you want answered.)

EER requests assistance to confirm the findings of the water assessment report and response to the information request. In particular, EER is seeking confirmation of the following:

- There are no GDE interactions as the groundwater is too deep to access therefore there's no dependent vegetation
- The groundwater impact assessment uses the Surat CMA UWIR modelling report – Origin state that the groundwater impact assessment is independent of the number of wells proposed due to the groundwater drawdown model modelling complete dewatering of the Bandanna Formation coals by assigning fixed-pressure boundary conditions (using the MODFLOW-USG drain package) within the area of the PLs – is this correct?
- Are the potential drawdown predictions accurate? i.e. 0.2-1.6m drawdown. Is Origin's statement correct that the maximum drawdown prediction is an overestimation due to the hydraulic parameters used in OGIA's uncertainty analysis for the Surat UWIR?

- Is it accurate to say there is limited connectivity between the coal seam and adjoining formations due to the Rewan Group aquitard limiting connectivity between the Bandanna Formation and overlying aquitards?

Part B – Technical Support Response

This part is to be filled out by the Technical Specialist only. This document will then be sent back to you with the response to the technical support work request shown here.

Section 10: Administrative details	
Name of Technical Specialist / Principal Technical Officer	
Date completed	
Did the Manager of Technical Support approve any extension of due date?	Yes/No If yes, please provide details:
Hours required for job	
ID Number (Located in SharePoint)	

Section 11: Background

Section 12: Issue(s)

Section 13: Assessment

Section 14: Conclusion(s)

Section 15: Recommendation(s)

Section 16: Attachments (if required)

Note: Technical Support responses are based on the information provided by the requesting officer. Although the information provided will be cross-checked and verified wherever possible, Technical Support cannot be responsible for their interpretations based on incorrect, inaccurate, incomplete or otherwise invalid information, nor for any subsequent decisions or actions made by the requesting officer or delegate based on such responses.

Section 17: Notes for the Technical Specialist / Principal Technical Officer
Saving Technical Support responses
Could all Technical Specialists please save their response in their allocated folder with the request date first, the requesting officer's name and document number. i.e. Date_of_request_(YYMMDD)_Requesting_Officer_Name_Technical_Support_Officer_Name_Job_Name_Issue_Type/s(e.g._air_noise_water_etc)_1 of 1; e.g.180117_A_Roberts_G_Cordingley_MRV_Tarong_Basin_Coal_Pty_Ltd_Kingaroy_UCG_Pilot_trial_site_water_contaminated_land_1_of_1; Date_of_request_(YYMMDD)_Technical_Support_Officer_Name_Requesting_Officer_Name_of_Job_Name_Issue_Type/s_(e.g._air_noise_water_etc)_1 of 2 and Date_of_request_(YYMMDD)_Technical_Support_Officer_Name_Requesting_Officer_Name_of_Job_Name_Issue_Type/s_2_of_2 etc. Folders are located here.
Feedback on completed work requests
Officers are advised that feedback is needed on every completed Technical Support work request (except 'meeting/call or 'other' category). Please attach the following message/link to outgoing work response email: Feedback on completed technical support work can be done by accessing and completing the form at: Feedback Form and click on "Save" when you are finished.
Please return completed forms to: technicalsupport@des.qld.gov.au

Checklist

Environmental Protection Act 1994

Amendment application - assessment level decision and public notice

This checklist is to be used to decide whether a proposed amendment to an environmental authority (EA) for a resource activity or PRCP schedule is a major amendment or minor amendment (the assessment level decision) as required under section 228 of the Environmental Protection Act 1994. *If a major amendment, this checklist is also used to determine whether public notice is required under sections 230, 232 or 152 of that Act (Note, this checklist is not relevant for condition conversion applications as these applications are automatically treated as minor amendments and do not require an assessment level decision).*

Part A–Application Details

Reference No:	EPPG00872113		
Applicant:	Australia Pacific LNG Pty Limited	**File No:**	101/0032521
Location:	ATP337/1191, PL450, PL451, PL457, PL1012	**Received Date:**	18 February 2020
Project Name:	Denison Mahalo	**ALD Due Date:**	3 March 2020
Amendment Application Description:	Origin Energy Resources Limited, as the upstream operator of Australia Pacific LNG Pty Ltd (APLNG) and Santos QNT Pty Ltd (Santos), as joint holders and operators of the Denison Trough/Mahalo tenures, applied to amend Environmental Authority (EA) EPPG00872113 on 18 February 2020. The EA currently authorises petroleum activities within Authority to Prospect (ATP) 1191 and Petroleum Leases (PLs) 450, 451, 457 and 1012, situated within the Denison Trough, on the western flank of the Bowen Basin. Stimulation of 131 unconventional CSG wells and 62 conventional gas wells (193 wells total) is currently authorised. APLNG has applied to: 1. Authorise PL1082 and PL1083 as additional resource tenures for the EA; and 2. Amend *Schedule A, Table 1 – Scale and Intensity for the Activities* to authorise an additional 190 petroleum wells within PL1082 and PL1083. No stimulation is planned for any of the proposed wells. APLNG and Santos as joint holders applied to the Department of Natural Resources, Mines and Energy in September 2019 for the new PLs over the northern area of ATP1191. In accordance with s121(1)(f) of the *Petroleum and Gas Act 2004*, an EA must be issued prior to the PL tenure being granted. PL1082 and PL1083 are approximately 470 km^2 in size, located 30km north east of Rolleston and are situated within the Central Highlands Council.		

Part B–Assessment considerations

An assessment level decision must be made within 10 business days from receipt of the amendment application (section 228). This decision determines whether the proposed amendment is low risk and involves straightforward changes to the EA or PRCP schedule, or whether the activities proposed are likely to lead to a significant increase in the scale or intensity of the activity, or level of environmental harm or impact. When completing the assessment considerations tables below, please refer to guideline 'Major and minor amendments (ESR/2015/1684[1]).

Where a joint EA and PRCP schedule amendment is lodged, an ALD and public notice decision is required for both instruments (one for the EA amendment and one for the PRCP schedule amendment). As such you will need to complete this form twice, one for each instrument.

Note: where an application is made to amend a condition that requires the relevant activity to comply with eligibility criteria for the activity, written refusal can be given without further assessment or assessment level decision (use Decision Notice ESR/2015/1787[1]). Under section 227A a site specific application can be required if the eligibility criteria can no longer be met and where it is reasonable to require a site-specific application. Alternatively, the application can proceed in the same way as a major amendment if requiring a site specific application is not reasonable (i.e. the application is not refused, but proceeds as a major amendment). For example: where the eligibility criteria require that the activity is not within 1km of the nearest sensitive receptor and a new sensitive receptor is subsequently established close to the existing activity.

Table 1–Considerations in making the assessment level decision for an environmental authority amendment (per section 223)

Consideration The amendment:	**YES / NO / N/A**	**Justification (if required)**
(a) is not a change to a condition identified in the authority as a standard condition, other than– (i) a change that is a condition conversion (ii) a change that is not a condition conversion but that replaces a standard condition of the authority with a standard condition for the environmentally relevant activity to which the authority relates	YES	The application does not seek to change any standard conditions.
(b) does not significantly increase the level of environmental harm caused by the relevant activity	NO	The proposed amendment represents a significant increase in the level of environmental harm. In total, 190 wells are proposed which according to the application requires ~1.2ha of clearing for initial well construction. Furthermore, ancillary activities will be undertaken including installation of gas and water gathering flowlines, and construction of associated supporting infrastructure (access road, power and communication systems, laydown and storage areas).

[1] This is the publication number, which can be used as a search term to find the latest version of the publication at www.qld.gov.au.

		The application states that 3,400ML of produced water will be generated by the additional wells. The application did not detail the location of the wells or whether stimulation was required. Without details of the locations and distance between wells (including their interactions), the risk to the environment from stimulation has the potential to significantly increase the level of environmental harm. On 27 February 2020, Origin were asked to provide confirmation whether stimulation was being applied for. Origin confirmed the same day that no stimulation is planned for any of the proposed wells.
(c) does not change any rehabilitation objectives stated in the EA in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the authority	YES	The proposed amendment states that land disturbance for the additional wells will be rehabilitated in accordance with existing conditions J3 (final rehabilitation acceptance criteria) and J4 (final rehabilitation acceptance criteria in environmentally sensitive areas). Rehabilitation of the proposed additional wells will therefore be captured under the existing rehabilitation conditions of the EA.
(d) does not significantly increase the scale or intensity of the relevant activity	NO	The EA currently authorises 131 unconventional wells (165ha) and 62 conventional gas wells (94ha) – 193 wells and 259ha total. The proposed amendment of 190 wells is almost equivalent to the existing authorised disturbance area both in well count and associated area and will take the total well count to 383 and 487ha disturbance. This is considered to be a significant increase to both the scale and intensity of the activity.
(e) does not relate to a new relevant resource tenure for the authority that is (i) a new mining lease; or (ii) a new petroleum lease; or (iii) a new geothermal lease under the Geothermal Energy Act; or (iv) a new GHG injection and storage lease under the GHG storage Act	NO	APLNG has applied for two additional PLs – PL1082 and PL1083.

(f) involves an addition to the surface area for the relevant activity of no more than 10% of the existing area	YES	The surface area will increase more than 10%. Assuming a 1.2ha per well clearing as detailed in the application, the area required is 228ha for 190 wells (an 88% increase on the current authorised disturbance area of 259ha).
(g) for an environmental authority for a petroleum activity, involves (i) constructing a new pipeline—the new pipeline does not exceed 150km; or (ii) extending an existing pipeline—the extension does not exceed 10% of the existing length of the pipeline	NO	The application does not detail any application for the construction of a new pipeline over 150km or extension of an existing pipeline over 10% of the existing length.
(h) relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit—and the amendment application under section 224 seeks an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit	NO	The application does not relate to an exploration permit or GHG permit. The application relates to a new petroleum production permit.

Table 3–Recommendation on type of amendment

Recommendation – major or minor amendment		
Complete part (a) **OR** (b) and check the Minor or Major check box.		
(a)	If all the 'Yes' boxes are marked, the application is a minor amendment. Complete the following:	
	• If the application relates to an EA, has the application been entered as a minor amendment in Connect? If no or if the application relates to a PRCP schedule, please email a copy of this signed checklist to Permit and Licence Management on **palm@des.qld.gov.au** to ensure Connect is updated.	**MINOR EA AMENDMENT ☐**
	• Send ALD Notice to applicant in accordance with section 229 within 10 business days	
	• Proceed to decide whether to grant or refuse the application	
(b)	If any of the 'No' boxes are marked, the application is a major amendment with issues likely to lead to a significant increase in the scale or intensity of the activity, or level of environmental harm or impact. *Exception: As per the Important Note in Table 2, in some circumstances the administering authority may determine that a PRCP schedule amendment is minor, despite answering no to paragraphs (e) or (f).* Complete the following:	

	• If the application relates to an EA, has the application been entered as a major amendment in Connect? If no or if the application relates to a PRCP schedule, please email a copy of this signed checklist to Permit and Licence Management on **palm@des.qld.gov.au** to ensure Connect is updated and they are aware the assessment fee is required to be paid.	**MAJOR EA AMENDMENT ☒**
	• Insert the required assessment fee into the assessment level decision notice (ESR/2016/3299) if the assessment level decision is 'major' and the assessment fee has not already been paid.	
	• Proceed to the public notification consideration (Part C)	

Part C–Public notification considerations–Major amendments

There are a number of different public notification processes that apply for a major amendment under the *Environmental Protection Act 1994*. Mark the relevant box and complete the relevant section:

(i)	Major amendment of an environmental authority or PRCP schedule for a resource activity (section 230)	☒	**Complete Table 4 and Table 5**
(ii)	Major amendment where an EIS process has been completed under the *Environmental Protection Act* (section 150)	☐	**Complete Table 6 and Table 7**
(iii)	None of the above	☐	**Public notification not required. Sign and date checklist and proceed to information stage if required.**

Table 4–Public notification consideration – Resource activity major amendments only (section 230)

Where an amendment application has been decided to be a **major amendment**, public notification requirements may be triggered. Resource activities may trigger public notification requirements where an activity is determined to involve a substantial increase in the risk of environmental harm and a substantial change in the quantity or quality or the results of the release of a quantity or quality of contaminant permitted to be released into the environment.

Consideration	YES / NO / N/A	Justification (If Required)
1. There is likely to be a substantial increase in the risk of environmental harm under the amended EA (section 230(2)(a)) and the risk is the result of a substantial change in the quantity or quality of contaminant permitted to be released into the environment (section 230(2)(b)(i)).	NO	Whilst there will be an increase in the risk of environmental harm under the amendment EA caused by the release of contaminants i.e. produced water, air emissions, noise and sediment caused by erosion/clearing, it is not considered that the risk is the result of a substantial change i.e. an increase in the quantity or quality of more than 10% in the quantity or quality of contaminant to be released into the environment. Note that the application does not seek to stimulate the additional wells, therefore there is no significant increase in environmental harm from the current authorised stimulation activities.
2. There is likely to be a substantial increase in the risk of environmental harm under the amended EA (section 230(2)(a)) and the risk is the result of a substantial change in the results of the release of a quantity or quality of contaminant permitted to be released into the environment (section 230(2)(b)(ii)).	NO	
Without limiting the above items, the following is taken to be a substantial change as per section 230(3): *- An increase of 10% or more in the quantity of a contaminant to be released into the environment* *- If the amendment application is for an environmental authority for a resource project, an amendment to add an ineligible ERA for the authority*		

Table 5–Recommendation on public notification under section 230

Recommendation – public notification under section 230	
☒ If both considerations above are marked 'NO' or "N/A", the application does not require public notification.	
☐ If either of the considerations above are marked 'Yes', the application may require public notification.	
Public Notification is not required	☒

- Send the Assessment level decision (ALD) notice (ESR/2016/3299) to the applicant in accordance with section 229 within 10 business days, stating the decision (i.e. a major amendment) and the reasons for the decision. The written notice is to also state the applicant's assessment fee that has been prescribed by the *Environmental Protection Regulation 2019* and that until the payment is made, the application will not be progressed.
- Proceed to information stage.

Public Notification is required ☐

- Send the Assessment level decision (ALD) notice (ESR/2016/3299) to the applicant in accordance with section 229 within 10 business days, stating the decision (i.e. a major amendment) and the reasons for the decision, and also include the public notification requirement (section 230), and the reasons for the decision (section 230(4)). The written notice is to also state the applicant's assessment fee that has been prescribed by the *Environmental Protection Regulation 2019* and that until the payment is made, the application will not be progressed.
- Proceed to information and notification stages.

Assessing Officer	**Reviewing Officer**
Sign:	Sign:
Date:	Date:
Name: Amelia Sellars	Name: Rachel Copp
Position: Principal Environmental Officer	Position: Team Leader
Delegate	
Recommendation:	APPROVED ☐ NOT APPROVED ☐

Sign:	
Date:	
Name:	Clancy Mackaway
Position:	Manager (Assessment)

Assessment within Connect

1. Application information

Application Number: APP0049581	**EA Number:** EPPG00872113
Company Name: Australia Pacific LNG Pty Limited	
Type of assessment: ☐ **Site specific** ☐ **Minor amendment** ☒ **Major amendment** ☐ **Variation** ☐ **SARA EA/DA**	

Background (just the background to what is being proposed):

Origin Energy Resources Limited, as the upstream operator of Australia Pacific LNG Pty Ltd (APLNG) and Santos QNT Pty Ltd (Santos), as joint holders and operators of the Denison Trough/Mahalo tenures, applied to amend Environmental Authority (EA) EPPG00872113 on 18 February 2020. The EA amendment application seeks the authorisation to conduct petroleum activities on new petroleum lease (PL) tenures PL1082 and PL1083, with 190 petroleum wells proposed. No stimulation has been proposed.

The application material consisted of the following (edocs # 8947678):

- Application form to amend an environmental authority
- Supporting Information Report – Mahalo EA Amendment
- Tax Invoice/Receipt 2401 1400023895
- APLNG Signature
- Santos Signature
- Appendices:
  - Appendix A1 – Regional Ecosystems Biodiversity Status for PL1082
  - Appendix A2 – Regional Ecosystems Biodiversity Status for PL1083
  - Appendix B1 – Environmentally Sensitive Areas PL1082
  - Appendix B2 – Environmentally Sensitive Areas PL1083
  - Appendix C1 – Matters of State Environmental Significance PL1082
  - Appendix C2 – Matters of State Environmental Significance PL1083

The EA currently authorises petroleum activities within Authority to Prospect (ATP) 1191 and Petroleum Leases (PLs) 450, 451, 457 and 1012, situated within the Denison Trough formation, on the western flank of the Bowen Basin. APLNG and Santos as joint holders applied to the Department of Natural Resources, Mines and Energy in September 2019 for the new PLs over the northern area of ATP1191. In accordance with s121(1)(f) of the *Petroleum and Gas Act 2004*, an EA must be issued prior to the PL tenure being granted.

PL1082 and PL1083 are approximately 470 km^2 in size, located 30km north east of Rolleston and are situated within the Central Highlands Council. The Mahalo Development Area is adjacent to other resource tenures including conventional gasfields to the west of the project, Rolleston open cut coal mine ~28km southwest, and Blackwater Mine ~8km north. The target gas producing formation for the Mahalo Development Area is the Bandanna Formation, of the Permo-Triassic Bowen Basin.

Assessment Level Decision (ALD):

In accordance with the considerations for amendment applications in s223 of the *Environmental Protection Act 1994* (EP Act), the ALD was deemed to be major on 3 March 2020. This is due to the amendment proposing:

- to significantly increase the level of environmental harm;
- to increase the scale and intensity;
- a disturbance area greater than 10%; and
- an application for two new petroleum leases.

Public notification

Public notification was not required for the application. Whilst the project significantly increases the level of environmental harm, it was not considered that the release in the quality or quantity of contaminants would substantially change what was already authorised to be released into the environment in accordance with s230 of the EP Act.

Information request:

An information request (IR) was issued on 29 April 2020. An initial assessment of the application supporting documents found that there was not enough detail provided in relation to the spatial and temporal extent of groundwater impacts and whether these extended beyond the project area, potential impacts to groundwater ecosystem dependency, and how the extraction of groundwater may affect the land and its land use. In particular, this required the applicant to address how potential ecological impacts such as subsidence or changes to overland flow that may occur due to the decline in water level and/or pressure when extracting groundwater may change the environmental value of the land and its use for irrigation, cropping and agriculture. Furthermore, further detail was requested to demonstrate the validity of the data provided in the water assessment report.

APLNG provided a response to the IR on 7 May 2020, which included a site specific terrestrial GDE assessment (edocs #9286172).

Technical Support Request:

A support request for groundwater assistance was sent to technical support on 15 May 2020 to verify the findings of the IR. A response was received on 2 June 2020. The comments received from technical support are included throughout the assessment below in their relevant sections.

Proposal (what is being proposed):

APLNG has applied to:

1. Add tenures PL1082 and PL1083 to the EA; and
2. Amend *Schedule A, Table 1 – Scale and Intensity for the Activities* to authorise an additional 190* petroleum wells within PL1082 and PL1083.

Associated infrastructure with the installation of wells includes connection to gas and water gathering lines, water management facilities and ancillary infrastructure.

The application details the proposed amendments will not result in a change to the rehabilitation objectives where disturbances will continue to be rehabilitated to meet the existing final acceptance criteria prescribed by the EA.

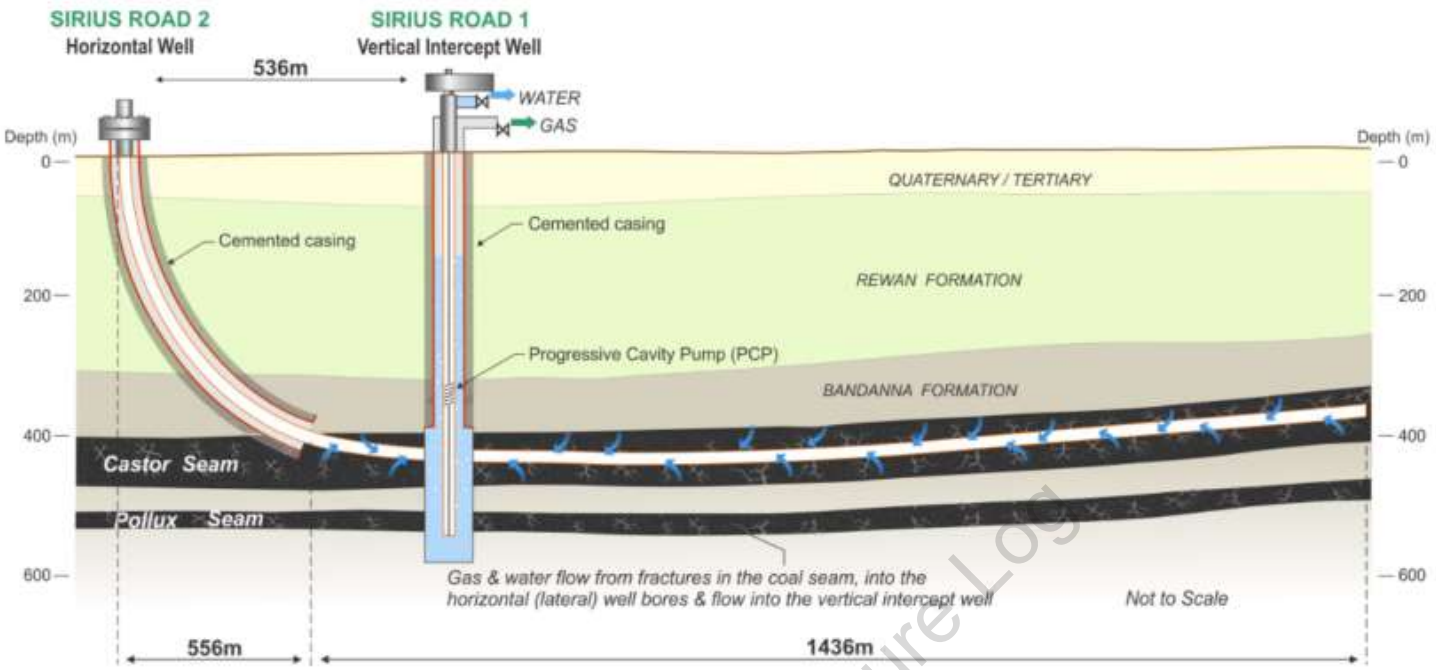
The amendment proposes to continue to comply with the existing EA emission limits for air and noise.

The application does not propose stimulation for all or part of the proposed 190 wells.

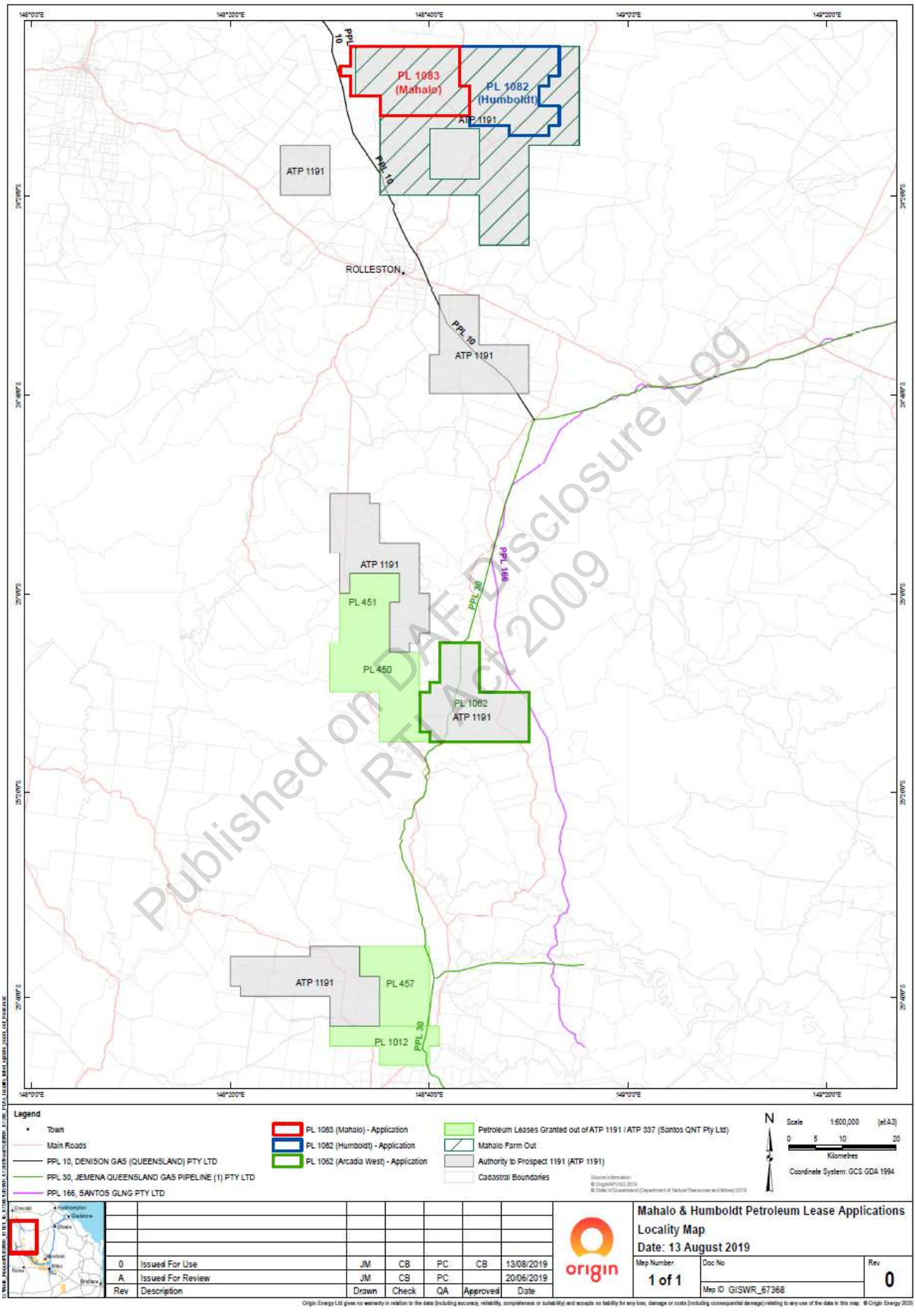
The proposed activities will result in changes to the management of produced water. Up to 3,400ML of produced water would be generated from the additional wells at a peak flow rate of 2.191ML/day.

Subject to relevant approvals, gas production and its associated water extraction will commence in 2021. The operating life of individual CSG production wells is anticipated to be between 20 and 30 years, meaning gas production is planned to cease by approximately 2050.

*Reference is made throughout the application material to both 190 wells and 95 production wells. Confirmation was sought from Origin during the information request phase to confirm the relevant well count and associated disturbance. Origin has confirmed that intersect wells may be constructed which involves the drilling of 2 separate wells which intersect within the coal seam to create a single production well. This means that 95 production wells will be constructed, however another well pad and well head will be used initially to construct the horizontal section of the well i.e. up to 2 well pads per production well. Only the production well utilises operational equipment to extract produced water and gas. A schematic of this is shown below. So for this reason, the report assesses groundwater extraction from 95 production wells while the amendment application describes 190 well pads.



Diagrams (insert diagrams of maps that are relevant):



2. Application Summary

Area of Interest - Environmental Offsets Act 2014, Matter of State Environmental Significance
Description
According to sections 16 to 18 of the application form, the applicant: • does not propose a significant residual impact to a prescribed environmental matter • does relate to an area of regional interest but is an exempt activity, and • does not trigger matters of national environmental significance (MNES) Appendix B of the application indicates the potential presence of a number of Matters of State Environmental Significance (MSES) within the tenures as follows: • High ecological significance wetlands on the map of referable wetlands (3.75ha) • Regulated Vegetation - Endangered/Of concern in Category B (remnant) (2602.92ha) • Regulated Vegetation - Endangered/Of concern in Category C (regrowth) (5.27ha) • Regulated Vegetation - Category R (GBR riverine regrowth) (43.64ha) • Regulated Vegetation - Essential habitat (1503.4ha) • Regulated Vegetation - intersecting a watercourse (365.3km) • Regulated Vegetation - within 100m of a Vegetation Management Wetland (96.3ha) The application states that well site development will be in accordance with the existing land disturbance conditions of the EA (schedule F). Central to these conditions is the requirement to ground truth biodiversity values (environmentally sensitive areas, prescribed environmental matters and wetlands) prior to undertaking significant land disturbance. Table 1 of Schedule F prescribes the authorised petroleum activities in ESAs and their protection zones. Under condition F8 of the EA, significant residual impacts to prescribed environmental matters are prohibited. Should APLNG want wells developed in any of the above mentioned matters, a separate EA application and subsequent approval would be required.
Likely affected: ☐ Yes ☒ No

3. Physical attributes*

Include all attributes such as sensitive receptors, water bodies etc. that may be impacted by any of the emissions from the site for each EV affected. You may need to include an attribute more than once (e.g. sensitive receptor (residence) may need to be included twice if affected by air emissions (dust and odour), and noise emissions). Physical attributes are both onsite and offsite specific features that applicants and/or DES identify that may be affected by the activity (e.g. National Park, specific river {Condamine River}, wetlands, a nearby housing estate or town).

Name of attribute (and EV)	Groundwater
Description	Irrigation, aquatic ecosystem, stockwater, drinking water
Name of attribute (and EV)	Sensitive receptors
Description	Acoustic amenity, Air quality
Name of attribute (and EV)	Springs, GDEs

Description	Loss of aquatic and terrestrial habitat

4. Impacted Environmental Values

Tick all boxes where a direct impact is made by emissions, and you want to assess specific impacts. You will not do a detailed assessment of an EV later if you do not tick the box for it here. Include a general description of the likely impacts, specific objectives/values if relevant. It is mandatory to provide justification for all the listed EVs as to the impact or lack of impact.

EVs	Justification
☒ Water	**Surface Water** The Mahalo Development Area is located within the Comet River Sub-Basin, a part of the Fitzroy Basin. Key watercourses within the vicinity of the project include Comet River, Meteor Creek, Planet Creek and Humboldt Creek – most of which are characteristically ephemeral. **Springs, wetlands and groundwater dependent ecosystems (GDEs)** There is one palustrine wetland mapped within the area listed as high ecological significance (HES). This HES wetland is located adjacent to the Comet River flow channel and may be considered as within the floodplain of the channel. The application states that well pads will be preferentially located outside of floodplain areas. There are no springs located within or nearby PLs 1082 and 1083 as shown on Figure 3 of the application supporting document. The nearest spring complex, Kullanda, sources water from the Clematis Group and is located approximately 20km northeast of the PLs. This is outside of the expected drawdown area of the project. The application states there are minimal potential groundwater dependent ecosystems (GDEs) located within the vicinity of the project. GDE mapping datasets have listed these as low-confidence GDEs. Available groundwater levels indicate the depth to groundwater is >30m below ground. Further information was requested during the Information Request phase to confirm these statements. The response included a site specific terrestrial GDEs assessment that states: • The maximum 95th percentile drawdown within Layer 1 of the model ranges from 0.2 m to 1.6 m; with the 0.2 m drawdown contour extending approximately 10 km to the north of the Project area • there are two areas where the predicted 95th percentile drawdown coincides with mapped GDEs, and these are located to the north of the Project area, (Northern Drawdown Area) and along Shotover Creek, within the Project area. • Northern Drawdown Area: Groundwater level occurs ~22m below the maximum rooting depth of the tree species so are not considered to be dependent on groundwater • Shotover Creek: Groundwater levels occur ~22-42m below the maximum rooting depth so are not considered to be dependent on groundwater. Confirmation was sought from technical support on the above statements. The report was considered inconclusive for the following reasons: • A limited number of bores available to assess • No bore logs have been provided to enable a review of the geological profile, well construction details and historical water bearing layers • No hydrographs to confirm that the current groundwater levels are a realistic representation of long term trends (i.e. and not a result of significant dewatering by the landholder as a result of drought conditions). • Groundwater levels presented in terms of depth below surface, rather than m AHD – makes interpretation of the regional groundwater depth difficult, especially without topographic contours • Surface topography in relation to the depth of groundwater has not been provided.

Origin has countered that the above information has been included in the groundwater impact assessment report, however the department considers there is still the potential for impacts to GDEs due to drawdown, and as such will consider the impacts in the environmental value assessment section below.

Groundwater

The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* provides the groundwater environmental values for the Comet River sub-basin. The identified values are aquatic ecosystem, irrigation, farm supply/use, stock water, primary recreation, drinking water, industrial use and cultural and spiritual. Groundwater is predominantly used for stock and domestic purposes with only 30 registered bores recorded directly within the project area, 15 of which are existing bores and the remainder abandoned or destroyed.

The Mahalo Development Area is located within the Surat Cumulative Management Area (CMA). The application states that outputs from the Surat CMA numerical model used for the 2019 Surat Underground Water Impact Report (UWIR) were used to consider potential drawdown impacts to groundwater. The application refers to a Water Assessment Report prepared on behalf of APLNG by Klohn Crippen Berger in September 2019 which has been provided as supporting information – note that the Water Assessment Report was prepared based on the draft 2019 Surat UWIR, which was not approved until 12 November 2019 and did not take effect until 16 December 2019. APLNG has stated to DES in the information request response that OGIA has advised that minimal or no changes were made to the model following simulation of groundwater extraction within the PLs between the consultation and final versions of the UWIR report.

A further issue with the Water Assessment Report prepared by Klohn Crippen Berger in September 2019 is that it assesses the potential water-related impacts of up to 95 gas production wells, however the application is for up to 190 wells. Origin provided in the response to information request that *"while the Water Assessment Report described 95 production wells, the UWIR model used to simulate groundwater drawdown modelled complete dewatering of the Bandanna Formation coals by assigning fixed-pressure boundary conditions (using the MODFLOW-USG drain package) within the area of the PLs. This is a highly conservative modelling approach of the UWIR which results in an overestimation of water production and associated drawdown predictions. Due to this modelling approach, the findings of the groundwater impact assessment are independent of the number of wells proposed by the amendment application. The number of proposed wellpads for the application is more relevant to surface disturbance and potential ecological impacts."* Confirmation of this statement was sought from technical support who provided that if the dewatering of this formation was planned and included in the 2019 Surat UWIR, then OGIA would model dewatering of the entire Bandanna Formation which would be independent of well count. Clarification was sought from Origin regarding whether the impacts were planned and modelled in the 2019 Surat UWIR. Origin provided that the Mahalo PLs (1082 and 1083) were not assessed in the 2019 Surat UWIR. Klohn Crippen Berger used the 2019 Surat groundwater model to simulate drawdown within all of the Bandanna Formation. The department's concern with using the model to simulate drawdown outside of the Surat CMA UWIR cycle is that any obligations that would fall to Origin out of the *Water Act 2000* (such as the Spring Impact Management Strategy and Water Monitoring Strategy) are not allocated. Origin provided that the annual reporting process under the *Water Act 2000* is designed to capture new tenures/operations, changes in existing operations, and new information such as monitoring data. The department (by way of reviewing OGIA's previous annual reports) has confirmed that development changes will be incorporated into that process. Specifically, OGIA's last annual report in 2018 states in section 3.3 that the groundwater model is re-run for the annual report based on the current cumulative industry development profile. Resource tenure holders within the Surat CMA area provide OGIA with annual updates from tenure holders about their current development profiles. Through the annual review process, OGIA determines whether there are changes to circumstances that would impact on the predictions reported in the UWIR, including the adequacy of the groundwater monitoring network. The department is satisfied that the Denison Mahalo development will be incorporated into this process and that no further conditions such as additional

	groundwater monitoring requirements are necessary under this EA assessment process. The next annual review is due to the department within 20 business days after 16 December 2020. The next Surat CMA UWIR is due for submission to the department 1 December 2021.
☒ Land	The potential impacts on land environmental values include: • clearing of remnant vegetation, good quality agricultural land and strategic cropping areas; • damage to topsoil, resulting in loss of biological and chemical properties; • change in land profile • increased soil erosion; • introduction of pest or weed species; • improper storage and handling of fuel, chemicals and flowback fluids has the potential to result in localised contamination of soil. • Impacts to areas of environmental significance such as Environmentally Sensitive Areas (ESAs) An issue raised during the information request phase was the impact to land and its use in irrigation, cropping, grazing etc – specifically how subsidence (caused by the drawdown of water) may impact the physical attributes of the land and contribute to the issues listed in the dotpoints above. Origin referred to a 2014 document produced by the Independent Expert Scientific Committee (IESC) that demonstrates that there is no confirmed subsidence resulting from coal seam gas development in Australia. Origin further provided justification that impacts to land (subsidence) are least likely to occur when production involves: • minimal volumes of produced water – the project will produce a maximum of 2.2ML/day, declining to <0.2ML/day from year 3 onwards; • there is limited connectivity between the coal seams and adjoining formations – Rewan Group aquitard limits connectivity between the Bandanna Formation and overlying aquitards; and • the overlying strata are dominated by sandstone and other more competent rocks – sandstone is not present, however Origin believe that the limited water production and limited connectivity / drawdown to shallow units pose a limited risk of subsidence in the area.
☐ Land use	The area has been subject to extensive significant previous disturbance as a result of broad scale clearing and ongoing agricultural operations. According to the application, approximately 93% of the PLs area has been extensively cleared of vegetation with some relatively small areas of remnant vegetation present. The dominant land use is grazing and cropping. The proposed land use does not seek to change the dominant current uses, rather requiring access via landholders/owners to conduct activities. Once installed and partially rehabilitated, the area remaining per well is 0.4ha. The application details there are 11 potential homesteads located within the relevant tenures. Origin has not ground truthed the homesteads and other sensitive receptors as the well locations and infrastructure are yet to be finalised. Queensland's land access laws (not administered by DES) mean that a resource authority holder, and its staff or agents, cannot generally enter private land to undertake advanced activities unless they have entered into one of the following: a Conduct and Compensation Agreement, a Deferral Agreement, or an Opt-Out Agreement with the affected landholder. A Land Access Ombudsman was also established in 2018 as an independent, impartial body to help landholders and resource companies resolve alleged breaches of conduct and compensation agreements and make good agreements.

☒ Air	The potential impacts upon air environmental values that may be associated with petroleum activities include: • Dust generation: Varying amounts of dust may be generated during periods of high vehicle movements and may potentially impact upon sensitive receptors in proximity to the sources. • Exhaust emissions: Exhaust emissions from equipment and onsite traffic, including emissions from diesel fuelled construction equipment and vehicles. • Fugitive emissions: There is the potential for fugitive emissions to emanate from petroleum wells that have been poorly constructed and completed. The applicant has not applied for new fuel burning or combustion facilities.
☐ Social	The applicant has not acknowledged impacts to social values. The administering authority however has considered the potential impacts listed above. Due to the location of the site, the limited sensitive receptors in the area and the applicant's requirement to conduct activities in accordance with the existing and proposed conditions of the EA, the potential risks are considered low and will not be considered further.
☒ Acoustic	The proposed activity has the potential to result in: • Noise from transportation of materials and machinery • noise from operation of machinery • impacts to sensitive receptors during drilling.

5. Environmental value assessment and environmental objective assessment

AIR

Impact 1 - Dust	
Attribute	Sensitive receptors
Sub value	Air
Action	Release of dust, air emissions (e.g. petroleum, diesel)
Contaminant	Dust
Unmitigated risk	
The unmitigated risk is as per the air component in section 4 above i.e. dust generation, and exhaust and fugitive emissions. Potential impacts are greater during the construction phase of the project, especially during clearing, pipeline construction and commissioning. The application material has identified 11 potential sensitive receptors (assumed to be homesteads) in the PLs, which are to be ground truthed once the location of infrastructure is finalised.	
Proposed mitigation strategy	

The application states that the proposed activity will be operated in a way that protects the environmental values of air and will not change the impacts beyond what is currently authorised. Mitigation measures include:

- Plant and equipment to be operated in their proper and effective condition to reduce emissions
- Fugitive emissions to be mitigated through appropriate well design and construction in accordance with DNRME's industry standard
- Use of produced water for dust suppression where required
- Progressive disturbance and rehabilitation to minimise areas exposed to wind and dust
- Low emissions technologies used where appropriate

Remaining risk

The remaining risk is considered to be managed via the existing EA conditions:

- Condition A8 requires monitoring and sampling of air and dust to be in accordance with Australian standards.
- Condition A15 prohibits environmental nuisance at a sensitive place, other than where an alternative agreement is in place.
- Condition D1 prescribes how venting is to be undertaken.
- Condition D2 prohibits the operation of fuel burning or combustion facilities.

The conditions listed above are in accordance with the departmental guideline - Streamlined model conditions for petroleum activities.

The administering authority has considered the potential air impacts listed above. These potential risks are considered low risk if activities are conducted in accordance with the existing and proposed conditions of the EA, especially once wells are commissioned.

Further information required?	☐ Yes ☒ No

The activity will be operated in a way that protects the environmental values of air. Does the application include a change or a consideration to the likely impacts to environmental values of air?

PO1

PO1.1 There is no discharge to air of contaminants that may cause an adverse effect on the environment from the operation of the activity.

OR

Does it meet the PO?	☐ Yes ☒ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.

The activity has the potential to discharge contaminants to air during the construction and operational phases of the activity.

PO2

PO1.2 All of the following—

a) fugitive emissions of contaminants from storage, handling and processing of materials and transporting materials within the site are prevented or minimised;

b) contingency measures will prevent or minimise adverse effects on the environment from unplanned emissions and shut down and start up emissions of contaminants to air;

c) releases of contaminants to the atmosphere for dispersion will be managed to prevent or minimise adverse effects on environmental values.

Does it meet the PO?	☒ Yes ☐ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.

If the activity is managed in accordance with the mitigation measures proposed, and conducted in line with EA conditions, the fugitive emissions and releases of contaminants to air are considered low risk. Existing EA conditions will ensure the activity meets PO1.2 via the following:

a) Condition A11 requires all plant and equipment to be maintained in a proper and effective condition.
b) Condition D1 prescribes the operational requirements for conducting flaring.
c) Condition A15 prohibits environmental nuisance at any sensitive place.

NOISE

Impact 2 - Noise	
Attribute	Sensitive receptors
Sub value	Acoustic value
Action	Release of noise from vehicles, drilling, land clearing etc
Contaminant	Noise

Unmitigated risk

The unmitigated risk is as per the noise requirement in section 4 above i.e. noise from machinery, and construction noise (drilling etc). It is unlikely there will be any noise impacts to sensitive receptors once the wells are commissioned. The application material has identified 11 potential sensitive receptors (assumed to be homesteads) in the PLs, which are to be ground truthed once the location of infrastructure is finalised.

Proposed mitigation strategy

The application states *"the proposed activity will be operated in accordance with the existing EA conditions and will protect the environmental values of the acoustic environment. Petroleum activities will not cause an environmental nuisance from noise at a sensitive place, other than where an alternative arrangement is in place."*

Proposed mitigation measures include:

- Noise modelling prior to construction and operation of additional wells to identify potential noise emissions in exceedance of the acoustic quality objectives listed in schedule 1 of the EPP Noise.
- Undertaking construction during daylights hours only
- Treatment of noise at the source e.g. noise barriers
- Alternative arrangements with the occupier of the sensitive receptor to offset potential noise impacts.

Remaining risk

The remaining risk is considered to be managed via the existing EA conditions:

- Condition A8 requires monitoring and sampling of noise to be in accordance with standards.
- Condition A15 prohibits environmental nuisance at a sensitive place, other than where an alternative agreement is in place.
- Condition C1 prescribes noise limits for the petroleum activity, including tonal and low frequency noise adjustments (Condition C2 and Condition C3).

- Conditions C4-C6 prescribe blast criteria including airblast overpressure and ground-borne vibration peak particle velocity.

The conditions listed above are in accordance with the departmental guideline - Streamlined model conditions for petroleum activities.

The administering authority has considered the potential noise impacts listed above. Due to the location of the project area, the limited sensitive receptors in the area and the low risk potential impacts to acoustic values, the administering authority is satisfied that the proposed activities are not expected to cause impacts to acoustic environmental values, further to what is already permitted under the EA.

Further information required?	☐ Yes ☒ No

The activity will be operated in a way that protects the environmental values of the acoustic environment. Does the application include a change or a consideration to the likely impacts to the environmental values of the acoustic environment?

PO1

PO5.1 Sound from the activity is not audible at a sensitive receptor.

OR

Does it meet the PO?	☐ Yes ☒ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.

Whilst the exact location of the wells and associated infrastructure is yet to be confirmed and the sensitive receptors ground truthed, there is a potential for noise to be audible at a sensitive receptor.

PO2

PO5.2 The release of sound to the environment from the activity is managed so that adverse effects on environmental values including health and wellbeing and sensitive ecosystems are prevented or minimised.

Does it meet the PO?	☒ Yes ☐ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.

The applicant states in the application that the activity;

- will be operated in accordance with the EA conditions that protect the environmental values of the acoustic environment; and
- noise modelling will be conducted prior to construction and operation to identify potential noise emissions in exceedance of the acoustic quality objectives in schedule 1 of the EPP Noise.

The EA contains conditions to address the requirement of PO5.2 including:

- Condition A15 prohibits environmental nuisance at a sensitive place, other than where an alternative agreement is in place.
- Condition C1 prescribes noise limits for the petroleum activity, including tonal and low frequency noise adjustments (Condition C2 and Condition C3).
- Conditions C4-C6 prescribe blast criteria including airblast overpressure and ground-borne vibration peak particle velocity.

The conditions listed above are in accordance with the departmental guideline - Streamlined model conditions for petroleum activities.

SURFACE WATER

Impact 3 – Water	
Attribute	Comet River, Meteor Creek, Planet Creek and Humboldt Creek
Sub value	Surface water
Action	Release of contaminants
Contaminant	Sediment, fuels, chemicals

Unmitigated risk

Potential for unplanned releases to surface water to occur may be a result of the following:

- Unplanned releases of sediment
- Unplanned releases of fuel and chemicals
- Unplanned releases from water storage facilities or stormwater management areas.
- Loss of/degradation of aquatic habitat and water quality

Proposed mitigation strategy

The proposal states that existing plans/management actions are in place to prevent impacts to surface water:

- No plans to consume or release to surface waters
- Wells pads to be preferentially located outside of floodplain areas of Comet River and Humboldt Creek
- Chemicals and fuels to be stored, transported and handled to meet Australian standards (AS 1940:2017)
- Produced water is appropriately managed on site in accordance with existing EA conditions to prevent ponding and releases off site i.e. irrigation uses.

Remaining risk

The remaining risk is considered to be managed via the existing EA conditions:

- Condition A9 requires notification to the department for unauthorised releases of prescribed contaminants to waters
- Condition A14 requires erosion and sediment control measures to be implemented
- Condition G1 prohibits contaminants from being released to waters
- Condition G2 prohibits extraction of groundwater causing environmental harm to wetlands
- Conditions G4-G9 prescribes the requirements to undertake only linear infrastructure in wetlands or watercourses.
- Condition E5 requires the containment of chemicals and fuels to meet Australian Standards.
- Conditions B7-B12 prescribes the requirements for the use of produced water, including quality of releases.
- Condition B3 requires the containment of waste fluids.

The conditions listed above are in accordance with the departmental guideline - Streamlined model conditions for petroleum activities.

The proposed activities are therefore not expected to cause any further impacts to surface water EVs beyond what is currently approved in the EA. No additional conditions are proposed.

Further information required?	☐ Yes ☒ No

The activity will be operated in a way that protects environmental values of waters. Does the application include a change or a consideration to the likely impacts to environmental values of water?

PO1

PO2.1 There is no actual or potential discharge to waters of contaminants that may cause an adverse effect on an environmental value from the operation of the activity.

OR

Does it meet the PO?	☐ Yes ☒ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.

There is the potential for a discharge depending on well site location and the operator's management of the activity.

PO2

PO2.2 All of the following—

a) the storage and handling of contaminants will include effective means of secondary containment to prevent or minimise releases to the environment from spillage or leaks;

b) contingency measures will prevent or minimise adverse effects on the environment due to unplanned releases or discharges of contaminants to water;

c) the activity will be managed so that stormwater contaminated by the activity that may cause an adverse effect on an environmental value will not leave the site without prior treatment;

d) the disturbance of any acid sulfate soil, or potential acid sulfate soil, will be managed to prevent or minimise adverse effects on environmental values;

e) acid producing rock will be managed to ensure that the production and release of acidic waste is prevented or minimised, including impacts during operation and after the environmental authority has been surrendered;

f) any discharge to water or a watercourse or wetland will be managed so that there will be no adverse effects due to the altering of existing flow regimes for water or a watercourse or wetland;

g) for a petroleum activity, the activity will be managed in a way that is consistent with the coal seam gas water management policy, including the prioritisation hierarchy for managing and using coal seam gas water and the prioritisation hierarchy for managing saline waste;

h) the activity will be managed so that adverse effects on environmental values are prevented or minimised.

Does it meet the PO?	☒ Yes ☐ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.

The activity is proposed to be operated in way that would comply with PO2.2

a) Condition E5 requires the containment of chemicals and fuels whilst condition B3 requires the containment of waste fluids.
b) Condition A14 ensures the implementation of erosion and sediment control measures.
c) As per b) above. The activity is also proposed to be operated outside floodplain areas.
d) Not relevant to site.
e) Not relevant to site.
f) No releases to surface waters are proposed.
g) The EA contains existing conditions in the waste schedule for managing and re-using produced water.
h) The EA contains condition G1 to prevent contaminants being released to waters.

SPRINGS, WETLANDS, GDEs

Impact 4 – Springs, Wetlands and GDEs	
Attribute	Springs, wetlands and GDEs
Sub value	Terrestrial and aquatic ecology, Groundwater
Action	Lack of access to water, decreased size/scale, changes to water pressure
Contaminant	Nil

Unmitigated risk

Unmitigated impacts to springs, wetlands and GDEs

- Loss of habitat for aquatic and terrestrial flora and fauna
- Shrinkage of wetlands/springs GDEs because of reduced access to groundwater

Proposed mitigation strategy

The proposal states that existing plans/management actions are in place to prevent impacts:

- Avoidance of direct disturbance within wetlands or watercourses
- 200m buffer around wetlands of high ecological significance
- No extraction of water proposed
- No discharges of produced water to water.

Remaining risk

The remaining risk is considered to be managed via the existing EA conditions as follows:

- Condition G2 prohibits direct or indirect environmental harm to a wetland.
- Condition G3 prohibits petroleum activities in or within 200m of a wetland of high ecological significance, Great Artesian Basin Spring, or subterranean cave GDE – this is an important condition given there is one high ecological significance wetland mapped within the project area.
- Conditions G4-G6 outlines the requirements for activities within wetlands of other environmental value including prohibiting the clearing of riparian vegetation outside of the minimum area practicable to carry out the works.
- Condition G8 prescribes the water quality limits for activities conducted within wetlands of other environmental values or watercourses.

The conditions listed above are in accordance with the departmental guideline - Streamlined model conditions for petroleum activities.

The proposed activities are therefore not expected to cause any further impacts to springs, wetland and GDE EVs beyond what is currently approved in the EA. No additional conditions are proposed.

