Santos

Site Specific Environmental Authority Application for Petroleum Lease (PL) 1059 – Towrie development

Response to Notice of Information Request – Application Reference No: APP0072009/PL1059

1. Introduction

Santos CSG Pty Ltd (Santos), Australia Pacific LNG (CSG) Pty Limited, Total E&P Australia III, KGLNG E&P Pty Ltd and PAPL Upstream Pty Limited (collectively, the applicant) lodged an application for a new Environmental Authority (EA) for Petroleum Lease (PL) 1059 with the Department of Environment and Science (DES) on 29 January 2021 (DES reference APP0072009/PL1059). The applicant received a Notice of Information Request on 17 May 2021 (Appendix A). The notice outlines the further information required by DES to assess the application.

The applicant provides the following information in response to all of the information requested in the Notice prior to the end of the information response period of 17 November 2021.

2. Information request and response

The following sections address each of the elements of the DES information request.

2.1. General

Provide information on:

1. *The maximum disturbance expected at any time within PL1059 for the proposed activities.*
2. *The expected quantity or length of each of the following proposed infrastructure:*
    a. *seismic lines*
    b. *pipelines*
    c. *compressors*
    d. *roads*
    e. *low hazard dams*
3. *The supporting information includes proposed conditions for the environmental authority applied for. Provide justification for each condition that is not a streamlined model condition for petroleum activities or that is varied from the streamlined model conditions for petroleum activities.*

Response

1. It is not possible to accurately determine the maximum disturbance expected within PL1059 at any one time, due to the nature of gas field development planning. Wells and other infrastructure will be developed and rehabilitated progressively over the life of the tenure. Timing and amount of future disturbance will be dictated by a number of factors including how prospective the resource is, well and reservoir performance, economics, broader Santos project priorities as well as considerations such as land access, cultural heritage and

environment. Consideration of these factors is completed in accordance with best practice gas field planning and the EA conditions.

Should all wells be developed, the total area of disturbance over the life of the tenure is not expected to exceed 800 hectares. However, it is very unlikely this would all be disturbed at one time.

2. It is not possible to accurately estimate the length and quantity of each infrastructure type to be developed over the life of the tenure. This is because the type of and specific placement of infrastructure is unknown until conditions are determined as appropriate (ie refer to 1) and site specific assessments for infrastructure placement are completed. However, based on development of similar gas fields in the area, and infrastructure proposed for the first phase of development, the following is predicted:
    a. Seismic lines: 100 km
    b. Pipelines: 200 km
    c. Compressors: none. All gas is proposed to be transferred to existing (or planned) compression facilities on adjoining tenures in Arcadia.
    d. Roads: 200 km
    e. Low hazard dams: Unlikely to be required. No regulated structures would be required as part of the proposed activity. The only structures which could be considered 'low hazard dams' would be pits or sumps on well leases. Santos prefers sumpless drilling methods and so pits or sumps on well leases are unlikely to be required. However, Santos would like the ability to construct pits or sumps on leases in the event that a different rig type is required or additional storage space is needed. The number required would be dependent on the size of the drilling campaign at any one time. Given this uncertainty, for the purpose of this response it has been assumed that 50% of wells will be drilled in one campaign and that all wells require a sump – that is 55. Produced water to be temporarily stored on site prior to beneficial reuse would be held in tanks only. Low hazard dams would not be used to store produced water.
3. As discussed in section 2.3.1 of the Environmental Authority Application Supporting Information, Santos is seeking EA conditions consistent with the Fairview Arcadia Project Area EA (EPPG00928713). These conditions were developed to regulate impacts from over 6000 wells and protect environmental values within the Fairview and Arcadia Valley region. PL1059 forms part of the broader Arcadia Valley and therefore has the same environmental values. Similarly, activities in PL1059 will be carried out in the same manner as in other parts of Arcadia Valley.

Creating different sets of conditions to regulate the same activity across an administrative tenure boundary is extremely difficult to manage on the ground, particularly if the two areas are part of the same project / development campaign.