Further information required?	☐ Yes ☒ No

The activity will be operated in way that protects the environmental values of wetlands. Does the application include a change or a consideration to the likely impacts to wetlands?
PO1 **PO3.1** There will be no potential or actual adverse effect on a wetland as part of carrying out the activity. OR

Does it meet the PO?	☐ Yes ☒ No ☐ Requires further info
Justification – describe the extent to which the application achieves the objective.	
Under the current EA conditions, the EA holder is not authorised to conduct activities within wetlands of high ecological significance, Great Artesian Basin Springs or subterranean cave GDEs, however they are authorised to conduct limited activities within wetlands of other environmental values or in a watercourse. It is therefore possible that there may be potential or actual adverse effects if the activity was not conducted in accordance with the EA.	
PO2 **PO3.2** The activity will be managed in a way that prevents or minimises adverse effects on wetlands.	
Does it meet the PO?	☒ Yes ☐ No ☐ Requires further info
Justification – describe the extent to which the application achieves the objective.	
If the activities are conducted as proposed and in accordance with the current EA conditions, it is expected that there will be no adverse impacts on wetlands. The current conditions in the EA prohibit activities in areas of high ecological significance and allow limited activities within other areas. The activities authorised in other areas are protected by prescribing the type of activities allowed, the release limits the activity has to achieve and when these activities can be conducted. Furthermore, in relation to springs and GDEs, the application demonstrates there is likely no presence of these in the PLs, however, once incorporated into the Surat CMA UWIR cycle, impacts will be monitored in accordance with a Spring Impact Management Strategy and Water Monitoring Strategy under the *Water Act 2000.*	

GROUNDWATER

Impact 4 - Groundwater	
Attribute	Groundwater
Sub value	Groundwater quality/drawdown
Action	Release of contaminants, decreased volume, changes to water pressure
Contaminant	Sediment, fuels, chemicals
Unmitigated risk	

Potential impacts may be a result of the following:

- Associated water production in coal seams potentially resulting in drawdown effects in landholder bores
- Reduction of baseflow and/or increase in stream losses and implications for river ecology, particularly during low flow
- Regional scale groundwater induced salinity
- Artificial connection between aquifers via CSG wells resulting in increased drawdown and water quality changes
- Potential for improper well construction (or abandonment) or casing failure possibly resulting in connection between discrete aquifer units

Proposed mitigation strategy

The application states that the proposed activity will be operated in a way that protects the environmental values of groundwater. The proposed amendment does not change the potential impacts to the environmental values for groundwater, beyond what is authorised on the EA.

The application states that potential impacts are assessed and managed by the Office of Groundwater Impact Assessment under the Surat Underground Water Impact Report including developing a water monitoring strategy, a spring management strategy, and undertaking baseline and bore assessments.

Note that the applicant will be responsible for meeting their obligations in accordance with the requirements of the Surat UWIR and may be subject to compliance action in accordance with the *Water Act 2000* if these obligations are not met.

Remaining risk

The remaining risk is considered managed via the following EA conditions:

- Schedule A, Table 1 will clearly outline the approved number of wells (190) and intensity of these wells (228 ha). Note the scoping table separates the approved activities of PL1082 and PL1083 away from the other granted tenures where stimulation is approved. Stimulation is not approved for PL1082 and PL1083.
- Condition A9 prescribes the circumstances in which a notification is required to the department e.g. potential or actual loss of well integrity.
- Condition A10 requires petroleum activities be undertaken in accordance with written contingency procedures.
- Condition H1 prohibits the use of oil based or synthetic based drilling muds being used.
- Condition H2 prohibits the connection of the target gas producing formation and other aquifers due to drilling activities.
- Condition H3 requires practices and procedures to be in place to detect any fractures that may result in the connection of aquifers.

The conditions listed above are in accordance with the departmental guideline - Streamlined model conditions for petroleum activities.

The proposed activities are therefore not expected to cause any further impacts to groundwater beyond what is currently approved in the EA. No additional conditions are proposed.

Further information required?	☐ Yes ☒ No

The activity will be operated in a way that protects the environmental values of groundwater and any associated surface ecological systems. Does the application include a change or a consideration to the likely impacts to groundwater?

PO1

PO4.1 Both of the following apply—

a) there will be no direct or indirect release of contaminants to groundwater from the operation of the activity;

b) there will be no actual or potential adverse effect on groundwater from the operation of the activity. OR	
Does it meet the PO?	☐ Yes ☒ No ☐ Requires further info
Justification – describe the extent to which the application achieves the objective.	
If approved, there is the potential for release of contaminants to groundwater and adverse impacts to the groundwater system if the activity is not operated in accordance with the proposed mitigation measures and in accordance with the EA.	
PO2 **PO4.2** The activity will be managed to prevent or minimise adverse effects on groundwater or any associated surface ecological systems. *Note—* Some activities involving direct releases to groundwater are prohibited under section 63 of this regulation.	
Does it meet the PO?	☒ Yes ☐ No ☐ Requires further info
Justification – describe the extent to which the application achieves the objective.	
If operated as applied for and in accordance with the EA conditions, the activity's potential to have adverse effects on groundwater and associated surface ecological systems is greatly minimised. The EA has a suite of conditions within Schedule H which directly addresses well construction and maintenance requirements. Furthermore there are conditions throughout the EA designed to holistically protect groundwater values such as the requirement to undertake the activity in accordance with procedures, requirement to rehabilitate areas where petroleum activities are no longer occurring, as well as conditions prescribing where activities can be carried out. Stimulation is not approved for any wells to be drilled on PL1082 and PL1083 – this also significantly decreases the risk of releases of contaminants to groundwater.	

Groundwater – s126A-227AA

Is there a change to the exercise of groundwater rights?
If yes – then needs to meet requirements under s126A (new application) or s227AA (amendments) – refer to this guideline.
The proposed amendment would result in the exercise of underground water rights associated with petroleum production within PL1082 and PL1083. In accordance with section 227AA of the EP Act, an application must state the matters mentioned in section 126A(2), if the application: • Relates to a site-specific EA for a resource project that increases a petroleum lease; and • The proposed amendment involves changes to the exercise of underground water rights. Table 5 of the supporting information report addresses the requirements of s126A(2) of the EP Act. An assessment of this information is provided in the environmental values assessment of groundwater above.

LAND

Impact 5 – Land	
Attribute	Land
Sub value	Ecological value, use in cropping/irrigation/grazing etc
Action	Clearing of land, release of soil, loss of soil structure/stability
Contaminant	Sediment, erosion,

Unmitigated risk

The unmitigated risk is as per the land component in section 4 above i.e. clearing, erosion and sediment control, introduction of pests and weeds etc. Potential impacts are greater during the construction phase of the project, especially during clearing, pipeline construction and commissioning.

Proposed mitigation strategy

The application states that the proposed activity will be operated in in accordance with existing EA conditions and will protect the environmental values of land. Mitigation measures include:

- stockpiling topsoil
- erosion and sediment controls to reduce loss of sediment
- ground truthing prior to significant disturbance to verify terrestrial ecology
- implementation of weed, pest and biosecurity management
- dust suppression of disturbed land to prevent soil loss

Remaining risk

The remaining risk is considered to be managed via the existing EA conditions:

- Condition E1 prohibits the release of contaminants to land
- Condition E3 requires that land be managed to ensure that erosion does not occur
- Conditions E7-E9 require rehabilitation of pipeline right of way
- Condition J2 requires rehabilitation within 12 months and maintenance
- Condition J3 and J4 prescribes rehabilitation acceptance criteria
- Condition F1 requires groundtruthing of sites prior to disturbance
- Condition F8 prohibits significant residual impacts to prescribed environmental matters

The conditions listed above are in accordance with the departmental guideline - Streamlined model conditions for petroleum activities.

The administering authority has considered the potential land impacts listed above. These potential risks are considered low risk if activities are conducted in accordance with the existing and proposed conditions of the EA, especially once wells are commissioned.

Further information required?	☐ Yes ☒ No

The activity is operated in a way that protects the environmental values of land including soils, subsoils, landforms and associated flora and fauna. Does the application include a change or a consideration to the likely impacts to land including soils, subsoils, landforms and associated flora and fauna?

PO1

PO7.1 There is no actual or potential disturbance or adverse effect to the environmental values of land as part of carrying out the activity.

OR	
Does it meet the PO?	☐ Yes ☒ No ☐ Requires further info
Justification – describe the extent to which the application achieves the objective.	
There is actual disturbance required to undertake this activity – this is associated with clearing for well pads (up to 1.5ha each), as well as for the ancillary infrastructure. There may be adverse effects to the environmental values of the land.	
PO2 **PO7.2** All of the following— a) activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be managed in a way that prevents or minimises adverse effects on the environmental values of land; b) areas disturbed will be rehabilitated or restored to achieve sites that are— i. safe to humans and wildlife; and ii. non-polluting; and iii. stable; and iv. able to sustain an appropriate land use after rehabilitation or restoration; c) the activity will be managed to prevent or minimise adverse effects on the environmental values of land due to unplanned releases or discharges, including spills and leaks of contaminants; d) the application of water or waste to the land is sustainable and is managed to prevent or minimise adverse effects on the composition or structure of soils and subsoils.	
Does it meet the PO?	☒ Yes ☐ No ☐ Requires further info
Justification – describe the extent to which the application achieves the objective.	
The activity is proposed to be operated in way that would comply with PO7.2: a) The EA contains conditions that prescribe where activities can occur, and the extent and scale to which they can occur. Furthermore, the EA requires that areas planned for disturbance are groundtruthed prior to causing any disturbance to confirm the ecological values of the land. b) The EA contains rehabilitation conditions for petroleum activities and pipeline right of ways. c) The EA contains conditions to prevent the release of contaminants to land (E1) and also more specific conditions into chemical storage where there is the potential for leaks/spills of hazardous contaminants (E5). d) Schedule B of the EA addresses both general waste management, the release of pipeline wastewater and authorised re-uses of produced water for petroleum activities. The conditions contained within the schedule outline how waste can be stored, and re-used. If re-use is authorised, conditions requiring the waste meet a certain criteria are included.	

6. Further environmental objective assessment

Waste

Any wastes generated, transported, or received as part of carrying out the activity are managed in a way that protects all the environmental values. Does the application include a change or a consideration to any wastes generated, transported or received as part of carrying out the activity? PO1 **PO8.1** Both of the following apply— a) waste generated, transported or received is managed in accordance with the waste and resource management hierarchy in the Waste Reduction and Recycling Act 2011; b) if waste is disposed of, it is disposed of in a way that prevents or minimises adverse effects on environmental values.

Does it meet the PO?	☒ Yes ☐ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.
The current EA regulates waste management for the project, and the proposed amendment does not change waste management for the project, beyond what is authorised on the EA. Condition B1 of the EA requires measures be implemented so that waste is managed in accordance with the waste and resource management hierarchy and the waste and resource management principles as specified in the *Waste Reduction and Recycling Act 2011.* The application states that produced water will be beneficially used through irrigation, dust suppression, construction and water supply in accordance with conditions B7-B12 of the EA.

Does the application meet performance outcome item 1a: Waste generated, transported or received is managed in accordance with the waste and resource management hierarchy in the Waste Reduction and Recycling Act 2011.

Does it meet the PO?	☐ Yes ☐ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.

Does the application meet performance outcome item 1b: If waste is disposed of, it is disposed of in a way that prevents or minimises adverse effects on environmental values?

Does it meet the PO?	☐ Yes ☐ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.

Site Suitability (for Resource only)

The choice of the site, at which the activity is to be carried out, minimises serious environmental harm on areas of high conservation value and special significance and sensitive land uses at

adjacent places. Does the application include a change or a consideration to the site at which the activity/ies is to be carried out?

PO1

1. Both of the following apply—

a) areas of high conservation value and special significance likely to be affected by the proposal are identified and evaluated and any adverse effects on the areas are minimised, including any edge effects on the areas;

b) the activity does not have an adverse effect beyond the site.

OR

Does it meet the PO?	☐ Yes ☒ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.

In total, 190 wells are proposed which according to the application requires ~1.2ha of clearing for initial well construction. Furthermore, ancillary activities will be undertaken including installation of gas and water gathering flowlines, and construction of associated supporting infrastructure (access roads, power and communication systems, laydown and storage areas). As the application does not detail the exact location of the wells and associated infrastructure, there is the potential for areas of high conservation values, special significance and sensitive land uses to be impacted.

PO2

2. Both of the following apply—

a) areas of high conservation value and special significance likely to be affected by the proposal are identified and evaluated and any adverse effects on the areas are minimised, including any edge effects on the areas;

b) critical design requirements will prevent emissions having an irreversible or widespread impact on adjacent areas.

Does it meet the PO?	☒ Yes ☐ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.

The application states that well site development will be in accordance with the existing land disturbance conditions of the EA (schedule F) and preferentially located outside of high conservation areas. Central to these conditions is the requirement to ground truth biodiversity values (environmentally sensitive areas, prescribed environmental matters and wetlands) prior to undertaking significant land disturbance. Table 1 of Schedule F prescribes the authorised petroleum activities in ESAs and their protection zones. Under condition F8 of the EA, significant residual impacts to prescribed environmental matters are prohibited. Should APLNG want wells developed in any of the above mentioned matters, a separate EA application and subsequent approval would be required. The department considers the existing EA conditions sufficient to achieve PO2 and does not consider additional EA conditions necessary to protect these values.

Location on Site (for Resource only)

The location for the activity on a site protects all environmental values relevant to adjacent sensitive uses. Does the application include a change or a consideration to the location of the activity/ies on site?

PO1 1. The location for the activity means there will be no adverse effect on any environmental values. OR

Does it meet the PO?	☐ Yes ☒ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.
As per section "site suitability" above, the activity may have an adverse effect on environmental values of the site depending on where the well pads and ancillary infrastructure is located.
PO2 2. Both of the following apply— a) the activity, and components of the activity, are carried out on the site in a way that prevents or minimises adverse effects on the use of surrounding land and allows for effective management of the environmental impacts of the activity; and b) areas used for storing environmentally hazardous materials in bulk are located taking into consideration the likelihood of flooding.

Does it meet the PO?	☒ Yes ☐ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.
The activity is proposed to be operated in a way that complies with PO2: a) Well site development is proposed to be in accordance with the existing land disturbance conditions of the EA (schedule F) and preferentially located outside of high conservation areas. The EA also contains rehabilitation requirements to ensure that disturbed areas no longer required for petroleum activities are rehabilitated within 12 months to a prescribed criteria. a) Condition E5 requires the containment of chemicals and fuels to meet Australian Standards. Condition B2 requires all waste fluids to be transported off site for re-use, remediation, recycling or disposal.

Design Requirements (for Resource only)

The design of the facility permits the operation of the site, at which the activity is to be carried out, in accordance with best practice environmental management. Does the application include a change or consideration to the design of the facility? *PO1* 1. The activity does not involve the storage, production, treatment or release of hazardous contaminants, or involve a regulated structure. OR

Does it meet the PO?	☐ Yes ☒ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.

The activity does not propose stimulation, therefore no stimulation fluids will be used to conduct the activity.
No dams (regulated structures) have been proposed.

Fuels and chemicals will be used in the construction and operational phase (maintenance activities) of the activity.
The proposed amendment would result in the generation of produced water. The application describes the beneficial use of produced water to prevent or minimises adverse effects on environmental values in accordance with conditions B7-B12 of the EA and/or approvals under the *Waste Reduction and Recycling Act 2011.*

PO2

2. All of the following apply—

a) all storage provided for hazardous contaminants includes secondary containment to prevent or minimise releases to the environment from spillage or leaks;

b) regulated structures comply with the 'Manual for Assessing Hazard Categories and Hydraulic Performance of Dams' published by the department;

c) provide containers for the storage of hazardous contaminants that are secured to prevent the removal of the containers from the site by a flood event;

d) the facility is designed to prevent or minimise the production of hazardous contaminants and waste;

e) the facility is designed to prevent or minimise, contain and treat hazardous contaminants rather than releasing them.

Does it meet the PO?	☒ Yes ☐ No ☐ Requires further info

Justification – describe the extent to which the application achieves the objective.

The proposed activity meets the above objectives via the existing conditions of the EA:

b) Condition B1 of the EA requires measures be implemented to manage waste in accordance with the waste management hierarchy. Condition E5 requires the containment of chemicals and fuels to meet Australian Standards. Conditions B7-B12 prescribes the requirements for the use of produced water, including quality of releases.
c) Condition I4 prohibits the use of regulated structures.
d) Condition B3 requires the containment of waste fluids.
e) Conditions B1-B12 provide requirements for specific types of waste including waste fluids, flare precipitant, green waste, residual drilling material, and produced water.
f) Condition B2 requires all waste fluids to be transported off site for re-use, remediation, recycling or disposal.

No additional conditions are deemed necessary as the above conditions address the potential risk of releasing contaminants.

7. Standard Criteria

Standard criteria	How the standard criteria have been considered
SC1 The following principles of environmental policy as set out in the Intergovernmental Agreement on the Environment—	1. The precautionary principal – due regard has been given to the precautionary principal, the applicant has proposed actions that are designed to prevent environmental harm occurring as a result of the activity. These measures have been complimented by the conditioning of the EA to

Standard criteria	How the standard criteria have been considered
(1) the precautionary principle; (2) intergenerational equity; (3) conservation of biological diversity and ecological integrity.	further prevent and reduce the risk of environmental harm occurring.
	2. Intergenerational equity – if managed appropriately, as per the applicant's proposal and the conditions of the EA, the activity is not expected to unduly impact on the health, diversity and productivity of the environment for future generations.
	3. Conservation of biological diversity and ecological integrity – if managed appropriately, as per the applicant's proposal and the conditions of the EA, the activity is not expected to unduly impact on conservation of biological diversity and ecological integrity.
SC2 Any Commonwealth or State government plans, standards, agreements or requirements about environmental protection or ecologically sustainable development.	The application states that proposed activities will be undertaken in accordance with the applicable requirements of the following: • *EP Act* • *EPBC Act* • *Petroleum and Gas (Production and Safety) Act* • *(P&G Act)* • *Nature Conservation Act 1992 (NC Act)* • *Vegetation Management Act 1999 (VM Act)* • *Regional Planning Interests Act 2014* • *Water Act 2000* • *Waste Reduction and Recycling Act 2011* • *Environmental Offsets Act 2014* The relevance of these Acts to this application is referenced throughout the supporting information.
SC3 Any relevant strategic environmental area designation.	There is no strategic environmental area designated for the area where the activity is proposed.
SC4 Any relevant environmental impact study, assessment or report.	The application and all supporting information were considered during the assessment of the application.
SC5 The character, resilience and values of the receiving environment.	The character, resilience and values of the receiving environment were considered in the assessment of the proposed activities. See assessment of EVs.
SC6 All submissions made by the applicant and submitters.	As this application was not publically notified, there are no submissions to be considered as part of the assessment. The department however has received concerns by seven landholders in the project area (also refer to public interest section below). Overall, the landholders were concerned about the quality of the EA application and the level of detail contained within the application supporting material, specifically about groundwater impacts. The department issued the information request to Origin prior to receiving the concerns from the landholders – fortunately these concerns were also identified by the department and further information was requested of the applicant to address these. An initial assessment of the application supporting

Standard criteria	How the standard criteria have been considered
	documents found that there was not enough detail provided in relation to the spatial and temporal extent of groundwater impacts and whether these extended beyond the project area, potential impacts to groundwater ecosystem dependency, and how the extraction of groundwater may affect the land and its land use. In particular, this required the applicant to address how potential ecological impacts such as subsidence or changes to overland flow that may occur due to the decline in water level and/or pressure when extracting groundwater may change the environmental value of the land and its use for irrigation, cropping and agriculture. Furthermore, further detail was requested to demonstrate the validity of the data provided in the water assessment report. The department considered that the response to the information request addressed the information gaps and was satisfied that enough information was provided by Origin to proceed with the assessment.
SC7 The best practice environmental management for activities under any relevant instrument, or proposed instrument, as follows— (1) an environmental authority; (2) a transitional environmental program; (3) an environmental protection order; (4) a disposal permit; (5) a development approval.	There are no 'best practice procedures' or any other instruments recognised by the department that relate to the proposed activity. The current EA conditions have been adopted from the streamlined model conditions for petroleum activities.
SC8 the financial implications of the requirements under an instrument, or proposed instrument, mentioned in paragraph (g) as they would relate to the type of activity or industry carried out, or proposed to be carried out, under the instrument.	The financial implications of complying with the conditions of the proposed EA are considered to be accepted by the applicant who has agreed to the conditions.
SC9 The public interest.	The EP Act defines the standard criteria, which includes the public interest. The term public interest however is not defined. Therefore when considering the public interest, a decision maker can take into account a wide range of factors and issues into consideration, limited only by the subject matter, scope and purposes of the EP Act. The EP Act even states that, the Act is to be administered, as far as practicable, in consultation with, and having regard to the views and interests of, industry, Aborigines and Torres Strait Islanders under Aboriginal tradition and Island customs, interested groups and persons and the community generally. As stated in the submissions section above, the department did consider information provided by the landholders as part of the assessment and decision making processes for the application. It is considered in the public interest to approve the proposed activities in a

Standard criteria	How the standard criteria have been considered
	manner which protects the environment and human wellbeing.
SC10 Any relevant site management plan.	No relevant site management plan was provided for consideration.
SC11 Any relevant integrated environmental management system or proposed integrated environmental management system.	No relevant integrated environmental system or proposed integrated management system was provided or referenced by the applicant.
SC12 Any other matter prescribed under a regulation.	Where applicable, matters prescribed by a regulation have been considered.

8. Recommendation

☒ **Approve**	☐ **Approve with conditions imposed**	☐ **Refuse**
Insert statement of reasons if recommending refusal:		

9. Conditions to be included

1. The scoping table in Schedule A has been updated to reflect the new approved activities (highlighted in blue):

Schedule A, Table 1 – Scale and Intensity for the Activities

Tenure Number(s)	Petroleum Activity	Scale of activities	Intensity (maximum size in total)
ATP 1191 PL 450 PL 451 PL 457 PL 1012	Coal seam gas, exploration, appraisal and development wells	131 wells	165 ha
	Conventional gas exploration, appraisal and development wells	62 wells	94 ha
	Stimulation activities – Coal Seam Gas	131 wells	N/A
	Stimulation activities – Conventional Gas	62 wells	N/A
	Sewage Treatment Plant(s) that discharge treated effluent to an infiltration trench or through an irrigation scheme	10	>21 EP ≤ 100 EP
PL1082 PL1083	Coal seam gas development wells	190 wells	228 ha

2. Financial assurance conditions have been removed from the EA. Financial assurance in resource activities has been replaced by Estimated Rehabilitation Cost (ERC). Section 297 of the EP Act requires an ERC decision to be made prior to activities being undertaken.

297 Condition about ERC decision

It is a condition of an environmental authority for a resource activity that the holder must not carry out, or allow the carrying out of, a resource activity under the authority unless—
(a) an ERC decision is in effect for the resource activity when the activity is carried out; and
(b) the holder has paid a contribution to the scheme fund or given a surety for the authority under the *Mineral and Energy Resources (Financial Provisioning) Act 2018*; and
(c) the holder has complied with the requirements under the *Mineral and Energy Resources (Financial Provisioning) Act 2018* for paying a contribution to the scheme fund, or giving a surety for the authority, as required from time to time.

As such, no further conditions are required to be placed into the EA. An application for an ERC decision will be required within 10 business days of the amendment approval in accordance with s304(2)(a) of the EP Act.

3. The definition for restricted stimulation fluids has also been updated to:

Restricted stimulation fluids has the meaning in section 206 of the *Environmental Protection Act 1994* and means fluids used for the purpose of stimulation, including fracturing, that contain the following chemicals in more than the maximum amount prescribed under a regulation-

a) Petroleum hydrocarbons containing benzene, ethylbenzene, toluene or xylene
b) Chemicals that produce, or are likely to produce, benzene, ethylbenzene, toluene or xylene as the chemical breaks down in the environment

The amount of any chemical is not measured in relation to water included in the restricted stimulation fluid.

The above highlighted sentence was agreed to have been included in a previous amendment process between Santos and DES (see edocs #9273939), but was missed. The addition of the sentence provides further clarification and does not change the intent of the definition. Origin agreed to this inclusion on 3 June 2020.

A draft EA was issued to Origin on 3 June 2020. Agreement on the EA was obtained from both Origin and Santos on 3 June 2020 (see edocs #9288052).

Date : 3/06/2020 2:32:30 PM
From : sch4p4(6)
To : "SELLARS Amelia"
Subject : FW: Information request for Denison Mahalo
Attachment :
image014.png;image002.jpg;image010.jpg;image012.jpg;image013.jpg;image017.jpg;image018.jpg;image019.jpg;image020.png;image022.jpg;image026.png;image028.jpg;image001.png;image003.png;image004.png;i

Hi Amelia,

We're happy with the conditions you've proposed.

Cheers,

sch4

From: sch4p4(6) Personal informa@santos.com>
Sent: Wednesday, 3 June 2020 2:30 PM
To: sch4p4(6) Pers upstream.originenergy.com.au>; sch4p4(6) Personal informa antos.com>
Subject: RE: Information request for Denison Mahalo

Thanks sch

The wording for restricted stimulation fluids is what we were after.

Cheers,

sch4p4(6)
Environmental Advisor
Environment and Access
Santos Limited, 32 Turbot Street, Brisbane QLD 4000
t: +61 sch4p4(
Part time: Monday to Thursday
santos.com

From: sch4p4(6) Persona@upstream.originenergy.com.au]
Sent: Wednesday, 3 June 2020 2:05 PM
To: sch4p4(6) Personal inform@santos.com>; sch4p4(6) Personal informa@santos.com>
Subject: ![EXT - SANTOS NAME]: FW: Information request for Denison Mahalo

You are OK with these changes? Includes the new stim fluid defn.

Looks good to me.

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Wednesday, 3 June 2020 1:40 PM
To: sch4p4(6) Pers pstream.originenergy.com.au>
Subject: RE: Information request for Denison Mahalo

Hi sch

Thanks for that response. I agree that OGIA's annual report is sufficient to determine if there are any further obligations required. Also, OGIA's next Surat UWIR is due to the department 1 December 2021 to incorporate the inclusion of coal mining within the Surat and Clarence Moreton Basins.

In relation to the presence of GDEs, I have considered the below information and continued with my assessment.

I have attached the draft EA for your review. Can you please also seek agreement from Santos on the draft conditions? Any changes I have made to the EA have been highlighted in blue:

- Updated scoping table in schedule A
- Removal of FA conditions as these are superseded by the ERC framework which is prescribed in the EP Act
- Updated definitions to reflect current legislation
- Updated definition of restricted stimulation fluids that was agreed to be amended in a previous EA amendment, but was missed.

Sorry for the short turnaround on this – Clancy will need to make a decision on it tomorrow. Can you let me know if there's any issues with the draft EA asap.

Thanks

Amelia Sellars
Principal Environmental Officer
Energy and Extractive Resources
Environmental Services and Regulation
Department of Environment and Science
P (07) 3330 5591 I **E** Amelia.Sellars@des.qld.gov.au
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane, QLD 4000
Queensland Government

From: sch4p4(6) Pel@upstream.originenergy.com.au>
Sent: Tuesday, 2 June 2020 9:42 PM
To: SELLARS Amelia
Subject: RE: Information request for Denison Mahalo

Hi Amelia,

We briefly discussed *Water Act 2000* requirements to operate under an approved UWIR. I forgot to mention the requirement for OGIA to annually update the UWIR model predictions, impact assessments, SIMS (s378), WMS (s379), and RTH obligations (s380) under s376(1)(e) of the *Water Act 2000:*

> ***376 Content of underground water impact report***
> *(1) An underground water impact report must include each of the following—*
> *(e) a program for—*
> *(i) conducting an annual review of the accuracy of each map prepared under paragraph (b)(iv) and (v); and*
> *(ii) giving the chief executive a summary of the outcome of each review, including a statement of whether there has been a material change in the information or predictions used to prepare the maps;*

This process is designed to capture new tenure / operations like Mahalo, changes in existing operations, or new information like monitoring data outside the ordinary 3 year UWIR cycle. Section 12.1 of the 2019 Surat CMA UWIR further describes this requirement:

> ***12.1 Annual reporting***
> *OGIA will continue to provide the Department of Environment and Science with annual reports on the implementation of the UWIR. Annual reports describe any changes to circumstances that may affect the predictions of impact made in the UWIR, and updates on the implementation of management actions specified in the UWIR. OGIA will continue to implement an independent multidisciplinary research program focussing on ongoing improvement in groundwater modelling, analysis and re-evaluation of trends in monitoring data as more data becomes available.*

This OGIA page includes links to all previous annual reports:

https://www.business.qld.gov.au/industries/mining-energy-water/resources/landholders/csg/surat-cma/uwir

Annual reports on the UWIR

The annual reports provide updates on the implementation of the UWIR management strategies.

They also discuss any changes to circumstances that could impact on the predictions made in the UWIR (e.g. changes to development planning by resource tenure holders).

- 2018 annual report on the Surat UWIR 2016 (PDF, 1.2MB)
- 2017 annual report on the Surat UWIR 2016 (PDF, 1MB)
- 2014 annual report on the Surat UWIR 2012 (PDF, 2.3MB)
- 2013 annual report on the Surat UWIR 2012 (PDF, 1.7MB)

Note: No annual report was published in 2015 because the Surat UWIR 2016 provided an update on the implementation of management strategies.

For example, as shown Section 6.2 of the 2018 Annual Report (https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0007/1397644/surat-uwir-annual-report-2018.pdf), the timing of potential spring impacts was updated resulting in a change to Santos' RTH obligations. This annual review is also reflected in the approval conditions (https://environment.des.qld.gov.au/__data/assets/pdf_file/0023/98150/decision-notice-surat-uwir.pdf) for the UWIR requiring an updated impact assessment with the first annual review of the 2019 Surat CMA UWIR (e.g. the 2020 Annual Report):

3. The **responsible entity** must submit an environmental values assessment with the first annual review that updates the assessment of impacts presented in the approved UWIR on the following environmental values:
   a. Terrestrial Groundwater Dependent Ecosystems;
   b. Changes in water quality of each aquifer (including water quality objectives, groundwater flow direction, rate, and movement); and
   c. Irrigation land.

   In addition to the information presented in the approved UWIR, the environmental values assessment must specifically differentiate between the impacts over the following time periods:
   - Impacts that have occurred or are likely to occur because of any previous exercise of underground water rights pursuant to s.376(1)(da) of the *Water Act 2000*;
   - Impacts that will occur or are likely to occur because of the exercise of underground water rights during the three (3) year period starting on the consultation day of the report pursuant to s.376(1)(db)(i) of the *Water Act 2000*; and
   - Impacts that will occur or are likely to occur because of the exercise of underground water rights over the projected life of the resource tenures pursuant to s.376(1)(db)(ii) of the *Water Act 2000*.

While production from Mahalo will be assessed in the 2022 Surat CMA UWIR (or an earlier UWIR if prepared), production from Mahalo will be simulated and subject to impact assessment by OGIA in the 2020 & 2021 annual reports. While any new RTH obligations would be assigned through this annual process, given the lack of nearby petroleum operations, relatively few groundwater users, and drawdown predictions based on the 2019 Surat CMA UWIR model, I don't envisage that APLNG would be assigned any obligations associated with production from the Mahalo PLs.

While you've indicated some uncertainty about the application's assertion of low potential for groundwater dependence, it might help to refresh our memory of the QLD Government's attached terrestrial GDE impact assessment process which considers that predicted drawdown of less than 1.0m has a low risk of impact for potential terrestrial GDEs. Using the calibrated drawdown results from the 2019 Surat CMA UWIR model, the Mahalo groundwater assessment used a similar impact assessment approach as described in Section 9.2.3:

> Using the 2019 UWIR methodology for assessing potential impacts to terrestrial GDEs, the impacts are categorised as 'low risk' (greater than 0.2 m but less than 1 m). Coupled with the depth to groundwater (i.e. greater than 30 m), it is considered that there is very limited potential for the potential terrestrial GDEs to be impacted.

See below for additional info:

- A limited number of bores available to assess

A limited number of groundwater bores exist in the area reflecting the generally poor groundwater availability and / or groundwater quality within both shallow and deeper groundwater units. This is best visualised in Figure 7.32 of the groundwater assessment (http://epbcnotices.environment.gov.au/_entity/annotation/feac3129-e6ea-e911-8923-00505684324c/a71d58ad-4cba-48b6-8dab-f3091fc31cd5?t=1591090293961) – note the paucity of groundwater bores within the PLs compared to surrounding areas and the limited bores within the PLs located proximal to watercourses sourcing groundwater from alluvium dominated by direct surface water recharge:

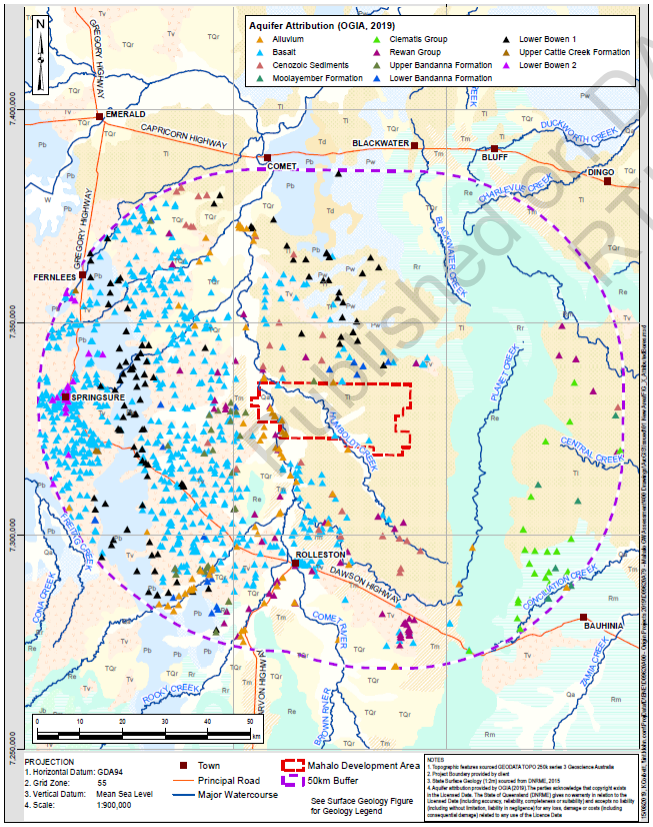


Figure 7.32 Location of Existing 'Water Supply' Bores and Attributed Aquifer (OGIA Dataset)

If significant groundwater resources existed within the Mahalo PLs, we'd expect to see more groundwater bores.

- No bore logs have been provided to enable a review of the geological profile, well construction details and historical water bearing layers

Figure 3-2 of the TGDE assessment references registered bore RN57408 as follows:

> 1. Measured groundwater level for RN57408, Queensland Groundwater Database State of Queensland (Department of Natural Resources, Mine and Energy) 2020.

Information from the records for this bore were sourced form the QLD Government's GWDB including historical groundwater level data. While this reference could've been missed by your QLD Government colleague, it's simple enough to enter this bore number into the QLD Government's bore report search (https://www.business.qld.gov.au/industries/mining-energy-water/water/bores-and-groundwater/bore-reports) to rapidly find these details which I've linked below:

http://resources.information.qld.gov.au/groundwater/reports/borereport?gw_pub_borecard&p_rn=57408

See attached (Attachment 1 – Technical Memorandum) for similar information prepared to address queries from the Federal government which provides additional confirmation of the geology of the area and groundwater levels. Critically, this work demonstrates the uniform presence of the Rewan Group aquitard within the PLs.

- No hydrographs to confirm that the current groundwater levels are a realistic representation of long term trends (i.e. and not a result of significant dewatering by the landholder as a result of drought conditions).

Section 2.2 of the attached technical memorandum provides analysis of groundwater levels in the area in addition to analysis of groundwater levels presented in Section 7.6 of the Mahalo groundwater assessment. As demonstrated above, significant dewatering is not undertaken by landholders due to the lack of groundwater bores in the area.

For arguments sake, if the groundwater level record was taken during a time of drought (a long term / multi-year period of low rainfall), the groundwater level record indicates that the RE is not dependent on groundwater for survival. A shallow groundwater level record intersecting with the root zone of the RE would indicate groundwater dependence if taken during a time of drought.

While I recognise that shallow groundwater levels can fluctuate, the TGDE assessment demonstrates significant separation of at least 22m between the maximum rooting depth of the RE and measured groundwater level. This at the very least demonstrates a very low level of groundwater dependence.

- Groundwater levels presented in terms of depth below surface, rather than m AHD – makes interpretation of the regional groundwater depth difficult, especially without topographic contours
- Surface topography in relation to the depth of groundwater has not been provided.

The topography of the area is relatively flat and consistent as described in Section 5 of the groundwater assessment making for less difficult interpretation of regional groundwater depth. Regardless, groundwater elevation contours are provided in Appendix IV of the Mahalo groundwater assessment.

From the additional information requested by your colleague, I get the impression that the TGDE assessment was technically reviewed in isolation of the Mahalo Groundwater Assessment?

Thank you for communicating your assessment progress and queries and providing me an opportunity to represent the application and wider framework. Much appreciated.

Cheers,

Dan

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Tuesday, 2 June 2020 2:52 PM
To: sch4p4(6) Pe @upstream.originenergy.com.au>
Subject: RE: Information request for Denison Mahalo

Hi sch

Thanks for clarifying. The concern I have with it not being modelled in the 2019 UWIR is that any potential obligations that fall out of the UWIR (i.e. the spring impact management strategy and water monitoring strategy) have not been allocated to Origin for ongoing monitoring and management. So I need to make sure that potential risks are appropriately managed until the next UWIR is approved that incorporates the project area. This may include putting specific conditions in the EA for example, a requirement to not impact on GDEs.

As discussed, I've also had advice on the site-specific GDE assessment. The report was considered inconclusive in that we cannot be certain there is no terrestrial dependence on groundwater for the following reasons:

- A limited number of bores available to assess
- No bore logs have been provided to enable a review of the geological profile, well construction details and historical water bearing layers
- No hydrographs to confirm that the current groundwater levels are a realistic representation of long term trends (i.e. and not a result of significant dewatering by the landholder as a result of drought conditions).
- Groundwater levels presented in terms of depth below surface, rather than m AHD – makes interpretation of the regional groundwater depth difficult, especially without topographic contours
- Surface topography in relation to the depth of groundwater has not been provided.

Please let me know if you have any input/comments on the above. As I said to you on the phone earlier, I am still progressing with my assessment.

Thanks

Amelia Sellars
Principal Environmental Officer
Energy and Extractive Resources
Environmental Services and Regulation
Department of Environment and Science

P (07) 3330 5591 I **E** Amelia.Sellars@des.qld.gov.au
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane, QLD 4000

From: sch4p4(6) Pe @upstream.originenergy.com.au>
Sent: Tuesday, 2 June 2020 2:04 PM
To: SELLARS Amelia
Subject: RE: Information request for Denison Mahalo

Hi Amelia,

The Mahalo PLs were not modelled / assessed in the 2019 Surat CMA UWIR.

The groundwater model for the 2019 Surat CMA UWIR was used to simulate drawdown within all of the Bandanna Formation within the area of the Mahalo PLs. This is documented in the groundwater assessment for the PLs and was assessed / approved by the Federal Department of Agriculture, Water, and the Environment (DAWE) and the Office of Water Science (OWS).

Compared to the GDE impact assessment presented in the 2019 Surat CMA UWIR, the groundwater assessment for Mahalo included in a more site-specific look at GDEs within the PLs and surrounds including analysis of ecological surveys and groundwater level records.

I'll give you a call to discuss – the different here is subtle but important.

Cheers,

sch4p

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Tuesday, 2 June 2020 1:25 PM
To: sch4p4(6) Pe @upstream.originenergy.com.au>
Subject: RE: Information request for Denison Mahalo

Hi sch

Quick question (hopefully) – can you confirm that the 2019 Surat UWIR modelled the complete dewatering of the entire Bandanna Formation?

Thanks

Amelia Sellars
Principal Environmental Officer
Energy and Extractive Resources
Environmental Services and Regulation
Department of Environment and Science

P (07) 3330 5591 I **E** Amelia.Sellars@des.qld.gov.au
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane, QLD 4000

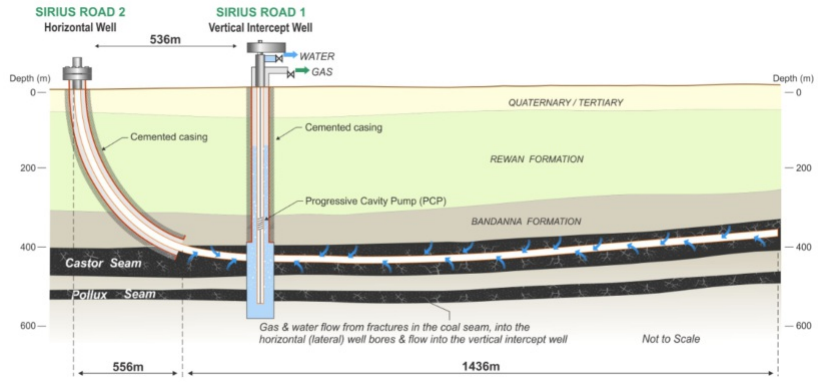
From: sch4p4(6) Pe @upstream.originenergy.com.au>
Sent: Tuesday, 12 May 2020 5:32 PM
To: SELLARS Amelia
Subject: RE: Information request for Denison Mahalo

Hi Amelia,

You're right – we did discuss this on the phone and I didn't fully detail the reason in my email.

In additional to standalone vertical wells, intersect wells may be constructed in the PLs under the DNRME Code of Practice. This initially involves the drilling of 2 separate wells which intersect within the coal seam to create a single well.

As shown in the below schematic of an existing Mahalo exploration well, intersect wells utilise 2 well pads however only one of the well pads (Sirius Road 1) utilises operational equipment to extract produced water. The other well pad (Sirius Road 2) is non-operational and used only initially to construct the horizontal section of the well.



For this reason, the report assesses groundwater extraction from 95 production wells while the amendment application describes 190 well pads (e.g. up to 2 well pads per production well).

As detailed below, the findings of the groundwater impact assessment are independent of the number of wells proposed in the amendment application due to the conservative modelling methodology for the Surat CMA UWIR (fixed-pressure drain boundary conditions across the full extent of the PLs).

Cheers,

sch4

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Tuesday, 12 May 2020 10:05 AM
To: sch4p4(6) Pe @upstream.originenergy.com.au>
Subject: RE: Information request for Denison Mahalo

Hi sc

Thanks for that information – I had an initial read through yesterday afternoon and believe it answers my questions but I'll let you know if I have any further questions as I work through each response more in depth.

Can you also please clarify between the 190 wells applied for and the 95 wells mentioned in the water assessment report. I know we talked about it briefly on the phone but would just like confirmation explaining where the difference lies.

Thanks

Amelia Sellars
Principal Environmental Officer
Energy and Extractive Resources
Environmental Services and Regulation
Department of Environment and Science

P (07) 3330 5591 I **E** Amelia.Sellars@des.qld.gov.au
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane, QLD 4000

From: sch4p4(6) Pe @upstream.originenergy.com.au>
Sent: Thursday, 7 May 2020 1:15 PM
To: SELLARS Amelia
Subject: RE: Information request for Denison Mahalo

Hi Amelia,

See below for the information requested:

> ***The application supporting material describes the ecosystem dependency on groundwater spatially, however does not describe temporal dependency. Confirm whether there are any temporal changes to ecosystem dependency on groundwater***
>
> ***Section 5.3.1.5 GDEs of the Supporting Information Report describes the mapped GDEs within the petroleum leases and potential dependency on groundwater for ecosystem function, however does not describe any potential dependencies on groundwater for GDEs outside of the petroleum leases that may be impacted. Please confirm that there are no potential impacts to mapped GDEs outside of the petroleum lease area that may be impacted by the exercise of groundwater rights***

The attached provides additional assessment of RE dependency on groundwater. This extra work confirms that:

- groundwater levels are too deep for REs to be reliant/dependent on this groundwater; or
- riparian vegetation is unlikely to be dependent on groundwater.

In terms of temporal dependency of these REs on groundwater, the work demonstrates limited potential for interaction over time (e.g. seasonal variation in groundwater levels) given:

- the significant depth to groundwater compared to the maximum potential root depth of REs; and
- surface water availability.

The attached includes an assessment of REs both within and outside of the PLs and confirms no potential significant impacts from the exercise of underground water rights.

> ***The application supporting material describes the regional and local groundwater quality, distribution of potential Groundwater Dependent Ecosystems (GDEs), springs within the project site, and potential drawdown to groundwater bores. Please describe ecological impacts (e.g. subsidence, changes to overland flow) to the environmental value of land and its use for irrigation, cropping, and agriculture that may occur due to the decline in water level and/or pressure as a result of the exercise of underdergound water.***

While there is no confirmed subsidence resulting from coal seam gas development in Australia, this Independent Expert Scientific Committee (IESC) document (https://www.environment.gov.au/system/files/resources/e9b69ac4-647c-4bbc-84db-83642227ab0d/files/background-review-subsidence_0.pdf) details how subsidence is least likely where production involves:

- minimal volumes of produced water;
- there is limited connectivity between the coal seams and adjoining formations; or
- the overlying strata are dominated by sandstone and other more competent rocks.

Minimal volumes of produced water

Section 5.3.1.1 of the of the Supporting Information Report for the EA amendment application provides a water production profile over the life of the PLs. This information demonstrates minimal water production of up to 2.2 ML/day compared to other CSG developments with up to 20+ ML/day of water production. This is partly due to the relatively few production wells proposed (up to 95 production wells) compared to larger gas developments (many hundreds of wells), and localised intra-seam faulting providing compartmentalisation acting as barrier to groundwater flow within the Bandanna Formation. The barrier effect is shown in Figure 6 of the Supporting Information Report showing a steep decline in water production from ~ Year 3 when groundwater within individual faulted 'compartments' is extracted with relatively small volumes of water subsequently entering these 'compartments'. Less than 0.2 ML/day of produced water is forecast for the most of the operational life of the PLs.

Limited connectivity between the coal seams and adjoining formations

Figure 5 of the Supporting Information Report provide the regional hydrostratigraphy within the PLs including the regionally present Rewan Group aquitard which limits connectivity between the Bandanna Formation and overlying aquitards. Drawdown results including those presented in the attached shows limited drawdown to overlying strata with a maximum of 1.6m of drawdown to shallow units with a thickness of approximately 30m. Keep in mind that this maximum drawdown prediction is very localised and based on the 95th%ile uncertainty analysis from the Surat CMA UWIR model – this represents a gross overestimation of drawdown due to the extreme values for hydraulic parameters used in OGIA's uncertainty analysis (e.g. hydraulic conductivity is increased by a factor of 5 over measured conductivity).

The overlying strata are dominated by sandstone and other more competent rocks

The overlying strata are not dominated by Sandstone and other competent rocks, however the limited water production and limited connectivity / drawdown to shallow units pose a limited risk of subsidence in the area. Accordingly, changes to existing overland flow regimes are not expected.

Existing land uses within the area are shown in Table 5.2 of the Water Assessment for the application:

Table 5.2 Summary of the Current Land Use within the Mahalo Development Area

Land Use Category			Area (km^2)	Percentage of Total Area
Primary	Secondary	Tertiary		
Conservation and natural environments	Other minimal use	Other minimal use	0.51	0.11%
		Residual native cover	3.15	0.67%
Production from dryland agriculture and plantations	Cropping	Cropping	31.47	6.71%
Production from relatively natural environments	Grazing native vegetation	Grazing native vegetation	433.70	92.46%
Water	Reservoir / dam	Reservoir / dam	0.23	0.05%
		Total	469.05	100%

This table shows that 92% of the land use is grazing with limited cropping. The application demonstrates how produced water would be managed in accordance with existing EA limits (e.g. ANZECC) and/or EoW Code approvals (e.g. ANZECC) to maintain or enhance these existing land uses.

Limited impacts to groundwater bores are predicted due to groundwater drawdown. These bores would be managed in accordance with the *Water Act* 2000 framework as described in Section 5.3.2 of the application including baseline assessments, and make good requirements if required.

Approval of the EA application does not does not change the need to gain new approvals or operate under existing approvals under the broader QLD environment and access framework including multiple approvals under the following:

- *Petroleum Act 1923 / Petroleum and Gas (Production and Safety) Act 2004* (e.g. CCAs)
- *Water Act 2000* (e.g. UWIR, baseline assessments, make good, water licencing)
- *Regional Planning Interests Act 2014* (e.g. RIDA in strategic cropping areas)
- *Waste Reduction and Recycling Act 2011* (e.g. End of Waste approvals for beneficial use of produced water such as dust suppression and irrigation)

The GasFields Commission provides a handy summary of the broader QLD environment and access framework (https://gasfieldscommissionqld.org.au/gas-industry/regulatory-framework).

Queensland's land access laws provide a balance between economic development and landholder rights. These laws mean that a resource authority holder, and its staff or agents, cannot generally enter private land to undertake advanced activities unless they have entered into one of the following: a Conduct and Compensation Agreement, a Deferral Agreement, or an Opt-Out Agreement with the affected landholder. Resource companies conducting exploration activities must also comply with the conditions of the Land Access Code 2016, which provides best practice guidelines for communication between resource companies and landholders, and imposes mandatory conditions on resource companies conducting activities on land. These mandatory conditions relate to key concerns landholders have regarding induction into the landholder's specific land access conditions, access points, use of roads and tracks, activities conducted around livestock and property, weeds and declared pests, camps, items brought onto land and gates, grids and fences. For more information about land access, refer to the publication: A guide to land access in Queensland A Land Access Ombudsman was also established in 2018 as an independent, impartial body to help landholders and resource companies resolve alleged breaches of conduct and compensation agreements and make good agreements. The GasFields Commission Queensland is an independent statutory body that facilitates stakeholder connections as well as engaging with and informing the community about aspects of Queensland's petroleum and gas industry.

> ***The Water Assessment Report prepared by Klohn Crippen Berger in September 2019 assesses the potential water-related impacts of up to 95 gas production wells, however the application is for up to 190 wells. Please provide information on further impacts (including both spatial and temporal) associated with the additional wells not described in the report.***

While the Water Assessment Report described 95 production wells, the UWIR model used to simulate groundwater drawdown modelled complete dewatering of the Bandanna Formation coals by assigning fixed-pressure boundary conditions (using the MODFLOW-USG drain package) within the area of the PLs. This is a highly conservative modelling approach of the UWIR which results in an overestimation of water production and associated drawdown predictions. This modelling approach is further described in Section 2.3.3 and 3.3.3 of the Surat CMA UWIR modelling report:

https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0008/1460627/groundwater-modelling-report-surat-cma.pdf

Due to this modelling approach, the findings of the groundwater impact assessment are independent of the number of wells proposed by the amendment application. The number of proposed wellpads for the application is more relevant to surface disturbance and potential ecological impacts.

> ***The Water Assessment Report prepared by Klohn Crippen Berger in September 2019 relies heavily on data from the 2019 Surat Cumulative Management Area Underground Water Impact Report (UWIR), which was not approved until 12 November 2019. Were there any material changes between the use of the draft 2019 UWIR and the final approved UWIR?***

The groundwater model for the 2019 UWIR was utilised to simulate water production within the area of the PLs prior to the approval of the UWIR. The OGIA have advised that minimal or no changes were made to the model following simulation of groundwater extraction within the PLs. The consultation report for the UWIR describes changes made during the consultation process limited to text changes to the report only (e.g. no modelling changes required):

https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0006/1461237/uwir-submissions-summary.pdf

I'm happy to provide more info if required.

Cheers,

sch4p4(6)

Strategic Approvals | Exploration & New Ventures

Origin
Level 29, 180 Ann Street, Brisbane QLD 4000
sch4p4(6)
upstream.originenergy.com.au
I pay my respect to the Traditional Owners whose land we live and work on. I acknowledge their Elders - past, present and emerging.

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Wednesday, 29 April 2020 3:26 PM
To: sch4p4(6) Personal information
Subject: Information request for Denison Mahalo

Hi sch4p4(6) Personal information

I've attached the information request for Denison Mahalo that Clancy signed off today.

Let me know if you have any questions.

Cheers

Amelia Sellars
Principal Environmental Officer
Energy and Extractive Resources
Environmental Services and Regulation
Department of Environment and Science

P (07) 3330 5591 I **E** Amelia.Sellars@des.qld.gov.au
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane, QLD 4000

Queensland Government

Date : 18/05/2020 5:47:45 PM
From : sch4p4(6) Pers
To : "SELLARS Amelia"
Subject : FW: Decision on referral: EPBC 2019/8534 Mahalo Development Area CSG Project [SEC=OFFICIAL]
Attachment : 2019-8534 Referral-Decision-Letter-Proponent.docx SIGNED 20200515.pdf;2019-8534 Referral-Decision-Decision notice.docx SIGNED 20200515.pdf;CMA factsheet.pdf;

Hi Amelia,

Hot off the press see attached for the not a controlled action decision for Mahalo.

This decision acknowledges no significant impacts to water resources or listed species and communities.

Cheers,

sch4p4

From: sch4p4(6) Personal informati@awe.gov.au>
Sent: Monday, 18 May 2020 9:43 AM
To: sch4p4(6) Personal information @origin.com.au>
Cc: sch4p4(6) Personal inf@upstream.originenergy.com.au>; sch4p4(6) Personal information awe.gov.au>
Subject: Decision on referral: EPBC 2019/8534 Mahalo Development Area CSG Project [SEC=OFFICIAL]

Good morning sch4p4(

I am writing to advise that a delegate of the Minister for the Environment has determined the Mahalo Development Area CSG Project (2019/8534) to be not a controlled action under the EPBC Act.

A letter providing more information, the decision notice (which will be published on the Department s website shortly), and a factsheet on the Department s compliance monitoring and auditing program are attached for your reference.

As always, please don t hesitate to get in touch if you have any questions.

Kind regards

sch4p4(6) Person

Queensland Assessments North Section | E: sch4p4(6) P@environment.gov.au
Assessments & Governance Branch | Environment Approvals Division
Department of Agriculture, Water and the Environment

Please note I m currently working remotely and my office phone has not been forwarded.

sch4p4(6) Personal informatio
Strategic Approvals Manager
Australia Pacific LNG PTY Limited
GPO Box 148
Brisbane QLD 4001

Dear sch4p4(6) Persona

Decision on referral
Mahalo Development Area CSG Project (EPBC 2019/8534)

Thank you for submitting a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This is to advise you of my decision about the proposed action to construct and operate 95 gas production wells and supporting infrastructure and facilities, approximately 40 km north-east of Rolleston, Queensland.

As a delegate of the Minister for the Environment, I have decided that the proposed action is not a controlled action. This means that the proposed action does not require further assessment and approval under the EPBC Act before it can proceed.

A copy of the document recording this decision is enclosed. This document will be published on the Department's website.

Please note that this decision relates only to the specific matters protected under Chapter 2 of the EPBC Act. This decision does not affect any requirement for separate state or local government environment assessment and approvals of the proposed action.

The Department has an active audit program for proposals that have been referred under the EPBC Act. The audit program aims to ensure that proposals are implemented as planned. Please note that your project may be selected for audit by the Department at any time and all related records and documents may be subject to scrutiny. Information about the Department's compliance monitoring and auditing program is enclosed.

If you have any questions about the referral process or this decision, please contact the project manager, sch4p4(6) Personal by email to sch4p4(6) Person@environment.gov.au or phone sch4p4(6) Persona and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

sch4p4(6) Personal information

Andrew McNee
Assistant Secretary
Assessments and Governance Branch
15 May 2020

Notification of

REFERRAL DECISION – not controlled action

Mahalo Development Area CSG Project (EPBC 2019/8534)

This decision is made under Section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Proposed action

Person proposing to take the action	Australia Pacific LNG Pty Limited ABN: 68001646331
proposed action	To construct and operate 95 gas production wells and supporting infrastructure and facilities, approximately 40 km north-east of Rolleston, Queensland [See EPBC Act referral 2019/8534].
Referral decision	Not a controlled action
status of proposed action	The proposed action is not a controlled action.

Person authorised to make decision

Name and position	Andrew McNee Assistant Secretary Assessments and Governance Branch
signature	sch4p4(6) Personal information
date of decision	15 May 2020

COMPLIANCE MONITORING AND AUDITING

This fact sheet provides an overview of the compliance monitoring and auditing program in place for projects referred under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and permits granted under the *Environment Protection (Sea Dumping) Act 1981* (the Sea Dumping Act).

What is the EPBC Act?

The EPBC Act is Australia's key national environment law. Under the EPBC Act, proposals which are likely to have a significant impact on matters of national environmental significance must be referred, assessed, and a decision made by the Minister or his delegate on whether to approve the proposal.

What is the Sea Dumping Act?

The Sea Dumping Act regulates the loading and dumping of waste at sea. The Sea Dumping Act fulfils Australia's international obligations under the London Protocol to prevent marine pollution by dumping of wastes and other matter. Permits are required from the Department for all ocean disposal activities.

What is compliance monitoring and auditing for?

The Department has implemented a program to monitor and audit projects that have been referred under the EPBC Act and the Sea Dumping Act to ensure they are complying with their approval/permit conditions or particular manner requirements and the legislation.

Compliance monitoring activities, including inspections and audits, aim to ensure projects with the potential to impact on nationally protected matters are implemented as planned. Monitoring and audits help the Australian Government to understand how well conditions or requirements are being understood and applied, and contribute to improving the effectiveness of the Department's operations.

All compliance monitoring activities, and any subsequent enforcement activities, are conducted in accordance with the Department's Compliance and Enforcement Policy.

What is a monitoring inspection?

Approved projects are subject to monitoring inspections to ensure and verify compliance with the conditions or requirements of the approval or permit. Projects are selected for a monitoring inspection based on a risk-based process informed through a number of factors, including sector, location, compliance history and the potential impact on listed matters (such as threatened species and ecological communities).

What is a compliance audit?

A compliance audit is an objective assessment of a project's compliance against selected criteria. Projects are audited against conditions or requirements. A compliance audit usually takes the form of a desktop document review and may include a site inspection, if necessary. In some cases, the document review provides the Department with enough information to verify that a project is compliant.

Projects can be chosen for audit based on a random selection process or a risk-focused selection process. If your project is selected for an audit, you will be contacted by a Departmental officer who will explain the process. All audit report summaries are posted on the Department's website. The results of audits may also be publicised through the general media.

Further information

For further information on the compliance monitoring and auditing program, please visit the Department's website at www.environment.gov.au or contact:

The Director, Monitoring and Assurance Section
Department of the Environment and Energy
GPO Box 787 CANBERRA ACT 2601
Telephone: (02) 6274 1111
Email: EPBCmonitoring@environment.gov.au



Permit

Environmental Protection Act 1994

Environmental authority EPPG00872113

This environmental authority is issued by the administering authority under Chapter 5 of the Environmental Protection Act 1994.

Environmental authority number: EPPG00872113

Environmental authority takes effect on 4 June 2020

Environmental authority holder(s)

Name(s)	Registered address
AUSTRALIA PACIFIC LNG PTY LIMITED	Level 4 139 Coronation Drive MILTON QLD 4064 Australia
SANTOS QNT PTY. LTD.	Ground Floor, Santos Centre 60 Flinders Street ADELAIDE SA 5000 Australia

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
Resource activity that is a petroleum activity and which includes the following: Item 8, Schedule 3 of the Environmental Protection Regulation 2019 - A petroleum or GHG storage activity, other than an activity mentioned in any items 1 to 7, that includes an activity from Schedule 2 for which an Aggregate Environmental Score is stated.	ATP337/1191, PL450, PL451, PL457, PL1012, PL1082, PL1083
Ancillary 63 - Sewage Treatment 1: Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of (a-i) more than 21 but not more than 100EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation scheme.	ATP337/1191, PL450, PL451, PL457, PL1012

Additional information for applicants

Environmentally relevant activities

The description of any environmentally relevant activity (ERA) for which an environmental authority (EA) is issued is a restatement of the ERA as defined by legislation at the time the EA is issued. Where there is any inconsistency between that description of an ERA and the conditions stated by an EA as to the scale, intensity or manner of carrying out an ERA, the conditions prevail to the extent of the inconsistency.

An EA authorises the carrying out of an ERA and does not authorise any environmental harm unless a condition stated by the EA specifically authorises environmental harm.

A person carrying out an ERA must also be a registered suitable operator under the *Environmental Protection Act 1994* (EP Act).

Contaminated land

It is a requirement of the EP Act that an owner or occupier of contaminated land give written notice to the administering authority if they become aware of the following:

- the happening of an event involving a hazardous contaminant on the contaminated land (notice must be given within 24 hours); or
- a change in the condition of the contaminated land (notice must be given within 24 hours); or
- a notifiable activity (as defined in Schedule 3) having been carried out, or is being carried out, on the contaminated land (notice must be given within 20 business days);

that is causing, or is reasonably likely to cause, serious or material environmental harm.

For further information, including the form for giving written notice, refer to the Queensland Government website www.qld.gov.au, using the search term 'duty to notify'.

Take effect

Please note that, in accordance with section 200 of the EP Act, an EA has effect:

a) if the authority is for a prescribed ERA and it states that it takes effect on the day nominated by the holder of the authority in a written notice given to the administering authority-on the nominated day; or

b) if the authority states a day or an event for it to take effect-on the stated day or when the stated event happens; or

c) otherwise-on the day the authority is issued.

However, if the EA is authorising an activity that requires an additional authorisation (a relevant tenure for a resource activity, a development permit under the *Sustainable Planning Act 2009* or an SDA Approval under the *State Development and Public Works Organisation Act 1971*), this EA will not take effect until the additional authorisation has taken effect.

If this EA takes effect when the additional authorisation takes effect, you must provide the administering authority written notice within 5 business days of receiving notification of the related additional authorisation taking effect.

If you have incorrectly claimed that an additional authorisation is not required, carrying out the ERA without the additional authorisation is not legal and could result in your prosecution for providing false or misleading information or operating without a valid environmental authority.

Clancy Mackaway
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Date issued: 4 June 2020

Enquiries:
Energy and Extractive Resources
Department of Environment and Science
GPO Box 2454, Brisbane QLD 4001
Phone (07) 3330 5715
Email: energyandextractive@des.qld.gov.au

Obligations under the *Environmental Protection Act 1994*

In addition to the requirements found in the conditions of this environmental authority, the holder must also meet their obligations under the EP Act, and the regulations made under the EP Act. For example, the holder must comply with the following provisions of the Act:

- general environmental duty (section 319)
- duty to notify environmental harm (section 320-320G)
- offence of causing serious or material environmental harm (sections 437-439)
- offence of causing environmental nuisance (section 440)
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)
- offence to place contaminant where environmental harm or nuisance may be caused (section 443)

ENVIRONMENTAL AUTHORITY CONDITIONS

This environmental authority consists of the following Schedules:

SCHEDULE A – GENERAL CONDITIONS

(A1) This environmental authority authorises the carrying out of the following resource activity(ies):

(a) the petroleum activities listed in *Schedule A Table 1 – Scale and Intensity for the Activities* to the extent they are carried out in accordance with the activity's scale and intensity; and

(b) the following specified relevant activity(ies):

(i) Sewage treatment - operating sewage treatment works, other than no-release works; and

(ii) Stimulation activities;

(c) seismic survey activities; and

(d) incidental petroleum activities that are not otherwise specified relevant activities.

Schedule A, Table 1 – Scale and Intensity for the Activities

Tenure Number(s)	Petroleum Activity	Scale of activities	Intensity (maximum size in total)
ATP 1191 PL 450 PL 451 PL 457 PL 1012	Coal seam gas, exploration, appraisal and development wells	131 wells	165 ha
	Conventional gas exploration, appraisal and development wells	62 wells	94 ha
	Stimulation activities – Coal Seam Gas	131 wells	N/A
	Stimulation activities – Conventional Gas	62 wells	N/A
	Sewage Treatment Plant(s) that discharge treated effluent to an infiltration trench or through an irrigation scheme	10	>21 EP ≤ 100 EP
PL1082 PL1083	Coal seam gas development wells	190 wells	228 ha

(A2) The resource activities in condition (A1) are authorised subject to the conditions of this environmental authority.

(A3) This environmental authority does not authorise a relevant act[1] to occur in carrying out an authorised resource activity unless a condition of this environmental authority expressly authorises the relevant act to occur. Where there is no condition, the lack of a condition must not be construed as authorising the relevant act.

[1] See section 493A of the *Environmental Protection Act 1994*

Monitoring standards

(A4) All monitoring must be undertaken by a suitably qualified person.

(A5) If requested by the administering authority in relation to investigating a complaint, monitoring must be commenced within 10 business days.

(A6) All laboratory analyses and tests must be undertaken by a laboratory that has NATA accreditation for such analyses and tests.

(A7) Notwithstanding condition (A6), where there are no NATA accredited laboratories for a specific analyte or substance, then duplicate samples must be sent to at least two separate laboratories for independent testing or evaluation.

(A8) Monitoring and sampling must be carried out in accordance with the requirements of the following documents (as relevant to the sampling being undertaken), as amended from time to time:

(a) for waters and aquatic environments, the Queensland Government's Monitoring and Sampling Manual 2009 – Environmental Protection (Water and Wetland Biodiversity) Policy 2019

(b) for groundwater, *Groundwater Sampling and Analysis – A Field Guide* (2009:27 GeoCat #6890.1)

(c) for noise, the Environmental Protection Regulation 2019

(d) for air, the *Queensland Air Quality Sampling Manual* and/or Australian Standard 4323.1:1995 *Stationary source emissions method 1: Selection of sampling positions*, as appropriate for the relevant measurement

(e) for soil, the *Guidelines for Surveying Soil and Land Resources, 2nd edition* (McKenzie *et al.* 2008), and/or the *Australian Soil and Land Survey Handbook, 3rd edition* (National Committee on Soil and Terrain, 2009)

(f) for dust, Australian Standard AS3580.

Notification

(A9) In addition to the requirements under Chapter 7, Part 1, Division 2 of the *Environmental Protection Act 1994*, the administering authority must be notified through the Pollution Hotline and in writing, as soon as possible, but within 48 hours of becoming aware of any of the following events:

(a) any unauthorised significant disturbance to land

(b) potential or actual loss of structural or hydraulic integrity of a dam

(c) potential or actual loss of well integrity

(d) when the seepage trigger action response procedure required under condition (G14(g)) is or should be implemented

(e) unauthorised releases of any volume of prescribed contaminants to waters

(f) unauthorised releases of volumes of contaminants, in any mixture, to land greater than:

i. 200 L of hydrocarbons; or

ii. 5 000 L of untreated coal seam gas water; or

iii. 5 000 L of raw sewage; or
iv. 10 000 L of treated sewage effluent.

(g) monitoring results where two out of any five consecutive samples do not comply with the relevant limits in the environmental authority.

Contingency procedures for emergency environmental incidents

(A10) From 1 January 2016, petroleum activities involving significant disturbance to land cannot be conducted until written contingency procedures for emergency environmental incidents have been developed which include, but are not necessarily limited to:

(a) A clear definition of what constitutes an environmental emergency incident or near miss for the petroleum activity.
(b) Consideration of the risks caused by the petroleum activity including the impact of flooding and other natural events on the petroleum activity.
(c) Response procedures to be implemented to prevent or minimise the risks of environmental harm occurring.
(d) The practices and procedures to be employed to restore the environment or mitigate any environmental harm caused.
(e) Procedures to investigate causes and impacts including impact monitoring programs for releases to waters and/or land.
(f) Training of staff to enable them to effectively respond.
(g) Procedures to notify the administering authority, local government and any potentially impacted landholder.

Maintenance of plant and equipment

(A11) All plant and equipment must be maintained and operated in their proper and effective condition.

(A12) The following infrastructure must be signed with a unique reference name or number in such a way that it is clearly observable:

(a) low consequence dams
(b) exploration, appraisal and development wells; and
(c) sewage treatment facilities.

(A13) Measures to prevent fauna being harmed from entrapment must be implemented during the construction and operation of well infrastructure, dams and pipeline trenches.

Erosion and sediment control

(A14) For activities involving significant disturbance to land, control measures that are commensurate to the site-specific risk of erosion, and risk of sediment release to waters must be implemented to:

(a) allow stormwater to pass through the site in a controlled manner and at non-erosive flow velocities

(b) minimise soil erosion resulting from wind, rain, and flowing water
(c) minimise the duration that disturbed soils are exposed to the erosive forces of wind, rain, and flowing water
(d) minimise work-related soil erosion and sediment runoff; and
(e) minimise negative impacts to land or properties adjacent to the activities (including roads).

Complaints

(A15) Petroleum activities must not cause environmental nuisance at a sensitive place, other than where an alternative arrangement is in place.

Documentation

(A16) A certification must be prepared by a suitably qualified person within 30 business days of completing every plan, procedure, program and report required to be developed under this environmental authority, which demonstrates that:
(a) relevant material, including current published guidelines (where available) have been considered in the written document
(b) the content of the written document is accurate and true; and
(c) the document meets the requirements of the relevant conditions of the environmental authority.

(A17) All plans, procedures, programs, reports and methodologies required under this environmental authority must be written and implemented.

(A18) All documents required to be developed under this environmental authority must be kept for five years.

(A19) All documents required to be prepared, held or kept under this environmental authority must be provided to the administering authority upon written request within the requested timeframe.

(A20) A record of all complaints must be kept including the date, complainant's details, source, reason for the complaint, description of investigations and actions undertaken in resolving the complaint.

SCHEDULE B - WASTE

General waste management

(B1) Measures must be implemented so that waste is managed in accordance with the waste and resource management hierarchy and the waste and resource management principles.

(B2) Waste, including waste fluids, but excluding waste used in closed-loop systems, must be transported off-site for lawful re-use, remediation, recycling or disposal, unless the waste is specifically authorised by conditions of the environmental authority to be disposed of or used on site.

(B3) Waste fluids, other than flare precipitant stored in flare pits, or residual drilling material or drilling fluids stored in sumps, must be contained in either:
- (a) an above ground container; or
- (b) a structure which contains the wetting front.

(B4) Green waste may be used on-site for either rehabilitation or sediment and erosion control, or both.

(B5) Vegetation waste may be burned if it relates to a state forest, timber reserve or forest entitlement area administered by the *Forestry Act 1959* and a permit has been obtained under the *Fire and Rescue Service Act 1990*.

Pipeline wastewater

(B6) Pipeline waste water, may be released to land provided that it:
- (a) can be demonstrated it meets the acceptable standards for release to land; and
- (b) is released in a way that does not result in visible scouring or erosion or pooling or run-off or vegetation die-off.

Authorised uses of produced water for petroleum activities

(B7) Produced water may be re-used in drilling and well hole activities.

(B8) Produced water may be used for dust suppression provided the following criteria are met:
- (a) the amount applied does not exceed the amount required to effectively suppress dust; and
- (b) the application:
  - i. does not cause on-site ponding or runoff
  - ii. is directly applied to the area being dust suppressed
  - iii. does not harm vegetation surrounding the area being dust suppressed; and
  - iv. does not cause visible salting.

(B9) Produced water may be used for construction purposes provided the use:

(a) does not result in negative impacts on the composition and structure of soil or subsoils
(b) is not directly or indirectly released to waters
(c) does not result in runoff from the construction site; and
(d) does not harm vegetation surrounding the construction site.

(B10) If there is any indication that any of the circumstances in condition (B8)(b)(i) to (B8(b)(iv) or (B9)(a) to (B9)(d) is occurring the use must cease immediately and the affected area must be remediated without delay.

Use of produced water for irrigation activities

(B11) Irrigation of produced water is authorised providing it ensures:
(a) that soil structure, stability and productive capacity can be maintained or improved
(b) toxic effects to crops do not result; and
(c) yields and produce quality are maintained or improved.

(B12) Irrigation of produced water is authorised providing a written report is provided to the chief executive which:
(a) certifies that the outcomes in condition (B11) will be achieved
(b) states water quality criteria, which has been determined in accordance with the assessment procedures outlined in *Schedule B, Table 1—Assessment procedures for water quality criteria*
(c) includes a water monitoring program to monitor that the outcomes listed in condition (B11) are being achieved.

Schedule B, Table 1—Assessment procedures for water quality criteria

Water quality criteria	Assessment procedure
electrical conductivity sodium adsorption ratio pH	Salinity Management Handbook, with reference to Chapter 11; and/or Australian and New Zealand Guidelines for Fresh and Marine Water Quality, with reference to Volume 1 Chapter 4 and Volume 3 Chapter 9. The assessment should consider: • soil properties within the root zone to be irrigated (e.g. clay content, cation exchange capacity, exchangeable sodium percentage) • water quality of the proposed resource (e.g. salinity, sodicity) • climate conditions (e.g. rainfall) • leaching fractions • average root zone salinity (calculated) • crop salt tolerance (e.g. impact threshold and yield decline) • management practices and objectives (e.g. irrigation application rate, amelioration techniques) • broader landscape issues (e.g. land use, depth to groundwater)

	• any additional modelling and tests undertaken to support the varied water quality parameters.
heavy metals	Australian and New Zealand Guidelines for Fresh and Marine Water Quality, with reference to Volume 1 Chapters 3 and 4 and Volume 3 Chapter 9. The assessment should aim to derive site specific trigger values (e.g. cumulative contaminant loading limit) based on the methodology provided in the above mentioned procedure.

Sewage treatment

(B13) Treated sewage effluent or greywater from a treatment system with a daily peak design capacity of equal to or less than100 equivalent persons (EP) may be released to land provided it:

(a) be to a fenced and signed contaminant release area(s);
(b) does not contain any properties nor contain any organisms or other contaminants in concentrations that are capable of causing environmental harm;
(c) not result in pooling or run-off or aerosols or spray drift or vegetation die-off;
(d) minimises deep drainage below the root zone of any vegetation;
(e) does not adversely affect the quality of shallow aquifers;
(f) be to a contaminant release area(s) that is kept vegetated with groundcover, that is:
    i. not a declared pest species; and
    ii. kept in a viable state for transpiration and nutrient uptake.

Residual drilling material

(B14) If sumps are used to store residual drilling material or drilling fluids, they must only be used for the duration of drilling activities.

(B15) Records must be kept to demonstrate compliance with condition (B14).

SCHEDULE C - NOISE

(C1) Notwithstanding condition (A18), emission of noise from the petroleum activity(ies) at levels less than those specified in *Schedule C, Table 1—Noise nuisance limits at a sensitive receptor* are not considered to be environmental nuisance.

Schedule C, Table 1—Noise nuisance limits at a sensitive receptor

Time period	Metric	Short term noise event	Medium term noise event	Long term noise event
7:00am—6:00pm	$L_{Aeq,adj,15\ min}$	45 dBA	43 dBA	40 dBA
6:00pm—10:00pm	$L_{Aeq,adj,15\ min}$	40 dBA	38 dBA	35 dBA
10:00pm—6:00am	$L_{Aeq,adj,15\ min}$	28 dBA	28 dBA	28 dBA
	Max $L_{pA,\ 15\ mins}$	55 dBA	55 dBA	55 dBA
6:00am—7:00am	$L_{Aeq,adj,15\ min}$	40 dBA	38 dBA	35 dBA

1. The noise limits in Table 1 have been set based on the following deemed background noise levels (L_{ABG}):
7:00am—6:00 pm: 35 dBA
6:00pm—10:00 pm: 30 dBA
10:00pm—6:00 am: 25 dBA
6:00am—7:00 am: 30 dBA

(C2) If the noise subject to a valid complaint is tonal or impulsive, the adjustments detailed in *Schedule C, Table 2—Adjustments to be added to noise levels at sensitive receptors* are to be added to the measured noise level(s) to derive $L_{Aeq,\ adj,\ 15\ min}$.

Schedule C, Table 2—Adjustments to be added to noise levels at sensitive receptors

Noise characteristic	Adjustment to noise
Tonal characteristic is just audible	+ 2 dBA
Tonal characteristic is clearly audible	+ 5 dBA
Impulsive characteristic is detectable	+ 2 to + 5 dBA

(C3) Notwithstanding condition (C1), emission of any low frequency noise must not exceed either (C3)(a) and (C3)(b), or (C3)(c) and (C3)(d) in the event of a valid complaint about low frequency noise being made to the administering authority:

(a) 60 dB(C) measured outside the sensitive receptor; and

(b) the difference between the external A-weighted and C-weighted noise levels is no greater than 20 dB; or

(c) 50 dB(Z) measured inside the sensitive receptor; and
(d) the difference between the internal A-weighted and Z-weighted (Max $L_{pZ, 15\ min}$) noise levels is no greater than 15 dB.

(C4) A Blast Management Plan must be developed for each blasting activity in accordance with Australian Standard 2187.

(C5) Blasting operations must be designed to not exceed an airblast overpressure level of 120 dB (linear peak) at any time, when measured at or extrapolated to any sensitive place.

(C6) Blasting operations must be designed to not exceed a ground-borne vibration peak particle velocity of 10mm/s at any time, when measured at or extrapolated to any sensitive place.

SCHEDULE D – AIR

Venting and flaring

(D1) Unless venting is authorised under the *Petroleum and Gas (Production and Safety) Act 2004* or the *Petroleum Act 1923*, waste gas must be flared in a manner that complies with all of (D1)(a) and (D1)(b) and (D1)(c), or with (D1)(d):

(a) an automatic ignition system is used, and

(b) a flame is visible at all times while the waste gas is being flared, and

(c) there are no visible smoke emissions other than for a total period of no more than 5 minutes in any 2 hours, or

(d) it uses an enclosed flare.

Fuel burning and combustion facilities

(D2) A fuel burning or combustion facility must not be operated on any of the petroleum tenures related to this environmental authority.

SCHEDULE E – LAND

(E1) Contaminants must not be directly or indirectly released to land except for those releases authorised by conditions of this environmental authority.

Top soil management

(E2) Top soil must be managed in a manner that preserves its biological and chemical properties.

Land management

(E3) Land that has been significantly disturbed by the petroleum activities must be managed to ensure that mass movement, gully erosion, rill erosion, sheet erosion and tunnel erosion do not occur on that land.

Acid sulfate soils

(E4) Acid sulfate soils must be treated and managed in accordance with the latest edition of the *Queensland Acid Sulfate Soil Technical Manual*.

Chemical storage

(E5) Chemicals and fuels stored, must be effectively contained and where relevant, meet Australian Standards, where such a standard is applicable.

Pipeline operation and maintenance

(E6) Pipeline operation and maintenance must be in accordance, to the greatest practicable extent, with the relevant section of the APIA Code of Environmental Practice: Onshore Pipelines (2009).

Pipeline reinstatement and revegetation

(E7) Pipeline trenches must be backfilled and topsoils reinstated within three months after pipe laying.

(E8) Reinstatement and revegetation of the pipeline right of way must commence within 6 months after cessation of petroleum activities for the purpose of pipeline construction.

(E9) Backfilled, reinstated and revegetated pipeline trenches and right of ways must be:
- (a) a stable landform
- (b) re-profiled to a level consistent with surrounding soils
- (c) re-profiled to original contours and established drainage lines; and
- (d) vegetated with groundcover which is not a declared pest species, and which is established and growing.

SCHEDULE F – BIODIVERSITY

Confirming biodiversity values

(F1) Prior to undertaking activities that result in significant disturbance to land in areas of native vegetation, confirmation of on-the-ground biodiversity values of the native vegetation communities at that location must be undertaken by a suitably qualified person.

(F2) A suitably qualified person must develop and certify a methodology so that condition (F1) can be complied with and which is appropriate to confirm on-the-ground biodiversity values.

(F3) Where mapped biodiversity values differ from those confirmed under conditions (F1) and (F2), petroleum activities may proceed in accordance with the conditions of the environmental authority based on the confirmed on-the-ground biodiversity value.

Planning for land disturbance

(F4) The location of the petroleum activity(ies) must be selected in accordance with the following site planning principles:

(a) maximise the use of areas of pre-existing disturbance
(b) in order of preference, avoid, minimise or mitigate any impacts, including cumulative impacts, on areas of native vegetation or other areas of ecological value
(c) minimise disturbance to land that may result in land degradation
(d) in order of preference, avoid then minimise isolation, fragmentation, edge effects or dissection of tracts of native vegetation; and
(e) in order of preference, avoid then minimise clearing of native mature trees.

Planning for land disturbance—linear infrastructure

(F5) Linear infrastructure construction corridors must:

(a) maximise co-location
(b) be minimised in width to the greatest practicable extent; and
(c) for linear infrastructure that is an essential petroleum activity authorised in an environmentally sensitive area or its protection zone, be no greater than 40m in total width.

Authorised disturbance to Environmentally Sensitive Areas

(F6) Where petroleum activities are to be carried out in environmentally sensitive areas or their protection zones, the petroleum activities must be carried out in accordance with *Schedule F, Table 1—Authorised petroleum activities in environmentally sensitive areas and their protection zones*

Schedule F, Table 1—Authorised petroleum activities in environmentally sensitive areas and their protection zones

Environmentally sensitive area	**Within the environmentally sensitive area**	**Primary protection zone of the environmentally sensitive area**	**Secondary protection zone of the environmentally sensitive area**
Category A environmentally sensitive areas	No petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B environmentally sensitive areas that are other than 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.
Category B environmentally sensitive areas that are 'endangered' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.
Category C environmentally sensitive areas that are 'nature refuges' or 'koala habitat'	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	
Category C environmentally sensitive areas that are 'essential habitat', 'essential regrowth habitat', or 'of concern' regional ecosystems	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	
Category C environmentally sensitive areas that are 'regional parks' (previously known as 'resources reserves')	Only essential petroleum activities permitted.	Only essential petroleum activities permitted.	
Category C environmentally sensitive areas that are 'state forests' or 'timber reserves'	Only essential petroleum activities permitted.	Petroleum activities permitted.	
Areas of vegetation that are 'critically limited'	Only low impact petroleum activities permitted.	Only essential petroleum activities permitted.	

(F7) A report must be prepared for each annual return period for all petroleum activities that involved clearing of any environmentally sensitive area or protection zone which includes:

(a) records able to demonstrate compliance with condition (F4), (F5), (F6) and (F7)

(b) a description of the works

(c) a description of the area and its pre-disturbance values (which may include maps or photographs, but must include GPS coordinates for the works); and

(d) based on the extent of environmentally sensitive areas and primary protection zones on the relevant resource authority(ies), the proportion of native vegetation cleared per environmentally sensitive area and primary protection zone, including regional ecosystem type, over the annual return period.

Impacts to prescribed environmental matters

(F8) Significant residual impacts to prescribed environmental matters, other than if the impacts were authorised by an existing authority issued before the commencement of the *Environmental Offsets Act 2014*, are not authorised under this environmental authority.

SCHEDULE G - WATER

(G1) Contaminants must not be directly or indirectly released to waters.

Authorised impacts to wetlands

(G2) The extraction of groundwater as part of the petroleum activity(ies) from underground aquifers must not directly or indirectly cause environmental harm to a wetland.

Authorised activities in waters

(G3) Petroleum activities must not occur in or within 200m of a:
- (a) wetland of high ecological significance
- (b) Great Artesian Basin Spring
- (c) subterranean cave GDE

(G4) Only construction or maintenance of linear infrastructure is permitted in or within any wetland of other environmental value or in a watercourse.

(G5) The construction or maintenance of linear infrastructure in a wetland of other environmental value must not result in the:
- (a) clearing of riparian vegetation outside of the minimum area practicable to carry out the works; or
- (b) ingress of saline water into freshwater aquifers; or
- (c) draining or filling of the wetland beyond the minimum area practicable to carry out the works.

(G6) After the construction or maintenance works for linear infrastructure in a wetland of other environmental value are completed, the linear infrastructure must not:
- (a) drain or fill the wetland
- (b) prohibit the flow of surface water in or out of the wetland
- (c) lower or raise the water table and hydrostatic pressure outside the bounds of natural variability that existed before the activities commenced
- (d) result in ongoing negative impacts to water quality
- (e) result in bank instability; or
- (f) result in fauna ceasing to use adjacent areas for habitat, feeding, roosting or nesting.

(G7) The construction or maintenance of linear infrastructure activities in a watercourse must be conducted in the following preferential order:
- (a) firstly, in times where there is no water present
- (b) secondly, in times of no flow
- (c) thirdly, in times of flow, providing a bankfull situation is not expected and that flow is maintained.

(G8) The construction or maintenance of linear infrastructure authorised under condition (G4) must comply with the water quality limits as specified in *Schedule G, Table 1—Release limits for construction or maintenance of linear infrastructure.*

Schedule G, Table 1—Release limits for construction or maintenance of linear infrastructure

Water quality parameters	Units	Water quality limits
Turbidity	Nephelometric Turbidity Units (NTU)	For a wetland of other environmental value, if background water turbidity is above 45 NTU, no greater than 25% above background water turbidity measured within a 50m radius of the construction or maintenance activity. For a watercourse, if background water turbidity is above 45 NTU, no greater than 25% above background water turbidity measured within 50m downstream of the construction or maintenance activity.
		For a wetland of other environmental value, if background water turbidity is equal to, or below 45 NTU, a turbidity limit of no greater than 55 NTU applies, measured within a 50m radius of the construction or maintenance activity. For a watercourse, if background water turbidity is equal to, or below 45 NTU, a turbidity limit of no greater than 55 NTU applies, measured within 50m downstream of the construction or maintenance activity.
Hydrocarbons	-	For a wetland of other environmental value, or watercourse, no visible sheen or slick

(G9) Monitoring must be undertaken at a frequency that is appropriate to demonstrate compliance with condition (G7).

Register of activities in wetlands and watercourses

(G10) A register must be kept of all linear infrastructure construction and maintenance activities in a wetland of other environmental value and watercourses, which must include:

(a) location of the activity (e.g. GPS coordinates (GDA94) and watercourse name)
(b) estimated flow rate of surface water at the time of the activity
(c) duration of works, and
(d) results of impact monitoring carried out under condition (G8).

Activities in River Improvement Areas

(G11) Measures must be taken to minimise negative impacts to, or reversal of, any river improvement works carried out in River Improvement Areas by Queensland's River Improvement Trusts.

Activities in Floodplains

(G12) Petroleum activity(ies) on floodplains must be carried out in a way that does not:
- (a) concentrate flood flows in a way that will or may cause or threaten a negative environmental impact; or
- (b) divert flood flows from natural drainage paths and alter flow distribution; or
- (c) increase the local duration of floods; or
- (d) increase the risk of detaining flood flows.

Seepage Monitoring Program

(G13) A seepage monitoring program must be developed by a suitably qualified person by 1 January 2016 which is commensurate with the site-specific risks of contaminant seepage from containment facilities, and which requires and plans for detection of any seepage of contaminants to groundwater as a result of storing contaminants.

(G14) The seepage monitoring program required by condition (G13) must include but not necessarily be limited to:
- (a) identification of the containment facilities for which seepage will be monitored
- (b) identification of trigger parameters that are associated with the potential or actual contaminants held in the containment facilities
- (c) identification of trigger concentration levels that are suitable for early detection of contaminant releases at the containment facilities
- (d) installation of background seepage monitoring bores where groundwater quality will not have been affected by the petroleum activities authorised under this environmental authority to use as reference sites for determining impacts
- (e) installation of seepage monitoring bores that:
  - i. are within formations potentially affected by the containment facilities authorised under this environmental authority (i.e. within the potential area of impact)
  - ii. provide for the early detection of negative impacts prior to reaching groundwater dependent ecosystems, landholder's active groundwater bores, or water supply bores
  - iii. provide for the early detection of negative impacts prior to reaching migration pathways to other formations (i.e. faults, areas of unconformities known to connect two or more formations)
- (f) monitoring of groundwater at each background and seepage monitoring bore at least quarterly for the trigger parameters identified in condition (G14(b))
- (g) seepage trigger action response procedures for when trigger parameters and trigger levels identified in conditions (G14(b)) and (G14(c)) trigger the early detection of seepage, or upon becoming aware of any monitoring results that indicate potential groundwater contamination
- (h) a rationale detailing the program conceptualisation including assumptions, determinations, monitoring equipment, sampling methods and data analysis; and
- (i) provides for annual updates to the program for new containment facilities constructed in each annual return period.

Seepage monitoring bore drill logs

(G15) A bore drill log must be completed for each seepage monitoring bore in condition (G14) which must include:

(a) bore identification reference and geographical coordinate location
(b) specific construction information including but not limited to depth of bore, depth and length of casing, depth and length of screening and bore sealing details
(c) standing groundwater level and water quality parameters including physical parameter and results of laboratory analysis for the possible trigger parameters
(d) lithological data, preferably a stratigraphic interpretation to identify the important features including the identification of any aquifers; and
(e) target formation of the bore.

SCHEDULE H – WELL CONSTRUCTION, MAINTENANCE AND STIMULATION ACTIVITIES

Drilling activities

(H1) Oil based or synthetic based drilling muds must not be used in the carrying out of the petroleum activity(ies).

(H2) Drilling activities must not result in the connection of the target gas producing formation and another aquifer.

(H3) Practices and procedures must be in place to detect, as soon as practicable, any fractures that have or may result in the connection of a target formation and another aquifer as a result of drilling activities.

Stimulation activities

(H4) Polycyclic aromatic hydrocarbons or products that contain polycyclic aromatic hydrocarbons must not be used in stimulation fluids in concentrations above the reporting limit.

(H5) Stimulation activities must not negatively affect water quality, other than that within the stimulation impact zone of the target gas producing formation.

(H6) Stimulation activities must not cause the connection of the target gas producing formation and another aquifer.

(H7) The internal and external mechanical integrity of the well system prior to and during stimulation must be ensured such that there is:
- (a) no significant leakage in the casing, tubing, or packer; and
- (b) there is no significant fluid movement into another aquifer through vertical channels adjacent to the well bore hole.

(H8) Practices and procedures must be in place to detect, as soon as practicable, any fractures that cause the connection of a target gas producing formation and another aquifer.

Stimulation risk assessment

(H9) Prior to undertaking stimulation activities, a risk assessment must be developed to ensure that stimulation activities are managed to prevent environmental harm.

(H10) The stimulation risk assessment must be carried out for every well to be stimulated prior to stimulation being carried out at that well and address issues at a relevant geospatial scale such that changes to features and attributes are adequately described and must include, but not necessarily be limited to:

(a) a process description of the stimulation activity to be applied, including equipment and a comparison to best international practice
(b) provide details of where, when and how often stimulation is to be undertaken on the tenures covered by this environmental authority
(c) a geological model of the field to be stimulated including geological names, descriptions and depths of the target gas producing formation(s)
(d) naturally occurring geological faults
(e) seismic history of the region (e.g. earth tremors, earthquakes)
(f) proximity of overlying and underlying aquifers
(g) description of the depths that aquifers with environmental values occur, both above and below the target gas producing formation
(h) identification and proximity of landholder' active groundwater bores in the area where stimulation activities are to be carried out
(i) the environmental values of groundwater in the area
(j) an assessment of the appropriate limits of reporting for all water quality indicators relevant to stimulation monitoring in order to accurately assess the risks to environmental values of groundwater
(k) description of overlying and underlying formations in respect of porosity, permeability, hydraulic conductivity, faulting and fracture propensity
(l) consideration of barriers or known direct connections between the target gas producing formation and the overlying and underlying aquifers
(m) a description of the well mechanical integrity testing program
(n) process control and assessment techniques to be applied for determining extent of stimulation activities (e.g. microseismic measurements, modelling etc.)
(o) practices and procedures to ensure that the stimulation activities are designed to be contained within the target gas producing formation
(p) groundwater transmissivity, flow rate, hydraulic conductivity and direction(s) of flow
(q) a description of the chemical compounds used in stimulation activities (including estimated total mass, estimated composition, chemical abstract service numbers and properties), their mixtures and the resultant compounds that are formed after stimulation
(r) a mass balance estimating the concentrations and absolute masses of chemical compounds that will be reacted, returned to the surface or left in the target gas producing formation subsequent to stimulation
(s) an environmental hazard assessment of the chemicals used including their mixtures and the resultant chemicals that are formed after stimulation including:
    i. toxicological and ecotoxicological information of chemical compounds used
    ii. information on the persistence and bioaccumulation potential of the chemical compounds used; and
    iii. identification of the chemicals of potential concern in stimulation fluids derived from the risk assessment
(t) an environmental hazard assessment of use, formation of, and detection of polycyclic aromatic hydrocarbons in stimulation activities

(u) if used, identification and an environmental hazard assessment of using radioactive tracer beads in stimulation activities
(v) an environmental hazard assessment of leaving chemical compounds in stimulation fluids in the target gas producing formation for extended periods subsequent to stimulation
(w) human health exposure pathways to operators and the regional population
(x) risk characterisation of environmental impacts based on the environmental hazard assessment
(y) potential impacts to landholder bores as a result of stimulation activities
(z) an assessment of cumulative underground impacts, spatially and temporally of the stimulation activities to be carried out on the tenures covered by this environmental authority; and
(aa) potential environmental or health impacts which may result from stimulation activities including but not limited to water quality, air quality (including suppression of dust and other airborne contaminants), noise and vibration.

Water quality baseline monitoring

(H11) Prior to undertaking any stimulation activity, a baseline bore assessment must be undertaken of the water quality of:
(a) all landholder's active groundwater bores (subject to access being permitted by the landholder) that are spatially located within a two (2) kilometre horizontal radius from the location of the stimulation initiation point within the target gas producing formation; and
(b) all landholders' active groundwater bores (subject to access being permitted by the landholder) in any aquifer that is within 200m above or below the target gas producing formation and is spatially located with a two (2) kilometre radius from the location of the stimulation initiation point; and
(c) any other bore that could potentially be adversely impacted by the stimulation activities in accordance with the findings of the risk assessment required by conditions (H9) and (H10).

(H12) Prior to undertaking stimulation activities at a well, there must be sufficient water quality data to accurately represent the water quality in the well to be stimulated. The data must include as a minimum the results of analyses for the parameters in condition (H13).

(H13) Stimulation Baseline bore and well assessments must include relevant analytes and physico-chemical parameters to be monitored in order to establish baseline water quality and must include, but not necessarily be limited to:
(a) pH
(b) electrical conductivity [µS/m]
(c) turbidity [NTU]
(d) total dissolved solids [mg/L]
(e) temperature [ºC]
(f) dissolved oxygen [mg/L]

(g) dissolved gases (methane, chlorine, carbon dioxide, hydrogen sulfide) [mg/L]

(h) alkalinity (bicarbonate, carbonate, hydroxide and total as $CaCO_3$) [mg/L]

(i) sodium adsorption ratio (SAR)

(j) anions (bicarbonate, carbonate, hydroxide, chloride, sulphate) [mg/L]

(k) cations (aluminium, calcium, magnesium, potassium, sodium) [mg/L]

(l) dissolved and total metals and metalloids (including but not necessarily being limited to: aluminium, arsenic, barium, borate (boron), cadmium, total chromium, copper, iron, fluoride, lead, manganese, mercury, nickel, selenium, silver, strontium, tin and zinc) [µg/L]

(m) total petroleum hydrocarbons [µg/L]

(n) BTEX (as benzene, toluene, ethylbenzene, ortho-xylene, para- and meta-xylene, and total xylene) [µg/L]

(o) polycyclic aromatic hydrocarbons (including but not necessarily being limited to: naphthalene, phenanthrene, benzo[a]pyrene) [µg/L]

(p) formaldehyde [mg/L]

(q) ethanol [mg/L]; and

(r) gross alpha + gross beta or radionuclides by gamma spectroscopy [Bq/L].

(H14) A stimulation impact monitoring program must be developed prior to the carrying out of stimulation activities which must be able to detect adverse impacts to water quality from stimulation activities and must consider the findings of the risk assessment required by conditions (H9) and (H10) that relate to stimulation activities and must include, as a minimum, monitoring of:

(a) the stimulation fluids to be used in stimulation activities at sufficient frequency and which sufficiently represent the quantity and quality of the fluids used; and

(b) flow back waters from stimulation activities at sufficient frequency and which sufficiently represents the quality of that flow back water; and

(c) flow back waters from stimulation activities at sufficient frequency and accuracy to demonstrate that 150% of the volume used in stimulation activities has been extracted from the stimulated well; and

(d) all bores in accordance with condition (H11) at the following minimum frequency:

i. Monthly for the first six months subsequent to stimulation activities being undertaken; and

ii. annually for the first five (5) years subsequent to stimulation activities being undertaken or until analytes and physico-chemical parameters identified in condition (H13) are not detected in concentrations above baseline bore monitoring data on two (2) consecutive monitoring occasions, whichever is shorter.

(H15) The stimulation impact monitoring program must provide for monitoring of:

(a) analytes and physico-chemical parameters relevant to baseline bore and well assessments to enable data referencing and comparison including, but not necessarily being limited to the analytes and physico-chemical parameters in condition (H13); and

(b) any other analyte or physico-chemical parameters that will enable detection of adverse water quality impacts and the inter-connection with a non-target aquifer as a result of stimulation activities including chemical compounds, identified in the respective Stimulation Risk Assessment, that are actually or potentially formed by chemical reactions with each other or coal seam materials during stimulation activities.

(H16) The results of the stimulation impact monitoring program must be made available to any potentially affected landholder upon request by that landholder.

SCHEDULE I – DAMS

Assessment of consequence category

(I1) The consequence category of any structure must be assessed by a suitably qualified and experienced person in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (EM635) at the following times:

(a) prior to the design and construction of the structure**,** if it is not an existing structure; or

(b) if it is an existing structure, prior to the adoption of this schedule; or

(c) prior to any change in its purpose or the nature of its stored contents.

(I2) A consequence assessment report and certification must be prepared for each structure assessed and the report may include a consequence assessment for more than one structure.

(I3) Certification must be provided by the suitably qualified and experienced person who undertook the assessment, in the form set out in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*.

Regulated Structures

(I4) Regulated structures are not authorised under this environmental authority.

SCHEDULE J – REHABILITATION

Rehabilitation planning

(J1) A Rehabilitation Plan must be developed by a suitably qualified person and must include the:
- (a) rehabilitation goals; and
- (b) procedures to be undertaken for rehabilitation that will:
  - i. achieve the requirements of conditions (J2) to (J8), inclusive; and
  - ii. provide for appropriate monitoring and maintenance.

Transitional rehabilitation

(J2) Significantly disturbed areas that are no longer required for the on-going petroleum activities, must be rehabilitated within 12 months (unless an exceptional circumstance in the area to be rehabilitated (e.g. a flood event) prevents this timeframe being met) and be maintained to meet the following acceptance criteria:
- (a) contaminated land resulting from petroleum activities is remediated and rehabilitated
- (b) the areas are:
  - i. non-polluting
  - ii. a stable landform
  - iii. re-profiled to contours consistent with the surrounding landform
- (c) surface drainage lines are re-established
- (d) top soil is reinstated; and
- (e) either:
  - i. groundcover, that is not a declared pest species, is growing; or
  - ii. an alternative soil stabilisation methodology that achieves effective stabilisation is implemented and maintained.

Final rehabilitation acceptance criteria

(J3) All significantly disturbed areas caused by petroleum activities which are not being or intended to be utilised by the landholder or overlapping tenure holder, must be rehabilitated to meet the following final acceptance criteria measured either against the highest ecological value adjacent land use or the pre-disturbed land use:
- (a) greater than or equal to 70% of native ground cover species richness
- (b) greater than or equal to the total per cent of ground cover
- (c) less than or equal to the per cent species richness of declared plant pest species; and
- (d) where the adjacent land use contains, or the pre-clearing land use contained, one or more regional ecosystem(s), then at least one regional ecosystem(s) from the same broad vegetation group, and with the equivalent biodiversity status or a biodiversity status with a higher conservation value as any of the regional ecosystem(s) in either the adjacent land or pre-disturbed land, must be present.

Final rehabilitation acceptance criteria in environmentally sensitive areas

(J4) Where significant disturbance to land has occurred in an environmentally sensitive area, the following final rehabilitation criteria as measured against the pre-disturbance biodiversity values assessment (required by conditions (F1) and (F2)) must be met:

(a) greater than or equal to 70% of native ground cover species richness
(b) greater than or equal to the total per cent ground cover
(c) less than or equal to the per cent species richness of declared plant pest species
(d) greater than or equal to 50% of organic litter cover
(e) greater than or equal to 50% of total density of coarse woody material; and
(f) all predominant species in the ecologically dominant layer, that define the pre-disturbance regional ecosystem(s) are present.

Continuing conditions

(J5) Conditions (J2), (J3) and (J4) continue to apply after this environmental authority has ended or ceased to have effect.

Rehabilitation reporting for relinquishment of part of an authority to prospect area under the *Petroleum and Gas (Production and Safety) Act 2004*

(J6) Prior to relinquishing all or part of an authority to prospect area, a rehabilitation report must be prepared which specifically relates to the area to be relinquished and demonstrates condition (J2), (J3) and (J4) has been met.

(J7) The report required under condition (J6) must be submitted to the administering authority at least 40 business days prior to the relinquishment notice being lodged with the administering authority for the *Petroleum and Gas (Production and Safety) Act 2004*.

Remaining dams

(J8) Where there is a dam (including a low consequence dam) that is being or intended to be utilised by the landholder or overlapping tenure holder, the dam must be decommissioned to no longer accept inflow from the petroleum activity(ies) and the contained water must be of a quality suitable for the intended on-going uses(s) by the landholder or overlapping tenure holder.

SCHEDULE K – DEFINITIONS

Note: Where a term is not defined in this environmental authority, the definition in the Environmental Protection Act 1994*, its regulations and Environmental Protection Policies, then the* Acts Interpretation Act 1954*, then the Macquarie Dictionary then the* Petroleum and Gas (Production and Safety) Act 2004 *or its regulations must be used in that order.*

"acceptable standards for release to land" means wastewater of the following quality as determined by monitoring results or by characterisation:

(a) electrical conductivity (EC) not exceeding 3000µS/cm
(b) sodium adsorption ratio (SAR) not exceeding 8
(c) pH between 6.0 and 9.0
(d) heavy metals (measured as total) meets the respective short term trigger value in section 4.2.6, Table 4.2.10—Heavy metals and metalloids in Australian and New Zealand Guidelines for Fresh and Marine Water Quality
(e) does not contain biocides.

"acid sulfate soil(s)" means a soil or soil horizon which contains sulfides or an acid soil horizon affected by oxidation of sulfides.

"adjacent land use(s)" means the **ecosystem function** adjacent to an area of significant disturbance, or where there is no ecosystem function, the use of the land. An adjacent land use does not include an adjacent area that shows evidence of edge effect.

"administering authority" means:

(a) for a matter, the administration and enforcement of which has been devolved to a local government under section 514 of the *Environmental Protection Act 1994*—the local government; or
(b) for all other matters—the Chief Executive of the Department of Environment and Heritage Protection; or
(c) another State Government Department, Authority, Storage Operator, Board or Trust, whose role is to administer provisions under other enacted legislation.

"alternative arrangement" means a written agreement about the way in which a particular environmental nuisance impact will be dealt with at a sensitive place, and may include an agreed period of time for which the arrangement is in place. An alternative arrangement may include, but is not limited to, a range of nuisance abatement measures to be installed at the sensitive place, or provision of alternative accommodation for the duration of the relevant nuisance impact.

"analogue site(s)" means an area of land which contains values and characteristics representative of an area to be rehabilitated prior to disturbance. Such values must encompass land use, topographic, soil, vegetation, vegetation community attributes and other ecological characteristics. Analogue sites can be the pre-disturbed site of interest where significant surveying effort has been undertaken to establish benchmark parameters.

"annual return period" means the most current 12-month period between two anniversary dates.

"appraisal well" means a petroleum well to test the potential of one (1) or more natural underground reservoirs for producing or storing petroleum. For clarity, an appraisal well does not include an exploration well.