Since the EA application for PL1059 (application reference APP0072009) was submitted, the Part A and B conditions of EA EPPG00928713 have been consolidated. Santos is therefore seeking conditions consistent with the current version of the FAPA conditions, where relevant. A revised set of proposed conditions, based on the current conditions of EPPG00928713, is included in Appendix B.

Santos is of the view that the information provided as part of the application and as part of this response is adequate for DES to determine the appropriateness of the conditions as proposed. If DES has any issues with any specific condition proposed, Santos is more than willing to discuss its appropriateness with the Department in context of the proposed development.

Justification of specific conditions relating to disturbance of land within ESAs

Proposed condition D6 and Schedule D, Table 1 – Petroleum Activities in Environmentally Sensitive Areas

The impacts of proposed activities on ESAs occurring or potentially occurring within PL1059 were assessed in the Environmental Authority Application Supporting Information and attached materials. The following ESAs are present or potentially present within the tenure:

- Category A ESAs: none
- Category B ESAs (excluding Endangered Regional Ecosystem (RE)s): none
- Category B ESAs (Endangered REs):
    - 11.3.1 *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains
    - 11.9.4a Semi-Evergreen Vine Thicket
    - 11.9.5 *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks
- Category C ESAs (excluding Of Concern REs): none
- Category C ESAs (Of Concern REs):
    - 11.3.2 *Eucalyptus populnea* woodland on alluvial plains
    - 11.3.25 *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines.

These ESAs are also Matters of State Environmental Significance (MSES). Impacts to MSES (including significance assessments) were assessed in section 7 and 9 of Appendix D of the

Supporting Information. The assessments determined there would not be a significant residual impact on any Endangered or Of Concern REs as a result of the proposed activities, based on the direct and indirect impacts of the activities and the mitigation measures proposed.

Schedule D, Table 1 seeks to permit "Limited impact petroleum activities" within the primary protection zone (PPZ) for Category A ESA, and the secondary protection zone (SPZ) for Category C and B ESAs. This is to allow Santos the flexibility to preferentially locate these activities within disturbed areas adjacent to ESAs over areas outside of protection zones which comprise "Least concern" remnant vegetation or have habitat other values. The table included in the streamlined model conditions unnecessarily prohibits "low impact petroleum activities" within protection zones even when it is heavily disturbed or comprises non-remnant vegetation. The avoidance of remnant vegetation should be a higher priority than existing disturbed areas even when these areas are adjacent to ESAs.

The term "limited petroleum activities" has been included within S*chedule D, Table 1 – Petroleum Activities in Environmentally Sensitive Areas* instead of "essential petroleum activities" for consistency with existing EAs across Santos and ease of use by operational staff.

2.2. Noise

Provide information on:

1. *The hours of operation during construction and operation.*
2. *An inventory of noise sources and sound power levels from the proposed activities including associated plant and equipment.*
3. *Given the rural nature of PL1059, provide measured background noise levels including at relevant sensitive receptors during daytime (7am-6pm), evening (6pm-10pm) and night-time (10pm-7am) to ensure the management intent of the Environmental Protection (Noise) Policy 2019 can be met. Measurements must be in line with the Departments Noise Measurement Manual (ESR/2016/2195) and Section 3.4 of the guideline; Application requirements for petroleum activities (EM705).*
4. *The locations of all identified relevant sensitive receptors within close proximity to PL1059.*

Response

1. The proposed hours of operation are described in section 8.2 of the EA Application Supporting Information report. Construction activities would occur from 6am-6pm, seven days per week. Operations would occur 24 hours per day, seven days per week. Drilling activities are a 24 hour operation that typically last seven days per well.

   The Arcadia Valley is a remote, rural environment, where ambient noise levels are low, influenced predominantly by natural sources (eg birds, wind etc) or mechanical sources

associated with agriculture and/or the petroleum and gas industry. Santos is taking the conservative view that background noise limits are below the minimum noise limit applied by DES to quiet areas of 25 dBA through standardised conditioning of petroleum activities in the Surat Basin. Background noise creep is therefore not a factor in our activities as we are not proposing to recalibrate background noise levels. Further given the lack of large plant proposed by the project, the noisiest activities will be temporary only.

Given the above, the deemed background levels nominated in the EA EPPG00407213 and the DES guideline - *Prescribing noise conditions for environmental authorities for petroleum activities* (ESR/2016/1935) have been adopted as being representative of the ambient acoustic environment. The deemed background levels are as follows:

- 7:00 am – 6:00 pm 35db(A)
- 6:00 pm – 10:00 pm 30db(A)
- 10:00 pm – 6:00 am 25db(a)
- 6:00 am – 7:00 am 30dB(A)

2. Potential noise emissions from the proposed petroleum activities within PL1059 would be consistent with those associated with other existing Santos petroleum activities in the broader Arcadia Valley authorised by EPPG00928713. Noise emissions are likely to be generated during construction, drilling, operations and rehabilitation activities from the operation of vehicles, plant, machinery, drilling and well completion activities and wellhead equipment like pumps.

   The table below provides the sound power level of typical noise generating activities associated with the construction and operation of petroleum wells. The occurrence of these activities varies, with some activities such as drilling and stimulation activities being once-off activities at each well location, compared to the ongoing maintenance and operation of petroleum wells which produce reoccurring emissions for the duration of the petroleum activity. These types of noise emissions are not new and are consistent with those authorised by the existing EA0001254 for the underlying ATP2033. The construction of the additional petroleum activities proposed by the application are likely to be undertaken in a staged manner and therefore not all constructed at a time. This will assist in minimising impacts associated with cumulative noise emissions from the proposed activities.

Typical sound power levels of petroleum activity noise sources

Noise source	Overall sound power level	Metric	Occurrence
Well construction, operation and maintenance			
Construction operation (drill rig)	117 dB(A)	L_{Aeq}	Once – off
Cementing operation	124 dB(A)	L_{Aeq}	Once – off
Workover Operation	114 dB(A)	L_{Aeq}	Reoccurring

Noise source	Overall sound power level	Metric	Occurrence
Operational well	87 dB(A)	L_{Aeq}	Continuous
Well Stimulation			
Stimulation Activity (fraccing) (combined sources)	123 dB(A)	L_{Aeq}	Once – off or Reoccurring (well dependent)
Other activities			
Flowline construction (trenching)	110 dB(A)		
Engine Brakes	110 – 115 dB(A)	L_{AMAX}	Reoccurring
Reversing Beeper	100 -105 dB(A)	L_{AMAX}	Reoccurring

3. Santos will manage noise impacts through a range of measures including appropriate buffer/offset distances, where these can be achieved, and land access conduct and compensation agreements. This is described in further detail below:

   Noise from Santos' proposed activities in PL1059 will be managed in accordance with the management hierarchy under the *Environmental Protection (Noise) Policy 2019* (EPP Noise) as follows:

   - Avoid: As far as practicable, proposed activities will be sited to ensure activities meet the noise limits specified under the EA at a sensitive place. The proposed activities include wells and associated infrastructure such as gathering systems and access tracks and do not include gas compression facilities, water treatment plants or other large facilities. The proposed wells and associated infrastructure are all highly moveable and therefore able to be located to meet noise limits in most instances. In addition, most noise impacts from the proposed activities are transient and temporary during construction as there will be no large, noise-generating fixed facilities.

     Santos conducts noise assessments (including predictions) as part of its infrastructure planning and design process to ensure activities comply with noise limits, or inform further design, mitigation and management actions where noise limits cannot be met.

     Santos previously engaged SLR to predict required offset buffer distances for drilling and other construction activities to enable Santos to manage noise impacts and ensure compliance with EA conditions. These buffer distances are provided for drilling (the noisiest activity) in section 8.2 of the EA Application Supporting Information.

   - Minimise: Santos would seek to minimise noise as far as practicable through:
     - treating noise the propagation pathway (such as through increased buffer distances between the activities and the receptor, orienting plant/equipment away from the receptor, or placing a barrier between the activities and receptor)

- substituting plant/equipment with quieter options where available
- maintaining plant, vehicles and equipment in good operating condition to minimise noise emissions
- installing engineering noise controls (such as exhaust silencers or enclosures) at the source.