"approved quality criteria" for the purposes of residual drilling materials, means the residual drilling material meet the following quality standards:

Part A In all cases:

Parameter	Maximum concentration
pH	6–10.5 (range)
Electrical Conductivity	20dS/m (20,000µS/cm)
Chloride*	8000mg/L

*Chloride analysis is only required if an additive containing chloride was used in the drilling process
The limits in Part A must be measured in the clarified filtrate of oversaturated solids prior to mixing.

Part B If any of the following metals are a component of the drilling fluids, then for that metal:

Parameter	Maximum concentration
Arsenic	20mg/kg
Selenium	5mg/kg
Boron	100mg/kg
Cadmium	3mg/kg
Chromium (total)	400mg/kg
Copper	100mg/kg
Lead	600mg/kg

The limits in Part B and Part C refer to the post soil/by-product mix.

Part C If a hydrocarbon sheen is visible, the following hydrocarbon fractions:

TPH	Maximum concentration
C6-C10	170mg/kg
C10-C16	150mg/kg
C16-C34	1300mg/kg
C34-C40	5600mg/kg
Total Polycyclic Aromatic Hydrocarbons (PAHs)	20mg/kg
Phenols (halogenated)	1mg/kg
Phenols (non-halogenated)	60mg/kg
Monocyclic aromatic hydrocarbons *(Total sum of benzene, toluene, ethyl benzene, xylenes (includes ortho, para and meta xylenes) and styrene)*	7mg/kg
Benzene	1mg/kg

"areas of pre-existing disturbance" means areas where environmental values have been negatively impacted as a result of anthropogenic activity and these impacts are still evident. Areas of pre-disturbance may include areas where legal clearing, logging, timber harvesting, or grazing activities have previously occurred, where high densities of weed or pest species are present which have inhibited re-colonisation of native regrowth, or

where there is existing infrastructure (regardless of whether the infrastructure is associated with the authorised petroleum activities). The term 'areas of pre-disturbance' does not include areas that have been impacted by wildfire/s, controlled burning, flood or natural vegetation die-back.

"assessed or assessment" by a suitably qualified and experienced person in relation to a consequence assessment of a dam, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit of the assessment:

(a) exactly what has been assessed and the precise nature of that determination;

(b) the relevant legislative, regulatory and technical criteria on which the assessment has been based;

(c) the relevant data and facts on which the assessment has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and

(d) the reasoning on which the assessment has been based using the relevant data and facts, and the relevant criteria.

"associated water" means underground water taken or interfered with, if the taking or interference happens during the course of, or results from, the carrying out of another authorised activity under a petroleum authority, such as a petroleum well, and includes waters also known as produced formation water. The term includes all contaminants suspended or dissolved within the water.

"associated works" in relation to a dam, means:

(a) operations of any kind and all things constructed, erected or installed for that dam; and
(b) any land used for those operations.

"Australian Standard 3580" means any of the following publications:

- AS3580.10.1 Methods for sampling and analysis of ambient air—Determination of particulate matter—Deposited matter—Gravimetric method.
- AS3580.9.6 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter—PM10 high volume sampler with size-selective inlet—Gravimetric method.
- AS3580.9.9 Methods for sampling and analysis of ambient air—Determination of suspended particulate matter— PM10 low volume sampler—Gravimetric sampler.

"background noise level" means the sound pressure level, measured in the absence of the noise under investigation, as the $L_{A90,T}$ being the A-weighted sound pressure level exceeded for 90% of the measurement time period T of not less than 15 minutes (or $L_{A\ 90,\ adj,\ 15\ mins}$), using Fast response.

"bankfull" means the channel flow rate that exists when the water is at the elevation of the channel bank above which water begins to spill out onto the floodplain. The term describes the condition of the channel relative to its banks (e.g. overbank, in-bank, bankfull, low banks, high bank).

"bed" of any waters, has the meaning in Schedule 19 of the Environmental Protection Regulation 2019 and—

(a) includes an area covered, permanently or intermittently, by tidal or non-tidal waters; but
(b) does not include land adjoining or adjacent to the bed that is from time to time covered by floodwater.

"being or intended to be utilised by the landholder or overlapping tenure holder" for significantly disturbed land, means there is a written agreement (e.g. land and compensation agreement) between the landholder or the overlapping tenure holder and the holder of the environmental authority identifying that the

landholder or the overlapping tenure holder has a preferred use of the land such that rehabilitation standards for revegetation by the holder of the environmental authority are not required.

For dams, means there is a written agreement (e.g. land and compensation agreement) between the landholder or the overlapping tenure holder and the holder of the environmental authority identifying that the landholder or the overlapping tenure holder has a preferred use for the dam such that rehabilitation standards for revegetation by the holder of the environmental authority are not required.

"biodiversity values" for the purposes of this environmental authority, means environmentally sensitive areas, prescribed environmental matters and wetlands.

"BTEX" means benzene, toluene, ethylbenzene, ortho-xylene, para-xylene, meta-xylene and total xylene.

"Category A Environmentally Sensitive Area" means any area listed in Schedule 19, Part 1 of the Environmental Protection Regulation 2019.

"Category B Environmentally Sensitive Area" means any area listed in Schedule 19, Part 2 of the Environmental Protection Regulation 2019.

"Category C Environmentally Sensitive Area" means any of the following areas:

- nature refuges as defined in the conservation agreement for that refuge under *the Nature Conservation Act 1992*
- koala habitat areas as defined under the Nature Conservation (Koala) Conservation Plan 2006
- state forests or timber reserves as defined under the *Forestry Act 1959*
- regional parks (previously known as resource reserves) under the *Nature Conservation Act 1992*
- an area validated as 'essential habitat' or 'essential regrowth habitat' from ground-truthing surveys in accordance with the *Vegetation Management Act 1999* for a species of wildlife listed as endangered or vulnerable under the *Nature Conservation Act 1992*
- 'of concern regional ecosystems' that are remnant vegetation and identified in the database called 'RE description database' containing regional ecosystem numbers and descriptions.

"certified or certification" in relation to any matter other than a design plan, 'as constructed' drawings or an annual report regarding dams means, a Statutory Declaration by a suitably qualified person or suitably qualified third party accompanying the written document stating:

- the person's qualifications and experience relevant to the function
- that the person has not knowingly included false, misleading or incomplete information in the document
- that the person has not knowingly failed to reveal any relevant information or document to the administering authority
- that the document addresses the relevant matters for the function and is factually correct; and
- that the opinions expressed in the document are honestly and reasonably held.

"certification" in relation to dams means assessment and approval must be undertaken by a suitably qualified and experienced person in relation to any assessment or documentation required by this Manual, including design plans, 'as constructed' drawings and specifications, construction, operation or an annual report regarding regulated structures, undertaken in accordance with the Board of Professional Engineers of Queensland Policy Certification by RPEQs (ID: 1.4 (2A)).

"certifying, **certify or certified"** in relation to dams have a corresponding meaning as 'certification'.

"clearing" has the meaning in the dictionary of the *Vegetation Management Act 2000* and for vegetation—
(a) means remove, cut down, ringbark, push over, poison or destroy in any way including by burning, flooding or draining; but
(b) does not include destroying standing vegetation by stock, or lopping a tree.

"closed-loop systems" means using waste on site in a way that does not release waste or contaminants in the waste to the environment.

"coal seam gas water" means groundwater that is necessarily or unavoidably brought to the surface in the process of coal seam gas exploration or production.

"consequence" in relation to a structure as defined, means the potential for environmental harm resulting from the collapse or failure of the structure to perform its primary purpose of containing, diverting or controlling flowable substances.

"consequence category" means a category, either low, significant or high, into which a dam is assessed as a result of the application of tables and other criteria in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635)*.

"construction or constructed" in relation to a dam includes building a new dam and modifying or lifting an existing dam, but does not include investigations and testing necessary for the purpose of preparing a design plan.

"control measure" has the meaning in section 31 of the Environmental Protection Regulation 2019 and means a device, equipment, structure, or management strategy used to prevent or control the release of a contaminant or waste to the environment.

"critically limited regional ecosystem" means the regional ecosystems defined and listed in Appendix 5 of the Queensland Biodiversity Offset Policy.

"daily peak design capacity" for sewage treatment works, has the meaning in Schedule 2, section 63(4) of the Environmental Protection Regulation 2019 as the higher equivalent person (EP) for the works calculated using each of the formulae found in the definition for EP.

"dam(s)" means a land-based structure or a void that contains, diverts or controls flowable substances, and includes any substances that are thereby contained, diverted or controlled by that land-based structure or void and associated works.

"declared pest species" has the meaning in the Land Protection (Pest and Stock Route Management) Regulation 2003 and is a live animal or plant declared to be a declared pest under section 36 (Declaring Pests by Regulation) or section 37(2) (Declaring Pest under Emergency Pest Notice) of that Act and includes reproductive material of the animal or plant.

"declared plant pest species" has the meaning in the Land Protection (Pest and Stock Route Management) Regulation 2003 and is a plant declared to be a declared pest under section 36 (Declaring Pests by Regulation) or section 37(2) (Declaring Pest under Emergency Pest Notice) of that Act and includes reproductive material of the plant.

"design plan" is a document setting out how all identified consequence scenarios are addressed in the planned design and operation of a regulated structure.

"development wells" means a petroleum well which produces or stores petroleum. For clarity, a development well does not include an appraisal well.

"document" has the meaning in the *Acts Interpretation Act 1954* and means:

- any paper or other material on which there is writing; and
- any paper or other material on which there are marks; and
- figures, symbols or perforations having a meaning for a person qualified to interpret them; and
- any disc, tape or other article or any material from which sounds, images, writings or messages are capable of being produced or reproduced (with or without the aid of another article or device).

"ecologically dominant layer" has the meaning in the Methodology for Surveying and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Version 3.2 August 2012) and means the layer making the greatest contribution to the overall biomass of the site and the vegetation community (NLWRA 2001). This is also referred to as the ecologically dominant stratum or the predominant canopy in woody ecosystems.

"ecosystem function" means the interactions between and within living and nonliving components of an ecosystem and generally correlates with the size, shape and location of the vegetation community.

"enclosed flare" means a device where the residual gas is burned in a cylindrical or rectilinear enclosure that includes a burning system and a damper where air for the combustion reaction is admitted.

"environmental harm" has the meaning in section 14 of the *Environmental Protection Act 1994* and means any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value, and includes environmental nuisance.

Environmental harm may be caused by an activity—

(a) whether the harm is a direct or indirect result of the activity; or
(b) whether the harm results from the activity alone or from the combined effects of the activity and other activities or factors.

"environmental nuisance" has the meaning in section 15 of the *Environmental Protection Act 1994 and means* unreasonable interference or likely interference with an environmental value caused by—

(a) aerosols, fumes, light, noise, odour, particles or smoke; or
(b) an unhealthy, offensive or unsightly condition because of contamination; or
(c) another way prescribed by regulation.

"environmentally sensitive area" means Category A, B or C environmentally sensitive areas (ESAs)

"equivalent person or EP" has the meaning under section 3 of the Planning Guidelines For Water Supply and Sewerage, 2005, published by the Queensland Government. It is calculated in accordance with Schedule 2, Section 63(4) of the Environmental Protection Regulation 2019 where:

- EP = V/200 where V is the volume, in litres, of the average dry weather flow of sewage that can be treated at the works in a day; or

- EP = M/2.5 where M is the mass, in grams, of phosphorus in the influent that the works are designed to treat as the inlet load in a day.

"essential petroleum activities" means activities that are essential to bringing the resource to the surface and are only the following:

- low impact petroleum activities
- geophysical, geotechnical, geological, topographic and cadastral surveys (including seismic, sample /test / geotechnical pits, core holes)
- single well sites not exceeding 1 hectare disturbance and multi-well sites not exceeding 1.5 hectare disturbance
- well sites with monitoring equipment (including monitoring bores):
  - for single well sites, not exceeding 1.25 hectares disturbance
  - for multi-well sites, not exceeding 1.75 hectares disturbance
- well sites with monitoring equipment (including monitoring bores) and tanks (minimum 1 ML) for above ground fluid storage:
  - for single well sites, not exceeding 1.5 hectares disturbance
  - for multi-well sites, not exceeding 2.0 hectares disturbance
- associated infrastructure located on a well site necessary for the construction and operations of wells:
  - water pumps and generators
  - flare pits
  - chemical / fuel storages
  - sumps for residual drilling material and drilling fluids
  - tanks, or dams which are not significant or high consequence dams to contain wastewater (e.g. stimulation flow back waters, produced water)
  - pipe laydown areas
  - soil and vegetation stockpile areas
  - a temporary camp associated with a drilling rig that may involve sewage treatment works that are no release works
  - temporary administration sites and warehouses
  - dust suppression activities using water that meets the quality and operational standards approved under the environmental authority
- communication and power lines that are necessary for the undertaking of petroleum activities and that are located within well sites, well pads and pipeline right of ways without increasing the disturbance area of petroleum activities
- supporting access tracks
- gathering / flow pipelines from a well head to the initial compression facility
- activities necessary to achieve compliance with the conditions of the environmental authority in relation to another essential petroleum activity (e.g. sediment and erosion control measures, rehabilitation).

"existing authority' has the meaning in section 94 of the *Environmental Offsets Act 2014.*

"existing structure" means a structure that was in existence prior to the adoption of this schedule of conditions under the authority.

"exploration well" means a petroleum well that is drilled to:

- explore for the presence of petroleum or natural underground reservoirs suitable for storing petroleum; or
- obtain stratigraphic information for the purpose of exploring for petroleum.

For clarity, an exploration well does not include an appraisal or development well.

"flare pit" has the meaning in the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (EM635), and means containment area where any hydrocarbon that is discovered in an over-pressured reservoir during a drilling operation is diverted to, and combusted. The flare pit is only used during the drilling and work over process on a petroleum well.

"flare precipitant" means waste fluids which result from the operation of a flare.

"floodplains" has the meaning in the *Water Act 2000* and means an area of reasonably flat land adjacent to a watercourse that—

- is covered from time to time by floodwater overflowing from the watercourse; and
- does not, other than in an upper valley reach, confine floodwater to generally follow the path of the watercourse; and
- has finer sediment deposits than the sediment deposits of any bench, bar or in-stream island of the watercourse.

"flowable substance" means matter or a mixture of materials which can flow under any conditions potentially affecting that substance. Constituents of a flowable substance can include water, other liquids fluids or solids, or a mixture that includes water and any other liquids fluids or solids either in solution or suspension.

"fuel burning or combustion facility" means a permanent fuel burning or combustion equipment which in isolation, or combined in operation, or which are interconnected, is, or are capable of burning more than 500 kg of fuel in an hour.

"GDA" means Geocentric Datum of Australia.

"Great Artesian Basin (GAB) spring" means an area protected under the *Environment Protection and Biodiversity Conservation Act 1999* because it is considered to be a Matter of National Environmental Significance and identified as a:

- community of native species dependent on natural discharge of groundwater from the Great Artesian Basin; or
- Great Artesian Basin spring; or
- Great Artesian Basin discharge spring wetland.

A GAB spring includes a spring vent, spring complex or watercourse spring and includes the land to which water rises naturally from below the ground and the land over which the water then flows.

Note: The Australian Government's Protected Matters Search Tool should be used to get an indication of whether the area of interest may contain an MNES spring.

Note: The GAB springs dataset can be requested from the Queensland Government Herbarium

"green waste" means waste that is grass cuttings, trees, bushes, shrubs, material lopped from trees, untreated timber or other waste that is similar in nature but does not include declared pest species.

"greywater" means wastewater generated from domestic activities such as laundry, dishwashing, and bathing. Greywater does not include sewage.

"growing" means to increase by natural development, as any living organism or part thereof by assimilation of nutriment; increase in size or substance.

"hydraulic integrity" refers to the capacity of a dam to contain or safely pass flowable substances based on its design.

"impacts to state significant biodiversity values" means to have a negative effect on a state significant biodiversity value as identified by the Queensland Biodiversity Offset Policy (Department of Environment and Heritage Protection, 2014). Examples may include, but are not necessarily limited to:

- clearing, removal or fragmentation of vegetation
- interference or disturbance of fauna habitat.

"impulsive (for noise)" means sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the background sound pressure. The duration of a single impulsive sound is usually less than one second.

"incidental activity" for this environmental authority means an activity that is not a specified relevant activity and is necessary to carry out the activities authorised under this environmental authority.

"LA 90, adj, 15 mins" means the A-weighted sound pressure level, adjusted for tonal character that is equal to or exceeded for 90% of any 15 minutes sample period equal, using Fast response.

"land degradation" has the meaning in the *Vegetation Management Act 1999* and means the following:

- soil erosion
- rising water tables
- the expression of salinity
- mass movement by gravity of soil or rock
- stream bank instability
- a process that results in declining water quality.

"landholder's active groundwater bore" means bores that are able to continue to provide a reasonable yield of water in terms of quantity for the bores authorised purpose or use. This term does not include monitoring bores owned by the administering authority of the *Water Act 2000*.

"linear infrastructure" means powerlines, pipelines, flowlines, roads and access tracks.

"liquid" means a substance which is flowing and offers no permanent resistance to changes of shape.

"long term noise event" means a noise exposure, when perceived at a sensitive receptor, persists for a period of greater than five (5) days, even when there are respite periods when the noise is inaudible within those five (5) days.

"low consequence dam" means any dam that is not classified as high or significant as assessed using the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures, published by the administering authority, as amended from time to time.

"low impact petroleum activities" means petroleum activities which do not result in the clearing of native vegetation, cause disruption to soil profiles through earthworks or excavation or result in significant disturbance to land which cannot be rehabilitated immediately using hand tools after the activity is completed. Examples of such activities include but are not necessarily limited to soil surveys (excluding test pits), topographic surveys, cadastral surveys and ecological surveys, may include installation of monitoring equipment provided that it is within the meaning of low impact and traversing land by car or foot via existing access tracks or routes or in such a way that does not result in permanent damage to vegetation.

"manual" means the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* published by the administering authority.

"Max $L_{pA,\ 15\ min}$" means the absolute maximum instantaneous A-weighted sound pressure level, measured over 15 minutes.

"Max $L_{pZ,\ 15\ min}$" means the maximum value of the Z-weighted sound pressure level measured over 15 minutes.

"medium term noise event" is a noise exposure, when perceived at a sensitive receptor, persists for an aggregate period not greater than five (5) days and does not re-occur for a period of at least four (4) weeks. Re-occurrence is deemed to apply where a noise of comparable level is observed at the same receptor location for a period of one hour or more, even if it originates from a difference source or source location.

"methodology" means the science of method, especially dealing with the logical principles underlying the organisation of the various special sciences, and the conduct of scientific inquiry.

"month" has the meaning in the *Acts Interpretation Act 1954* and means a calendar month and is a period starting at the beginning of any day of one (1) of the 12 named months and ending—

- immediately before the beginning of the corresponding day of the next named month; or
- if there is no such corresponding day—at the end of the next named month.

"NATA accreditation" means accreditation by the National Association of Testing Authorities Australia.

"pipeline waste water" means hydrostatic testing water, flush water or water from low point drains.

"pre-disturbed land use" means the function or use of the land as documented prior to significant disturbance occurring at that location.

"predominant species" has the meaning in the Methodology for Surveying and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Version 3.2 August 2012) and means a species that contributes most to the overall above-ground biomass of a particular stratum.

"prescribed contaminants" has the meaning in section 440ZD of the *Environmental Protection Act 1994* and means:
(a) earth; or
(b) a contaminant prescribed under section 440ZF.

"prescribed environmental matters" has the meaning in section 10 of the *Environmental Offsets Act 2014*, limited to the matters of State environmental significant listed in schedule 2 of the Environmental Offsets Regulation 2014.

"primary protection zone" means an area within 200m from the boundary of any Category A, B or C ESA.

"produced water" has the meaning in Section 15A of the *Petroleum and Gas (Production and Safety) Act 2004* and means CSG water or associated water for a petroleum tenure.

"protection zone" means the primary protection zone of any Category A, B or C ESA or the secondary protection zone of any Category A or B ESA.

"regional ecosystem" has the meaning in the Methodology for Surveying and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (Version 3.2 August 2012) and means a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil. Regional ecosystems of Queensland were originally described in Sattler and Williams (1999). The Regional Ecosystem Description Database (Queensland Herbarium 2013) is maintained by Queensland Herbarium and contains the current descriptions of regional ecosystems.

"regulated structure" includes land-based containment structures, levees, bunds and voids, but not a tank or container designed and constructed to an Australian Standard that deals with strength and structural integrity.

"rehabilitation or rehabilitated" means the process of reshaping and revegetating land to restore it to a stable landform and in accordance with acceptance criteria and, where relevant, includes remediation of contaminated land. For the purposes of pipeline rehabilitation, rehabilitation includes reinstatement, revegetation and restoration.

"reinstate or reinstatement" for pipelines, means the process of bulk earth works and structural replacement of pre-existing conditions of a site (i.e. soil surface typography, watercourses, culverts, fences and gates and other landscape(d) features) and is detailed in the Australian Pipeline Industry Association (APIA) Code of Environmental Practice: Onshore Pipelines (2013).

"reporting limit" means the lowest concentration that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions. For many analytes, the reporting limit is selected as the lowest non-zero standard in the calibration curve. Results that fall below the reporting limit will be reported as "less than" the value of the reporting limit. The reporting limit is also referred to as the practical quantitation limit or the limit of quantitation. For polycyclic aromatic hydrocarbons, the reporting limit must be based on super-ultra trace methods and, depending on the specific polycyclic aromatic hydrocarbon, will range between 0.005 µg/L–0.02 µg/L.

"residual drilling material" means waste drilling materials including muds and cuttings or cement returns from well holes and which have been left behind after the drilling fluids are pumped out.

"restoration" means the replacement of structural habitat complexity, ecosystem processes, services and function from a disturbed or degraded site to that of a pre-determined or analogue site. For the purposes of pipelines, restoration applies to final rehabilitation after pipeline decommissioning.

"restricted stimulation fluids" has the meaning in section 206 of the *Environmental Protection Act 1994* and means fluids used for the purpose of stimulation, including fracturing, that contain the following chemicals in more than the maximum amount prescribed under a regulation —

(a) petroleum hydrocarbons containing benzene, ethylbenzene, toluene or xylene
(b) chemicals that produce, or are likely to produce, benzene, ethylbenzene, toluene or xylene as the chemical breaks down in the environment.

The amount of any chemical is not measured in relation to water included in the restricted stimulation fluid.

"revegetation or revegetating or revegetate" means to actively re-establish vegetation through seeding or planting techniques in accordance with site specific management plans.

"secondary protection zone" in relation to a Category A or Category B ESA means an area within 100 metres from the boundary of the primary protection zone.

"sensitive place" means:

- a dwelling (including residential allotment, mobile home or caravan park, residential marina or other residential premises, motel, hotel or hostel)
- a library, childcare centre, kindergarten, school, university or other educational institution
- a medical centre, surgery or hospital
- a protected area
- a public park or garden that is open to the public (whether or not on payment of money) for use other than for sport or organised entertainment
- a work place used as an office or for business or commercial purposes, which is not part of the petroleum activity(ies) and does not include employees accommodation or public roads
- for noise, a place defined as a sensitive receptor for the purposes of the Environmental Protection (Noise) Policy 2019.

"sensitive receptor" is defined in Schedule 2 of the Environmental Protection (Noise) Policy 2019, and means an area or place where noise is measured.

"short term noise event" is a noise exposure, when perceived at a sensitive receptor, persists for an aggregate period not greater than eight hours and does not re-occur for a period of at least seven (7) days. Re-occurrence is deemed to apply where a noise of comparable level is observed at the same receptor location for a period of one hour or more, even if it originates from a different source or source location.

"significantly disturbed or significant disturbance or significant disturbance to land or areas" means land is significantly disturbed if—

(a) it is contaminated land; or
(b) it has been disturbed and human intervention is needed to rehabilitate it—
    (i) to a condition required under the relevant environmental authority; or
    (ii) if the environmental authority does not require the land to be rehabilitated to a particular condition—to the condition it was in immediately before the disturbance.

Without limiting subsection (1)(b), land requires human intervention to rehabilitate it if–

(a) the disturbance has made the land more susceptible to erosion; or
(b) the land use capability or suitability of the land is diminished; or
(c) the quality of water in a watercourse downstream of the land has been significantly reduced.

"significant residual impact" has the meaning in section 8 *Environmental Offsets Act 2014*.

"species richness" means the number of different species in a given area.

"specified relevant activities" for this environmental authority means an activity that:

(a) but for being carried out as a resource activity, would be an activity prescribed under Section 19A of the *Environmental Protection Act 1994* as an environmentally relevant activity; or
(b) stimulation activities.

"stable" has the meaning in Schedule 5 of the Environmental Protection Regulation 2008 and, for a site, means the rehabilitation and restoration of the site is enduring or permanent so that the site is unlikely to collapse, erode or subside.

"stimulation" means a technique used to increase the permeability of natural underground reservoir that is undertaken above the formation pressure and involves the addition of chemicals. It includes hydraulic fracturing / hydrofraccing, fracture acidizing and the use of proppant treatments.

Note: This definition is restricted from that in the *Petroleum and Gas (Production and Safety) Act 2004* in order to only capture the types of stimulation activities that pose a risk to environmental values of water quality in aquifers.

"stimulation fluid" means the fluid injected underground to increase permeability of a natural underground reservoir. For clarity, the term stimulation fluid only applies to fluid injected down well post-perforation.

"**stimulation impact zone"** means a 100m maximum radial distance from the stimulation target location within a gas producing formation.

"structure" means a dam or levee.

"subterranean cave GDE"

- means an area identified as a subterranean cave in the mapping produced by the Queensland Government and identified in the Queensland Government Information System, as amended from time to time; and
- means a cave ecosystem which requires access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to matraintain its communities of plants and animals, ecological processes and ecosystem services. Subterranean cave GDEs are caves dependent on the subterranean presence of groundwater. Subterranean cave GDEs have some degree of groundwater connectivity and are indicated by either high moisture levels or the presence of stygofauna, or both, referred to in the Queensland Government WetlandsInfo mapping program, as amended from time to time.

Note: the Subterranean GDE (caves) dataset can be displayed through the Queensland Government WetlandInfo mapping program.

Note: the Subterranean GDE (caves) dataset can be obtained from the Queensland Government Information System.

"suitably qualified and experienced person" in relation to regulated structures means a person who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the *Professional Engineers Act 2002*, and has demonstrated competency and relevant experience:

- for regulated dams, an RPEQ who is a civil engineer with the required qualifications in dam safety and dam design.

- for regulated levees, an RPEQ who is a civil engineer with the required qualifications in the design of flood protection embankments.

Note: It is permissible that a suitably qualified and experienced person obtain subsidiary certification from an RPEQ who has demonstrated competence and relevant experience in either geomechanics, hydraulic design or engineering hydrology.

"suitably qualified person" means 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.

"suitably qualified third party" means a person who:

(a) has qualifications and experience relevant to performing the function including but not limited to:
    i. a bachelor's degree in science or engineering; and
    ii. 3 years' experience in undertaking soil contamination assessments; and
(b) is a member of at least one organisation prescribed in Schedule 14 of the Environmental Protection Regulation 2019; and
(c) not be an employee of, nor have a financial interest or any involvement which would lead to a conflict of interest with the holder(s) of the environmental authority.

"sump" means a pit in which waste residual drilling material or drilling fluids are stored only for the duration of drilling activities.

"synthetic based drilling mud" means a mud where the base fluid is a synthetic oil, consisting of chemical compounds which are artificially made or synthesised by chemically modifying petroleum components or other raw materials rather than the whole crude oil.

"top soil" means the surface (top) layer of a soil profile, which is more fertile, darker in colour, better structured and supports greater biological activity than underlying layers. The surface layer may vary in depth depending on soil forming factors, including parent material, location and slope, but generally is not greater than about 300mm in depth from the natural surface.

"total density of coarse woody material" means the total length of logs on the ground greater than or equal to 10cm diameter per hectare and number of logs on the ground greater than or equal to 10cm diameter per hectare.

"transmissivity" means the rate of flow of water through a vertical strip of aquifer which is one unit wide and which extends the full saturated depth of the aquifer.

"valid complaint" means all complaints unless considered by the administering authority to be frivolous, vexatious or based on mistaken belief.

"void" means any constructed, open excavation in the ground.

"waste and resource management hierarchy" has the meaning provided in section 9 of the *Waste Reduction and Recycling Act 2011 and* is the following precepts, listed in the preferred order in which waste and resource management options should be considered—

(a) AVOID unnecessary resource consumption
(b) REDUCE waste generation and disposal

(c) RE-USE waste resources without further manufacturing
(d) RECYCLE waste resources to make the same or different products
(e) RECOVER waste resources, including the recovery of energy
(f) TREAT waste before disposal, including reducing the hazardous nature of waste
(g) DISPOSE of waste only if there is no viable alternative.

"waste and resource management principles" has the meaning provided in section 4(2)(b) of the *Waste Reduction and Recycling Act 2011* and means the:
(a) polluter pays principle
(b) user pays principle
(c) proximity principle
(d) product stewardship principle.

"waste fluids" has the meaning in section 13 of the *Environmental Protection Act 1994* in conjunction with the common meaning of "fluid" which is "a substance which is capable of flowing and offers no permanent resistance to changes of shape". Accordingly, to be a waste fluid, the waste must be a substance which is capable of flowing and offers no permanent resistance to changes of shape.

"watercourse" has the meaning in Schedule 4 of the *Environmental Protection Act 1994* and means:
1) a river, creek or stream in which water flows permanently or intermittently—
    a) in a natural channel, whether artificially improved or not; or
    b) in an artificial channel that has changed the course of the watercourse.
2) Watercourse includes the bed and banks and any other element of a river, creek or stream confining or containing water.

"waters" includes all or any part of a creek, river, stream, lake, lagoon, swamp, wetland, spring, unconfined surface water, unconfined water in natural or artificial watercourses, bed and bank of any waters, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and underground water.

"well integrity" the ability of a well to contain the substances flowing through it.

"wetland" for the purpose of this environmental authority, wetland means an area shown as a wetland on the map of Queensland Wetland Environmental Values.
Note: The Environmental Protection (Water and Wetland Biodiversity) Policy 2019 Schedule 2, Map of Queensland Wetland Environmental Values means the document 'Map of Queensland Wetland Environmental Values' made by the Chief Executive and published on the website.
Environmental values in section 8 of the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 apply to wetland areas on the map, which are categorised as wetlands of high or general ecological significance.

"wetland of high ecological significance" means a wetland that meets the definition of a wetland and that is shown as a wetland of 'high ecological significance' or wetland of 'high ecological value' on the Map of Queensland Wetland Environmental Values.

"wetland of other environmental value" means a wetland that meets the definition of a wetland and that is shown as a wetland of 'general environmental significance' or wetland of 'other environmental value' on the Map of Queensland Wetland Environmental Values.

END OF CONDITIONS

Environmental Protection Act 1994

Information request

This information request is issued by the administering authority under section 140 of the Environmental Protection Act 1994 *to request further information needed to assess an amendment application for a site-specific environmental authority.*

To: SANTOS QNT PTY. LTD.
Ground Floor, Santos Centre
60 Flinders Street
ADELAIDE SA 5000

cc: Australia Pacific LNG Pty Limited
Level 4
139 Coronation Drive
MILTON QLD 4064

Email: Envapprovals@upstream.originenergy.com.au

ATTN: sch4p4(6) Per

Our reference: EPPG00872113

Further information is required to assess an amendment application for a site-specific environmental authority

1. Application details

The amendment application for a site-specific environmental authority was received by the administering authority on 18 February 2020.

Land description: PL450, ATP337, PL1012, PL451, ATP1191, PL457

2. Information request

The administering authority has considered the abovementioned application and is writing to inform you that further information is required to assess the application (an information request).

The information requested is provided below:

- The application supporting material describes the ecosystem dependency on groundwater spatially, however does not describe temporal dependency. Confirm whether there are any temporal changes to ecosystem dependency on groundwater.
- The application supporting material describes the regional and local groundwater quality, distribution of potential Groundwater Dependent Ecosystems (GDEs), springs within the project site, and potential drawdown to groundwater bores. Please describe ecological impacts (e.g. subsidence, changes to overland flow) to the environmental value of land and its use for irrigation, cropping, and agriculture that may occur due to the decline in water level and/or pressure as a result of the exercise of underderground water.

- Section 5.3.1.5 GDEs of the Supporting Information Report describes the mapped GDEs within the petroleum leases and potential dependency on groundwater for ecosystem function, however does not describe any potential dependencies on groundwater for GDEs outside of the petroleum leases that may be impacted. Please confirm that there are no potential impacts to mapped GDEs outside of the petroleum lease area that may be impacted by the exercise of groundwater rights.
- The Water Assessment Report prepared by Klohn Crippen Berger in September 2019 assesses the potential water-related impacts of up to 95 gas production wells, however the application is for up to 190 wells. Please provide information on further impacts (including both spatial and temporal) associated with the additional wells not described in the report.
- The Water Assessment Report prepared by Klohn Crippen Berger in September 2019 relies heavily on data from the 2019 Surat Cumulative Management Area Underground Water Impact Report (UWIR), which was not approved until 12 November 2019. Were there any material changes between the use of the draft 2019 UWIR and the final approved UWIR?

3. Actions

The abovementioned application will lapse unless you respond by giving the administering authority -

(a) all of the information requested; or
(b) part of the information requested together with a written notice asking the authority to proceed with the assessment of the application; or
(c) a written notice –
    i. stating that you do not intend to supply any of the information requested; and
    ii. asking the administering authority to proceed with the assessment of the application.

A response to the information requested must be provided by 30 October 2020 (the information response period). If you wish to extend the information response period, a request to extend the period must be made at least 10 business days before the last day of the information response period.

The response to this information request or a request to extend the information response period can be submitted to the administering authority by email to EnergyandExtractive@des.qld.gov.au.

If the information provided in response to this information request is still not adequate for the administering authority to make a decision, your application may be refused as a result of section 176 of the *Environmental Protection Act 1994,* where the administering authority must have regard to any response given for an information request.

4. Review and appeal rights

You may apply to the administering authority for a review of this decision within 10 business days after receiving this notice. Information about your review rights is attached to this notice. This information is guidance only and you may have other legal rights and obligations.

If you require more information, please contact Amelia Sellars, Principal Environmental Officer on (07) 3330 5591 or via Amelia.Sellars@des.qld.gov.au.

sch4p4(6) Personal information

Signature

29 April 2020

Date

Clancy Mackaway
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
Energy and Extractive Resources
Department of Environment and Science
GPO Box 2454, Brisbane QLD 4001
Phone (07) 3330 5715
Email: energyandextractive@des.qld.gov.au

Attachments

Information sheet: Internal review and appeals (ESR/2015/1742)

Date : 3/03/2020 4:17:14 PM
From : "COPP Rachel"
To : "SELLARS Amelia"
Subject : RE: ALD Notice EPPG00872113 Denison Mahalo
Attachment : image001.png;image003.png;image004.png;

Thank you Amelia.

I approve the assessment level decision for a major amendment without public notification and note the issues regarding the annual fee/assessment fee.

Kind regards,

Queensland Government

Rachel Copp
A/Manager (Assessment)
Energy and Extractive Resources
Department of Environment and Science

P 07 3330 5585
Level 7 400 George St, Brisbane
GPO Box 2454, Brisbane QLD 4001

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Tuesday, 3 March 2020 4:13 PM
To: COPP Rachel
Subject: ALD Notice EPPG00872113 Denison Mahalo

Hi Rachel

Attached is the ALD notice for the Denison Mahalo amendment application (connect ref APP0049581). The ALD decision is due today. I am recommending the ALD decision be major with no public notification required.

I found these issues with the annual fee and assessment fee in connect that means the decision should be made outside of connect:

- Annual fee – the EA holder is being charged for a non-scheduled petroleum activity, not a site specific EA. Their annual fee is ~$700 when it should be >$100,000.
- Assessment fee – for the major amendment, the major fee generating in connect is ~$200 because of the wrong ERA. The fee should be around $35,000-$40,000.

Once you have endorsed I will email sch4p4(6) nd let him know of the decision. Under s229 of the EP Act we have 10bd to issue the ALD notice.

Thanks

Queensland Government

Amelia Sellars
Principal Environmental Officer
Energy and Extractive Resources
Environmental Services and Regulation
Department of Environment and Science

P (07) 3330 5591 I **E** Amelia.Sellars@des.qld.gov.au
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane, QLD 4000

Date : 4/06/2020 9:03:31 AM
From : "MACKAWAY Clancy"
To : "SELLARS Amelia"
Cc : "COPP Rachel"
Subject : RE: For signing: Denison Mahalo EA
Attachment : Notice of Decision 20200604 EPPG00872113 APLNG Santos Denison Mahalo.pdf;image001.png;image003.png;image004.png;image007.png;image008.png;image011.png;

Very tidy assessment report, thank you Amelia.

I have approved the decision, attached is a signed version of the Decision Notice.

Clancy.

Clancy Mackaway
Manager (Assessment)
Energy and Extractive Resources
Department of Environment and Science

T 07 3330 5641 I 0476 817 176
400 George Street, Brisbane Qld 4000
GPO Box 2454, Brisbane Qld 4001

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Thursday, 4 June 2020 8:32 AM
To: MACKAWAY Clancy
Cc: COPP Rachel
Subject: For signing: Denison Mahalo EA

Hi Clancy

Attached are the documents for today's decision on Denison Mahalo:

- Assessment report
- EA permit in word and pdf
- For signing - Notice of Decision – this is being done outside of connect because there were issues with the ERAs on the permit record generating the wrong assessment fees. Will do a bridge migration post-approval.

Origin and Santos have both agreed to the draft EA. Rachel endorsed the documents yesterday. Let me know if you have any questions.

Thanks

Amelia Sellars
Principal Environmental Officer
Energy and Extractive Resources
Environmental Services and Regulation
Department of Environment and Science

P (07) 3330 5591 I **E** Amelia.Sellars@des.qld.gov.au
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane, QLD 4000

From: COPP Rachel <Rachel.Copp@des.qld.gov.au>
Sent: Wednesday, 3 June 2020 5:23 PM
To: SELLARS Amelia
Subject: RE: For review: Denison Mahalo EA

Thank you Amelia.

I endorse the recommendation to approve the major amendment for EA EPPG00872113. Please progress to Clancy for approval.

Note that I made a comment on the EA that I didn't pick up earlier – the ERA reference on the front page should be for Schedule 3 and not Schedule 2A.

Thank you,

Rachel Copp
Team Leader
Energy, Extractive and Southwest Compliance
Department of Environment and Science

P 07 3330 5585
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane QLD 4001

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Wednesday, 3 June 2020 2:58 PM
To: COPP Rachel
Subject: RE: For review: Denison Mahalo EA

Hi Rachel

Final versions of Assessment Report and EA, plus the decision notice for final endorsement. Highlighted sections removed from EA and assessment report.

Thanks

Amelia Sellars
Principal Environmental Officer
Energy and Extractive Resources
Environmental Services and Regulation
Department of Environment and Science

P (07) 3330 5591 l **E** Amelia.Sellars@des.qld.gov.au
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane, QLD 4000

From: COPP Rachel <Rachel.Copp@des.qld.gov.au>
Sent: Wednesday, 3 June 2020 1:34 PM
To: SELLARS Amelia
Subject: RE: For review: Denison Mahalo EA

Thanks Amelia!

Yes you can send a draft EA off to Origin and agree with the FA condition removal.

I don't think I made any edits with the assessment report so once you remove the highlights and receive agreement with the draft EA conditions I'll endorse or sign the AR. I did forget that this one wasn't in Connect.

Cheers,
Rach

Rachel Copp
Team Leader
Energy, Extractive and Southwest Compliance
Department of Environment and Science

P 07 3330 5585
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane QLD 4001

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Wednesday, 3 June 2020 11:19 AM
To: COPP Rachel
Subject: For review: Denison Mahalo EA

Hi Rachel

I've finished the assessment report – I've highlighted any changes I've made in green since your last review so you don't have to re-read the whole thing.

The draft EA, I just incorporated your last edits. Any changes are highlighted in blue and they will be changes I will keep highlighted for Origin to check. Hopefully I can get a draft to them this arve? Also realised the EA has FA conditions, so proposing to remove those.

If you have any questions, let me know!

Thanks

Amelia Sellars
Principal Environmental Officer
Energy and Extractive Resources
Environmental Services and Regulation
Department of Environment and Science

P (07) 3330 5591 l **E** Amelia.Sellars@des.qld.gov.au
Level 7, 400 George St, Brisbane QLD 4000

Decision on major amendment application

This non-statutory notice is issued by the administering authority to advise you that your major amendment application has been approved under section 172(2)(a) of the *Environmental Protection Act 1994.*

To Australia Pacific LNG Pty Limited
Level 4
139 Coronation Drive
MILTON QLD 4064

SANTOS QNT PTY. LTD.
Ground Floor, Santos Centre
60 Flinders Street
ADELAIDE SA 5000

ATTN: sch4p4(6) Pe Envapprovals@upstream.originenergy.com.au

Our reference: EPPG00872113

Decision on major amendment application

1 Application details

The application to amend environmental authority EPPG00872113 was received by the administering authority on **18 February 2020**.

Land description: PL450, ATP337, PL1012, PL451, ATP1191, PL457, PL1082, PL1083.

2 Decision

The administering authority has considered the abovementioned application and is writing to inform you that the application has been approved.

3 Anniversary day

The amended environmental authority takes effect on the effective date shown in the attached environmental authority.

The anniversary day of this environmental authority remains 3 November.

Should you have any questions in relation to this notice, please contact the department using the contact details provided below.

sch4p4(6) Personal information	4 June 2020
Signature	Date

Clancy Mackaway
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
Energy and Extractive Resources
Department of Environment and Science
GPO Box 2454, Brisbane QLD 4001
Phone (07) 3330 5715
Email: energyandextractive@des.qld.gov.au

Attachments

Environmental authority EPPG00872113

Date : 29/04/2020 1:56:38 PM
From : "MACKAWAY Clancy"
To : "SELLARS Amelia"
Subject : RE: For review: EA Amendment Information Request EPPG00872113 Australia Pacific LNG Pty Limited
Attachment : v1-EA_Amendment_20200430_Information_Request_EPPG00872113_Australia_Pacific_LNG_Pty_Limited.pdf;image001.png;image003.png;image004.png;image007.png;

There you go.

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Wednesday, 29 April 2020 1:53 PM
To: MACKAWAY Clancy
Subject: RE: For review: EA Amendment Information Request EPPG00872113 Australia Pacific LNG Pty Limited

I think you have to sign this one. I'm still waiting on connect to fix some issues with the application so I can't generate it through connect, sorry.

From: MACKAWAY Clancy <Clancy.Mackaway@des.qld.gov.au>
Sent: Wednesday, 29 April 2020 1:14 PM
To: SELLARS Amelia
Subject: RE: For review: EA Amendment Information Request EPPG00872113 Australia Pacific LNG Pty Limited

Approved. Thanks Amelia.

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Wednesday, 29 April 2020 9:31 AM
To: MACKAWAY Clancy
Subject: For review: EA Amendment Information Request EPPG00872113 Australia Pacific LNG Pty Limited

Hi Clancy

Attached for your endorsement is the IR for Origin's Denison Mahalo EA Amendment. The application is to add 190 new gas wells (no stimulation).

Rachel has endorsed in the below email. This is due to Origin tomorrow.

Thanks

Queensland Government

Amelia Sellars
Principal Environmental Officer
Energy and Extractive Resources
Environmental Services and Regulation
Department of Environment and Science

P (07) 3330 5591 I **E** Amelia.Sellars@des.qld.gov.au
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane, QLD 4000

From: COPP Rachel <Rachel.Copp@des.qld.gov.au>
Sent: Wednesday, 29 April 2020 9:21 AM
To: SELLARS Amelia
Subject: RE: For review: EA Amendment Information Request EPPG00872113 Australia Pacific LNG Pty Limited

Thanks Amelia!

I'm happy with this information request. If there's nothing else please send on to Clancy for review and signing.

Rach

Queensland Government

Rachel Copp
Team Leader
Energy, Extractive and Southwest Compliance
Department of Environment and Science

P 07 3330 5585
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane QLD 4001

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Tuesday, 28 April 2020 9:09 AM
To: COPP Rachel
Subject: For review: EA Amendment Information Request EPPG00872113 Australia Pacific LNG Pty Limited

Hi Rachel

Information request for Origin/Santos' Denison Mahalo EA Amendment to add 190 new gas wells (no stimulation). This is one I'm doing outside of connect due to the ERAs/fees issue (Connect still hasn't cancelled the original connect application).

This is due Thursday. Let me know if you have any issues with opening edocs.

Thanks

Queensland Government

Amelia Sellars
Principal Environmental Officer
Energy and Extractive Resources
Environmental Services and Regulation
Department of Environment and Science

P (07) 3330 5591 I **E** Amelia.Sellars@des.qld.gov.au
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane, QLD 4000

Environmental Protection Act 1994

Information request

This information request is issued by the administering authority under section 140 of the Environmental Protection Act 1994 *to request further information needed to assess an amendment application for a site-specific environmental authority.*

To: SANTOS QNT PTY. LTD.
Ground Floor, Santos Centre
60 Flinders Street
ADELAIDE SA 5000

cc: Australia Pacific LNG Pty Limited
Level 4
139 Coronation Drive
MILTON QLD 4064

Email: Envapprovals@upstream.originenergy.com.au

ATTN: sch4p4(6) Pe

Our reference: EPPG00872113

Further information is required to assess an amendment application for a site-specific environmental authority

1. Application details

The amendment application for a site-specific environmental authority was received by the administering authority on 18 February 2020.

Land description: PL450, ATP337, PL1012, PL451, ATP1191, PL457

2. Information request

The administering authority has considered the abovementioned application and is writing to inform you that further information is required to assess the application (an information request).

The information requested is provided below:

- The application supporting material describes the ecosystem dependency on groundwater spatially, however does not describe temporal dependency. Confirm whether there are any temporal changes to ecosystem dependency on groundwater.
- The application supporting material describes the regional and local groundwater quality, distribution of potential Groundwater Dependent Ecosystems (GDEs), springs within the project site, and potential drawdown to groundwater bores. Please describe ecological impacts (e.g. subsidence, changes to overland flow) to the environmental value of land and its use for irrigation, cropping, and agriculture that may occur due to the decline in water level and/or pressure as a result of the exercise of underderground water.

- Section 5.3.1.5 GDEs of the Supporting Information Report describes the mapped GDEs within the petroleum leases and potential dependency on groundwater for ecosystem function, however does not describe any potential dependencies on groundwater for GDEs outside of the petroleum leases that may be impacted. Please confirm that there are no potential impacts to mapped GDEs outside of the petroleum lease area that may be impacted by the exercise of groundwater rights.
- The Water Assessment Report prepared by Klohn Crippen Berger in September 2019 assesses the potential water-related impacts of up to 95 gas production wells, however the application is for up to 190 wells. Please provide information on further impacts (including both spatial and temporal) associated with the additional wells not described in the report.
- The Water Assessment Report prepared by Klohn Crippen Berger in September 2019 relies heavily on data from the 2019 Surat Cumulative Management Area Underground Water Impact Report (UWIR), which was not approved until 12 November 2019. Were there any material changes between the use of the draft 2019 UWIR and the final approved UWIR?

3. Actions

The abovementioned application will lapse unless you respond by giving the administering authority -

(a) all of the information requested; or
(b) part of the information requested together with a written notice asking the authority to proceed with the assessment of the application; or
(c) a written notice –
    i. stating that you do not intend to supply any of the information requested; and
    ii. asking the administering authority to proceed with the assessment of the application.

A response to the information requested must be provided by 30 October 2020 (the information response period). If you wish to extend the information response period, a request to extend the period must be made at least 10 business days before the last day of the information response period.

The response to this information request or a request to extend the information response period can be submitted to the administering authority by email to EnergyandExtractive@des.qld.gov.au.

If the information provided in response to this information request is still not adequate for the administering authority to make a decision, your application may be refused as a result of section 176 of the *Environmental Protection Act 1994,* where the administering authority must have regard to any response given for an information request.

4. Review and appeal rights

You may apply to the administering authority for a review of this decision within 10 business days after receiving this notice. Information about your review rights is attached to this notice. This information is guidance only and you may have other legal rights and obligations.

If you require more information, please contact Amelia Sellars, Principal Environmental Officer on (07) 3330 5591 or via Amelia.Sellars@des.qld.gov.au.

sch4p4(6) Personal information	29 April 2020
Signature	Date

Clancy Mackaway
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
Energy and Extractive Resources
Department of Environment and Science
GPO Box 2454, Brisbane QLD 4001
Phone (07) 3330 5715
Email: energyandextractive@des.qld.gov.au

Attachments

Information sheet: Internal review and appeals (ESR/2015/1742)

Date : 7/05/2020 1:14:32 PM
From : sch4p4(6) Perso
To : "SELLARS Amelia"
Subject : RE: Information request for Denison Mahalo
Attachment : 200408_Mahalo TGDE Assessment.pdf;image001.png;image004.jpg;image005.png;

Hi Amelia,

See below for the information requested:

> ***The application supporting material describes the ecosystem dependency on groundwater spatially, however does not describe temporal dependency. Confirm whether there are any temporal changes to ecosystem dependency on groundwater***
>
> ***Section 5.3.1.5 GDEs of the Supporting Information Report describes the mapped GDEs within the petroleum leases and potential dependency on groundwater for ecosystem function, however does not describe any potential dependencies on groundwater for GDEs outside of the petroleum leases that may be impacted. Please confirm that there are no potential impacts to mapped GDEs outside of the petroleum lease area that may be impacted by the exercise of groundwater rights***

The attached provides additional assessment of RE dependency on groundwater. This extra work confirms that:

- groundwater levels are too deep for REs to be reliant/dependent on this groundwater; or
- riparian vegetation is unlikely to be dependent on groundwater.

In terms of temporal dependency of these REs on groundwater, the work demonstrates limited potential for interaction over time (e.g. seasonal variation in groundwater levels) given:

- the significant depth to groundwater compared to the maximum potential root depth of REs; and
- surface water availability.

The attached includes an assessment of REs both within and outside of the PLs and confirms no potential significant impacts from the exercise of underground water rights.

> ***The application supporting material describes the regional and local groundwater quality, distribution of potential Groundwater Dependent Ecosystems (GDEs), springs within the project site, and potential drawdown to groundwater bores. Please describe ecological impacts (e.g. subsidence, changes to overland flow) to the environmental value of land and its use for irrigation, cropping, and agriculture that may occur due to the decline in water level and/or pressure as a result of the exercise of underderground water.***

While there is no confirmed subsidence resulting from coal seam gas development in Australia, this Independent Expert Scientific Committee (IESC) document (https://www.environment.gov.au/system/files/resources/e9b69ac4-647c-4bbc-84db-83642227ab0d/files/background-review-subsidence_0.pdf) details how subsidence is least likely where production involves:

- minimal volumes of produced water;
- there is limited connectivity between the coal seams and adjoining formations; or
- the overlying strata are dominated by sandstone and other more competent rocks.

Minimal volumes of produced water

Section 5.3.1.1 of the of the Supporting Information Report for the EA amendment application provides a water production profile over the life of the PLs. This information demonstrates minimal water production of up to 2.2 ML/day compared to other CSG developments with up to 20+ ML/day of water production. This is partly due to the relatively few production wells proposed (up to 95 production wells) compared to larger gas developments (many hundreds of wells), and localised intra-seam faulting providing compartmentalisation acting as barrier to groundwater flow within the Bandanna Formation. The barrier effect is shown in Figure 6 of the Supporting Information Report showing a steep decline in water production from ~ Year 3 when groundwater within individual faulted ❖compartments❖ is extracted with relatively small volumes of water subsequently entering these ❖compartments❖. Less than 0.2 ML/day of produced water is forecast for the most of the operational life of the PLs.

Limited connectivity between the coal seams and adjoining formations

Figure 5 of the Supporting Information Report provide the regional hydrostratigraphy within the PLs including the regionally present Rewan Group aquitard which limits connectivity between the Bandanna Formation and overlying aquitards. Drawdown results including those presented in the attached shows limited drawdown to overlying strata with a maximum of 1.6m of drawdown to shallow units with a thickness of approximately 30m. Keep in mind that this maximum drawdown prediction is very localised and based on the 95th%ile uncertainty analysis from the Surat CMA UWIR model ❖ this represents a gross overestimation of drawdown due to the extreme values for hydraulic parameters used in OGIA❖s uncertainty analysis (e.g. hydraulic conductivity is increased by a factor of 5 over measured conductivity).

The overlying strata are dominated by sandstone and other more competent rocks

The overlying strata are not dominated by Sandstone and other competent rocks, however the limited water production and limited connectivity / drawdown to shallow units pose a limited risk of subsidence in the area. Accordingly, changes to existing overland flow regimes are not expected.

Existing land uses within the area are shown in Table 5.2 of the Water Assessment for the application:

Table 5.2 Summary of the Current Land Use within the Mahalo Development Area

Land Use Category			Area (km^2)	Percentage of Total Area
Primary	Secondary	Tertiary		
Conservation and natural environments	Other minimal use	Other minimal use	0.51	0.11%
		Residual native cover	3.15	0.67%
Production from dryland agriculture and plantations	Cropping	Cropping	31.47	6.71%
Production from relatively natural environments	Grazing native vegetation	Grazing native vegetation	433.70	92.46%
Water	Reservoir / dam	Reservoir / dam	0.23	0.05%
		Total	469.05	100%

This table shows that 92% of the land use is grazing with limited cropping. The application demonstrates how produced water would be managed in accordance with existing EA limits (e.g. ANZECC) and/or EoW Code approvals (e.g. ANZECC) to maintain or enhance these existing land uses.

Limited impacts to groundwater bores are predicted due to groundwater drawdown. These bores would be managed in accordance with the *Water Act* 2000 framework as described in Section 5.3.2 of the application including baseline assessments, and make good requirements if required.

Approval of the EA application does not does not change the need to gain new approvals or operate under existing approvals under the broader QLD environment and access framework including multiple approvals under the following:

- *Petroleum Act 1923* / *Petroleum and Gas (Production and Safety) Act 2004* (e.g. CCAs)
- *Water Act 2000* (e.g. UWIR, baseline assessments, make good, water licencing)
- *Regional Planning Interests Act 2014* (e.g. RIDA in strategic cropping areas)
- *Waste Reduction and Recycling Act 2011* (e.g. End of Waste approvals for beneficial use of produced water such as dust suppression and irrigation)

The GasFields Commission provides a handy summary of the broader QLD environment and access framework (https://gasfieldscommissionqld.org.au/gas-industry/regulatory-framework).

Queensland's land access laws provide a balance between economic development and landholder rights. These laws mean that a resource authority holder, and its staff or agents, cannot generally enter private land to undertake advanced activities unless they have entered into one of the following: a Conduct and Compensation Agreement, a Deferral Agreement, or an Opt-Out Agreement with the affected landholder. Resource companies conducting exploration activities must also comply with the conditions of the Land Access Code 2016, which provides best practice guidelines for communication between resource companies and landholders, and imposes mandatory conditions on resource companies conducting activities on land. These mandatory conditions relate to key concerns landholders have regarding induction into the landholder's specific land access conditions, access points, use of roads and tracks, activities conducted around livestock and property, weeds and declared pests, camps, items brought onto land and gates, grids and fences. For more information about land access, refer to the publication: A guide to land access in Queensland A Land Access Ombudsman was also established in 2018 as an independent, impartial body to help landholders and resource companies resolve alleged breaches of conduct and compensation agreements and make good agreements. The GasFields Commission Queensland is an independent statutory body that facilitates stakeholder connections as well as engaging with and informing the community about aspects of Queensland's petroleum and gas industry.

> ***The Water Assessment Report prepared by Klohn Crippen Berger in September 2019 assesses the potential water-related impacts of up to 95 gas production wells, however the application is for up to 190 wells. Please provide information on further impacts (including both spatial and temporal) associated with the additional wells not described in the report.***

While the Water Assessment Report described 95 production wells, the UWIR model used to simulate groundwater drawdown modelled complete dewatering of the Bandanna Formation coals by assigning fixed-pressure boundary conditions (using the MODFLOW-USG drain package) within the area of the PLs. This is a highly conservative modelling approach of the UWIR which results in an overestimation of water production and associated drawdown predictions. This modelling approach is further described in Section 2.3.3 and 3.3.3 of the Surat CMA UWIR modelling report:

https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0008/1460627/groundwater-modelling-report-surat-cma.pdf

Due to this modelling approach, the findings of the groundwater impact assessment are independent of the number of wells proposed by the amendment application. The number of proposed wellpads for the application is more relevant to surface disturbance and potential ecological impacts.

> ***The Water Assessment Report prepared by Klohn Crippen Berger in September 2019 relies heavily on data from the 2019 Surat Cumulative Management Area Underground Water Impact Report (UWIR), which was not approved until 12 November 2019. Were there any material changes between the use of the draft 2019 UWIR and the final approved UWIR?***

The groundwater model for the 2019 UWIR was utilised to simulate water production within the area of the PLs prior to the approval of the UWIR. The OGIA have advised that minimal or no changes were made to the model following simulation of groundwater extraction within the PLs. The consultation report for the UWIR describes changes made during the consultation process limited to text changes to the report only (e.g. no modelling changes required):

https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0006/1461237/uwir-submissions-summary.pdf

I'm happy to provide more info if required.

Cheers,

sch4p4(6) Per

Strategic Approvals | Exploration & New Ventures

Origin
Level 29, 180 Ann Street, Brisbane QLD 4000
m sch4p4(6) Pe
sch4p4(6)@upstream.originenergy.com.au
I pay my respect to the Traditional Owners whose land we live and work on. I acknowledge their Elders - past, present and emerging.

From: SELLARS Amelia <Amelia.Sellars@des.qld.gov.au>
Sent: Wednesday, 29 April 2020 3:26 PM
To: sch4p4(6) Personal information
Subject: Information request for Denison Mahalo

Hi sch4

sch4p4(6) Personal information

I✓ve attached the information request for Denison Mahalo that Clancy signed off today.

Let me know if you have any questions.

Cheers

Amelia Sellars
Principal Environmental Officer
Energy and Extractive Resources
Environmental Services and Regulation
Department of Environment and Science

P (07) 3330 5591 I **E** Amelia.Sellars@des.qld.gov.au
Level 7, 400 George St, Brisbane QLD 4000
GPO Box 2454, Brisbane, QLD 4000

8 April 2020

APLNG Pty Ltd
Email Delivery: sch4p4(6) Pe@upstream.originenergy.com.au

sch4p4(6) Perso

Strategic Approvals – Exploration & New Ventures

Dear sch4p4(6) Pe

Mahalo Development Area
TGDE Drawdown Impact Supplementary Information

1 INTRODUCTION & BACKGROUND

Predicted groundwater level drawdown, as a result of proposed gas development at Australian Pacific LNG Pty Ltd's (APLNG) Mahalo Development Area (the Project), was completed by the Office of Groundwater Impact Assessment (OGIA). Simulation of the Project development was completed using OGIA's Surat Cumulative Management Area (CMA) groundwater model, with results comprising the base case drawdown prediction and uncertainty analysis results. These results were provided in the Mahalo Development Area Water Assessment Report (KCB, 2019), along with the interpretation of potential impacts to terrestrial groundwater dependent ecosystems (TGDE) as a result of the predicted drawdown. The water assessment report was provided to the Department of Agriculture, Water and the Environment (DAWE), formerly the Department of Environment and Energy (DoEE), in September 2019.

Following a review of the water assessment report DAWE requested additional information regarding potential impacts to potential TGDEs as a result of the Project development. This supplementary letter provides additional localised information regarding the predicted groundwater level drawdown within the vicinity of mapped TGDEs.

2 OGIA MODEL RESULTS

The predicted groundwater level drawdown results provided by OGIA for the Project development comprised a "Base Case" groundwater level drawdown, which are predictive results based on the calibrated parameters for the model domain; and, uncertainty analysis groundwater level drawdowns based on a null space Monte Carlo (NSMC) approach for uncertainty analysis. The water assessment report presented potential drawdown impacts based on the "Base Case" groundwater level drawdown, however, the potential drawdown impacts discussed in this document are based on the 95th percentile drawdown results from the uncertainty analysis. It is important to note that the 95th percentile drawdown represents the 95th percentile of a statistical analysis of groundwater levels from 450 realisations of groundwater model parameter variations. Therefore, the drawdown extent presented as the 95th percentile would capture 95% of the drawdown extent from the 450 realisations. The remaining 5% of realisation results, beyond the

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95th percentile are considered outliers. Therefore, the 95th percentile drawdown extent presented in the figures of this document represents the statistical upper-bound of predicted drawdown extent for the project development.

The drawdown results across the Project area, based on the 95th percentile uncertainty analysis from the model, is presented in Figure 2-1. The drawdown results indicate that the maximum 95th percentile drawdown within Layer 1 of the model ranges from 0.2 m to 1.6 m; with the 0.2 m drawdown contour extending approximately 10 km to the north of the Project area. In relation to areas of mapped TGDEs, there are two areas where the predicted 95th percentile drawdown coincides with mapped TGDEs, and these are located to the north of the Project area (Northern Drawdown Area) and along Shotover Creek, within the Project area. Further discussions on these mapped TGDEs and the potential impacts on them as a result of the predicted 95th percentile drawdown is provided in the following sections.

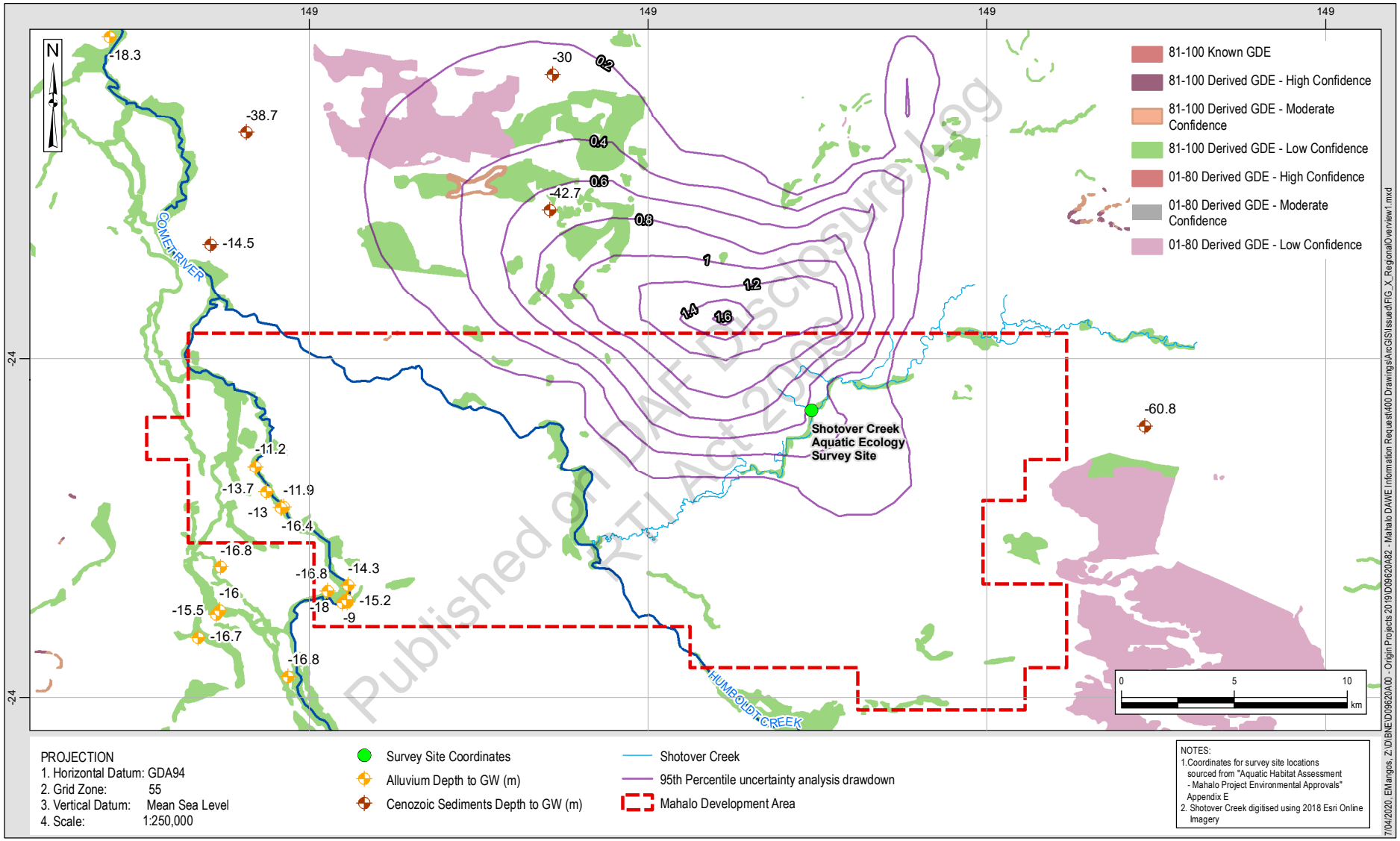


Figure 2-1: Predicted 95th Percentile Uncertainty Analysis Groundwater Level Drawdown (Layer 1) – Mahalo Development Area

3 TGDE IMPACT ASSESSMENT

The discussion surrounding potential impacts to the mapped TGDEs in the Northern Drawdown Area and along Shotover Creek, as a result of the predicted 95th percentile drawdown is provided in the following sections.

3.1 Northern Drawdown Area

Maximum predicted groundwater level drawdown (95th percentile) within the vicinity of the Northern Drawdown Area, and across the mapped TGDE within this area, ranges from approximately 0.2 m to 1 m (Figure 3-1). The Regional Ecosystem (RE), comprising both remnant and non-remnant ecosystems, mapped within the vicinity of the Northern Drawdown area comprise RE 11.4.8 (with dominant tree species *Eucalyptus cambageana, Acacia harpophylla, Acacia argyrodendron, Eremophila mitchellii*) and RE 11.5.3 (with dominant tree species *Eucalyptus populnea, Eucalyptus melanophloia, Eucalyptus cambageana, Eucalyptus brownii Corymbia clarksoniana, Corymbia dallachiana*). Based on these dominant tree species within the vicinity of the mapped potential TGDE area, the maximum rooting depth for this potential TGDE is limited to a depth of ~20 m (Eamus et. al. 2006).

The geology within the vicinity of the Northern Drawdown Area comprises Cenozoic Sediments from the surface to ~60 m below ground surface, followed by ~20 m of low permeability Rewan Formation, which is underlain by the Bandanna Formation. Groundwater in the Northern Drawdown Area is observed in the Cenozoic Sediments, with third-party groundwater bores installed and screened within the Cenozoic Sediments (bore locations provided in Figure 3-1). Monitoring of groundwater from these bores indicate that groundwater levels across the Northern Drawdown Area ranges from 30 m to 42.7 m below the ground surface.

The information provided above is summarised in Figure 3-2 as a stratigraphic column, which conceptualises the localised hydrogeological system. This figure highlights the vertical separation / offset between the maximum rooting depth of the identified dominant tree species and the observed groundwater level in the area; with the groundwater level occurring ~22 m below the maximum rooting depth of the identified tree species. As a result, the TGDE identified within the Northern Drawdown Area are not considered to be dependent upon the regional groundwater system, and therefore, are not considered to be impacted by the predicted 95th percentile drawdown resulting from the Project development.

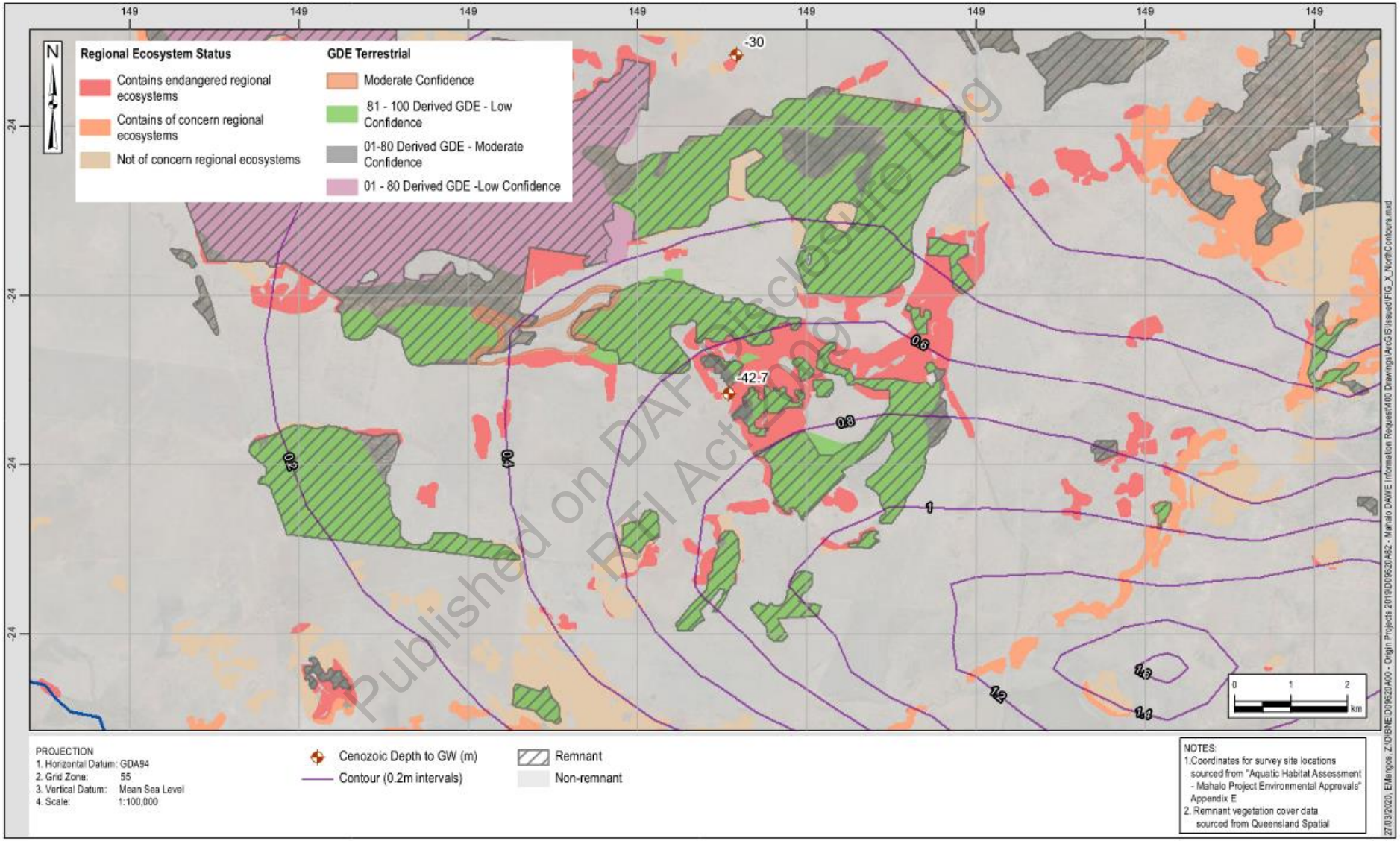
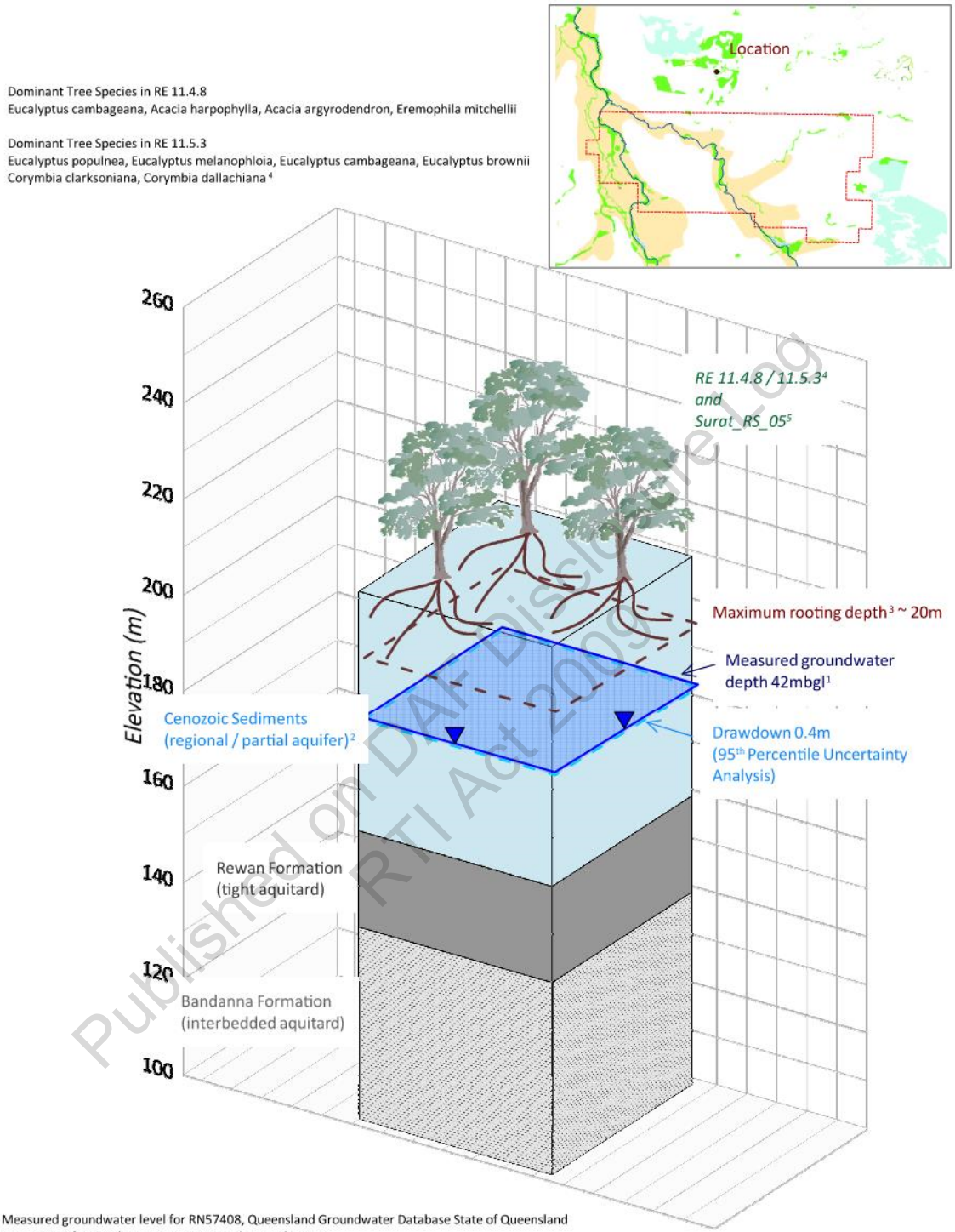


Figure 3-1: Predicted 95th Percentile Uncertainty Analysis Groundwater Level Drawdown (Layer 1) – Northern Drawdown Area



1. Measured groundwater level for RN57408, Queensland Groundwater Database State of Queensland (Department of Natural Resources, Mine and Energy) 2020.
2. Aquifer classification from Section 3.3 page, Figure 3-6, UWIR Office of Groundwater Impact Assessment July 2019.
3. Kath, J, K Reardon-Smith, AF Le Brocque, FJ Dyer, E Dafny, L Fritz, and M Batterham. 2014. "Groundwater Decline and Tree Change in Floodplain Landscapes: Identifying Non-Linear Threshold Responses in Canopy Condition." Global Ecology and Conservation 2: 148–60
4. Regional ecosystem desciptions - Remnant regional ecosystems are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. State of Queensland (Department Environment and Science) 2018.
5. Queensland Government (2017) Groundwater dependent ecosystem mapping rule-sets for the Comet, Dawson and Mackenzie River catchments: version 1.5, Queensland Government, Brisbane.

Figure 3-2: Conceptual Hydrogeological Stratigraphic Column

3.2 Shotover Creek

Maximum groundwater level drawdown (95th percentile) within the vicinity of the Shotover Creek area ranges from 0.4 m to 0.6 m (Figure 3-3). An ecological survey along Shotover Creek, and within the area of the predicted drawdown, has been previously undertaken. The results from this survey are presented in a summary table in Figure 3-3, however, the dominant RE that has been identified in this area is RE 11.3.25, with *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines being verified as the most dominant vegetation type.

The geology within the vicinity of Shotover Creek is similar to what is observed at the Northern Drawdown Area, with a profile comprising Cenozoic Sediment, Rewan Formation and Bandanna Formation, however, the Rewan Formation is thicker in this area (~200 m thick). In addition to these geological units, Quaternary alluvium (Qa) has also been mapped within, and adjacent to, the drainage line of Shotover Creek. The extent of this alluvium is mapped from the confluence of Shotover Creek and Humboldt Creek to ~10 km upstream in Shotover Creek.

The closest groundwater level monitoring points to Shotover Creek is ~10 km to the northwest and ~10 km to the east, with groundwater levels of 42.7 m and 60 m below the ground surface, respectively (Figure 2-1). These observed groundwater levels are well below the maximum rooting depths (~20 m below ground surface) for the identified dominant tree species, *Eucalyptus tereticornis,* within the Shotover Creek area. Furthermore, field verification of the RE along Shotover Creek confirms that the riparian vegetation present along Shotover Creek represents RE 11.3.25 and not RE 11.3.2 as indicated by Government mapping. Attachment A provides confirmation of the RE for riparian vegetation along Shotover Creek contrasting against the mapped RE 11.3.2, as shown in Table 3.1.

Table 3.1: Shotover Creek RE Comparison (Field Verified vs. Mapped)

RE Code	Short Description	Dominant Tree Species	Landform Association	Wetland Association	Relevant Comments	Mapped GDE?
11.3.25[1] **(field verified)**	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	*Eucalyptus tereticornis* (observed)	Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region.	Riverine wetland or fringing riverine wetland.	Often associated with RE 11.3.2 which may occur on adjacent alluvial plains. In highly cleared subregions a narrow fringe of riparian vegetation is often the only surviving woody vegetation	No
11.3.2[2] **(QLD Govt mapping)**	*Eucalyptus populnea* woodland on alluvial plains	*Eucalyptus populnea*	Occurs on Cainozoic alluvial plains.	Palustrine wetlands (non-riverine or non-channel systems)	N/A	Yes

As shown in Table 3.1, RE 11.3.25 only occurs along drainage lines which indicates species dependence more on surface water than groundwater. Based on the observed regional groundwater levels, the field verified RE 11.3.25 surface water dependence, and the predicted 95th percentile groundwater level drawdown of less than 0.6m, the Project is not considered likely to impact the riparian vegetation (mapped as a potential TGDE) associated with Shotover Creek.

[1] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=11.3.25
[2] https://apps.des.qld.gov.au/regional-ecosystems/details/?re=11.3.2

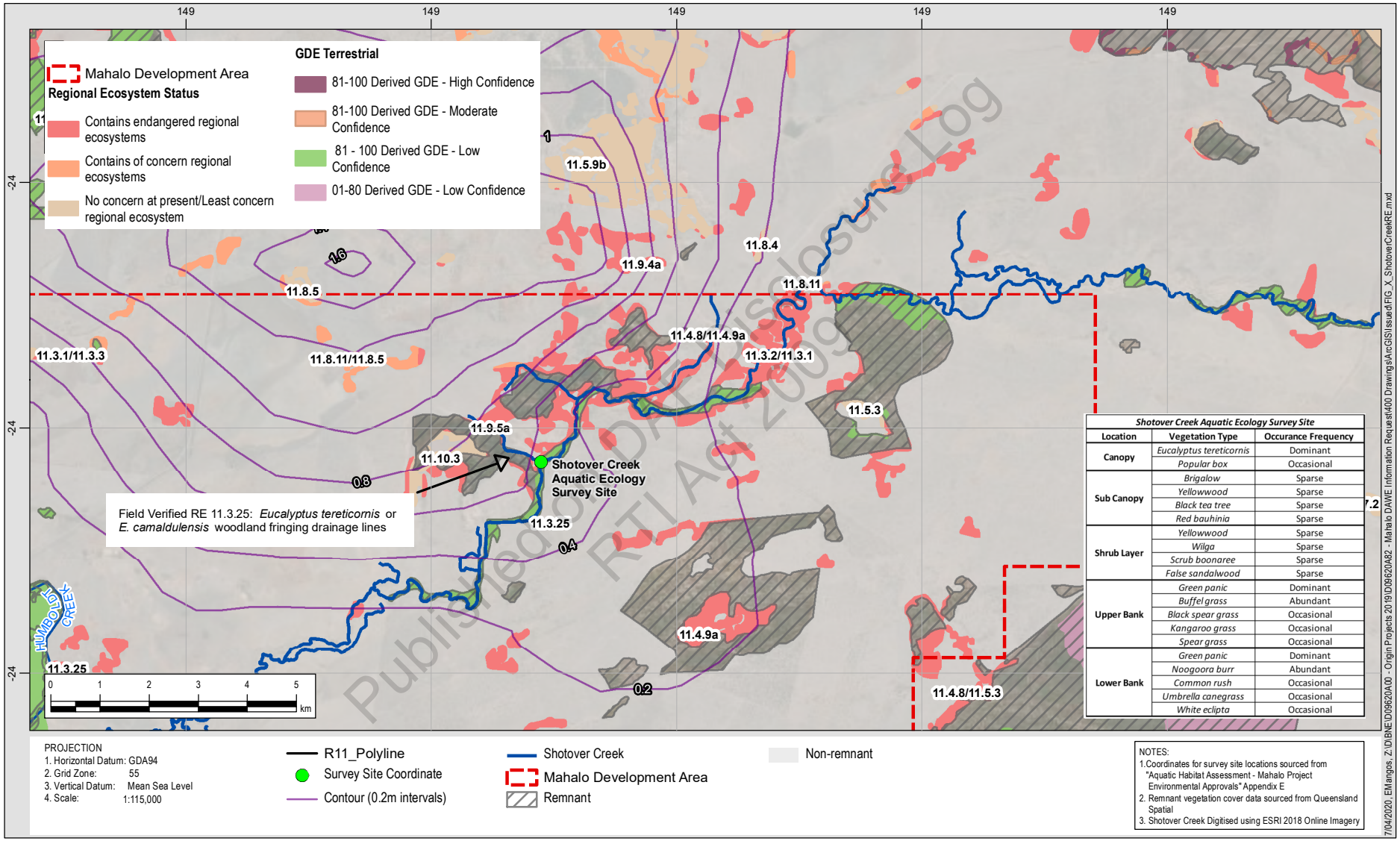


Figure 3-3: Predicted 95th Percentile Uncertainty Analysis Groundwater Level Drawdown (Layer 1) – Shotover Creek

4 DOCUMENT CLOSURE

KCB is pleased to provide this supplementary information regarding the potential drawdown impacts to TGDEs as a result of the Mahalo Development Area. Should you have any queries regarding this document, please do not hesitate to contact the undersigned on sch4p4(6) Personal infor or sch4p4(6) Pers klohn.com.

Yours truly,

KCB AUSTRALIA PTY LTD.

sch4p4(6) Personal infor

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sch4p4(6) Personal infor

Principal Hydrogeologist

CS:DK

REFERENCES

Eamus D, Froend R, Loomes R, Hose G and Murray B (2006). A functional methodology for determining the groundwater regime needed to maintain the health of groundwater dependent vegetation. Australian Journal of Botany 54: 97-114.

ATTACHMENT A

Shotover Creek Aquatic Habitat Assessment

Site Code: R11 **Location:** Shotover Creek, Humboldt **Stream order:** 4 **Latitude:** -24.1017 **Longitude:** 148.8137 **Date:** 20/02/2018 **Season:** Wet


Upstream


Left Bank


Downstream


Right Bank

General Site Description

Site attributes

Fourth order watercourse; well defined bed and banks; no local catchment erosion detected; bankfull width approximately 15 m and bankfull height approximately 3 m; isolated deep (>0.5 m) pool at the time of assessment; in-stream habitat included shallow pool, deep pool, large woody debris and fringing macrophytes; bed substrates comprised approximately 20% cobble (64-256 mm), 10% pebble (4-64 mm), 5% gravel (2-4 mm), 20% sand (0.05-2 mm) and 45% silt/clay (<0.05 mm); substrates in the edge habitat comprised approximately 20% cobble (64-256 mm), 10% pebble (4-64 mm), 5% gravel (2-4 mm), 15% sand (0.05-2 mm) and 50% silt/clay (<0.05 mm); clay loam banks; upstream and adjacent land use includes moderate cattle grazing on a mix of cleared land and remnant vegetation.

Aquatic and riparian vegetation

Study reach positioned within remnant vegetation state mapped as RE 11.3.2/11.3.1, but reflective of RE 11.3.25 – '*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines'; riparian vegetation included woodland dominated by Queensland blue gum (*Eucalyptus tereticornis*), with occasional poplar box (*E. populnea*); sparse sub-canopy of brigalow (*Acacia harpophylla*), yellowwood (*Terminalia oblongata*), black tea tree (*Melaleuca bracteata*) and red bauhinia (*Lysiphyllum carronii*); sparse shrub layer of yellowwood, wilga (*Geijera parviflora*), scrub boonaree (*Alectryon diversifolius*), false sandalwood (*Eremophila mitchellii*) and *Acacia* spp.; ground layer of the upper bank dominated by green panic (*Megathyrsus maximus*)*, with abundant buffel grass (*Cenchrus ciliaris*)*, occasional black spear grass (*Heteropogon contortus*) and kangaroo grass (*Themeda triandra*); ground layer of the lower bank dominated by green panic*, with abundant forest bluegrass (*Bothriochloa bladhii*) and Noogoora burr (*Xanthium occidentale*)*. Occasional fringing semi-aquatic macrophytes, including common rush (*Juncus usitatus*) (little), umbrella canegrass (*Leptochloa digitata*) (little) and white eclipta (*Eclipta prostrata*) (little).

Erosion risk

Low – banks appeared to be moderately stable, and 50-79% of surfaces covered by vegetation, gravel or larger material.

Aquatic fauna, including breeding habitat

The waterway provides seasonal, opportunistic habitat for waterfowl and wader birds, fish and turtles. Unlikely habitat for platypus.

Endangered, Vulnerable, Near Threatened (EVNT), Special Least Concern (SLC), or Priority flora and fauna

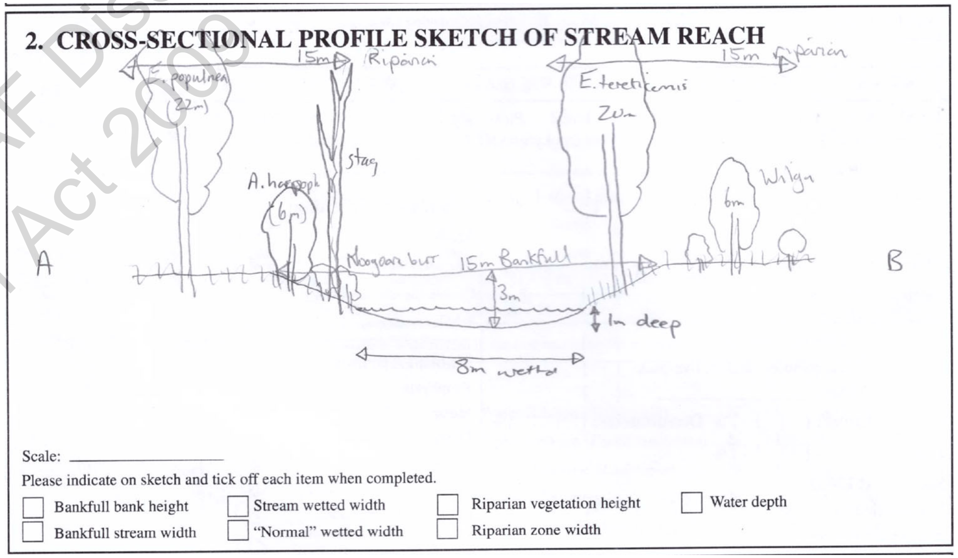
No EVNT, SLC or Priority aquatic flora or fauna species were detected at the time of the site visit (although no fauna survey effort undertaken). The Critically Endangered (EPBC Act) southern snapping turtle (*Elseya albagula*) and Vulnerable Fitzroy River turtle (*Rheodytes leukops*) are recorded from the Comet River drainage sub-basin (DES 2018). The waterway lacks habitat features suitable for these species.

Physico-chemical water quality

Collection time: 11:30 EST; water temp.: 29.4˚C; specific conductivity: 130 µS/cm (fresh); turbidity: 87 NTU (moderate to poor clarity); dissolved oxygen: 62.7%, 4.79 (low); pH 7.01 (neutral). Summary: Normal (low DO likely influenced by a combination of shading, time of day, poor light penetration into turbid water, lack of flow, and oxygen consumption by aerobic bacteria).

Overall aquatic values

Low.



Report

Environmental Authority EPPG00872113 Amendment Application - Supporting Information Report

Australia Pacific LNG Upstream

Table of Contents

List of Tables

List of Figures

List of Appendix Documents

Appendix A - DES Regional Ecosystems Reports

Appendix B - DES Environmentally Sensitive Area Maps

Appendix C - DES Matters of State Environmental Significance Reports

1. Introduction

Origin Energy Resources Limited, as the upstream operator of Australia Pacific LNG Pty Ltd (Australia Pacific LNG) and Santos QNT Pty Ltd (Santos), as joint holders and operators of the Denison Trough/Mahalo tenures, are applying to amend Environmental Authority (EA) EPPG00872113. EA EPPG00872113 authorises petroleum activities within Authority to Prospect (ATP) 1191 and Petroleum Leases (PLs) 450, 451, 457 and 1012, situated within the Denison Trough, on the western flank of the Bowen Basin.

The EA amendment application comprises the following documents:

- Completed amendment application form; and
- Supporting Information Report (this document).

1.1. Overview

The proposed amendment seeks to:

1) Authorise PL1082 and PL1083 as additional resource tenures for the EA; and
2) Amend *Schedule A, Table 1 - Scale and Intensity for the Activities* to authorise 190 additional petroleum wells within PL1082 and PL1083.

In September 2019, Australia Pacific LNG and Santos applied to the Department of Natural Resources, Mines and Energy for the new PLs over the area of ATP1191. Section 121(1)(f) of the *Petroleum and Gas Act 2004* requires a relevant EA to be issued prior to the relevant minister granting the PL tenure.

1.2. Land Details

ATP1191 is located approximately 40 km north-northeast of Rolleston, in the Central Highlands Regional Council as shown on Figure 1.

PL1082 and PL1083 are approximately 470 km^2 in size consisting of the contiguous sub-blocks shown in Table 1.

Table 1: Tenure Details

Tenure Details			
Tenure number	**PL1082**		
Tenure holders	Australia Pacific LNG Pty Limited Santos QNT Pty Ltd		
Status	Application		
Local Authority	Central Highlands Council, approx. 30km north east of Rolleston		
Sub-blocks	BIM: Charleville	BLOCK: 129	D, E, J, K, O, P, T, U, Z
		BLOCK: 130	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, R, S, T, U, W, X, Y, Z
		BLOCK: 131	A, B, C, F, G, H, L, M, N, Q, R, V
		BLOCK: 201	E, K, P
		BLOCK: 202	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, T, U
		BLOCK: 203	A, F, G, H, L, M, N, Q, R
Tenure number	**PL1083**		
Tenure holders	Australia Pacific LNG Pty Limited Santos QNT Pty Ltd		
Status	Application		
Local Authority	Central Highlands Council, approx. 30km north east of Rolleston		
Sub-blocks	BIM: Charleville	BLOCK: 127	C, D, E, H, J, K, M, N, O, P, S, T, U, X, Y, Z

Tenure Details			
		BLOCK: 128	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z
		BLOCK: 129	A, B, C, F, G, H, L, M, N, Q, R, S, V, W, X, Y
		BLOCK: 200	A, B, C, D, E, F, G, H, J, K
		BLOCK: 201	A, B, C, D, F, G, H, J

148°0'0"E 148°20'0"E 148°40'0"E 149°0'0"E 149°20'0"E

24°20'0"S 24°40'0"S 25°0'0"S 25°20'0"S 25°40'0"S

PPL 10

PL 1083 (Mahalo)

PL 1082 (Humboldt)

ATP 1191

ATP 1191

PPL 10

ROLLESTON

PPL 10

ATP 1191

ATP 1191

PL 451

PL 450

PPL 30

PPL 166

PL 1062

ATP 1191

ATP 1191

PL 457

PL 1012

PPL 30

Legend

- Town
- Main Roads
- PPL 10, DENISON GAS (QUEENSLAND) PTY LTD
- PPL 30, JEMENA QUEENSLAND GAS PIPELINE (1) PTY LTD
- PPL 166, SANTOS GLNG PTY LTD
- PL 1083 (Mahalo) - Application
- PL 1082 (Humboldt) - Application
- PL 1062 (Arcadia West) - Application
- Petroleum Leases Granted out of ATP 1191 / ATP 337 (Santos QNT Pty Ltd)
- Mahalo Farm Out
- Authority to Prospect 1191 (ATP 1191)
- Cadastral Boundaries

Source Information:
© Origin/APLNG 2019.
© State of Queensland (Department of Natural Resources and Mines) 2019.

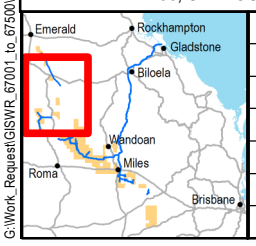
N

Scale 1:600,000 (at A3)

0 5 10 20

Kilometres

Coordinate System: GCS GDA 1994



Rev	Description	Drawn	Check	QA	Approved	Date
0	Issued For Use	JM	CB	PC	CB	13/08/2019
A	Issued For Review	JM	CB	PC		20/06/2019

origin

Mahalo & Humboldt Petroleum Lease Applications

Locality Map

Date: 13 August 2019

Map Number	Doc No	Rev
1 of 1		0
	Map ID GISWR_67368	

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2. Proposed Amendment 1: PL1082 and PL1083

2.1. Scope

The scope of amendment 1 is to authorise petroleum production under PL1082 and PL1083 as additional resource authorities for the EA. The EA currently authorises petroleum exploration activities within ATP1191 and production activities within PLs 450, 451, 457, and 1012.

Authorised and incidental activities for ATPs and PLs are prescribed under Chapter 2, Part 1, Division 1, and Chapter 2, Part 2, Division 2 (respectively) of the *Petroleum and Gas (Production and Safety) Act 2004*. The authorised and incidental activities for ATPs and PLs are substantially the same; the key difference is that petroleum production (e.g. the sale of gas) is only authorised under PLs in accordance with s15(1) and s109(1)(c) of the *Petroleum and Gas (Production and Safety) Act 2004*. Refer to section 2.1.1 below.

2.1.1. Authorised activities under ATPs/PLs

The activities authorised (including incidental activities) under an ATP or a PL are substantially the same if authorised; the key difference being that *petroleum production* is only authorised under a PL (s109(1)(c)). Relevant excerpts of the *Petroleum and Gas (Production and Safety) Act 2004* are compared in Table 2 below (emphasis added on s109(1)(c)).

Table 2: Authorised and Incidental Activities under ATPs and PLs

Authorised activities - ATP	Authorised activities - PL
Part 1 Authorities to prospect ***Division 1 Key authorised activities*** ***32 Exploration and testing*** *(1) The authority to prospect holder may carry out any of the following activities in the area of the authority—* *(a) exploring for petroleum;*	***Part 2 Petroleum leases*** ***Division 1 Key authorised activities*** ***109 Exploration, production and storage activities*** *(1) The lease holder may carry out the following activities in the area of the lease—* *(a) exploring for petroleum;*
(b) testing for petroleum production;	*(b) subject to section 152—* *(i) testing for petroleum production; and*
(c) evaluating the feasibility of petroleum production;	*(ii) evaluating the feasibility of petroleum production; and* *(iii) testing natural underground reservoirs for storage of petroleum or a prescribed storage gas;*
N/A	*(c) petroleum production;*
(d) evaluating or testing natural underground reservoirs for the storage of petroleum or a prescribed storage gas;	*(d) evaluating, developing and using natural underground reservoirs for petroleum storage or to store prescribed storage gases, including, for example, to store petroleum or prescribed storage gases for others;*
(e) plugging and abandoning, or otherwise remediating, a bore or well the holder reasonably believes is a legacy borehole and rehabilitating the surrounding area in compliance with the requirements prescribed under a regulation.	*(e) plugging and abandoning, or otherwise remediating, a bore or well the lease holder reasonably believes is a legacy borehole and rehabilitating the surrounding area in compliance with the requirements prescribed under a regulation.*
(2) However, the holder must not carry out any of the following— *(a) extraction or production of a gasification or retorting product from coal or oil shale by a chemical or thermal process;*	*2) However, the holder must not carry out any of the following—* *(a) extraction or production of a gasification or retorting product from coal or oil shale by a chemical or thermal process;*
(b) exploration for coal or oil shale to carry out extraction or production mentioned in paragraph (a);	*(b) exploration for coal or oil shale to carry out extraction or production mentioned in paragraph (a);*
(c) GHG stream storage.	*(c) GHG stream storage.*
(3) The carrying out of activities mentioned in subsection (1), other than exploring for petroleum, is subject to section 73.	*N/A*

Authorised activities - ATP	Authorised activities - PL
(4) The rights under subsection (1) may be exercised only by or for the holder.	*(3) The rights under subsection (1) may be exercised only by or for the holder.* *(4) The right to store petroleum or prescribed storage gases for others is subject to part 6.*
33 Incidental activities *(1) The authority to prospect holder may carry out an activity (an incidental activity) in the area of the authority if carrying out the activity is reasonably necessary for, or incidental to, an authorised activity under section 32(1) for the authority or another authority to prospect.*	***112 Incidental activities*** *(1) The lease holder may carry out an activity (an incidental activity) in the area of the lease if carrying out the activity is reasonably necessary for, or incidental to—* *(a) another authorised activity for the lease; or* *(b) an authorised activity for another petroleum lease or an authority to prospect.*
Examples of incidental activities— *1 constructing or operating plant or works, including, for example, communication systems, pipelines associated with petroleum testing, powerlines, roads, separation plants, evaporation or storage ponds, tanks and water pipelines*	*Examples of incidental activities—* *1 constructing or operating plant or works, including, for example, communication systems, compressors, powerlines, pumping stations, reservoirs, roads, evaporation or storage ponds and tanks*
2 constructing or using temporary structures or structures of an industrial or technical nature, including, for example, mobile and temporary camps	*2 constructing or using temporary structures or structures of an industrial or technical nature, including, for example, mobile and temporary camps*
3 removing vegetation for, or for the safety of, exploration or testing under section 32(1) *Note— See also part 10, section 239, chapter 5 and section 20.*	*3 removing vegetation for, or for the safety of, exploration or testing under section 152(1)* *Note— See also part 10, section 239, chapter 5 and section 20(2).*
(2) However, neither of the following activities is an incidental activity— *(a) constructing or using a structure, other than a temporary structure, for office or residential accommodation;* *Note— For development generally, see the Sustainable Planning Act 2009, chapter 6.*	*(2) However, constructing or using a structure, other than a temporary structure, for office or residential accommodation is not an incidental activity.* *Note— For development generally, see the Sustainable Planning Act 2009, chapter 6 (Integrated development assessment system (IDAS)).*
(b) the processing of gaseous petroleum, other than gaseous petroleum produced as an unavoidable result of ATP production testing. *(3) In this section—* ***gaseous petroleum** means petroleum in a gaseous state.* ***processing**, of gaseous petroleum, means treating the petroleum to be suitable for transport.*	*N/A*

Table 2 demonstrates that additional petroleum activities authorised by the proposed amendment are limited to *petroleum production* being the long-term operation of petroleum wells consistent with the s15(1) of the *Petroleum and Gas (Production and Safety) Act 2004*:

15 When petroleum is produced

(1) Petroleum is produced when it is—

> *(a) recovered to ground level from a natural underground reservoir in which it has been contained; or*
>
> *(b) released to ground level from a natural underground reservoir from which it is extracted.*

The existing operation of petroleum wells for exploration is authorised consistent with s14 of the *Petroleum and Gas (Production and Safety) Act 2004*.

3. Proposed Amendment 2: Additional petroleum wells

3.1. Scope

The scope of amendment 2 is to authorise 190 additional petroleum wells within PLs 1082 and 1083 in *Schedule A, Table 1* of the EA. The additional wells will be constructed and operated in accordance with the DNRME *Code of Practice the construction and abandonment of coal seam gas and petroleum wells, and associated bores in Queensland*[1]. The code outlines mandatory requirements and good practice for drilling and completion of gas wells to ensure long-term well integrity and protection of groundwater resources including the many mandatory and best practice requirements detailed in Section 5.

Ancillary activities will be undertaken for the additional wells, including the following:

- Installation, operation and maintenance of gas and water gathering flowlines.
- Installation, operation and maintenance of associated supporting infrastructure (e.g. access roads, power and communication systems, laydowns, stockpiles and storage areas).
- Management of produced water.
- Decommissioning and rehabilitation of infrastructure and disturbed areas.

All infrastructure is offered to landholders in the first instance to allow them to leverage the infrastructure for their operations. If the infrastructure is no longer required, it will be removed and re-used, recycled, or disposed of. The disturbed area will then be rehabilitated in accordance with the current EA conditions.

3.1.1. Location of additional wells

Consistent with the existing EA conditions, well sites will generally be constructed in an operational area of up to approximately 1.2 ha for the initial construction of the well. Following construction, sites will be partially rehabilitated, leaving an area of up to approximately 0.4 ha allowing for well maintenance if required during operation of the well. Following drilling and completion, a pump will be installed to dewater the coal seam and facilitate gas production.

Well sites would be located in accordance with the existing land disturbance and water management conditions of the EA (e.g. Schedule F, and Schedule G), including avoidance of the following:

- endangered regional ecosystems (REs);
- nature refuges and koala habitat including a 200m buffer / protection zone;
- essential habitat;
- essential regrowth habitat;
- of concern REs;
- wetlands of high ecological significance including a 200m buffer / protection zone;
- wetlands of other environmental value; and
- watercourses.

In accordance with existing Condition F8 of the EA, well sites would also be located and designed with reference to the Queensland Environmental Offsets Policy Significant Residual Impact Guideline[2] to avoid significant residual impacts to prescribed environmental matters. Additional environmental design requirements are detailed in Section 5.

[1] https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0006/1461093/code-of-practice-petroleum-wells-bores.pdf

[2] https://environment.des.qld.gov.au/__data/assets/pdf_file/0017/90404/significant-residual-impact-guide.pdf

An internal disturbance approval process ensures the project execution aligns with conditions of approvals and management commitments, particularly avoidance of key environmental impacts where there are reasonable and practicable design alternatives. The disturbance approval process occurs over a number of stages:

1. **Preliminary concept developed** – Conceptual Layout (well spacing, number, type) is designed based on reservoir modelling
2. **Constraints assessment** – Conceptual layout is updated giving consideration to the constraints including an environmental constraint assessment (ecology assessment/EA conditions), landholder requirements and engineering constraints
3. **Layout finalised** – A final site assessment to assess the proposed infrastructure locations and the layout is finalised
4. **Approvals obtained** - Required approvals are obtained, for example, environmental authority approvals or land access; and
5. **Design completed** - Detailed design is completed and construction commences.

4. Legislative Considerations

4.1. Environmental Protection Act 1994

4.1.1. Application Requirements (s226)

Section 226 of the EP Act sets out the requirements for making an application to amend an EA. Table 3 lists these requirements and where they are addressed in the application material.

Table 3: s226 Application Requirements

Application requirement (s226)(1)	Where addressed in application material
(a) Made to the administering authority;	The application was made to the Department of Environment and Science
(b) Be in the approved form;	The approved form was used.
(c) Be accompanied by the prescribed fee;	The prescribed fee was paid to the Department of Environment and Science.
(d) Describe the proposed amendment;	Refer to section 2 and 0.
(e) Describe the land that will be affected by the proposed amendment; and	Sections 1.2, 3.1.1 and 0 describe the land that will be affected by the proposed amendment.
(f) include any other document relating to the application prescribed by regulation	N/A - No other documents have been prescribed
Application requirement (s226A)(1)	**Where addressed in application material**
(a) Describe any development permits in effect under the Sustainable Planning Act 2009 for the carrying out of the relevant activity for the authority;	N/A – There are no development permits in effect under SPA relevant to the carrying out of the resource activity.
(b) State whether each relevant activity will, if the amendment is made, comply with any eligibility criteria for the activity;	N/A – there are no eligibility criteria to the activity.
(c) If the application states that each relevant activity will, if the amendment is made, comply	N/A – there are no eligibility criteria to the activity.

with any eligibility criteria for the activity—include a declaration that the statement is correct;	
(d) State whether the application seeks to change a condition identified in the authority as a standard condition;	N/A – the application does not seek to change any conditions identified by the authority as standard conditions
(e) If the application relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit—state whether the applicant seeks an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit;	N/A – The application does not relate to an exploration permit or GHG permit. The application relates to a new petroleum production permit.
(f) Include an assessment of the likely impact of the proposed amendment on the environmental values, including:	Refer to section 5 of this Supporting Information Report.
(i) a description of the environmental values likely to be affected by the proposed amendment;	
(ii) details of any emissions or releases likely to be generated by the proposed amendment;	
(iii) a description of the risk and likely magnitude of impacts on the environmental values;	
(iv) details of the management practices proposed to be implemented to prevent or minimise adverse impacts; and	
(v) if a PRCP schedule does not apply for each relevant activity - details of how the land the subject of the application will be rehabilitated after each relevant activity ends;	Refer to 5.5.2 of this Supporting Information Report.
(g) Include a description of the proposed measures for minimising and managing waste generated by any amendments to the relevant activity;	N/A - Refer to Question 18 of the approved form submitted with this application.
(h) Include details of any site management plan or environmental protection order that relates to the land the subject of the application.	N/A – There are no known site management plans or environmental protection orders relating to the land the subject of the application.

4.1.2. Requirements for site-specific applications (s227))

In accordance with section 227 of the EP Act, an application must state the matters mentioned in section 126(1) and comply with section 126(2), if the application:

- relates to an environmental authority; and
- the proposed amendment would result in changes to the management of produced water; and
- the activity in an ineligible ERA.

Table 4 lists these requirements and where they are addressed in the application material.

Table 4: s126(1)/(2) Application Requirements

Application requirement (s126)(1)	Where addressed in application material
(a) the quantity of CSG water the applicant reasonably expects will be generated in connection with carrying out each relevant CSG activity;	Refer to section 5.3.1.1 Up to approximately 3,400 ML of produced water would be generated from the proposed additional wells at the forecast production rate shown in Figure 6
(b) the flow rate at which the applicant reasonably expects the water will be generated;	Refer to section 5.3.1.1
(c) the quality of the water, including changes in the water quality the applicant reasonably expects will happen while each relevant CSG activity is carried out;	Refer to section 5.3.1.2 and Table 10: *Regional Groundwater Quality*
(d) the proposed management of the water including, for example, the use, treatment, storage or disposal of the water;	Refer to section 5.5.2 Water volumes associated with the Project will be managed via the existing approvals under EA and / or End of Waste Codes under the *Waste Reduction and Recycling Act 2011*. Water management beneficial uses authorised by these approvals include: • dust suppression and construction; • irrigation; • landscaping and revegetation; and • stock watering.
(e) the measurable criteria (the management criteria) against which the applicant will monitor and assess the effectiveness of the management of the water, including, for example, criteria for each of the following— i. the quantity and quality of the water used, treated, stored or disposed of; ii. protection of the environmental values affected by each relevant CSG activity; iii. the disposal of waste, including, for example, salt, generated from the management of the water;	The measurable criteria are listed in section 5.5.2
(f) the action proposed to be taken if any of the management criteria are not complied with, to ensure the criteria will be able to be complied with in the future.	Refer to section 5.5.2. A review and update of the water management scheme for the project will be undertaken throughout a continuous improvement cycle that may be triggered by the failure to meet the management criteria.
Application requirement (s126)(2)	**Where addressed in application material**
The proposed management of the water can not provide for using a CSG evaporation dam in connection with carrying out a relevant CSG activity unless— (a) the application includes an evaluation of— i. best practice environmental management for managing the CSG water; and	N/A - Evaporation Dams are not authorised on Petroleum Leases.

ii. alternative ways for managing the water; and	
(b) the evaluation shows there is no feasible alternative to a CSG evaporation dam for managing the water.	N/A.

4.1.3. Exercise of underground water rights (s227AA)

In accordance with section 227AA of the EP Act, an application must state the matters mentioned in section 126A(2), if the application:

- Relates to a site-specific EA for a resource project that increases a petroleum lease; and
- The proposed amendment involves changes to the exercise of underground water rights.

Table 5 lists these requirements and where they are addressed in the application material.

Table 5: s126A(2) Application Requirements

Application requirement (s126A(2))	Where addressed in application material
(a) any proposed exercise of underground water rights during the period in which resource activities will be carried out under the relevant tenure;	The proposed amendment would result in the exercise of underground water rights associated with petroleum production.
(b) the areas in which underground water rights are proposed to be exercised;	The underground water rights are proposed to be exercised within PL1082 and PL1083.
(c) for each aquifer affected, or likely to be affected, by the exercise of underground water rights— i. a description of the aquifer; and	Section 0 and Figure 5 of the Supporting Information Report presents the regional hydrostratigraphy.
ii. an analysis of the movement of underground water to and from the aquifer, including how the aquifer interacts with other aquifers and surface water; and	Section 0of the Supporting Information Report describes aquifer interactions.
iii. a description of the area of the aquifer where the water level is predicted to decline because of the exercise of underground water rights; and	Section 5.3 of the Supporting Information Report presents the areas and predicted water level decline.
iv. the predicted quantities of water to be taken or interfered with because of the exercise of underground water rights during the period in which resource activities are carried out;	Refer to Section 5.3.1.1.
(d) the environmental values that will, or may, be affected by the exercise of underground water rights and the nature and extent of the impacts on the environmental values;	Section 5.3 of the Supporting Information Report presents the environmental values for groundwater relevant to the proposed amendment.
(e) any impacts on the quality of groundwater that will, or may, happen because of the exercise of underground water rights during or	There are no impacts to groundwater quality proposed as part of this application.

	after the period in which resource activities are carried out;	Section 5.3 of the Supporting Information Report presents the environmental values for groundwater relevant to the proposed amendment.
(f)	strategies for avoiding, mitigating or managing the predicted impacts on the environmental values stated for paragraph (d) or the impacts on the quality of groundwater mentioned in paragraph (e).	Section 5.3 of the Supporting Impact Report describes groundwater management.

4.1.4. The Standard Criteria (EP Act)

The standard criteria (as defined by Schedule 4 of the EP Act) are required to be considered by the administering authority for both a major and minor amendment application. Refer to Table 6 for an assessment of the proposed amendment against the standard criteria.

Table 6: Standard Criteria (s241)

Schedule 4 EP Act	Relevance
(a) the following principles of environmental policy as set out in the Intergovernmental Agreement on the Environment - *(i) the precautionary principle;* *(ii) intergenerational equity;* *(iii) conservation of biological diversity and ecological integrity; and*	The proposed amendments were contemplated within the context of intergenerational equity and sustainable development. The amendments will not result in significant or permanent impact to the existing environmental values of the PL area. Petroleum activities undertaken within the PLs will be conducted in accordance with the conditions of the EA and the mitigation measures described in Section 5 to conserve biological diversity and ecological integrity. The proposed amendments were contemplated within the context of the precautionary principle. The amendments do not pose a threat of serious or irreversible environmental harm, and scientific uncertainty does not exist as to the level of potential environmental harm as demonstrated in the supporting information provided with this amendment application. Compliance with the existing conditions of the EA and the mitigation measures described in Section 5 will be met during the conduct of authorised activities to achieve best practice environmental management (BPEM).
(b) any Commonwealth or State government plans, standards, agreements or requirements about environmental protection or ecologically sustainable development	The proposed activities will be undertaken in accordance with the applicable requirements of the following: • EP Act • EPBC Act • *Petroleum and Gas (Production and Safety) Act (P&G Act)* • *Nature Conservation Act 1992* (NC Act) • *Vegetation Management Act 1999 (VM Act)* • *Regional Planning Interests Act 2014* • *Water Act 2000* • *Environmental Offsets Act 2014* The relevance of these Acts to this application is referenced throughout the supporting information.
(c) any relevant environmental impact study, assessment or report	Relevant assessments and reports are described throughout this supporting information report.

Schedule 4 EP Act	Relevance
(d) the character, resilience and values of the receiving environment	Refer to Section 5.
(e) all submissions made by the application and submitters	N/A
(f) Best Practice Environmental Management (BPEM) for activities under any relevant instrument, or proposed instrument, as follows- *(i) an environmental authority;* *(ii) a transitional environmental program;* *(iii) an environmental protection order;* *(iv) a disposal permit;* *(v) a development approval;*	BPEM of the proposed activities will be achieved through compliance with the existing conditions of the EA and implementation of environmental management measures described in this report.
(g) financial implications of the requirements under an instrument, or proposed instrument, mentioned in paragraph (g) as they would relate to the type of activity or industry carried out, or proposed to be carried out under the instrument;	The EA holders will continue to provide adequate funds, equipment and staff time to comply with the existing conditions of the EA.
(h) public Interest	The extraction of oil and gas is in the public interest as it facilitates the production of energy required to meet the needs of customers in Queensland and other Australian States and Territories. Resources produced also generate taxes and royalties to the Queensland Government which provide an ongoing source of revenue to support Government services provided to the general public.
(i) site management plan (SMP)	There are no relevant SMPs applicable to this amendment application.
(j) integrated environmental management system (IEMS) or proposed IEMS	N/A
(k) other matters prescribed under a regulation	Refer to Section 4.2.

4.2. Environmental Protection Regulation 2019

4.2.1. Environmental Objective Assessment

Chapter 4 of the EP Reg describes the matters to be considered by the administering authority in making an environmental management decision. For the purposes of this amendment application, section 35 of the EP Reg requires the administering authority to:

- carry out an environmental objective assessment against the environmental objective and performance outcomes mentioned in Schedule 8, Part 3, divisions 1 and 2; and
- consider the environmental values declared under the EP Reg.

The proposed amendment would protect the environmental values of air, water, wetlands, noise and land as the application does not include the discharge of air, water or noise contaminants/emissions above the existing authorisations of EPPG00872113. In addition, there will be no alteration of the hydrology of wetlands above the existing authorisations of EPPG00872113.

Refer to Table 7 and Table 8 for an assessment of the proposed amendment against the environmental objectives and performance outcomes relating to groundwater and waste.

Table 7: Schedule 8, Part 3, Division 1 - Groundwater

Schedule 8, Part 3, Division 1 *EP Reg*	Relevance to amendment application
GROUNDWATER	
Environmental Objective	
The activity will be operated in a way that protects the environmental values of groundwater and any associated surface ecological systems.	Section 5.2 and 5.3 demonstrates the continued protection of environmental values of groundwater and associated surface ecological systems from the proposed amendments.
Performance Outcomes	
1 Both of the following apply— (a) there will be no direct or indirect release of contaminants to groundwater from the operation of the activity;	The proposed amendment does not include the release of contaminants to groundwater. Section 5.3 demonstrates the continued protection of environmental values of groundwater and any associated surface ecological systems from this amendment.
(b) there will be no actual or potential adverse effect on groundwater from the operation of the activity.	
2 The activity will be managed to prevent or minimise adverse effects on groundwater or any associated surface ecological systems.	

Table 8: Schedule 8, Part 3, Division 1 - Waste

Schedule 8, Part 3, Division 1 EP Reg	Relevance to amendment application
WASTE	
Environmental Objective	
Any waste generated, transported or received as part of carrying out the activity is managed in a way that protects all environmental values.	The proposed amendment would result in the generation of produced water
Performance Outcomes	
1 Both of the following apply— *(a) waste generated, transported or received is managed in accordance with the waste and resource management hierarchy in the Waste Reduction and Recycling Act 2011;*	Refer to Section 6. Section 5 describes produced water management in accordance with the *Waste Reduction and Recycling Act 2011.*
(b) if waste is disposed of, it is disposed of in a way that prevents or minimises adverse effects on environmental values.	Sections 5 and 6 describe the beneficial use of produced water to prevent or minimises adverse effects on environmental values in accordance with conditions B7-B12 of the EA and/or approvals under the *Waste Reduction and Recycling Act 2011.*

4.2.2. Waste and Resource Management Hierarchy (Waste Reduction and *Recycling Act 2011*) (WRR Act)

Section 5 describes produced water management in accordance with the *Waste Reduction and Recycling Act 2011*.

4.2.3. Prescribed matters for particular resource activities (s24AA EP Regulation)

Section 226 of the EP Act specifies the general requirements for an EA amendment application. This includes item (1)(n) which specifies any other documents relating to the application prescribed under a regulation. Section 24AA of the EP Reg describes the prescribed documents for an application for environmental authority for a CSG activity. The proposed amendment includes the management of produced water via beneficial uses (e.g. Priority 1 uses in accordance with the DES CSG Water Management Policy).

4.3. Environmental Protection Policies (EPP)

Section 35 of the *EP Reg* requires consideration of the management hierarchy, the environmental values, the quality objectives and the management intent of all relevant EPPs. It is considered that the proposed activities will not impact on the environmental values and quality objectives of Air, Noise or Water as described in the Environmental Protection Policies.

4.3.1. Additional Regulatory Requirements (EPP)

Chapter 4 of the *EP Reg* includes additional regulatory requirements, which must be considered by the administering authority in making an environmental management decision where the management decision relates to an activity mentioned in either section 58 or 63. However, the amendment application does not relate to an activity mentioned in sections 58 or 63 of the EP Reg as there is no release of water or waste to wetlands for treatment, nor does the activity involve the direct release of waste to groundwater.

4.4. Environmental Offsets Act 2014

In accordance with s207(1)(c) of the EP Act, the administering authority may impose an environmental offset condition on an environmental authority. However, s14(2) of the *Environmental Offsets Act 2014* (EO Act) states that an offset condition may only be imposed on an environmental authority if the proposed activity will, or is likely to have a significant residual impact on the prescribed environmental matter, and all reasonable on-site mitigation measures for the prescribed activity have been, or will be, undertaken. The proposed additional wells will be located to avoid significant residual impacts on prescribed environmental matters as described in Section 2.

Condition F8 of the EA prohibits significant residual impacts to prescribed environmental matters associated with activities subject to this amendment application.

5. Relevant Environmental Values

The following provides a description of environmental values relevant to the amendment, as well as relevant potential impacts to environmental values and the management practices to be implemented. The current Denison/Mahalo EA EA00872113 authorises impacts to environmental values, and the proposed amendment does not substantially change the potential impacts to the environmental values, beyond what is authorised on the EA.

5.1. Air Quality

Environmental Objective (EP Reg): The activity will be operated in a way that protects the environmental values of air.

The proposed activity will be operated in a way that protects the environmental values of air. The proposed amendment does not change the potential impacts to the environmental values for air, beyond what is authorised on the EA. Petroleum activities on the new PL1082 and PL1083 will not cause an environmental nuisance from air emissions at a sensitive place, other than where an alternative arrangement is in place for potential nuisance impacts (condition A11).

5.1.1. Environmental Values

The EP Act provides the framework for the management of the air environment in Queensland. The *Environmental Protection (Air) Policy 2019* (EPP Air) sets the environmental values, as follows:

The environmental values to be enhanced and protected are quality of air environment that is conducive to:

- *Protecting the health and biodiversity of ecosystems;*
- *Human health and wellbeing;*
- *Protecting aesthetics of the environment, including the appearance of buildings, structures and other property; and*
- *Protecting agricultural use of the environment.*

Sensitive Places

There are no towns within the 470 km^2 area of the PLs and only 11 potential sensitive receptors located within PL1082 and PL1083. These sensitive receptors will be ground-truthed once the location is infrastructure and finalised. The relative scarcity of sensitive receptors within the PLs reflects the agricultural land use of the area.

Climate

The nearest Bureau of Meteorology monitoring station is located at the Rolleston Airport, approximately 20km south of the PLs. The climatic conditions over the area, particularly in relation to the generation of dust and the transport and dispersion of air pollutants, are summarised as follows:

- The prevailing wind direction for autumn, winter and spring is south to south easterly. The prevailing wind directions for summer are north east and southerly.
- The average wind speed is 2.5m/s, considered light on the Beaufort scale.
- Heaviest rainfall occurs between November and March of each year, with the highest average rainfall in December (96mm) and the lowest average rainfall in July (13.4) (data based on a five-year period)
- The warmest average monthly temperatures are from November to February, all above 25°C. The lowest temperatures are from June to August, with an average of 15.5°C.

Ambient Air Quality

The air quality within the development area and adjacent surrounds is considered to be consistent with a rural setting and therefore of high quality. Localised air quality impacts are from dust generated from stock movements, dust of natural origin, bushfires and controlled burns, vehicular movements on unsealed roads, and from other gas/mining operations in the region.

DES monitors ambient air quality in major population centres to assess compliance against the National Environment Protection (Ambient Air Quality) Measure (NEPM) and the EPP Air. The closest DES monitoring stations to the Denison/Mahalo tenures is located in Toowoomba. This monitoring station was operational from July 2003 to December 2010, and recorded ambient concentrations of oxides of nitrogen (NO/NO2), carbon monoxide (CO), ozone (O3) and fine particulate matter (PM10 and PM2.5). The Toowoomba monitoring station observations have been used to characterise the existing air quality in the development area for NO2, CO and O3. More recently, Origin Energy, as part of the GISERA Surat Basin Air Quality study, funded three air quality monitoring stations at Hopeland, Miles Airport and Condamine.

The highest maximum monthly concentration recorded at the Miles Airport has been adopted to represent background air quality for the PLs. Table 9 shows the background air quality and air quality objectives (based on Schedule 1 of the EPP Air). The background air quality levels show in Table 9 are considered to be a conservative estimate given the remote and rural nature of the area with no significant existing air emission sources apart from agricultural operations and existing petroleum exploration activities.

Table 9: Background air quality

Pollutant	Averaging Period	Concentration[1] ($\mu g/m^3$)	Objective ($\mu g/m^3$)
NO_2	1 hour	47	250
	Annual[2]	4.1	62
CO	8 hours	1,500	11,000

Notes:
1 – The 70th percentile has been used to represent background concentrations of NO_2.
2 - The annual average is the highest annual average concentration from the monitoring period.

5.1.2. Environmental values assessment and mitigation measures

The proposed activity will be operated in a way that protects the environmental values of air. The proposed amendment does not change the potential impacts to the environmental values for air, beyond what is authorised on the EA. No new fuel burning or combustion facilities that will trigger ERA levels are proposed in this application.

Emissions to the ambient air environment from petroleum activities carried out on the development area include:

- Exhaust fumes from temporary use of generators, construction machinery and equipment;
- Fugitive emissions from wells and associated infrastructure; and
- Dust generated by construction machinery and equipment use and vehicle movements on site.

Through the implementation of the management practices listed below, the residual risk and magnitude of potential impacts to the air environment is considered low to negligible and limited in extent and duration.

Construction and operational controls

- Operation of the proposed wells and ancillary infrastructure will not require fuel burning equipment; this infrastructure would use electrically driven motors powered from the local electricity transmission network.
- Alternative arrangements will be entered into as required as specified under the EA.
- Sensitive receptors and sensitive environmental areas will be considered during development, through the siting of infrastructure based on environmental constraints, GIS data and landholder information, thereby ensuring infrastructure is preferentially located away from these areas.
- Emissions from vehicles, plant and equipment will be managed through regular maintenance to ensure all machinery is in good working order and does not generate excessive air emissions. Plant and equipment must be operated in their proper and effective condition.
- Fugitive emissions will be mitigated through appropriate well design and construction, undertaken in accordance with the acceptable industry standard, including compliance with the requirements of the DNRME *Code of Practice For the construction and abandonment of petroleum wells and associated bores in Queensland*[3] and the *Code of Practice For leak management, detection and reporting for petroleum operating plant*[4].
- Dust suppression measures will be implemented. Produced water may be used for dust suppression, in accordance with the EA conditions or an approval under the *Waste Reduction and Recycling Act 2011*.
- The disturbance area and duration of disturbance will be minimised through project design and planning, progressive disturbance, and progressive rehabilitation.
- Waste gas will be flared in accordance with Condition D1 of the EA.

Rehabilitation and Maintenance

- Disturbed areas will be rehabilitated as soon as reasonably practicable to minimise areas exposed to wind erosion and dust.
- All vehicles and machinery will be fitted with appropriate emission control equipment and will be maintained.
- Preventative maintenance programs will be implemented to ensure equipment operates efficiently.
- Low emissions technologies will be used, as appropriate.
- In the event of an environmental nuisance complaint, an incident report will be raised and investigated.
- Any complaints relating to air quality including environmental nuisance will be recorded in line with the EA conditions and actioned in a timely manner.

5.2. Water (surface water and wetlands)

Environmental Objective (EP Reg): The activity will be operated in a way that protects the environmental values of waters and wetlands.

The proposed activity will be operated in a way that protects the environmental values of waters and wetlands. The current EA conditions limit activities within wetlands, lakes, springs and watercourses,

[3] https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0006/1461093/code-of-practice-petroleum-wells-bores.pdf

[4] https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0009/1258038/code-of-practice-leak-management.pdf

and the proposed amendment does not change the potential impacts to the environmental values for waters and wetlands, beyond what is currently authorised.

5.2.1. Environmental values

Wetlands

A review of PLs 1082 and 1083 on the DES 'Wetland Info' website was undertaken. The area includes lacustrine and palustrine wetlands shown on Figure 2. Lacustrine wetlands are open water dominated systems (e.g. dams and lakes). In turn, palustrine wetlands lack open or flowing water (e.g. marsh or bogs).

There is one palustrine wetland mapped within the area listed as high ecological significance (HES). This HES wetland is located adjacent to the Comet River flow channel and may be considered as within the floodplain of the channel.

The lacustrine wetlands in most cases would provide water for farming activities including, but not limited to, livestock watering, and irrigation, and as a secondary means as a habitat for aquatic and terrestrial flora and fauna.

Watercourses

PLs 1082 and 1083 are located within the Comet River catchment consisting of a network of watercourses (Figure 2) that are largely ephemeral and typically only flow during and immediately after significant rainfall events. Larger watercourses such as the Comet River, may contain perennial waterholes isolated by dry river channels during the dry season. The Comet River sub-catchment is heavily influenced by anthropogenic pressures. The State of Rivers Survey identified that the catchment was regarded as being in a moderate to poor condition, with prominent bank instability caused by the presence of stock within the riparian zone, runoff, and vegetation clearing.

Flood modelling indicates that for a 1 in 100-year flood event, flooding may occur within the area in proximity to the Comet River and Humboldt Creek. Humboldt Creek is generally located at elevations greater than 300 m AHD and within broad, partially confined sinuous valleys and consisting of a single channel. This channel is predominately stable with sediment accumulation typically found as side or point bars. Located further downstream of this creek, and towards the Comet River, the geomorphology of these creeks becomes a laterally unconfined valley setting with a higher degree of sinuosity.

Surface water flow is monitored at DNRME gauging station 130506A in the Comet River located immediately downstream of the area. Flow data indicates the majority of the flow, up to approximately 160 ML/day, occurs during December to March in response to wet season rainfall events with little or no flow during other periods highlighting the ephemeral nature of the watercourse

Springs

There are no springs located within or nearby PLs 1082 and 1083 as shown on Figure 3. The nearest spring complex, Kullanda, sources water from the Clematis Group and is located approximately 20 km northeast of the PLs.

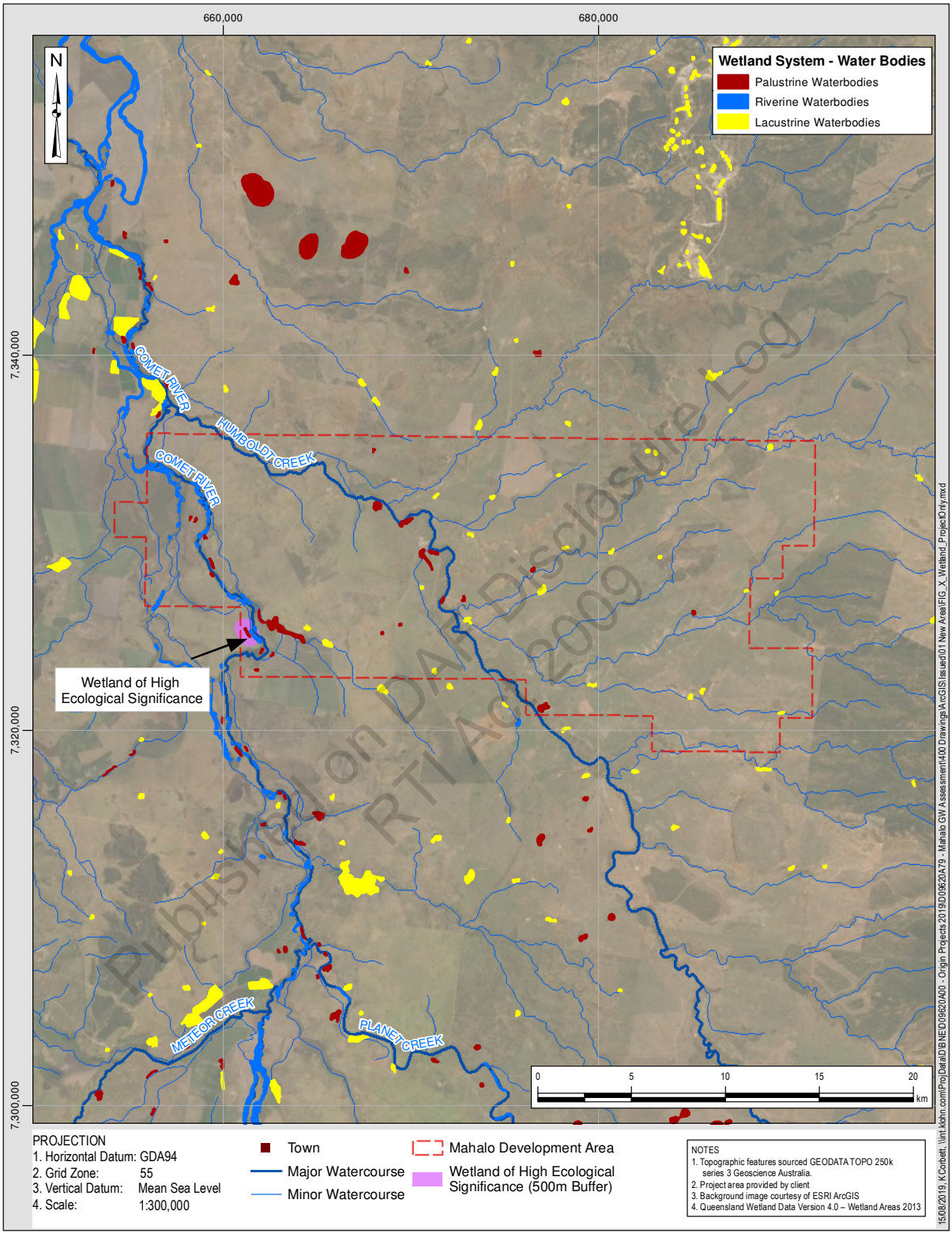


Figure 2 – Watercourses and Wetlands within PLs 1082 and 1083

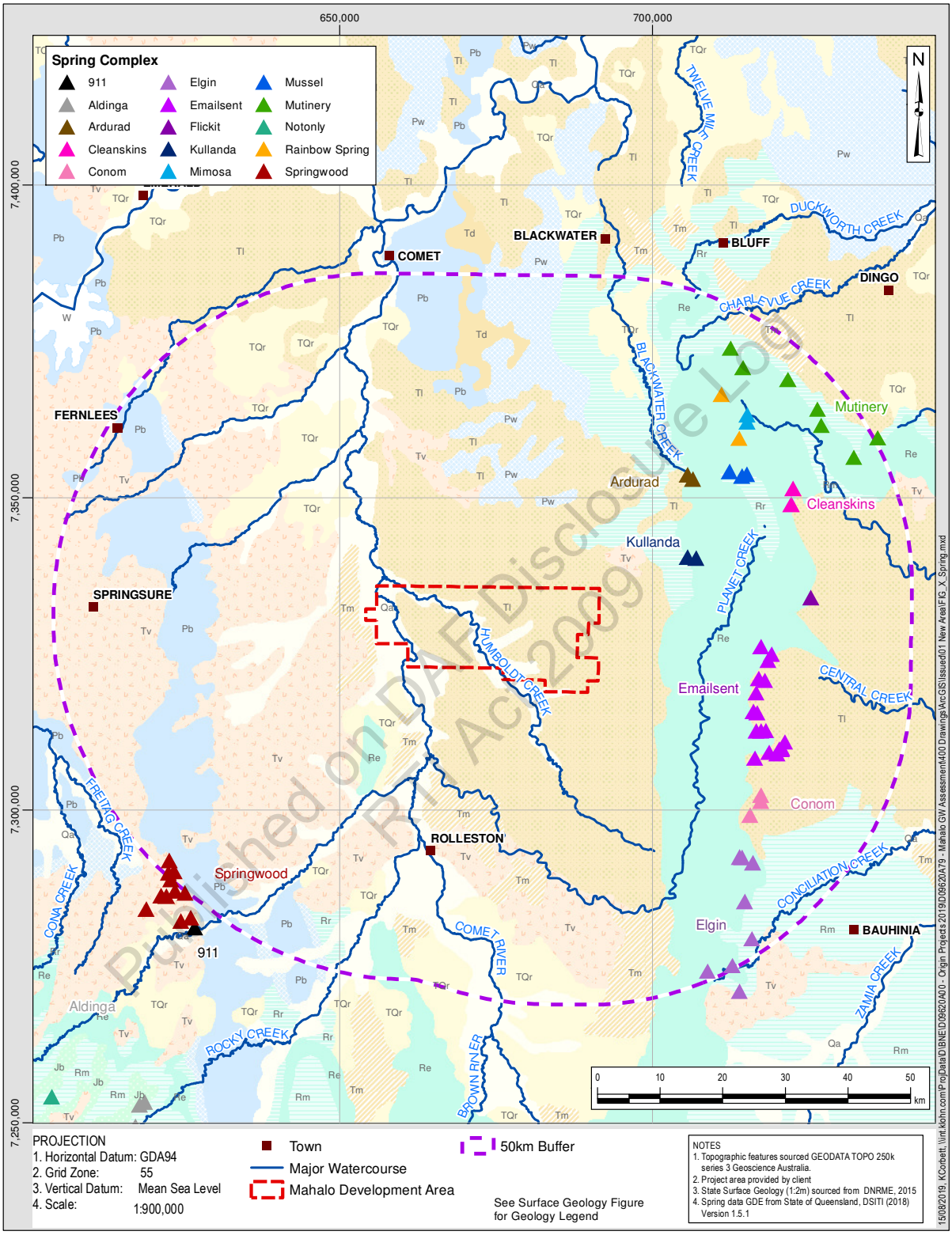


Figure 3 - Springs (not located within or nearby PLs 1082 and 1083)

5.2.2. Environmental values assessment and mitigation measures

Avoidance of Direct Disturbance

As described in Section 3.1.1, the additional proposed wells and associated infrastructure would be located in accordance with the existing water management conditions of the EA, including avoidance of the following:

- wetlands of high ecological significance including a 200m buffer / protection zone;
- wetlands of other environmental value; and
- watercourses.

There are no springs located within PLs 1082 or 1083.

No Surface Water Extraction

The proposed amendment does not include the extraction of surface water.

Produced Water Management

Produced water would be managed as described in Section 5.2, including no discharges to surface water. Irrigation beneficial uses of produced water would be managed to minimise localised runoff to avoid discharge to surface waters.

Floodplains

Well pads for the additional wells will be preferentially located outside of floodplain areas associated with the Comet River and Humboldt Creek. Well pads located within these areas will be designed to:

- minimise concentration of flood flows;
- minimise diversion of flood flows from natural drainage paths / flow distributions;
- not increase the local duration of floods, or the risk of detaining flood flows.

Chemical and Fuel Management

Chemicals and fuel will be stored, transported and handled on-site will be effectively contained and where relevant, meet the relevant Australian Standards (e.g. AS 1940:2017 for the storage and handling of flammable and combustible liquids.

The proposed amendment would not significantly increase the risk and likely magnitude of impacts on the environmental values of surface water of the area given the avoidance of disturbance to surface water, no discharge to or extraction from surface waters, and implementation of the above management measures.

5.3. Groundwater

Environmental Objective (EP Reg): The activity will be operated in a way that protects the environmental values of groundwater and any associated surface ecological systems.

In Queensland, the *Petroleum and Gas (Production and Safety) Act 2004* authorises petroleum tenure holders to undertake activities related to petroleum exploration and production. Petroleum tenure holders have a statutory right to take or interfere with underground water (or groundwater).

The proposed activity will be operated in a way that protects the environmental values of groundwater. The proposed amendment does not change the potential impacts to the environmental values for groundwater, beyond what is authorised on the EA.

5.3.1. Environmental values

Geological Setting

The regional geology of the area comprises sediments from the Early Permian to Middle Triassic age Bowen Basin. The Bowen Basin is an elongated, north to south trending basin extending over 160,000 km^2 from central Queensland, south beneath the Surat Basin, and into New South Wales, where it connects with the Gunnedah and Sydney basins (OGIA 2016).

The Bowen Basin contains up to 10 km of terrestrial and shallow-marine sediments (Green 1997; R. Korsch and Totterdell 2009). The southern Queensland and northernmost New South Wales portion of the basin is overlaid by up to 2.5 km of Early Jurassic to Early Cretaceous Surat Basin sedimentary sequences (Fielding et al. 2000; R. Korsch and Totterdell 2009). In the vicinity of the area, sediments from the Surat Basin have been eroded and the Bowen Basin units reside under Cenozoic cover.

The area is located on the mid-western extent of the Bowen Basin, on the southern end of the Comet Ridge crest, and is flanked by the Taroom Trough to the east and the Denison Trough to the west (Green 1997; Fielding et al. 2000; R. Korsch and Totterdell 2009). Having developed inbound of an active convergence margin during the New England Orogeny, the Bowen Basin formed within a backarc tectonic setting (R. Korsch and Totterdell 2009), concurrently with the Gunnedah Basin.

Regionally, Cenozoic sedimentary deposits overlay the Bowen Basin units, formed through subsidence-related faulting and erosion, in conjunction with fluvial sedimentary depositional processes (Laronne and Shlomi 2007; Nichols and Fisher 2007; R. J. Korsch et al. 2009). Crustal thinning due to extensional tectonic events resulted in magma upwelling and intermittent volcanism, expressed as basaltic lava flows in the vicinity of the Project as well as interbedded tuff and volcanolithic fragments within the Cenozoic sedimentary sequences (R. Korsch and Totterdell 2009).

Structural Elements

PLs 1082 and 1083 are situated in the eastern extent of the north-northwest to south-southeast trending Denison Trough (Olgers et al. 1963; Totterdell 1990), which is bounded by the Anakie Inlier and the Colinsville, Springsure and Roma shelves in the west, and the Comet Platform to the east (Totterdell 1990).

Early Permian east-west or northeast-southwest extension formed a series of half-grabens across the Denison Trough (McLoughlin 1986). Recent studies have indicated that a complex interplay of volcanism, mechanical extension, thermal cooling, thrust related flexuring of the lithosphere and dynamic platform tilting resulted in block subsidence during the Late Carboniferous to Early Permian, resulting in rapid sedimentary infill forming a thin veneer across the Trough (R. Korsch and Totterdell 2009). Extension was followed by mid-Permian mild compression, then more intense northeast-southwest oriented compression in the Late Triassic (McLoughlin 1986; R. J. Korsch et al. 2009; R. Korsch and Totterdell 2009).

Various northwest to southeast trending extensional bounding-faults of half-grabens, resulting from block subsidence during the Late Carboniferous to Early Permian, occur regionally across the Denison Trough (R. Korsch and Totterdell 2009; R. J. Korsch et al. 2009).

In addition to faulting, a series of regional scale, meridional en échelon synclines and anticlines occur adjacent to the faulting in a north-northwest to south-southeast orientation (McLoughlin 1986). Folds such as the Springsure Anticline, Inglis Serocold Anticline, Rewan Syncline and Consuelo Anticline are located to the southwest of the Project, and the Mimosa Syncline to the southeast (McLoughlin 1986; R. Korsch and Totterdell 2009; R. J. Korsch et al. 2009). Small-scale, discontinuous folds occur sporadically across the area, and are likely parasitic to the larger folds previously mentioned (McLoughlin 1986). The structural history of this area (Denison Trough) indicates that the major folding

event effecting the Permian rocks occurred between the Triassic and Jurassic (Power 1967; McLoughlin 1986).

Regional Hydrostratigraphy

The mapped geology within the vicinity of PLs 1082 and 1083 is presented on Figure 4. Stratigraphic units of relevance include:

- Quaternary alluvial deposits located along the Comet River and major tributaries;
- Surficial Cenozoic deposits;
- Localised basalt;
- Early to Middle Triassic sediments of the Clematis Group;
- Early Triassic sediments of the Rewan Group;
- Late Permian sediments of the Bandanna Formation; and
- Late Permian sediments of the Back Creek Group (including the Black Alley Shale and Aldebaran Sandstone).

Figure 4 shows how the Rewan Group (Rr), a regional aquitard, is present within the entirety of PLs 1082 and 1083.

Figure 5 presents the hydrostratigraphic column for the units occurring in PLs 1082 and 1083. The figure also indicates the hydrogeology condition of each unit as presented by OGIA (OGIA 2019), as well as the relevance to the area.

A summary of each of these units is provided in the following sections (from youngest to oldest):

Alluvium

The Quaternary alluvium comprises an unconsolidated and heterogeneous profile of sediments, deposited during periods of fluvial flooding events as overbank deposits (Laronne and Shlomi 2007; Nichols and Fisher 2007). The alluvium consists of fine to coarse-grained gravels and channel sands interbedded with clays. Published geological mapping indicates the presence of Quaternary alluvium up to 3 km either side of the Comet River and Humboldt Creek within the area. Quaternary alluvial sediments overlie sub-cropping Triassic and Permian bedrock, basalt and Cenozoic-age sediments.

Cenozoic Deposits

Quaternary colluvium is mapped as occurring within the PLs, and consists of clay, silt, sand and gravel.

Cenozoic-age sediments comprise a discontinuity of consolidated and semi-consolidated heterogeneous sediment / weathered residual deposits (referred to as the Emerald Formation) that overlie the northeastern portion of the Comet River catchment, infilling valley floors. These deposits consist of deeply weathered fluviatile and lacustrine claystone and siltstone, quartzose sandstone, pebbly sandstone, and gravel. Cenozoic-sediments are widely distributed over the PLs.

Basalt

Basalt occurs within the PLs, with major flows towards the west and south. The basalt comprises mostly olivine basalt with some areas of nephelinite and basanite (Olgers et al. 1963). The basalt presents as flat lying lava flows, unconformably overlying the sedimentary units. The basalt in the PLs is considered an aquifer.

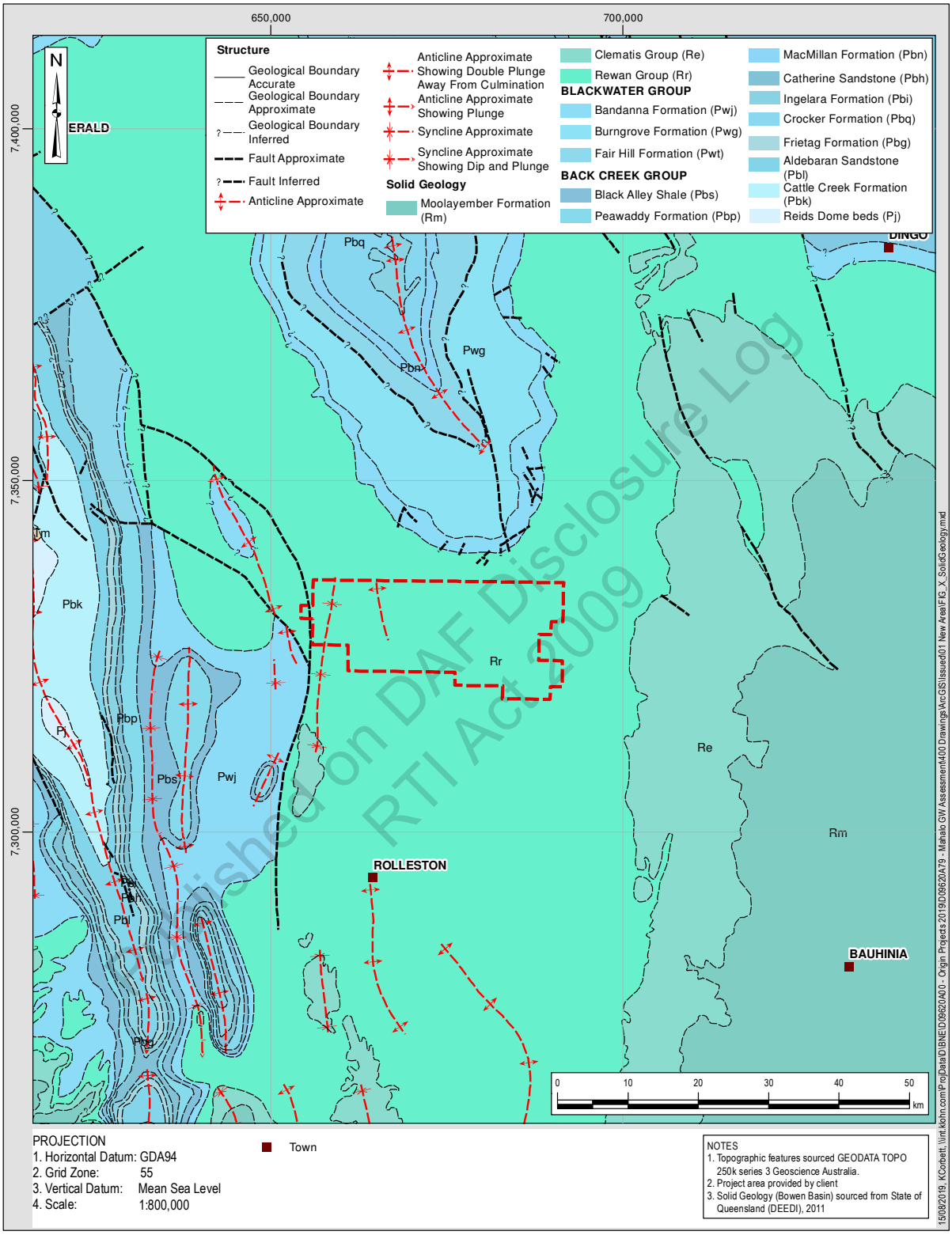


Figure 4 - Solid Geology of PLs 1082 and 1083

Figure 5 - Hydrostratigraphy within PLs 1082 and 1083 (after R. J. Korsch et al. 1997; OGIA 2019)

Age		Formation		Hydrostratigraphic Description	Relevance to PLs 1082 and 1083
Quaternary		Alluvium		Aquifer	Mapped associated with watercourses
Tertiary		Sediments		-	Deposits across the PLs
		Basalt		Aquifer	Located west of the PLs
Triassic	Middle	Moolayember Formation		Tight Aquitard	Located east of the PLs
		Showground Sandstone	Clematis Group	Major Aquifer	Located east of the PLs
	Early				
Permian	Late	Rewan Group		Tight Aquitard	Sub-crops in the PLs
		Bandanna Formation		Interbedded Aquitard	Target CSG formation
		Back Creek Group	Black Alley Shale	-	Sub-crops west of the PLs
			Peawaddy Formation		
			Catherine Sandstone		
			Ingelara Formation Freitag Formation		
	Early		Upper Aldebaran Sandstone		
			Lower Aldebaran Sandstone		
			Cattle Creek Formation	Productive Coal Seam	
			Reids Dome Beds	-	

Moolayember Formation

The Middle to Upper Triassic Moolayember Formation comprises interbedded mudstones, lithic, medium to coarse-grained sandstone, carbonaceous shales, siltstones, and conglomerates, and is the youngest formation within the Bowen Basin (Green et al. 1997; Green 1997). The lower part of the Moolayember Formation was deposited in a lacustrine depositional environment that grades upwards into an alluvial plain with alluvial fans on the eastern margin (Golin and Smyth 1986). The thickness of this formation varies from 200 m on the Springsure Shelf to nearly 1,500 m in the centre of the Taroom Trough (Radke et al. 2000). The Moolayember Formation is characterised as a tight aquitard (OGIA 2019b). The formation is limited in spatial distribution within the vicinity of the PLs.

Clematis Group

The Lower to Middle Triassic Clematis Group (formally, Clematis Sandstone) consists of: medium to coarse-grained, cross-bedded, quartzose to sub-labile and micaceous sandstone; siltstone, mudstone and granule to pebble conglomerate; some fine conglomerate; and grey and red mudstone, deposited within a fluvial environment. The Clematis Group includes two geological formations within the Denison Trough: The Expedition Sandstone (a quartzose sandstone, conglomerate, siltstone and mudstone package) and The Glenidal Formation (thinly bedded, very fine to medium-grained sandstone with common siltstones and mudstones), which conformably overlies the Early Triassic Rewan Group (Brakel et al. 2009). The Expedition Sandstone is equivalent to the Showgrounds Sandstone in the Taroom Trough (Hoffmann, Green, and Gray 1997).

The Clematis Group is considered to be a major aquifer of the Great Artesian Basin (GAB). The formation is limited in spatial distribution within the vicinity of the Project. Outcrops of the Clematis Group are located east of the PLs within the Expedition Range (Olgers et al. 1963; Brakel et al. 2009). It is not considered a significant aquifer in the local area in terms of third-party groundwater use, however is the source of a number of GAB spring complexes located some distance from the PLs. The Clematis Group is separated from the Bandanna Formation (target for CSG production) by a thick sequence of the Rewan Group aquitard.

Rewan Group

The Early Triassic Rewan Group conformably overlies Permian sediments, and predominantly consists of lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanolithic pebble conglomerate (at base), deposited in a fluvial-lacustrine environment (Brakel et al. 2009). This sedimentary sequence thickens towards the centre of the Taroom Trough, east of the Project, and outcrops to the northeast. The Rewan Group is considered to be a tight aquitard (OGIA 2019).

Bandanna Formation

The Late Permian Bandanna Formation conformably overlies the Late Permian Back Creek Group (McLoughlin 1986), and consists of calcareous sandstone, calcareous shale, mudstone, permeable coal seams, and concretionary limestone (Huleatt 1991).

The calcareous sediments of the Bandanna Formation are interbedded with regionally discontinuous coal seams, which are the target for gas production for the PLs, as well as much of the coal mining in the Bowen Basin (Huleatt 1991). Individual coal seams can be identified, with the PLs targeting the Castor, Pollux, Aries and Orion seams.

The sedimentary sequences of the Bandanna Formation deepen towards the southeast, and outcrop north of the PL area (Huleatt 1991). The Bandanna Formation is one of the most widespread and youngest coal-bearing Permian sequences in the Bowen Basin, and correlates with the upper sections of the Baralaba Coal Measures in the southeast and the upper part of the Rangal Coal Measures in the southwest of the basin (Huleatt 1991).

The Bandanna Formation is considered as an interbedded aquitard (OGIA 2019).

Back Creek Group

The Late Permian Back Creek Group comprises quartzose to lithic sandstone, siltstone, mudstone, carbonaceous shale, calcareous sandstone and siltstone, conglomerate, coal, limestone and sandy coquinite. The Back Creek Group contains various Permian sedimentary units, most notably the Black Alley Shale, Aldebaran Sandstone, the Cattle Creek Formation, and the Reids Dome Beds (Bowen Basin basement sequence).

Directly underlying the Bandanna Formation (and confining the earlier successions of the Back Creek Group) is the Black Alley Shale, composed of marine mudstone facies, which becomes increasingly sandy northwards of the northern Taroom Trough (Ayaz et al. 2016). The Black Alley Shale varies in thickness between 7 and 200 m in the southern extents of the Bowen Basin, and thickens into the Denison Trough (Ayaz et al. 2016). The Black Alley Shale is most likely the result of deposition from an eastward progradation of deltaic lobes during a minor transgression or restricted marine event in the Bowen Basin.

The Aldebaran Sandstone is a thick sequence of sandstones, conglomerates and minor mudstones and coals which accumulated within, and eventually beyond, the Denison Trough during the early Permian (Olgers et al. 1963). The unit reaches a maximum thickness of over 700 m and is covered by up to 1,400 m of Permo-Triassic strata of the upper Bowen Basin, Jurassic strata of the Surat Basin and Cenozoic basalt and alluvium. In the far south, it directly overlies the Reids Dome Beds (J. C. Baker 1991). The Aldebaran Sandstone represents a deltaic depositional environment that gradually replaced the marine environment of the Cattle Creek Formation (Dickins and Malone 1973).

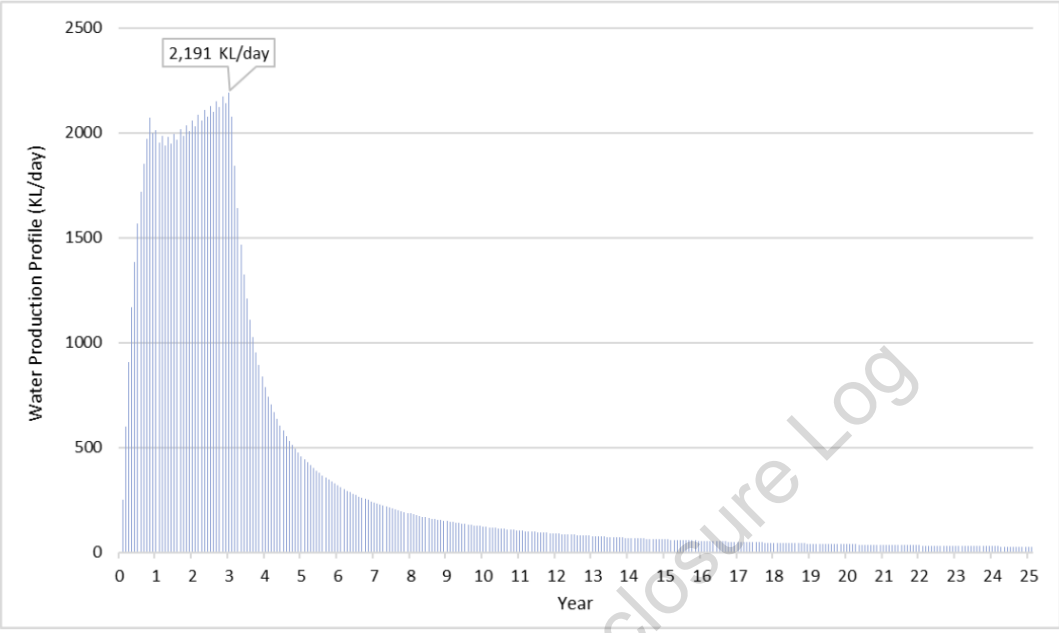
Horizons of the Cattle Creek Formation comprises dark grey, poorly sorted and poorly bedded conglomeratic silty sandstone and mudstone containing scattered large angular boulders, with thin interbeds of limestone and calcareous sandstone (Dickins and Malone 1973). Coal is also present within the Cattle Creek Formation, and has recently been a target for gas exploration (OGIA 2019). The Cattle Creek Formation was deposited within a shallow marine shelf to prodelta depositional environment (Dickins and Malone 1973; Jackson, Hawkins, and Bennett 1980).

The Reids Dome Beds, the lowest unit of the Back Creek Group, outcrop in areas of the Springsure Anticline and as a thin sequence approximately 110 km west of Springsure (Dickins and Malone 1973). These beds have a maximum thickness of approximately 2,760 m, and consist of: a basal unit of black shale and mudstone with coal seams interbedded with hard carbonaceous sandstones and orthoquartzites; a middle unit of black to grey carbonaceous micaceous shale, siltstone and sandstone with minor coal and thin dolomite beds with local thick beds of polymictic conglomerate (particularly in the south); and an upper unit of interbedded fine- to coarse-grained carbonaceous sandstone, dark carbonaceous siltstone, shale and coal (Olgers et al. 1963; Dickins and Malone 1973).

5.3.1.1 Water production

Up to approximately 3,400 ML of produced water would be generated from the proposed additional wells at the forecast production rate shown on Figure 6. The forecast production rate peaks at approximately 2.2 ML/day and rapidly declines to less than 0.2 ML/day for the majority of the operational life of the wells. Produced water will be managed to achieve water quality limits and requirements to support beneficial uses, this may include treatment of the produced water via reverse osmosis. Produced water and water treatment by-products such as brine would be stored in tanks; water treatment by-products would be removed from the PLs and disposed at an off-site facility licenced under the EP Act.

Figure 6 - Water Production Rate



5.3.1.2 Groundwater Quality

Groundwater chemistry within the Bowen Basin has been considered using information reported by OGIA (2019) and data sourced from the groundwater database (GWDB). Table 10 presents a summary of regional groundwater chemistry from OGIA (2019) for formations present within PLs 1082 and 1083.

Table 10: Regional Groundwater Quality

Analyte	Percentile	Alluvium	Basalt	Moolayember Formation	Clematis Group	Rewan Group	Bandanna Formation	Bandanna Formation (coal seams)	Undivided lower Bowen Basin	Undivided Permian Upper
Ca	25th	30	22	14	9	27	2	7	28	32
	50th	46	46	27	24	81	6	11	38	62
	75th	77	80	89	39	281	32	13	58	84
Mg	25th	22	15	5	5	51	1	5	34	36
	50th	40	52	22	14	72	1	6	49	52
	75th	80	98	81	39	201	36	9	76	85
Na	25th	100	75	119	32	252	272	1,210	80	143
	50th	205	106	384	76	706	498	1,470	164	372
	75th	500	155	1,124	120	2,326	935	1,715	1,097	628
K	25th	0.1	0.1	0.1	8	0.1	0.1	23	1	1
	50th	1	1	1	12	1	1	39	4	3
	75th	3	3	6	16	8	2	62	8	6
Alkalinity	25th	308	244	150	120	143	549	967	317	474
	50th	403	393	282	323	342	676	1,150	534	722
	75th	512	537	461	465	382	993	1,520	743	891
Cl	25th	84	86	99	34	273	51	1,230	58	137
	50th	250	170	445	50	1,141	177	1,420	164	343
	75th	780	310	1,655	69	4,215	866	1,975	1,610	595
SO_4	25th	5	3	0.1	2	1	1	0.1	14	0.1
	50th	15	9	5	6	26	1	0.1	25	16
	75th	70	19	24	17	165	12	4	84	85
F	25th	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.2	0.2
	50th	0.2	0.2	0.3	0.2	0.3	1.5	0.4	0.3	0.4
	75th	0.3	0.3	0.6	0.2	0.5	2.3	0.5	0.5	0.6
TDS	25th	649	537	538	227	1,139	946	3,539	731	1,244

Analyte	Percentile	Alluvium	Basalt	Moolayember Formation	Clematis Group	Rewan Group	Bandanna Formation	Bandanna Formation (coal seams)	Undivided lower Bowen Basin	Undivided Permian Upper
	50th	1,064	826	1,402	522	2,648	1,577	4,437	992	1,770
	75th	2,016	1,179	3,657	745	7,009	2,768	5,026	3,762	2,342
pH	25th	7.6	7.7	7.5	7.1	7.4	7.8	8	7.9	7.9
	50th	7.9	7.9	7.9	7.8	7.4	8.1	8.2	8.1	8
	75th	8.2	8.2	8.2	8	7.6	8.2	8.4	8.3	8.1
SAR	25th	3	2	5	2	6	15	71	2	3
	50th	5	3	13	2	17	45	86	8	8
	75th	12	6	26	4	29	97	102	20	15

A summary of the average water quality of produced water from limited samples taken within PLs 1082 and 1083 is provided below in Table 11.

Table 11: Local Produced Water Quality

Parameter	Unit	Average Value
Total dissolved solids	mg/L	7,417
Electrical conductivity	µS/cm	12,254
Total alkalinity	mg/L	190
Sodium adsorption ratio	-	34
Sodium†	mg/L	2 421
Calcium†	mg/L	273
Magnesium†	mg/L	36
Iron (total)	mg/L	23
Iron (filtered)	mg/L	4
Strontium (total)	mg/L	24
Ammonia as N (total)	mg/L	2.2
Potassium†	mg/L	59
Barium†	mg/L	10.5
Chloride†	mg/L	3 870
Sulphur/Sulphate as SO_4†	mg/L	14
Bromide (total)	mg/L	15.2
Iodide (total)	mg/L	23.1
Fluoride†	mg/L	0.5
Silicon as Si (filtered)	mg/L	6.9
Silicon as SiO_2 (filtered)	mg/L	14.7

Parameter	Unit	Average Value
Aluminium (total)	mg/L	0.43
Aluminium (filtered)	mg/L	0.03
Antimony (total)	mg/L	0.0008
Antimony (filtered)	mg/L	0.0004
Arsenic (total	mg/L	0.005
Arsenic (filtered)	mg/L	0.002
Boron†	mg/L	0.99
Cadmium†	mg/L	0.0036
Chromium (III+VI)†	mg/L	0.052
Cobalt†	mg/L	0.003
Copper†	mg/L	0.021
Lead†	mg/L	0.0091
Lithium†	mg/L	0.125
Manganese†	mg/L	0.29
Mercury†	mg/L	0.00086
Molybdenum†	mg/L	0.0065
Nickel†	mg/L	0.007
Selenium†	mg/L	0.010
Tin†	mg/L	0.002
Vanadium†	mg/L	0.0023
Zinc†	mg/L	0.22

† Total and filtered results were combined into a single dataset when the numbers were closely aligned, or if for each sample, only one of the total/filtered parameter was analysed for.

The electrical conductivity of the produced water demonstrates the minimal local environmental values of the Bandanna Formation as a groundwater resource. Produced water quality is not expected to significantly change during operation of the additional petroleum wells based on the water quality from existing operating wells and the confined nature of the Bandanna Formation. As illustrated in Section 5.3.1.4, the relative paucity of groundwater bores indicates the general low availability of groundwater and and/or poor groundwater quality within the PLs.

5.3.1.3 Surat Cumulative Management Area (CMA)

PLs 1082 and 1083 are located within the Surat Cumulative Management Area (CMA). Potential impacts associated with petroleum activities within the CMA are assessed and managed by the Queensland Office of Groundwater Impact Assessment (OGIA). The OGIA is required to prepare an Underground Water Impact Report (UWIR) for the CMA. The *Water Act 2000* defines the requirements for a UWIR, which include, but are not limited to:

- The quantity of water historically produced and an estimate of the quantity of water to be produced because of the exercise of underground water rights.
- For each aquifer affected or likely to be affected a description of the aquifer and an analysis of the movement of groundwater between aquifers, including the changes due to the exercising of underground water rights.
- A Water Monitoring Strategy (WMS), including:
    - The rationale for the strategy and locations to be monitored; and
    - The parameters to be measured and their measurement frequency.
- A Spring Impact Management Strategy, including:
    - An assessment of the hydraulic connection between the spring and underlying aquifer(s);
    - The predicted risk to the spring due to declining water levels at its location, and likely impact on ecosystem and ecological values of the spring due to declining water levels; and
    - Options available and a strategy for preventing or mitigating predicted impacts on the spring.

5.3.1.4 Groundwater Bores

There are 30 registered groundwater bores located within PLs 1082 and 1083 as shown on Figure 7, with 15 registered as existing bores and the remainder known to be abandoned or destroyed. Baseline assessments of eight bores in the vicinity of existing appraisal activities have been undertaken. Only two of these bores surveyed during the assessment were correlated to bores registered within the groundwater database. The location of bores for which a baseline assessment has been undertaken are shown on Figure 8. Only two of the bores were installed with a pump and used for water supply purposes, with the remainder abandoned.

As required under the *Water Act 2000* and the Surat CMA UWIR WMS, further baseline assessments will be undertaken prior to production activities. Under the *Water Act 2000*, petroleum tenure holders are required to undertake baseline assessment of water bores prior to commencement of production. Baseline assessments are undertaken in accordance with the 'Baseline Assessment Guideline' (DES 2017), to obtain information such as:

- bore status;
- bore type and purpose;
- information related to the construction of the bore, including
    - depth installed;
    - screen interval and source aquifer;
    - groundwater level and quality and field gas measurement; and
    - bore equipment including pump depth, pumping frequency and flow rate.

5.3.1.5 Groundwater Dependent Ecosystems (GDEs)

The distribution of potential terrestrial GDEs, as mapped by the Queensland Groundwater Dependent Ecosystems and Potential GDE Aquifer Mapping, Version 1.5[5] within the vicinity of the PLs is shown on Figure 9. The potential GDEs are generally located in the vicinity of the watercourses, such as the Comet River and associated tributaries (Humboldt Creek, Planet Creek, Meteor Creek). The GDE mapping data provides the following categories of "confidence in the groundwater dependence of the ecosystem"[6]:

1. Known GDE.
2. Derived GDE – high confidence.

[5] https://wetlandinfo.ehp.qld.gov.au/wetlands/ecology/aquatic-ecosystems-natural/groundwater-dependent/

[6] https://wetlandinfo.des.qld.gov.au/wetlands/facts-maps/gde-background/gde-faq/field-descriptions.html

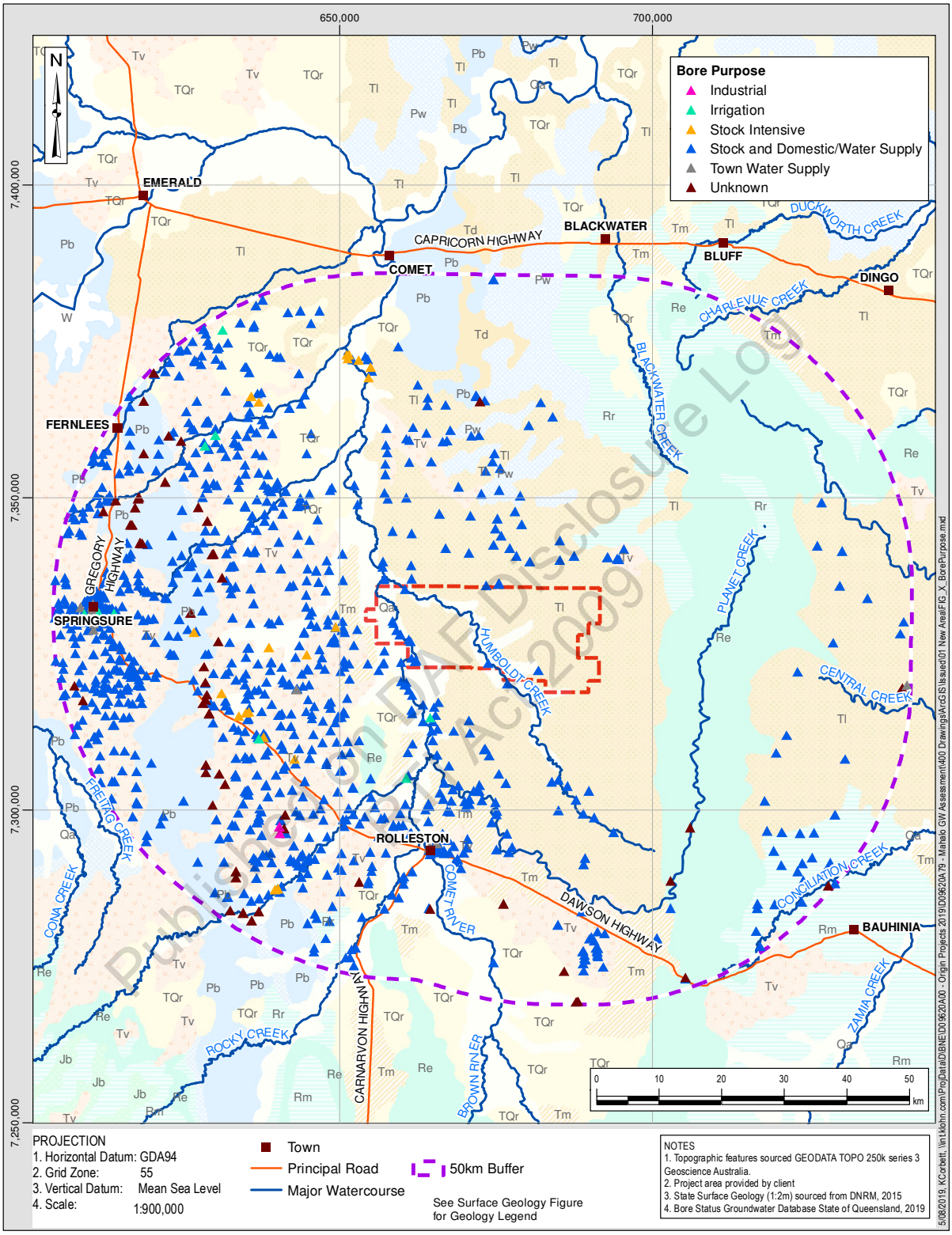


Figure 7 - Registered Groundwater Bores within PLs 1082 and 1083

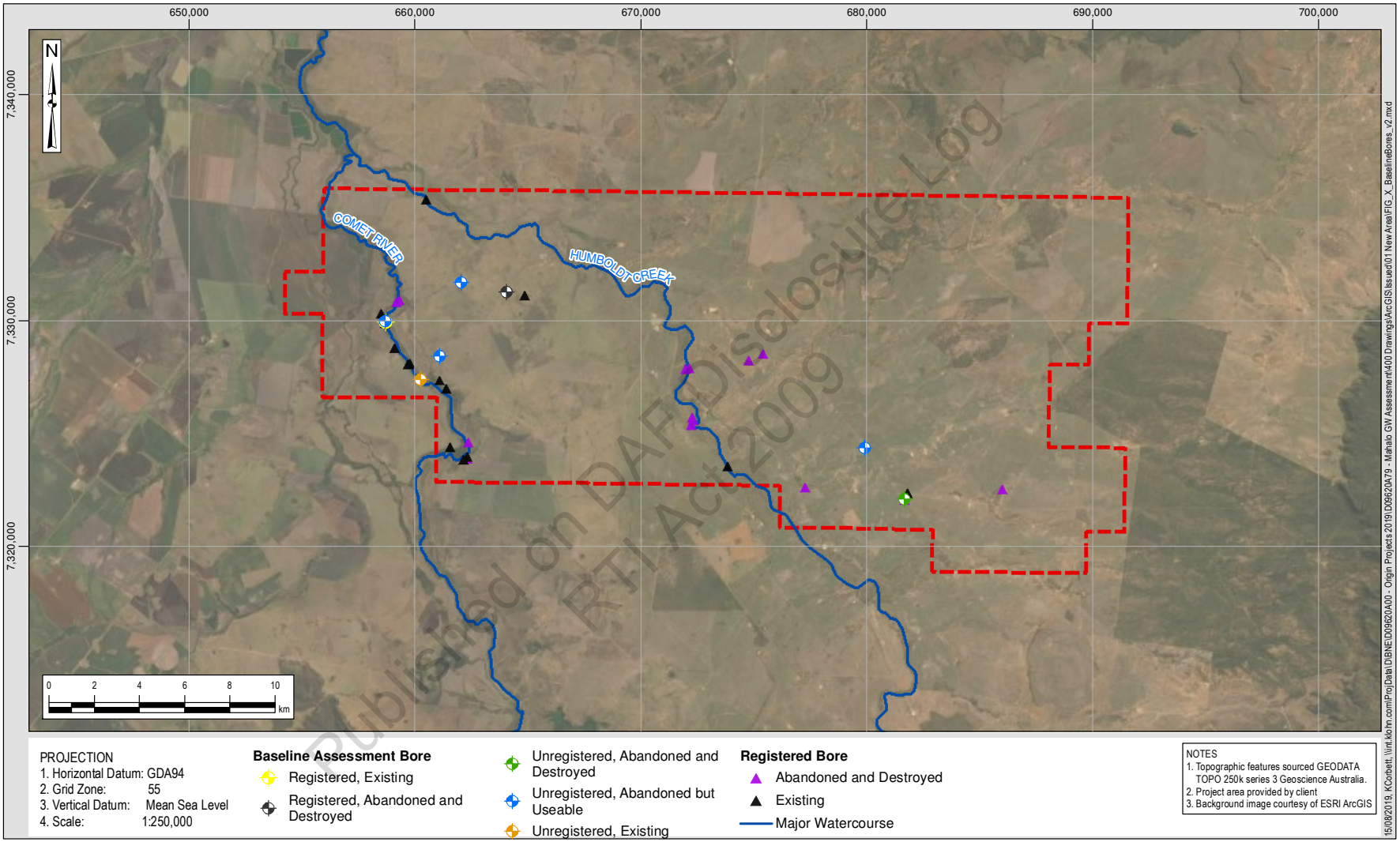


Figure 8 - Completed Baseline Assessments within PLs 1082 and 1083

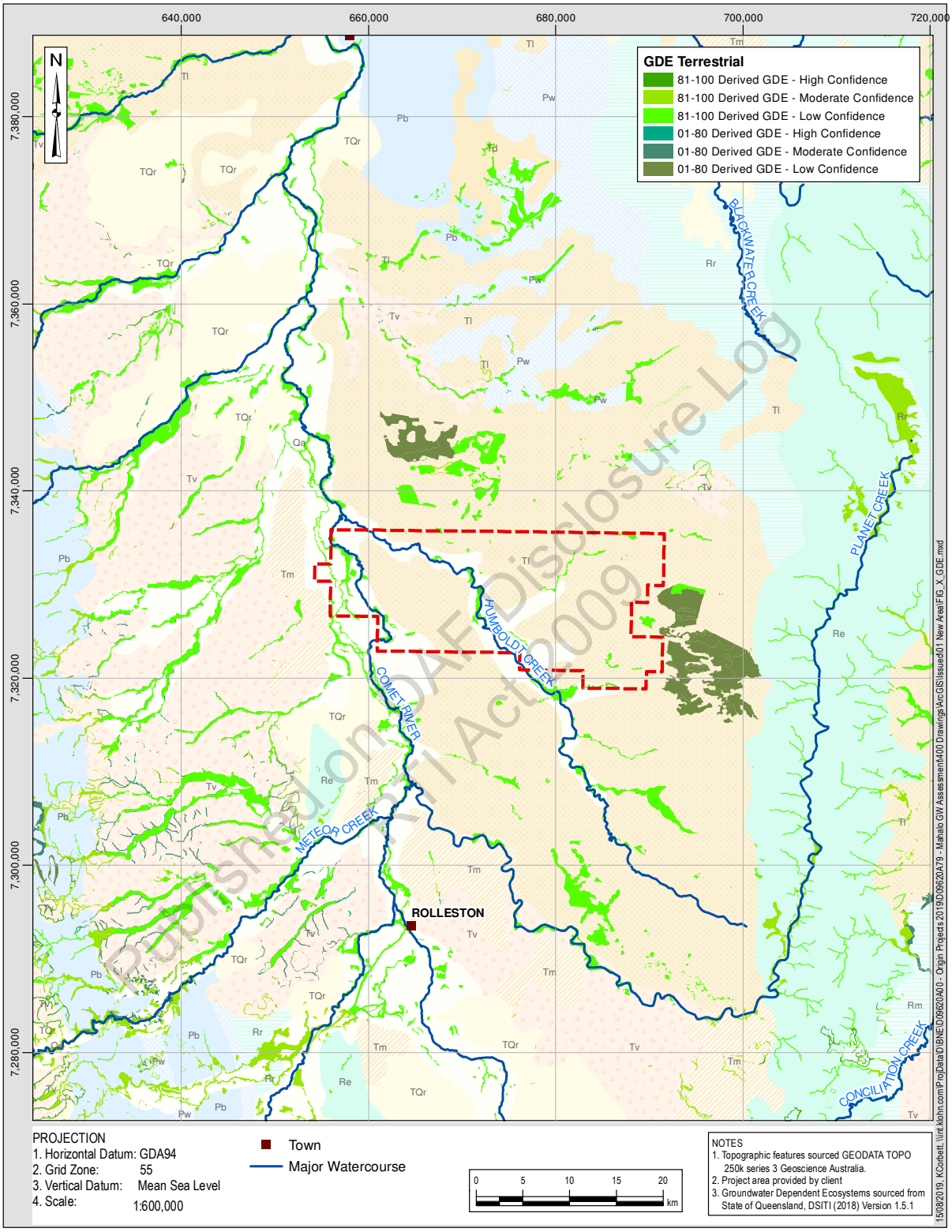


Figure 9 – Potential GDEs within the PLs and Surrounds

3. Derived GDE – moderate confidence.
4. Derived GDE – low confidence.
5. Unknown confidence.

The potential GDEs mapped within the PLs are "Derived GDE – Low confidence"; based on expert opinion, these GDEs are unlikely to be dependent on groundwater for ecosystem function of the RE. The QLD WetlandMaps[7] mapping provides the potential shallow aquifers (groundwater source for the GDE) for these low confidence GDEs as being from the following mapping rule sets:

- SURAT_RS_01D: Quaternary alluvial aquifers with fluctuating, intermittent groundwater connectivity regime and neutral pH
- SURAT_RS_05: Permeable old loamy or sandy plain aquifers with fresh, intermittent groundwater connectivity regime

The QLD WetlandMaps mapping provides the dominant recharge process for these shallow aquifers as "infiltration (local)" being the localised infiltration of shallow aquifers from rainfall.

For the alluvium aquifer adjacent to the Comet River, the depth to groundwater is recorded as ranging between 9 and 18 mbGL. For the Cenozoic aquifer, the depth to groundwater is recorded as ranging between 30 and 42.7 mbGL. For the potential terrestrial GDEs to be reliant on groundwater from the alluvium and Cenozoic sediments, the vegetation would be required to extend their roots to this depth.

5.3.2. Environmental values assessment and mitigation measures

Well Construction

The additional proposed wells are required to be constructed in accordance with the DNRME *Code of Practice for the Construction and Abandonment of Coal Seam Gas and Petroleum Wells, and Associated Bores in Queensland*[8] (The Code). Requirements of this code relevant to the proposed amendment are described below.

Well mechanical integrity

A critical component of maintaining a high degree of protection of the various aquifers within the Surat and Bowen Basin sequences is through the robustness and longevity of the well construction itself. The well is required to isolate the production fluids from the aquifer units during its working life and beyond, even after it has been formally abandoned by the mandated well abandonment processes (including pressure cementing). It is this robustness of construction that permits the well to maintain its integrity.

Throughout the entire process, stringent quality control and testing is undertaken to ensure the integrity of the casing and seals. These quality control procedures are implemented through the material selection and sourcing process and installation.

Maintaining a gas production well's integrity is essential for the two following reasons:

- To isolate the internal conduit of the well, namely the well casing pipe, from the surface and subsurface environment. This is critical in protecting the environment, including the groundwater, and in enabling well drilling and production; and
- To isolate and contain the wells produced fluid (i.e. the gas) to a production well casing pipe within the well.

[7] https://wetlandinfo.des.qld.gov.au/wetlandmaps/

[8] https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0006/1461093/code-of-practice-petroleum-wells-bores.pdf

Groundwater is protected from the contents of the gas well during drilling, and production by a combination of drilling muds used in the process, steel casing and cement sheaths, and other mechanical isolation devices installed as a part of the well construction process. The construction of the well is done to prevent communication (the migration and/or transport of fluids between these subsurface layers).

The primary method used for protecting groundwater during drilling operations consists of drilling the well borehole through the groundwater aquifers (and aquitards) and then cementing this steel pipe into place using specialised cement types prior to advancing into deeper petroleum units. The casing and cement are specifically selected to accommodate a number of factors including formation types, groundwater quality, gas characteristics and operational conditions. The steel casing protects the zones from material inside the wellbore during subsequent drilling operations and, in combination with other steel casing and cement 'sheaths' that are subsequently installed, protects the groundwater with multiple layers of protection for the life of the well.

Petroleum and Gas legislation specifically address groundwater protection, including requirements for the surface casing to be set below the lowest groundwater aquifer. The steel casing protects the zones from material inside the wellbore during subsequent drilling operations and, in combination with other steel casing and cement 'sheaths' that are subsequently installed, protects the groundwater with multiple layers of protection for the life of the well.

The coal seams containing gas produce into the well through a well screen or perforations in the steel pipe and cement sheaths opposite the respective coal seams, with the produced gas being contained within the well pipe and the production all the way to the surface. The concrete annular seal between the casing and the formation. This containment is what is meant by the term 'well integrity'.

Regular monitoring takes place during drilling and production operations to ensure that these operations proceed within established parameters and in accordance with the well design, well plan, and permit requirements. This includes testing of the well integrity during well construction and over the life of the well.

Drilling and Well Completions

Drilling a typical oil or gas well consists of several cycles of drilling, running casing (steel pipe for well construction), and cementing the casing in place to ensure isolation. In each cycle, steel casing is installed in sequentially smaller sizes inside the previous installed casing string. The last cycle of the well construction is well completion including perforating the steel pipe opposite the coal seam.

Casing

To ensure long term casing integrity, detailed specifications have been developed for all well casings and well completion materials. These materials have been specifically designed and selected for the proposed application and lifecycle of the well. All materials are inspected prior to installation to ensure compliance with specifications. A similar process of inspections and testing are utilized throughout the drilling and casing installation program.

Logging the borehole

Borehole and well logging are carried out at gas well sites at various stages of the wells drilling and completion. Upon completion of the drilling of a borehole section, and before casing is installed and cementing operations begin, sensor instruments are run into the open (uncased) drilled borehole on a data cable. The information collected and the process used is typically referred to as 'well logging' or 'geophysical borehole logging'. Typical geophysical logging methods that are run in a well are designed for the specific location, geology, resource and well design.

Logging produces detailed information on all rock formations logged and the groundwater quality they might contain. Logging also determines the actual depth and thickness of the subsurface formations in the drilled hole.

This information is important in design of the production well and allows installation of casing strings in exactly the right place to achieve the well design objectives and to properly achieve the isolation benefits of the casing and cement.

A key result of the cased-hole logging program is to know the exact location of the casing, casing collars and quality of the cement job relative to each other and relative to the subsurface formation locations. This ensures that the well drilling and construction is adequate and achieves the desired design integrity and longevity objectives. It is also used to provide information in subsequent surveys of well integrity and seals over the production life of the gas well.

Well Completion Design

The well design and specifications include wellbore preparation, mud removal, casing pipe running and cement placement to provide barriers that prevent fluid migration and well leakage. The selection of the materials for cementing and casing, and the process of cement placement are important considerations in designing the well such that it ensures optimum performance of the barrier system to protect groundwater and isolate the hydrocarbon bearing zones. The well design process also includes contingency planning to mitigate and eliminate the risk failure due to unforeseen events.

Casing design and completion

The first borehole drilled is for installing the conductor pipe. This is followed by a series of sequentially drilled deeper boreholes designed to install the various sleeved or sheathed casing pipes as follows: surface casing, intermediate casing (if necessary), and the production casing. Casing pressure tests are carried out at each stage to ensure integrity of the casing pipe for further drilling or operational conditions. These tests are conducted at pressures that will determine whether the casing integrity is adequate to meet the well design and construction objectives.

Cementing

Cement types, additives and mixes are engineered products and are selected and designed to address site-specific conditions relevant to a particular well. Cement mixtures and installation techniques are employed to provide a robust seal that isolates the well from the surrounding formations, and protects the well materials from potentially aggressive groundwater or formation conditions. The selected cement types, additives and mixing fluid are specifically designed and laboratory tested in advance to ensure they meet the requirements of the well design and subsurface conditions at the well location.

Placement of the cement is carried out in such a manner (and using appropriate centralising equipment) as to completely surround the casing pipe to achieve successful seal isolation and pipe integrity. That is, effective isolation of the well pipe from the various subsurface formations requires complete and even annular filling and tight cement interfaces with the formation and casing. Complete displacement of drilling fluid by cement (to eliminate 'bubbles' or voids) and good bonding of the cement interfaces between the drilled hole and the casing immediately above the gas-bearing coal are important factors taken into account when designing and completing the well to ensure effective and long-lasting well and seal integrity.

The following well design, materials selection and cement procedures are typically implemented at well completion sites:

- A well design team prepares an appropriate well completion design based on a detailed assessment of borehole core, the regional geological model, reservoir analysis, and the history of nearby wells. Historical problems encountered in the area (lost returns, irregular hole erosion, poor hole cleaning, poor cement displacement, etc.) are considered during the design process;
- Computer simulation and completion planning is carried out to optimise cement placement procedures;
- Drilling contractors are selected based on their repute, adherence to industry best practice methods and regulatory requirements. Importantly, as it effects cementing, they are required to use established, effective drilling practices to achieve a uniform, stable well

borehole with desired hole geometry. Additionally, they are required to satisfy health-safety-environmental requirements with regard to their personnel and equipment. They are required to ensure that their cementing equipment provides adequate mixing, blending and pumping of the cement in the field;

- Drilling contractors are required to ensure that the drilling fluid selection is appropriate for the designed well and the geologic conditions likely to be encountered, and present a low risk to the environment;
- Site drilling and cementing equipment are selected to adequately achieve the well design that will meet the well design objective and ensure effective isolation;
- Prior to cementing a section of well casing pipe in place, drilling contractors ensure that appropriate well borehole preparation, hole cleaning, and conditioning measured implemented to ensure the cementing works are effective;
- Drilling contractors are required to employ casing pipe centralisers to help centre the casing pipe within the borehole and provide for good mud removal and cement placement, especially in critical areas, such as coal seam zones, and groundwater aquifers;
- Drilling contractors are required to use appropriate cement testing procedures to ensure cement slurry quality and designs are adequate. These include implementation of appropriate cement slurry quality controls - with testing to measure the following parameters depending on site- specific geological and groundwater quality conditions:
    - Slurry density
    - Thickening time
    - Fluid loss control
    - Free fluid
    - Compressive strength development
    - Fluid compatibility (cement, mix fluid, mud)
    - Sedimentation control
    - Expansion or shrinkage characteristics of the set cement
    - Static gel strength development
    - Mechanical properties (Young's Modulus, Poisson's Ratio, elastic/compressibility characteristics, etc.)
- Cement design may include placement in two stages, using a 'lead' cement of lower density and a 'tail' cement of higher density and compressive strength. Typically, the tail cement is used to isolate critical intervals in the well; and
- Appropriate setting times are adhered to ensure that the cement seals are optimal prior to commencing further drilling, and/or operational testing.

Groundwater Drawdown Modelling

Kthn Crippen Berger Ltd (KCB) has assessed potential groundwater drawdown from long term operation of the proposed additional wells in a Water Assessment Report[9]. OGIA have modelled the groundwater drawdown of produced water extraction from the Bandanna coal formation within PLs 1082 and 1083 using their numerical groundwater model for the 2019 Underground Water Impact Report (UWIR) for the Surat Cumulative Management Area[10] (CMA). The outputs of the model were then provided to KCB to analyse the model outputs and assess the potential impacts of predicted groundwater drawdown.

Groundwater Bores

Potential long-term drawdown impacts to groundwater bores were also modelled and assessed against the *Water Act 2000* bore threshold of 2 m for an unconsolidated aquifer and 5 m for a consolidated aquifer. The UWIR model indicated that 4 groundwater bores will experience drawdown in exceedance

[9] http://epbcnotices.environment.gov.au/_entity/annotation/cb63101e-e6ea-e911-8923-00505684324c/a71d58ad-4cba-48b6-8dab-f3091fc31cd5?t=1574417176333; http://epbcnotices.environment.gov.au/_entity/annotation/feac3129-e6ea-e911-8923-00505684324c/a71d58ad-4cba-48b6-8dab-f3091fc31cd5?t=1574417176333

[10] https://www.dnrme.qld.gov.au/__data/assets/pdf_file/0019/1461241/uwir-full-report.pdf

of these impact thresholds. However, these four bores are recorded as sourcing water from the Bandanna Formation, the target gas formation for the Project. The recorded use for these bores is for stock and domestic purposes. However, as demonstrated by the produced water quality, the relatively high salinity (e.g. electrical conductivity of approximately 12,000 µS/cm) of groundwater in the Bandanna Formation would not allow for untreated stock and domestic use. In addition, the groundwater database and drilling logs suggest alternate, non-coal, water sources for these bores. These bores, if in use, are likely to access groundwater formations shallower than the Bandanna Coal Formation, where the drawdown predicted would be of a smaller magnitude. Baseline bore assessments will be undertaken as required by the *Water Act 2000* to determine the groundwater source for these bores.

If it is confirmed that these bores are sourcing water from the Bandanna Formation, the 'make good' requirements under the *Water Act 2000* as applicable, including one or more of the of the following measures:

- adding a rising main to lower the pump setting in the bore;
- increasing the water column above the pump;
- improving the pressure at the bore head, including new headworks and piping, if the affected supply is artesian;
- changing the pump so that it is better suited to the decreased water level in the bore;
- deepening the bore to allow it to tap a deeper part of the aquifer;
- reconditioning of the water bore to improve its hydraulic efficiency;
- drilling a new bore;
- providing an alternate water supply; or
- providing the water bore owner compensation (monetary or otherwise) to offset reduced water supply from the bore.

Given the existing water quality of the Bandanna Formation, and baseline assessment 'make good' requirements of the *Water Act 2000*, impacts to existing groundwater users are considered unlikely.

Springs

There are no springs within or nearby the PLs; the closest spring is located approximately 30km from the PLs as shown on Figure 3. Potential impacts to far-field spring complexes and watercourse springs were considered with respect to the *Water Act 2000* impact threshold for springs (0.2 m drawdown) using the predicted drawdown to the known groundwater sources for the springs. Exceedance of this spring impact threshold was not predicted.

GDEs

The groundwater model predicts drawdown within the uppermost layer of the model, which simulates the alluvium, basalt and Cenezoic sediments. These shallow aquifers are relevant to the GDE mapping rule sets described in Section 5.3.1. The maximum drawdown predicted at the location of the potential low confidence GDEs is 0.3 m drawdown predicted in the area underlying the potential GDEs. Based on groundwater level records for this area as well as the potential GDEs classified as 'low confidence', the water table is considered too deep (greater than ~30 m) for the vegetation roots to reach and therefore has very limited potential to be impacted.

UWIR

Groundwater production from PLs 1082 and 1083, including the proposed additional wells, will be included in future revisions of the Surat CMA UWIR or a standalone UWIR, providing an additional level of impact assessment under the *Water Act 2000*, duplicating the requirements of the EP Act.

The proposed amendment would not significantly increase the risk and likely magnitude of impacts on the environmental values of groundwater of the area given the results of site-specific groundwater modelling, and implementation of the above mitigation measures.

5.4. Noise

Environmental Objective (EP Reg): The activity will be operated in a way that protects the environmental values of the acoustic environment.

The proposed activity will be operated in accordance with the existing EA conditions and will protect the environmental values of the acoustic environment. Petroleum activities will not cause an environmental nuisance from noise at a sensitive place, other than where an alternative arrangement is in place. The proposed amendment does not change the potential impacts to the environmental values for the acoustic environment, beyond what is authorised on the EA.

5.4.1. Environmental values

The EP Act provides the framework for the management of the acoustic environment in Queensland. The *Environmental Protection (Noise) Policy 2019* (EPP Noise) sets the environmental values and acoustic quality objectives, as follows:

The environmental values are identified as the qualities of the acoustic environment conducive to:

- *Protecting the health and biodiversity of ecosystems;*
- *Ensuring a suitable acoustic environment for individuals to sleep, study or learn, or be involved in recreation including relaxation and conversation; and*
- *Protecting the amenity of the community.*

Sensitive Places

Desktop assessments have identified that there are 11 potential homesteads located within PL1082 and PL1083. Homesteads and other sensitive receptors will be ground-truthed once the location is infrastructure and finalised.

Site Topography

The Project Area is characterised by undulating land with alluvial lowlands and elevated sandstone landforms. The local ground elevation across the project varies from 188m to 290m above Australian Height Datum.

Background Noise Levels

The existing noise environment throughout the area is typical of sparsely populated, rural settings with low ambient noise dominated by natural sources. The environmental value adopted for the development area is a rural acoustic environment conducive to the wellbeing of the community, including its social and economic amenity, and the wellbeing of an individual, including the opportunity to have sleep, relaxation and conservation without unreasonable interference from intrusive noise (above background levels). In accordance with Schedule C of the EA, the deemed background noise levels for the EA are:

- 7:00am-6:00p: 35 dBA.
- 6:00pm-10:00pm: 30 dBA.
- 10:00pm-6:00am: 25 dBA.
- 6:00am-7:00am: 30 dBA.

5.4.2. Environmental values and mitigation measures

The proposed amendment does not change the potential impacts to the environmental values for the acoustic environment, beyond what is authorised on the EA. There are no proposed emissions or releases that would cause an environmental nuisance for noise, at a sensitive place proposed as part of this application.

Through the implementation of the management practices listed below, the residual risk and magnitude of potential impacts to the acoustic environment is considered low to negligible and limited in extent and duration.

Noise modelling would be conducted prior to construction and operational of the additional wells to identify potential noise emissions in exceedance of the acoustic quality objectives listed in Schedule 1 of the EPP Noise. Section 8(2) of the EPP Noise prescribes the management hierarchy for potential exceedances of these acoustic quality objectives as follows:

Table 12: Noise Management Measures (EPP Noise)

Section 8(2) of EPP Noise *To the extent it is reasonable to do so, noise must be dealt with in the following order of preference—*	**Management Measures**
firstly—avoid the noise;	The results of noise modelling are used to inform the location of the proposed wells with respect to sensitive receptors.
secondly—minimise the noise, in the following order— *firstly—orientate an activity to minimise the noise;*	To the extent necessary, the location of noise generating equipment (e.g. pumps) can be orientated on the well pad to minimise the resultant noise level at sensitive receptors.
secondly—use best available technology to minimise the noise;	Noise generating equipment (e.g. pumps) with lesser noise emissions can potentially be substituted.
thirdly—manage the noise.	• Undertaking construction during daytime hours only. • Treatment of the noise at the source, including: – Noise enclosures or barriers orientated between the noise source and the sensitive receiver. • Where appropriate, and in consultation with owner/occupier, treatment of the noise at the receptor, including: – Installation of window glazing. – Installation of insulation. – Installation of air conditioning. • Alternative arrangements with the occupier of the sensitive receptor to offset potential noise impacts and avoid nuisance events.

In accordance with the management hierarchy, one of, or a combination of the management measures listed in Table 12 can be implemented for the proposed wells to avoid / minimise / manage noise.

5.5. Land Resources

Environmental Objective (EP Reg): The activity will be operated in a way that protects the environmental values of land including soils, subsoils, landforms and associated flora and fauna.

The proposed activity will be operated in accordance with existing EA conditions and will protect the environmental values of land. The current EA regulates land impacts for the development, and the proposed amendment does not change the potential impacts to the environmental values for land, beyond what is authorised on the EA.

5.5.1. Environmental values

Land-Use

Figure 10 shows the land uses within PLs 1082 and 1083. The area has been subject to extensive significant previous disturbance as a result of broad scale clearing and ongoing agricultural operations; approximately 93% of the PLs area has been extensively cleared of vegetation with some relatively small areas of remnant vegetation present.

There are four types of primary land use within the PL areas as shown in Table 13. The dominant land use is production from relatively natural environments, specifically grazing from native vegetation. Cropping is also undertaken with negligible artificial water storage activities.

Table 13: Land Uses within PLs 1082 and 1083

Land Use Category			Area (km^2)	Percentage of Total Area
Primary	Secondary	Tertiary		
Conservation and natural environments	Other minimal use	Other minimal use	0.51	0.11%
		Residual native cover	3.15	0.67%
Production from dryland agriculture and plantations	Cropping	Cropping	31.47	6.71%
Production from relatively natural environments	Grazing native vegetation	Grazing native vegetation	433.70	92.46%
Water	Reservoir / dam	Reservoir / dam	0.23	0.05%

Dominant Ecosystems, Topographic Features and Soils

The PL areas are situated at the intersection of the Shotover, Expedition, and Dawson ranges, and are characterised by undulating land with alluvial lowlands and elevated sandstone landforms. Ground elevation varies from approximately 190m to 290m above Australian Height Datum (AHD). Elevation decreases toward the lower lying alluvial channels of the Comet River and Humboldt Creek which flow generally from the northwest to the south and southeast of the area.

The Atlas of Australian Soils shows the land units and dominant soil types present within PLs 1082 and 1083 including, the following:

- Gently undulating or levels plains (CC21) dominated by Vertosol soils of deep cracking clays with a moderate to strong gilgai microrelief with associated thin surfaced dark loamy duplex soils. Gilgai associated with soils containing shrink-swell properties.
- Level alluvial floodplains associated with major streams (CC23) dominated by Vertosols soils of deep cracking clays.
- Gently or moderately undulating lands (Kd8) dominated by Vertosol soils of mostly deep dark cracking clays with areas of deep red-brown cracking clays.
- Low hilly to hilly terrain no volcanic rocks and appearing as open valleys to mountainous land, gently to moderate side slopes to shallow streams with significant flats (MM7) dominated by Vertosol soils of neutral dark and yellow friable earths with friable brown soils.

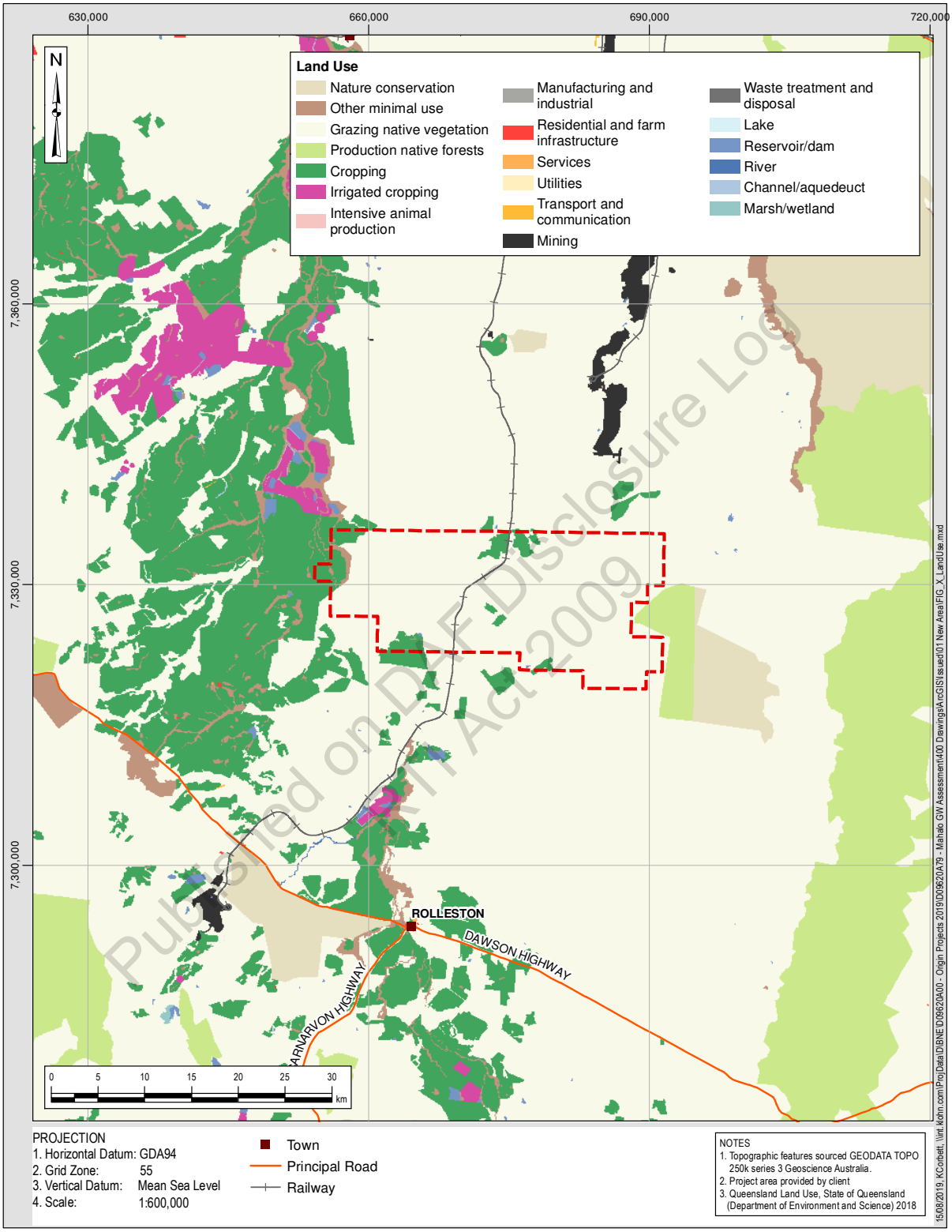


Figure 10 - Land Uses within ATP1191

- Undulating elevated plains with some steep-scarped dissected margins and occasional low mesa-like residual hills (My21) dominated by Chromosol and Kandosol soils of loamy red massive earths. Kandosols generally have a sandy to loamy-surface soil, grading to porous sandy-clay subsoils.
- Broadly undulating lands (Oc24) dominated by Sodosols of red loamy duplex soils with brown duplex soils. Generally, have impermeable subsoils due to the concentration of sodium.

Regional Interests

The RPI Act restricts the carrying out of resource or regulated activities where the activity is not exempt from the provisions of the RPI Act, or a regional interests development approval (RIDA) has not been granted. A Strategic Cropping Area (SCA) occurs within the area of the PLs as shown on Figure 11.

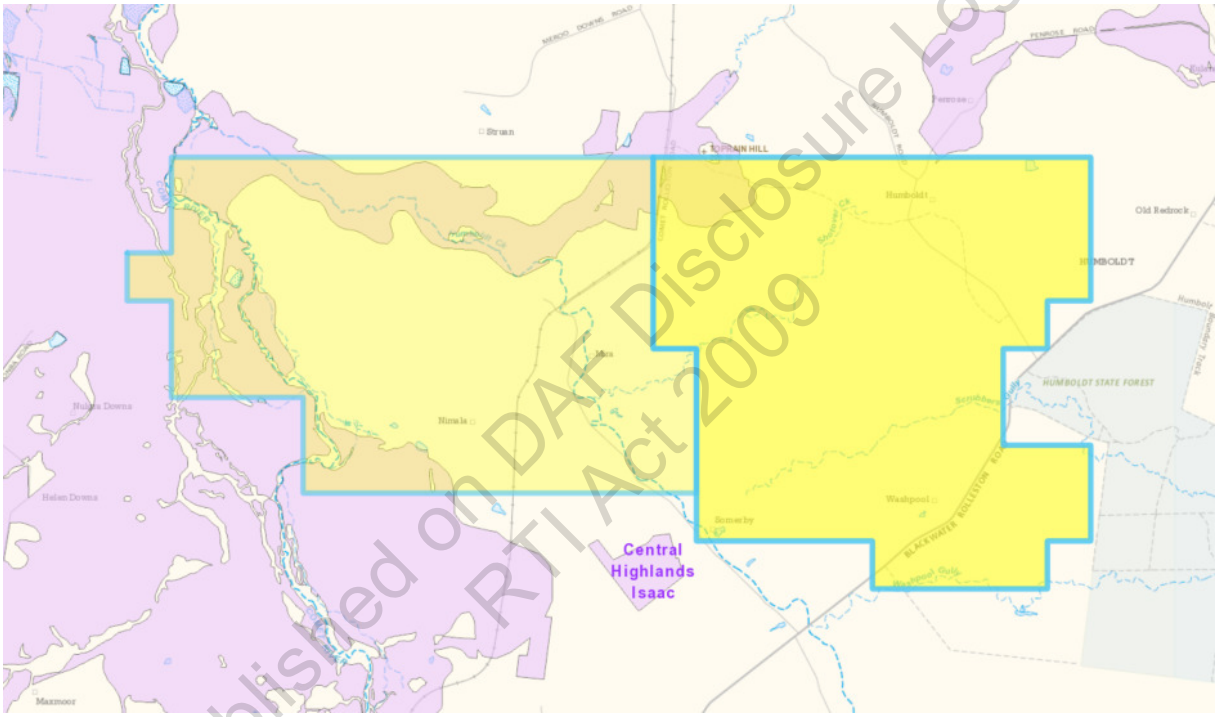


Figure 11 – Strategic Cropping Area within PLs 1082 and 1083

5.5.2. Environmental values assessment and mitigation measures

The following emissions and releases to land may be generated from the proposed activities:

- Residual drilling material; and
- Irrigation from sewage treatment plants associated with temporary drill camps.

All emissions and releases to land will be in accordance with existing EA conditions.

Through the implementation of the management practices outlined below, the residual risk and magnitude of potential impacts to the land environmental values is considered low to negligible and limited in extent and duration.

The proposed amendment would not significantly increase the risk and likely magnitude of impacts on the environmental values of land resources of the area given the extensive previous disturbance as a result of broad scale clearing, and implementation of the above mitigation measures.

Soil Management and Rehabilitation

Soil management would be undertaken during the construction and operation of well pads for the proposed additional wells, including the following:

- Stripping and separate stockpiling of topsoils and subsoils.
- Reinstatement of soils consistent with the surrounding soil horizon.
- Establishing groundcover on long-term soil stockpiles.
- Erosion and sediment controls to minimise the mobilisation / transport of soil resources.

Land disturbance for the proposed additional wells would be rehabilitated in accordance with Condition J2 of the EA to conserve soil resources and re-establish existing contours consistent with surrounding landforms:

Transitional rehabilitation

(J2) Significantly disturbed areas that are no longer required for the on-going petroleum activities, must be rehabilitated within 12 months (unless an exceptional circumstance in the area to be rehabilitated (e.g. a flood event) prevents this timeframe being met) and be maintained to meet the following acceptance criteria:

(a) contaminated land resulting from petroleum activities is remediated and rehabilitated

(b) the areas are:

i) non-polluting

ii) stable landform

iii) re-profiled to contours consistent with the surrounding landform

(c) surface drainage lines are re-established

(d) topsoil is reinstated; and

(e) either:

i) groundcover, that is not a declared pest species, is growing; or

ii) an alternative soil stabilisation methodology that achieves effective stabilisation is implemented and maintained.

Chemical and Fuel Management

Chemicals and fuel would be stored, transported and handled on-site will be effectively contained and where relevant, meet the relevant Australian Standards (e.g. AS 1940:2017 for the storage and handling of flammable and combustible liquids.

Produced Water Management

Produced water from the proposed additional wells would be stored in tanks and managed in accordance with existing conditions of the EA and / or End of Waste Codes under the *Waste Reduction and Recycling Act 2011*. Water management uses authorised by these approvals include:

- dust suppression and construction;
- irrigation;
- landscaping and revegetation; and
- stock watering.

These existing approvals provide water management standards including the water quality requirements show in Table 14.

Table 14: Water Quality Requirements

Water Quality Parameter	Water Quality Requirements		
	Irrigation	Landscaping and Revegetation	Stock Watering
Total dissolved solids	ANZECC Guidelines Volume 1, Chapter 4, and Volume 3, Chapter 9	< 1,000 mg/L	ANZECC Guidelines Volume 1, Chapter 4.3, Tables 4.3.1, 4.3.2, and 4.3.3
pH		6.0 – 9.5	
Sodium adsorption ratio		Non-toxic to plant growth (e.g. ANZECC Guidelines Volume 3, Section 9.2.1.3)	
Aluminium	ANZECC Guidelines Volume 1, Chapters 3 & 4, and Volume 3, Chapter 9		
Arsenic			
Beryllium			
Boron			
Cadmium			
Chromium			
Cobalt			
Copper			
Fluoride			
Iron			
Lead			
Lithium			
Manganese			
Mercury			
Molybdenum			
Nickel			
Selenium			
Uranium			
Vanadium			
Zinc			

Water management requirements for dust suppression includes the following:

- the amount of water applied for dust suppression does not exceed the amount required to effectively suppress dust;
- dust suppression does not cause on-site ponding or runoff;
- water is applied directly to the area being dust suppressed;
- surrounding vegetation is not harmed; and
- dust suppression does not cause visible salting.

Water management requirements for construction uses includes the following:

- the composition and structure of soils or subsoils is not negatively impacted;
- there is no runoff from the construction site or release to waters; and
- surrounding vegetation is not harmed.

Water quality will be determined through testing prior to dust suppression or construction uses.

Table 15 provides the management criteria to monitor and assess effectiveness of produced water management.

Table 15: Produced Water Management Criteria

Objective	Task	Performance Indicator	Proposed Action for non-compliance
No unauthorised disturbance to land for water management infrastructure	• Locate non-linear water management infrastructure outside of the following areas: ○ endangered regional ecosystems; ○ nature refuges and koala habitat including a 200m buffer / protection zone; ○ essential habitat; ○ essential regrowth habitat; and ○ of concern REs.	Number of related notifications made under Condition (A9) of the EA	• Review the design and construction process prescribing the location of non-linear water management infrastructure. • Other actions prescribed by DES.
No unauthorised releases from water pipelines	• Design and construction of pipelines in accordance with the Australasian Pipelines and Gas Association Code of Practice Upstream Polyethylene Gathering Networks - CSG Industry Version 4.0. • Implement operation and maintenance plans for pipelines, including isolation vales, and leakage detection.	Number of related notifications made under Condition (A9) of the EA	• Review the operation and maintenance plans for pipelines, including isolation vales, and leakage detection. • Other actions prescribed by DES.
No unauthorised releases from water storages	• Implement operation and maintenance plans for water storage structures including leak detection. • Seepage monitoring in accordance with Condition G12 of the EA.	Number of related notifications made under Condition (A9) of the EA	• Review the operation and maintenance plans for water storage structures including leak detection. • Other actions prescribed by DES.
Minimise the generation of water treatment by-products	• Preferentially manage water using non-treatment methods (e.g. blending). • Preferentially use water for construction and dust suppression beneficially uses.	Volume of produced water treated via reverse osmosis	N/A
Off-site disposal of water treatment by-products	• Disposal of water treatment by-products at an off-site facility licenced under the EP Act.	Volume of water treatment by-products disposed off-site	• Review the storage, handling, and transport of water treatment by-products • Other actions prescribed by DES.
Maximise the beneficial use of produced water	• Maintain a water balance model to optimise the size and capacity of water management infrastructure. • Prioritise water management in accordance with the hierarchy defined in the CSG Water Management Policy. • Monitor produced water quality changes over time. • Record produced water volumes for each beneficial use.	Volume of produced water beneficially used	N/A

5.6. Terrestrial Ecology

Assessments will be conducted prior to significant disturbance to verify any potential Category A, B or C Environmentally Sensitive Areas, Matters of State Environmental Significance, Queensland Government Regional Ecosystem Mapping and, where required, any potential endangered, vulnerable or near threatened species listed under the *Nature Conservation Act 1992* (NC Act).

5.6.1. Environmental values

Regional Ecosystems

PLs 1082 and 1083 are located within the Brigalow Belt South Bioregion. The Brigalow Belt Bioregion comprises over 269,300 km^2 in size and is characterised by Brigalow (*Acacia harpophylla*) in a mosaic of open forest and woodland communities on clay soils. Semi-evergreen vine thickets, heath and eucalypt open woodlands are scattered within this region, with small pockets of eucalypt open forests.

As shown in Table 16 and Map 2 within Appendix A, approximately 93% of the area has been cleared and represents non-remnant vegetation. The limited tracts of vegetation are generally located within riparian corridoes associated with watercourse areas.

Table 16 provides details of the limited REs within PLs 1082 and 1083.

Table 16: Extent of REs within PLs 1082 and 1083

RE Code	RE Description	Biodiversity status	Area
Non-Remnant	None	None	**93.29%**
11.10.3	*Acacia catenulata* and/or *A. shirleyi* form a distinct but discontinuous low open forest to open forest canopy (8-12, rarely 18m high). Other Acacia spp. such as *A. sparsiflora* and *A. rhodoxylon* may form part of the canopy and in places may predominate. Scattered *Eucalyptus spp.* emergents (up to 25m high) occur, the most frequent being *E. decorticans*. *Eucalyptus exserta* is conspicuous in places. Scattered tall shrubs may occur. A low shrubby layer is usually conspicuous. The ground layer is sparse and composed of both grasses and forbs. Occurs on crests and ridge tops formed on consolidated, medium to coarse-grained sediments.	No concern at present	0.11%
11.3.1	Open forest dominated by *Acacia harpophylla* and/or *Casuarina cristata* (particularly in southern parts), with or without scattered emergent *Eucalyptus spp.* such as *E. coolabah*, *E. largiflorens*, *E. populnea*, *E. orgadophila*, *and E. woollsiana*. A low tree layer dominated by *Geijera parviflora* and *Eremophila mitchellii* is usually present. The vegetation sometimes occurs as low open forest or woodland. Tree height generally about 11-15m and the low tree (to tall shrub) understorey layer is between 2 and 8m high (where present). Ground cover is generally sparse. Associated with Cainozoic alluvial plains which may be occasionally flooded. Landforms range from level to very gently sloping plains, alluvial flats, drainage floors, back-swamps and abandoned channels. Associated soils are predominantly deep to very deep cracking clays, sometimes with gilgai or texture contrast soils with sandy surface (particularly where *Eucalyptus populnea* is present).	Endangered	0.68%
11.3.11	Semi-evergreen vine thicket or semi-deciduous notophyll rainforest, frequently with emergent *Eucalyptus tereticornis* or *E. raveretiana*. Common species include *Diospyros humilis*, *D. geminata*, *Brachychiton australis*, *B. rupestris*, *Geijera salicifolia*, *Lysiphyllum spp.*, *Mallotus philippensis* and *Streblus brunonianus*. Occasional shrubs such as Carissa ovata may be present. Forbs such as *Nyssanthes spp.* May also be present. Occurs on Cainozoic alluvial plains.	Endangered	0.07%
11.3.2	*Eucalyptus populnea* woodland to open woodland. *E. melanophloia* may be present and locally dominant. There is sometimes a distinct low tree layer dominated by species such as *Geijera parviflora*, *Eremophila mitchellii*, *Acacia salicina*, *Acacia pendula*, *Lysiphyllum*	Of concern	0.9%

RE Code	RE Description	Biodiversity status	Area
	spp., *Cassia brewsteri*, *Callitris glaucophylla* and *Acacia excelsa*. The ground layer is grassy dominated by a range of species depending on soil and management conditions. Species include *Bothriochloa decipiens*, *Enteropogon acicularis*, *Aristida ramosa* and *Tripogon loliiformis*. Occurs on Cainozoic alluvial plains with variable soil types including texture contrast, deep uniform clays, massive earths and sometimes cracking clays.		
11.3.25	*Eucalyptus camaldulensis* or *E. tereticornis* woodland to open forest. Other tree species such as *Casuarina cunninghamiana*, *E. coolabah*, *Melaleuca bracteata*, *Melaleuca viminalis*, *Livistona spp.* (in north), *Melaleuca spp.* and *Angophora floribunda* are commonly present and may be locally dominant. An open to sparse, tall shrub layer is frequently present dominated by species including *Acacia salicina*, *A. stenophylla* or *Lysiphyllum carronii*. Low shrubs are present, but rarely form a conspicuous layer. The ground layer is open to sparse and dominated by perennial grasses, sedges or forbs such as *Imperata cylindrica*, *Bothriochloa bladhii*, *B. ewartiana*, *Chrysopogon fallax*, *Cyperus dactylotes*, *C. difformis*, *C. exaltatus*, *C. gracilis*, *C. iria*, *C. rigidellus*, *C. victoriensis*, *Dichanthium sericeum*, *Leptochloa digitata*, *Lomandra longifolia* or *Panicum spp.* Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays with or without some texture contrast. These are usually moderately deep to deep, soft or firm, acid, neutral or alkaline brown sands, loams or black cracking or non-cracking clays, and may be sodic at depth	Of concern	0.73%
11.3.3	*Eucalyptus coolabah* woodland to open woodland with a grassy understorey. A mid layer is often absent but scattered tree or shrub species, such as *E. populnea*, *Melaleuca bracteata*, *Acacia stenophylla*, *Alectryon oleifolius*, *Terminalia oblongata* (in the north) and *Acacia pendula*, *A. cambagei*, and occasionally *Duma florulenta* may be present. The ground layer is dominated by a range of grass and forb species depending on season, soil and management conditions. Can include small areas of grassland with scattered trees. Occurs on Cainozoic alluvial plains or levees with clay or sometimes texture contrast soils.	Of concern	0.69%
11.4.8	Woodland to open forest dominated by *Eucalyptus cambageana* and *Acacia harpophylla* or, sometimes in the north, *A. argyrodendron*. *E. thozetiana* is sometimes present on shallower soils. There is a moderately dense low tree layer (5m high) layer dominated by species such as *Eremophila mitchellii* and a low shrub layer (2m high) dominated by species such as *Carissa ovata* and *Geijera parviflora*. Occurs on level to gently undulating plains formed from Cainozoic deposits. Associated soils are usually deep texture contrast with thin loamy or sandy surface horizons overlying strongly alkaline clay subsoils. Surface or subsurface gravel is common.	Endangered	1.41%
11.4.9a	Open forest, occasionally woodland, dominated by *Acacia harpophylla* usually with a low tree mid-storey of *Terminalia oblongata* and *Eremophila mitchellii*. *Casuarina cristata* sometimes replaces *Acacia harpophylla* in the overstorey and *Lysiphyllum cunninghamii* sometimes co-dominates. Other low tree or shrub species such as *Alectryon diversifolius*, *Carissa ovata*, *Pittosporum spinescens*, *Ehretia membranifolia*, *Geijera parviflora* and *Flindersia dissosperma*	Endangered	1.48%

RE Code	RE Description	Biodiversity status	Area
	may occur in the mid-storey or low shrub layer. *Acacia harpophylla* trees have been recorded as 11- 17m high, the mid-storey layer 2- 8m high and the low shrub layer 1-2m high. Occurs on level to gently undulating Cainozoic plains, including weathered basalt. Associated soils are predominantly moderately deep to deep cracking clays that may be brown, red-brown or grey-brown, and with much surface gravel in some areas.		
11.5.3	*Eucalyptus populnea* +/- *E. melanophloia* +/- *Corymbia clarksoniana* +/- *C. dallachiana* and occasionally *E. cambageana* or *E. brownii* dominate the tree layer (14m median height and 11-15m range) woodland. Localised areas may be dominated by *E. melanophloia*, occasionally *E. crebra* and other canopy species. There is generally a distinctive low tree layer (8, 6-11m high) dominated by species such as *Eremophila mitchellii*, *Geijera parviflora*, *Archidendropsis basaltica*, *Erythroxylum australe*, *Cassia brewsteri*, *Ventilago viminalis* and occasionally *Allocasuarina luehmannii* or *Callitris glaucophylla*. A low shrub layer (2-6m high) dominated by species such as *Carissa ovata*, *Erythroxylum australe*, *Capparis lasiantha* is also often present. Occurs on flat to gently undulating plains formed from Cainozoic sediments. Associated soils are generally deep texture contrast with thick sandy surface horizons with some deep red earths.	No concern at present	0.25%
11.5.5c	*Eucalyptus melanophloia* predominates forming a distinct but discontinuous canopy (12-18m high) often in association with *E. populnea* which may dominate localised areas. Scattered other *Eucalyptus spp.* may be present such as *E. chloroclada* (in south) *Corymbia tessellaris* (in north) and sometimes *E. crebra*. *Callitris glaucophylla* dominates the lower tree layer (9-12m high), with occasional *Acacia spp.* and *Allocasuarina luehmannii* trees. The shrub layer is often absent or sparse but may be prominent and dominated by tall shrubs such as *Geijera parviflora* and *Eremophila mitchellii* and scattered low shrubs, especially in disturbed areas. The ground layer is sparse to open, and dominated by perennial grasses such as *Aristida spp.*, *Bothriochloa decipiens* and *Eragrostis spp.* Occurs on undulating plains and rises formed on Cainozoic deposits. Associated soils are usually deep texture contrast soils, with thick, sandy surface horizons overlying yellow, mottled clay subsoil's	No concern at present	0.14%
11.8.11	Grassland dominated by *Dichanthium sericeum*, *Aristida spp.*, *Astrebla spp.* and *Panicum decompositum* with or without trees such as *Eucalyptus orgadophila*, *E. melanophloia*, *Corymbia erythrophloia* and *Acacia salicina*, (height 11+/-3 m). However, dominance and cover may vary with seasonal and other environmental conditions. Frequently occurring and sometimes locally dominant, species include the grasses *Aristida lazaridis*, *A. ramosa*, *Bothriochloa ewartiana*, *Dichanthium sericeum*, *Chrysopogon fallax*, *Heteropogon contortus*, *Enneapogon gracilis*, *Themeda triandra* and *Tragus australianus* and the herbs *Brunoniella australis*, *Evolvulus alsinoides*, *Galactia tenuiflora* and *Indigofera linnaei*. Isolated emergent trees (tree height 12+/-4 m - species including *Eucalyptus orgadophila*, *E. melanophloia* and *Corymbia erythrophloia*) or small areas of open woodland may also be present. Occurs on Cainozoic igneous rocks, particularly fresh basalt, and is generally associated with undulating to gently undulating rises. It usually occurs on the crests and middle and upper slopes (slopes 2-6%), although also present on lower slopes	Of concern	0.01%

RE Code	RE Description	Biodiversity status	Area
	and flat areas (slopes 0-2%). Associated soils are moderately shallow to deep cracking clay soils, dark brown to reddish brown in colour, often self-mulching, and with gravel, stone or linear gilgai sometimes present. Surface stone 10-15 cm diameter is present in the south-western remnants.		
11.8.4	*Eucalyptus melanophloia* and/or *E. crebra* +/- *E. orgadophila* +/- *Corymbia erythrophloia* grassy open woodland. *Macrozamia moorei* is a conspicuous element of the mid layer in the Central Highlands. Localised patches of *Corymbia citriodora* occur on volcanic plugs such as Minerva Hills. Generally occurs on slopes of mountains and hills formed from Cainozoic igneous rocks usually with shallow stony soils and extensive outcropping.	No concern at present	0.02%
11.8.5	*Eucalyptus orgadophila* grassy open woodland. *Eucalyptus orgadophila* predominates and forms a distinct but discontinuous canopy sometimes with other sub-dominant species such as *Corymbia erythrophloia, E. melanophloia* and occasionally *E. crebra*. Shrubs are usually scarce and scattered although a well-defined shrubby layer does develop in some areas. On the lower slopes at better sites, softwood scrub species may form tall and low shrub layers under the canopy of *Eucalyptus orgadophila*. The ground layer is moderately dense to dense, and dominated by species that include the grasses *Aristida lazaridis, A. ramosa, Bothriochloa ewartiana, Dichanthium sericeum, Chrysopogon fallax, Heteropogon contortus, Enneapogon gracilis, Themeda triandra* and *Tragus australianus* and the herbs *Brunoniella australis, Evolvulus alsinoides, Galactia tenuiflora* and *Indigofera linnaei*. Occurs on undulating plains, rises, low hills or sometimes flat tablelands on top of mountains, formed from basalt. Generally soils are shallow to moderately shallow, often rocky or stony clays.	No concern at present	0.01%
11.9.4a	Semi-evergreen vine thicket generally dominated by a low tree layer (5-10m high) which is floristically diverse and variable. Common codominant species include *Croton insularis, Denhamia oleaster*. There is also a tall and low shrub layer (2-6m high) dominated by species such as *Ehretia membranifolia, Apophyllum anomalum, Geijera parviflora, Capparis spp., Croton phebalioides, Erythroxylum australe, Alectryon diversifolius* and *Carissa ovata*. Emergents (16-25m high) are usually present including species such as *Cadellia pentastylis* and *Brachychiton spp*. usually on better sites, and *Eucalyptus orgadophila* and *Casuarina cristata* on drier, poorer sites. Vines are frequent. The ground layer is very sparse, and is most frequently composed of *Ancistrachne uncinulata* and *Eragrostis megalosperma*. Occurs on steep upper and middle slopes where heavy clay soils have formed from sediments. It may grade into *Acacia harpophylla*, softwood spp. (11.9.5a) on the lower slopes. It is prominent on the steep slopes of sandstone ranges, where shale has been exposed, and aspect, rainfall and runoff provide sufficient available water for its development. The soils are generally shallow, brown or grey-brown loams or light clays grading into medium or heavy clays. The soil reaction may become strongly acidic or alkaline at depth, depending on the acidity of parent material. May also occur on deep texture contrast soils, where a thin sandy colluvium overlies the clay subsoil. Loose fragments of sandstone may be present over the soil surface.	Endangered	0.02%

RE Code	RE Description	Biodiversity status	Area
11.9.5a	Open forest dominated by *Acacia harpophylla* and/or *Casuarina cristata* (10-20m) or *Acacia harpophylla* with a semi-evergreen vine thicket understorey. Open forest dominated by *C. cristata* is more common in southern parts of the bioregion. A prominent low tree or tall shrub layer dominated by species such as *Geijera parviflora* and *Eremophila mitchellii*, and often with semi-evergreen vine thicket species is often present. The latter include *Flindersia dissosperma, Brachychiton rupestris, Excoecaria dallachyana, Macropteranthes leichhardtii and Acalypha eremorum* in eastern areas, and species such *as Carissa ovata, Owenia acidula, Croton insularis, Denhamia oleaster* and *Notelaea microcarpa* in south-western areas. *Melaleuca bracteata* may be present along watercourses. Occurs on fine-grained sediments. The topography includes gently undulating plains, valley floors and undulating footslopes and rarely on low hills. The soils are generally deep texture-contrast and cracking clays. The cracking clays are usually black or grey to brown or reddish-brown in colour, often self-mulching and sometimes with gilgai microrelief in flatter areas. Some texture contrast soils are shallow to only moderately deep.	Endangered	0.19%

As shown in Table 4 and on Map 2 within Appendix A, approximately 93% of the area has been cleared and represents non-remnant vegetation. The limited tracts of vegetation are generally located within riparian corridors associated with watercourses in the area.

Environmentally Sensitive Areas

Appendix B shows the location of the following environmentally sensitive areas (ESAs) within PLs 1082 and 1083:

- Endangered Regional Ecosystems (Category B);
- Of Concern Regional Ecosystems (Category C); and
- Essential Habitat (Category C).

Matters of State Environmental Significance

Appendix C details the matters of state environmental significance (MSES) from DES' environmental reports for PLs 1082 and 1083. Table 17 summarises the MSES detailed in these reports.

Table 17: Extent of MSES within PLs 1082 and 1083

MSES	Total Area PL Area	Extent within PLs Area
1a Protected Areas- estates	0 ha	0%
1b Protected Areas- nature refuges	0 ha	0%
2 State Marine Parks- highly protected zones	0 ha	0%
3 Fish habitat areas (A and B areas)	0 ha	0%
4 Strategic Environmental Areas (SEA)	0 ha	0%
5 High Ecological Significance wetlands on the map of Referable Wetlands	3.75 ha	0.01%
6a High Ecological Value (HEV) wetlands	0 ha	0%
6b High Ecological Value (HEV) waterways	0 ha	0%
7 Threatened species and Iconic species	0 ha	0%

MSES	Total Area PL Area	Extent within PLs Area
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	2602.92 ha	5.55%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	5.27 ha	0.01%
8c Regulated Vegetation - Category R (GBR riverine regrowth)	43.64 ha	0.09%
8d Regulated Vegetation - Essential habitat	1503.4 ha	3.21%
8e Regulated Vegetation - intersecting a watercourse	365.3 km	N/A
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	96.3 ha	0.21%
9a Legally secured offset areas- offset register areas	0 ha	0%
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0 ha	0%

5.6.2. Environmental values assessment and mitigation measures

As described in Section 3.1.1, well sites would be located in accordance with the existing land disturbance and water management conditions of the EA (e.g. Schedule F, and Schedule G), including avoidance of the following:

- endangered regional ecosystems (REs);
- nature refuges and koala habitat including a 200m buffer / protection zone;
- essential habitat;
- essential regrowth habitat;
- of concern REs;
- wetlands of high ecological significance including a 200m buffer / protection zone;
- wetlands of other environmental value; and
- watercourses.

Site-specific ecological assessments would be conducted to confirm the presence / absence of these environmental values and MSES prior to land disturbance. In accordance with existing Condition F8 of the EA, well sites would also be located and designed with reference to the Queensland Environmental Offsets Policy Significant Residual Impact Guideline to avoid significant residual impacts to prescribed environmental matters.

Rehabilitation

Land disturbance for the proposed additional wells would be rehabilitated in accordance with Condition J3 and J4 of the existing EA:

Final rehabilitation acceptance criteria

(J3) All significantly disturbed areas caused by petroleum activities which are not being or intended to be utilised by the landholder or overlapping tenure holder, must be rehabilitated to meet the following final acceptance criteria measured either against the highest ecological value adjacent land use or the pre-disturbed land use:

(a) greater than or equal to 70% of native ground cover species richness

(b) greater than or equal to the total per cent of ground cover

(c) *less than or equal to the per cent species richness of declared plant pest species; and*

(d) *where the adjacent land use contains, or the pre-clearing land use contained, one or more regional ecosystem(s), then at least one regional ecosystem(s) from the same broad vegetation group, and with the equivalent biodiversity status or a biodiversity status with a higher conservation value as any of the regional ecosystem(s) in either the adjacent land or pre-disturbed land, must be present.*

Final rehabilitation acceptance criteria in environmentally sensitive areas

(J4) *Where significant disturbance to land has occurred in an environmentally sensitive area, the following final rehabilitation criteria as measured against the pre-disturbance biodiversity values assessment (required by conditions (F1) and (F2)) must be met:*

(a) *greater than or equal to 70% of native ground cover species richness*

(b) *greater than or equal to the total per cent ground cover*

(c) *less than or equal to the per cent species richness of declared plant pest species*

(d) *greater than or equal to 50% of organic litter cover*

(e) *greater than or equal to 50% of total density of coarse woody material; and*

(f) *all predominant species in the ecologically dominant layer, that define the pre-disturbance regional ecosystem(s) are present.*

(g) *relinquishment notice being lodged with the administering authority for the Petroleum and Gas (Production and Safety) Act 2004.*

Potential Offsite Impacts

The following management measures would be undertaken for construction of the proposed additional wells to minimise potential offsite impacts to terrestrial ecological values:

- Prohibition of keeping domestic animals (e.g. dogs or cats) within PLs 1082 and 1083 and surrounds by personnel employed for the construction and operation of petroleum activities
- Implementation of a weed, pest and biosecurity management plan including compliance with obligations under the QLD *Biosecurity Act 2014*, including hygiene procedures to manage unintentional introduction and spread of *Phytophthora cinnamomi* and Myrtle Rust
- A speed limit of 60 km/hr will be enforced on non-public roads within PLs 1082 and 1083 to minimise potential collision of vehicles with fauna
- Management of putrescible waste to reduce potential attraction of predatory fauna and pest species
- Disturbed land will be minimised and progressively stabilised following construction
- Dust suppression would be undertaken including the watering of disturbed areas as required
- Activities with the potential to generate increased dust (e.g. soil stripping) will be minimised during windy conditions
- Noise attenuation devices (e.g. mufflers) will be installed and maintained on all significant noise generating equipment operating adjacent to REs
- Site vehicles will be equipped with fire extinguishers
- Flammable material will not be stockpiled or stored near hot work activities (including vegetation stockpiles)
- Smoking areas will be designated with provision for containers for safe disposal of cigarette butts

- Hot works permits will be followed at all times where applicable
- Construction activities will be undertaken in accordance with the Risk Minimisation Requirements of the QLD Department of Agriculture and Fisheries Queensland Biosecurity Manual
- A pre-clearance weed survey will be conducted to identify the presence of declared weeds.
- Reinstated areas will be monitored for the presence of weeds
- All waste will be stored, handled and transported in accordance with the waste and resource management hierarchy, waste and resource management principles prescribed by the *Waste Reduction and Recycling Act 2011*.

The proposed amendment would not significantly increase the risk and likely magnitude of impacts on the environmental values of terrestrial ecology of the area given the extensive previous disturbance as a result of broad scale clearing, ongoing agricultural operations, avoidance of disturbance to terrestrial ecological values, rehabilitation of disturbance, and implementation of the above management measures.

6. Waste Management

Environmental Objective (EP Reg): Any waste generated, transported, or received as part of carrying out the activity is managed in a way that protects all environmental values.

The current EA regulates waste management for the project, and the proposed amendment does not change waste management for the project, beyond what is authorised on the EA.

Waste Management

All waste generated, transported, or received as part of the Denison/Mahalo Project is managed in accordance with the Waste and Resource Management Hierarchy, as specified in the *Waste Reduction and Recycling Act 2011*. The hierarchy lists waste and resource management options that should be considered in the preferred order:

(a) *AVOID unnecessary resource consumption;*
(b) *REDUCE waste generation and disposal;*
(c) *RE-USE waste resources without further manufacturing;*
(d) *RECYCLE waste resources to make the same or different products;*
(e) *RECOVER waste resources, including the recovery of energy;*
(f) *TREAT waste before disposal, including reducing the hazardous nature of waste;*
(g) *DISPOSE of waste only if there is no viable alternative.*

All waste generated associated with the proposed amendment will be beneficially used or disposed of in a way that prevents and minimises adverse impacts on environmental values. This includes the beneficial use of all produced water through irrigation, dust suppression, construction, and water supply in accordance with Conditions B7-B12 of the EA and/or approvals under the *Waste Reduction and Recycling Act 2011*.

Types of waste

Wastes that will be generated from activities on the Denison/Mahalo Project Area comprise:

- *General waste* - those not defined as regulated waste under legislation. General wastes comprise putrescible wastes (easily decomposed, recyclable by composting) and non-putrescible wastes (not easily decomposed, may be recyclable);
- *Recyclable waste* – this waste type is able to be reconditioned, reprocessed or reused; and
- *Regulated waste* - regulated wastes are those that require specific controls or actions as defined by legislation. Listed, hazardous, regulated, controlled or trackable wastes typically have unique handling and disposal requirements in order to manage specific associated hazards.

The typical wastes expected to be generated as part of the Project are:

Table 18: Typical Waste Streams

Source	Waste	Characteristics / nature
Earthworks/Clearing vegetation	Soils	Inert material - Reused in rehabilitation
	Green waste	Organic material - Reused in rehabilitation
Production Activities	General construction waste (e.g. pipe off-cuts, concrete, rubble, timber, pallets)	General and recyclable waste.
	Produced water	Non-regulated waste. Beneficially re-used where applicable
	Waste oils, grease and fuels, empty fuel containers	Regulated waste

Source	Waste	Characteristics / nature
	Residual drilling materials	Inert material - Reused in drilling process until unsuitable for reuse
	Used chemicals, empty chemical, paint, solvent containers	Regulated waste
General Activities/Temporary Camps	Putrescible and general waste	General waste and recyclable waste
	Paper and cardboard	Recyclable waste
	Batteries	Regulated
	Treated effluent and grey water	Regulated waste - Treated and used for onsite irrigation

7. Estimated Rehabilitation Cost

The EP Act requires estimated rehabilitation cost to be in place prior to significant disturbance to land. The ERC for the Project will be amended as required and prior to any new significant disturbance occurring as a result of this amendment application.

Queensland Government

Department of Environment and Science
Level 32
1 William Street, Brisbane
GPO BOX 2454
BRISBANE, QLD, 4001
ABN: 46640294485

Tax Invoice/ Receipt

Tax Invoice Number: 1400024879

Receipt Number: 1400024879

Tax Invoice Date: 31/03/2020

Date Printed: 03/04/2020

Purchaser:

AUSTRALIA PACIFIC LNG PTY LIMITED
BRISBANE QLD 4000

Contact Details

Contact: Customer Support Service Call Centre

Phone: 1300 146 370

Email: AR.Receipting@hpw.qld.gov.au

Payment Information	
Additional Identifier:	BPOINT - Biller - 888180
Payment Mode:	Direct Bank Deposit
Drawer/Card Name/Money Order No.:	Zendesk52634 APP0049581 - ALD EPPG008721

Details

Supply Date	Account	Item	Company	Total amount Payable excluding GST	GST Amount Payable	Total Amount Payable including GST
31/03/2020	431063	Zendesk 52634 AUSTRALIA PACIFIC LNG PTY LIMITED	2401	$31,336.20	$0.00	$31,336.20
			TOTAL	$31,336.20	$0.00	$31,336.20

Total Amount Payable excluding GST	$31,336.20
GST Amount Payable	$0.00
Total Amount Payable including GST	$31,336.20

Payment Received

TOTAL PAID includes GST	$31,336.20
Net Amount Due	$0.00

If you require any further information regarding this tax invoice/receipt, please refer to the contact details above.

PRIVACY STATEMENT.

The Queensland Government is committed to protecting your privacy. Your personal details will be securely stored on a Queensland Government database which will only be accessible by authorised persons of government agencies where the disclosure is necessary to fulfil statutory, administrative or other public responsibilities. The personal information will only be used for the purpose for which you provide it and will not be given to another person or body without your consent, or unless required by law. Details of the Queensland Government Privacy Scheme can be accessed through https://www.forgov.qld.gov.au and search for 'information privacy'.

Work Request Form
Technical Support

Part A – Administrative details

Date of request: 14/05/2020	Due date of request: 28/05/2020

Section 1: Notes for the requesting officer
This work request form is used to request advice and assistance from Technical Support in accordance with the guideline Technical and scientific support for officers. Further information is available on the Technical Support SharePoint site. The completed work request form should be **approved by your Manager** sent to the DES Technical Support inbox technicalsupport@des.qld.gov.au . Please attach relevant files to request and/or state EDOCS items number(s) in this form. If you require **advice on water quality, release to water or MEDLI then that is provided by DES Water Sciences**. Please CC these requests to water.workrequests@des.qld.gov.au . Standard response time is 10bds. If a response needed in less than 10bds from receipt of work request, you must telephone the Manager of Technical Support on 3330 5713, prior to sending the request. Every effort will be made to accommodate your request but precedence will be given to statutory timeframes and environmental issues of an urgent nature. Some negotiation of timeframes may be required in circumstances of high workloads. Feedback is needed on your completed work request (except 'meeting/call or 'other' category). This can be provided by accessing and completing the form at: Feedback Form and click on "Save" when you are finished.

Section 2: Requesting Officer's contact details	
Your name	Amelia Sellars
Your contact phone number	3330 5591
Your unit	Energy and Extractive Resources
Your Manager's name	Clancy Mackaway
Your Director's name	Kerynne Birch
Email Address(es) for response	Amelia.sellars@des.qld.gov.au

Section 3: Request type (Tick the relevant request type below.)	
EIS / High risk assessment	☒
Compliance	☐
Policy advice	☐

Section 4: Statutory requests (Priority to be given to statutory requests.)	
Is there a statutory deadline? Yes	
If yes, type of statutory request? Other	If other request type, please specify below: EA amendment application – decision due 4/06/2020

Section 5: Technical Support expertise (Tick the relevant issues below)			
Air	☐	Regulated structures	☐
Contaminated land	☐	Rehabilitation	☐
Contaminated land – auditor's report (CLID)	☐	Surface water discharge	☐
Groundwater	☒	Waste	☐
Noise / vibration	☐	Waste water	☐
PFAS	☐	Other (If other, provide details below)	☐
Does the request relate to mining / petroleum and gas? Yes/No			

Part B – Site details

Section 6: Site location and company / person's name	
Name of Project (if relevant)	Denison Mahalo
Company / Person's name (if relevant)	Australia Pacific LNG Pty Limited
Street Address / and Property description (if relevant)	N/A
Tenures (if relevant)	PL1082, PL1083
EMR/CLR number (if relevant)	N/A

Section 7: DES References	
Environmental authority number (if relevant)	EPPG00872113
eDOCS reference number(s) (if relevant)	101/0032521
Community response number. (if relevant)	

Section 8: Background and issue(s) (Provide below a brief background and describe the issue(s).)

Origin Energy Resources Limited, as the upstream operator of Australia Pacific LNG Pty Ltd (APLNG) and Santos QNT Pty Ltd (Santos), as joint holders and operators of the Denison Trough/Mahalo tenures, applied to amend Environmental Authority (EA) EPPG00872113 on 18 February 2020. The EA amendment application seeks the authorisation to conduct petroleum activities on new petroleum lease (PL) tenures PL1082 and PL1083, with 190 petroleum wells proposed. No stimulation has been proposed. The current EA authorises 193 wells.

PL1082 and PL1083 are approximately 470 km^2 in size, located 30km north east of Rolleston and are situated within the Central Highlands Council. The Mahalo Development Area is adjacent to other resource tenures including conventional gasfields to the west of the project, Rolleston open cut coal mine ~28km southwest, and Blackwater Mine ~8km north. The target gas producing formation for the Mahalo Development Area is the Bandanna Formation, of the Permo-Triassic Bowen Basin.

The ALD was deemed to be major on 3 March 2020. This is due to the amendment proposing:

- to significantly increase the level of environmental harm;
- to increase the scale and intensity;
- a disturbance area greater than 10%; and
- an application for two new petroleum leases.

Public notification was not required for the application. An information request was issued on 29 April 2020. An initial assessment of the application supporting documents found that there was not enough detail provided in relation to the spatial and temporal extent of groundwater impacts and whether these extended beyond the project area, potential impacts to groundwater ecosystem dependency, and how the extraction of groundwater may affect the land and its land use. In particular, this required the applicant to address how potential ecological impacts such as subsidence or changes to overland flow that may occur due to the decline in water level and/or pressure when extracting groundwater and whether this changes the environmental value of the land and its use for irrigation, cropping and agriculture. Furthermore, further detail was requested to demonstrate the validity of the data provided in the water assessment report. APLNG has provided a response to the information request A decision on the application is currently due by 4 June 2020.

Section 9: Nature of assistance requested (Describe below what advice is needed and/or what question(s) do you want answered.)

EER requests assistance to confirm the findings of the water assessment report and response to the information request. In particular, EER is seeking confirmation of the following:

- There are no GDE interactions as the groundwater is too deep to access therefore there's no dependent vegetation
- The groundwater impact assessment uses the Surat CMA UWIR modelling report – Origin state that the groundwater impact assessment is independent of the number of wells proposed due to the groundwater drawdown model modelling complete dewatering of the Bandanna Formation coals by assigning fixed-pressure boundary conditions (using the MODFLOW-USG drain package) within the area of the PLs – is this correct?
- Are the potential drawdown predictions accurate? i.e. 0.2-1.6m drawdown. Is Origin's statement correct that the maximum drawdown prediction is an overestimation due to the hydraulic parameters used in OGIA's uncertainty analysis for the Surat UWIR?

- Is it accurate to say there is limited connectivity between the coal seam and adjoining formations due to the Rewan Group aquitard limiting connectivity between the Bandanna Formation and overlying aquitards?

Part B – Technical Support Response

This part is to be filled out by the Technical Specialist only. This document will then be sent back to you with the response to the technical support work request shown here.

Section 10: Administrative details	
Name of Technical Specialist / Principal Technical Officer	
Date completed	**Click or tap to enter a date.**
Did the Manager of Technical Support approve any extension of due date?	Yes/No If yes, please provide details:
Hours required for job	
ID Number (Located in SharePoint)	

Request Item

Confirm the findings of the water assessment report and response to the information request. In particular, EER is seeking confirmation of the following:

1) ***There are no GDE interactions as the groundwater is too deep to access therefore there's no dependent vegetation***
2) ***The groundwater impact assessment uses the Surat CMA UWIR modelling report – Origin state that the groundwater impact assessment is independent of the number of wells proposed due to the groundwater drawdown model modelling complete dewatering of the Bandanna Formation coals by assigning fixed-pressure boundary conditions (using the MODFLOW-USG drain package) within the area of the PLs – is this correct?***
3) ***Are the potential drawdown predictions accurate? i.e. 0.2-1.6m drawdown. Is Origin's statement correct that the maximum drawdown prediction is an overestimation due to the hydraulic parameters used in OGIA's uncertainty analysis for the Surat UWIR?***
4) ***Is it accurate to say there is limited connectivity between the coal seam and adjoining formations due to the Rewan Group aquitard limiting connectivity between the Bandanna Formation and overlying aquitards?***

Response Item

1) Based on review of Klohn Crippen Berger (April 2020) the report identifies relatively significant depths to groundwater at the locations assessed; however, there is only a very limited number of bores available/assess, no bore logs have been provide to enable review of the geological profile or well construction details or historical water bearing layers, etc. and there are no hydrographs to confirm that the current groundwater levels are a realistic representation of long term trends (i.e. and not a result of significant dewatering by the landholder as a result of drought conditions). In addition to there being no mention of the aforementioned matters, the groundwater levels

are also presented in terms of depth below surface, rather than in m AHD. This makes it not possible to interpret regional the significance of the depth to groundwater regionally, without the addition of topographic contours and some relevant interpretation. No of surface topography in relation to the depth to groundwater within the investigation area has not been provided either. Klohn Crippen Berger (Sept 2019) states that within the Cenozoic sediments, “groundwater elevations have ranged between 167 and 247 m AHD, with a depth range between 10 and 60 mBGL. This is a groundwater level delta of over 80 m within this formation.
Based on the foregoing, the report should be considered inconclusive with respect to the depth to regional groundwater levels and any potential impact to TGDEs resulting from potential drawdown (i.e. there could be some TGDE present, but they have not been assessed).

2) Dewatering of the entire Bandanna Formation would be required for the project to liberate the CH4, and would likely be modelled by OGIA if the planned dewatering of this formation was planned and included in the latest version of the model. I it has not been provided, the proponent wold have provided false and misleading information. I have not checked the OGIA model inputs. The modelling would then look at potential connectivity with other aquifers on the basis of depressurising the target formation (e.g. potential impact to overlying aquifers) and permeability of aquitards etc.. Without checking inputs into the OGIA regional model, the statement it is considered likely to be correct.

3) The predictions would be as predicted, but ongoing monitoring of inputs would be the only way to confirm, and the model updated (i.e. calibrated) based on the provision of new information.

4) Based on the geological maps, the Rewan Group formation is mapped as being present across the majority of the Mahalo Development area, but not the entire area. The cross section in Klohn Crippen Berger (Sept 2019) pp. 62 shows the Rewan Group extent to the north within the project area, where the upper Bandana is in connection with the Cenozoic formation. Where present, the Rewan Group aquitard limiting connectivity between the Bandanna Formation and overlying aquitards.

Checklist

Environmental Protection Act 1994

Validating an amendment application

This checklist is to be used to assess whether an amendment application contains the information required under section 226 of the Environmental Protection Act 1994, *the requirements for amendment applications for environmental authorities under section 226A and section 227AA, the requirements for amendment applications for PRCP schedules under section 226B, and the requirements for amendment applications for coal seam gas activities under section 227.*

APPLICATION NO:	EPPG00872113 / APP0049581	**PROJECT NO:**	
APPLICANT:	Australia Pacific LNG Pty Limited	**FILE NO:**	101/0032521
LOCATION	ATP337/1191, PL450, PL451, PL457, PL1012	**RECEIVED DATE:**	18 February 2020
PROJECT NAME:	Denison Mahalo	**CHECKLIST DUE:**	
AMENDMENT APPLICATION DESCRIPTION:	Origin Energy Resources Limited, as the upstream operator of Australia Pacific LNG Pty Ltd (APLNG) and Santos QNT Pty Ltd (Santos), as joint holders and operators of the Denison Trough/Mahalo tenures, applied to amend Environmental Authority (EA) EPPG00872113 on 18 February 2020. The EA currently authorises petroleum activities within Authority to Prospect (ATP) 1191 and Petroleum Leases (PLs) 450, 451, 457 and 1012, situated within the Denison Trough, on the western flank of the Bowen Basin. Stimulation of 131 unconventional csg wells and 62 conventional gas wells (193 wells total) is currently authorised. APLNG has applied to: 1. Authorise PL1082 and PL1083 as additional resource tenures for the EA; and 2. Amend *Schedule A, Table 1 – Scale and Intensity for the Activities* to authorise an additional 190 petroleum wells within PL1082 and PL1083. No stimulation is planned for any of the proposed wells. APLNG and Santos as joint holders applied to the Department of Natural Resources, Mines and Energy in September 2019 for the new PLs over the northern area of ATP1191. In accordance with s121(1)(f) of the *Petroleum and Gas Act 2004*, an EA must be issued prior to the PL tenure being granted. PL1082 and PL1083 are approximately 470 km^2 in size, located 30km north east of Rolleston and are situated within the Central Highlands Council.		

For an environmental authority (EA) amendment application to meet the content requirements of the *Environmental Protection Act 1994* (EP Act) it must include all of the information required for amendment applications generally (section 226), requirements for EA amendment applications (section 226A) and particular requirements for where relevant, such as coal seam gas (CSG) activities (section 227) and underground water rights (section 227AA).

For a PRCP schedule amendment application to meet the content requirements of the EP Act it must include all of the information required for amendment applications generally (section 226) and the requirements of section 226B.

For a joint EA and PRCP schedule amendment, all the relevant EA and PRCP schedule amendment application requirements in the EP Act must be met.

The amendment application only needs to include the points below to the extent of the proposed amendment. Indicate by marking the 'YES' / 'NO' / 'N/A' below whether the information in the checklist has been provided in the amendment application. Where appropriate, include a justification to this determination.

Table 1–Amendment application requirements under section 226

Amendment application content information requirements for applications generally (section 226) An amendment application must:	**YES / NO / N/A**	**Justification** (if required)
(a) be made to the administering authority	YES	The application was made to the Department of Environment and Science on 18/02/2020.
(b) be in the approved form	YES	The approved form was used (ESR/2015/1733).
(c) be accompanied by the fee prescribed under regulation	YES	The application fee was invoiced and paid on 18/02/2020.
(d) describe the proposed amendment	YES	The application describes the proposed amendment to the specific conditions of the EA.
(e) describe the land that will be affected by the proposed amendment	YES	Land and tenure details are provided
(f) include any other document relating to the application prescribed by regulation	NO	No other documents have been prescribed.

Insert 'ENTERS' otherwise delete.

Table 2–Amendment application requirements for environmental authorities under section 226A

Amendment application content information requirements for environmental authorities (section 226A) An amendment application must:	**YES / NO / N/A**	**Justification** (if required)
(a) describe any development permits in effect under the *Planning Act 2016* for the carrying out of the relevant activity for the authority	N/A	N/A – There are no development permits in relevant to the carrying out of the resource activity.
(b) state whether each relevant activity will, if the amendment is made, comply with any eligibility criteria for the activity	N/A	N/A – there are no eligibility criteria to the activity.
(c) if the application states that each relevant activity will, if the amendment is made, comply with any eligibility criteria for the activity – include a declaration that the statement is correct	N/A	N/A – there are no eligibility criteria to the activity.
(d) state whether the applicant seeks to change a condition identified in the authority as a standard condition	N/A	N/A – the application does not seek to change any conditions identified by the authority as standard conditions

(e) if the application related to a new relevant resource tenure for the authority that is an exploration permit or GHG permit – state whether the applicant seeks an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit.	NO	N/A – The application does not relate to an exploration permit or GHG permit. The application relates to new petroleum production tenures.
(f) include an assessment of the likely impact of the proposed amendment on the environmental values, including–		
(i) a description of the environmental values likely to be affected by the proposed amendment	YES	Detailed in the supporting information report for the application, including biodiversity reports for the project area.
(ii) details of any emissions or releases likely to be generated by the proposed amendment	YES	Detailed in the supporting information report for the application, including underground water extraction.
(iii) a description of the risk and likely magnitude of impacts on the environmental values	YES	Detailed in the supporting information report for the application.
(iv) details of the management practices proposed to be implemented to prevent or minimise adverse impacts	YES	Detailed in the supporting information report for the application – including the existing EA conditions, where relevant.
(v) if a PRCP schedule does not apply for each relevant activity – details of how the land the subject of the application will be rehabilitated after each relevant activity ends	YES	Detailed as complying with existing EA conditions – no changes to rehabilitation management proposed.
(g) include a description of the proposed measures for minimising and managing waste generated by any amendments to the relevant activity	YES	Detailed as being managed via existing approvals under the EA and/or End of Waste Codes.
(h) include details of any site management plan or environmental protection order that relates to the land the subject of the application	N/A	N/A – There are no known site management plans or environmental protection orders relating to the land the subject of the application.

Table 4–Amendment application requirements for site-specific applications (CSG activities) under section 227

Amendment application content information additional requirements for CSG activities (section 227)	**YES / NO / N/A**	**Justification** (if required)
This section applies if: • The amendment application relates to an environmental authority for a CSG activity; and • The proposed amendment would result in changes to the management of CSG water; and • The CSG activity is an ineligible ERA. Refer to section 126(1) and 126(2) of the EP Act.		
(1) A site-specific application for a CSG activity must also state the following–		
(a) the quantity of CSG water the applicant reasonably expects will be generated in	YES	Provided in Table 4 of the application.

	connection with carrying out each relevant CSG activity		
(b)	the flow rate at which the applicant reasonably expects the water will be generated	YES	Provided in Figure 6 of the application.
(c)	the quality of the water, including changes in the water quality that the applicant reasonably expects will happen while each relevant CSG activity is carried out	YES	Provided in section 5.3.1.2 and Table 10 using data from the Office of Groundwater Impact Assessment
(d)	the proposed management of the water including the use, treatment, storage or disposal of the CSG water	YES	Provided in section 5.5.2. Detailed as being managed via existing approvals under the EA and/or End of Waste Codes.
(e)	the measurable criteria (the *management criteria*) against which the applicant will monitor and assess the effectiveness of the management of the water, including, for example, criteria for each of the following—		
	(i) the quantity and quality of the water used, treated, stored or disposed of	YES	Provided in section 5.5.2.
	(ii) protection of the environmental values affected by each relevant CSG activity	YES	Provided in section 5.5.2.
	(iii) for the disposal of waste, including, for example, salt generated from the management of the water	YES	Provided in section 5.5.2.
(f)	The action proposed to be taken if any of the management criteria are not complied with, to ensure the criteria will be able to be complied with in the future.	YES	Detailed in section 5.5.2 as being a continuous improvement cycle.
(2)	The proposed management of the water cannot provide for using a CSG evaporation dam in connection with carrying out a relevant CSG activity unless–		
(a)	the applicant includes an evaluation of—		
	(i) best practice environmental management for managing the CSG water	N/A	N/A evaporation dams are not authorised.
	(ii) alternative ways for managing the CSG water	N/A	
(b)	the evaluation shows that there is no feasible alternative to a CSG evaporation dam for managing the CSG water	N/A	

Table 5–Amendment application requirements for site-specific applications (underground water rights) under section 227AA

Amendment application content information additional requirements for underground water rights (section 227AA)	**YES / NO / N/A**	**Justification** (if required)
This section applies if: • The application relates to a site-specific environmental authority for: - a resource project that includes a resource tenure that is a mineral development licence, mining lease or petroleum lease; or		

- a resource activity for which the relevant tenure is a mineral development licence, mining lease of petroleum lease; and • The proposed amendment involves changes to the exercise of underground water rights. Refer to section 126A(2) of the EP Act.			
(2) The application must also state the following–			
(a)	any proposed exercise of underground water rights during the period in which resource activities will be carried out under the relevant tenure	YES	The proposed amendment would result in the exercise of underground water rights associated with petroleum production.
(b)	the areas in which underground water rights are proposed to be exercised	YES	The underground water rights are proposed to be exercised within PL1082 and PL1083.
(c)	for each aquifer affected, or likely to be affected, by the exercise of underground water rights–		
(i)	a description of the aquifer	YES	Section 5.3.1 and Figure 5 of the Supporting Information Report presents the regional hydrostratigraphy.
(ii)	an analysis of the movement of underground water to and from the aquifer, including how the aquifer interacts with other aquifers and surface water	YES	Detailed in section 5.3.1 of the application.
(iii)	a description of the area of the aquifer where the water level is predicted to decline because of the exercise of underground water rights	YES	Detailed in section 5.3.1 of the application.
(iv)	the predicted quantities of water to be taken or interfered with because of the exercise of underground water rights during the period in which resource activities are carried out	YES	Provided in Table 4 of the application.
(d)	the environmental values that will, or may, be affected by the exercise of underground water rights and the nature and extent of the impacts on the environmental values	YES	Section 5.3 of the Supporting Information Report presents the environmental values for groundwater relevant to the proposed amendment.
(e)	any impacts on the quality of groundwater that will, or may, happen because of the exercise of underground water rights during or after the period in which resource activities are carried out	YES	The application details that there are no impacts to groundwater quality proposed as part of this application, however also provided is a Water Assessment Report to accompany the application.
(f)	strategies for avoiding, mitigating or managing the predicted impacts on the environmental values stated for paragraph (d) or the impacts on the quality of groundwater mentioned in paragraph (e).	YES	Section 5.3 of the Supporting Impact Report describes groundwater management.

Table 6–Relevant information and comments

Comments / Notes Insert any relevant information to support the decision
DES confirmed with the applicant on 27 February that: • the proposal does not seek the approval for stimulation of any or all of the 190 wells, and • question 16 of the application form submitted should be ticked as a no for environmental offsets (this was left blank in the submission). Signatures for both EA holders, Santos and APLNG were provided for the declaration of the application form.

Table 7–Recommendation and Decision

Recommendation	
After completing the list/s above, mark which of the following applies:	
(a) The content of the amendment application is complete and valid.	**VALID** ☒
(b) The content of the amendment application is incomplete.	**INVALID** ☐

Assessing Officer		**Reviewing Officer**	
Sign:		Sign:	
Date:	3/03/2020	Date:	3/03/2020
Name:	Amelia Sellars	Name:	Rachel Copp
Position:	Principal Environmental Officer	Position:	Team Leader

Delegate			
Recommendation:		APPROVED ☐ NOT APPROVED ☐	
Sign:		Date:	3/03/2020
Name:	Rachel Copp		
Position:	**Manager (Assessment)**		