- Where noise limits specified under the EA cannot be met at a sensitive place, even with the above measures, Santos would seek an alternative arrangement with the affected receptor.
- Manage: Santos would manage residual noise impacts through the following:
  - Keeping landowners and neighbours informed of its activities
  - Investigating any complaints received, including conducting noise monitoring (where warranted) and appropriate corrective actions.
- Operational noise: The proposed activities do not include any gas compressors, water treatment plants or other facilities (such as permanent flares) capable of generating high noise levels. The long-term noise impacts from the proposed activities will be limited to:
  - operation and occasional workover of wells
  - road traffic noise from operational and maintenance vehicles
  - occasional maintenance activities.

  Road traffic noise will be transient and can effectively be managed through implementation of site speed limits. Operational vehicles will generally be light vehicles only and be very limited in number. Maintenance activities will be managed similarly to construction activities as listed above.

  Noise from well operations is expected to be minimal. Wells will be located to ensure noise nuisance limits under the EA (or an alternative arrangement, if in place) can be met. This will include consideration of cumulative noise levels from multiple wells.

4. As discussed in section 8.1 of the EA Application Supporting Information, there is only one sensitive place located on PL1059—Arcadia Valley State School. Five other sensitive receptors exist within 1 km of PL1059, with 11 in total occurring within 2.5 km of PL1059. Any others identified in the vicinity of PL1059 would be confirmed during the infrastructure planning and design process described above.

   A map of potential sensitive receptors is provided as Appendix C.

2.3. Heritage

Provide information on:

1. *Any heritage places within PL1059 and relevant management practices which are in line with section 3.6 of the guideline: Application requirements for petroleum activities (EM705).*

Response

1. Section 3.4 of the EA Application Supplementary Information states that no particular heritage values were identified within PL1059. This statement was informed by searches of the Queensland Heritage Register within the Central Highlands Regional Council and Maranoa Regional Council local government areas (LGAs).

   The search results are included in Table 1. No heritage places were identified within PL1059. The nearest heritage place to the tenure is the former Rewan Police Horse Breeding Station which is located over 45 km north-west of the tenure boundary.

Table 1 Queensland Heritage Register search results (Central Highlands and Maranoa Regional LGAs)

Ref no	Name	Address	LGA
650097	Duaringa State School	Charlotte Street, Duaringa	Central Highlands Regional Council
600490	Emerald Railway Station Complex	Clermont Street (Capricorn Highway), Emerald	Central Highlands Regional Council
602167	Lilyvale Stand Monument	Lilyvale Road, Capella	Central Highlands Regional Council
600026	Old Rainworth Stone Store	Wealwandangie Road, Springsure	Central Highlands Regional Council
650094	Rewan Police Horse Breeding Station (former)	Rewan Road, Rewan	Central Highlands Regional Council
600025	Springsure Hospital Museum	13 Woodbine Street, Springsure	Central Highlands Regional Council
602184	Tieri War Memorial	Talagai Avenue, Tieri	Central Highlands Regional Council
602661	Tomahawk Creek Huts	Rubyvale	Central Highlands Regional Council
602352	Astor Theatre	77 Burrowes Street, Surat	Maranoa Regional Council

Ref no	Name	Address	LGA
601689	Hibernian Hall	38-44 Hawthorne Street, Roma	Maranoa Regional Council
601775	Hunter's Emporium (former)	86 McDowell Street, Roma	Maranoa Regional Council
601077	Mitchell Railway Station	Oxford Street (passenger station), Alice Street (goods shed) and Sheffield Street (station master's, Mitchell	Maranoa Regional Council
600038	Mitchell War Memorial	Cambridge Street, Mitchell	Maranoa Regional Council
600371	Mount Abundance Homestead	Warrego Highway, Roma	Maranoa Regional Council
602378	Nostalgic Queen's Theatre	George Street, Wallumbilla	Maranoa Regional Council
601285	Roma Court House and Police Buildings	McDowall Street, Roma	Maranoa Regional Council
601536	Roma Government Complex	42 Bungil Street, Roma	Maranoa Regional Council
601767	Romavilla Winery	77 Northern Road, Roma	Maranoa Regional Council
602155	State Butchers Shop (former)	75 Arthur Street, Roma	Maranoa Regional Council
600824	War Memorial and Heroes Avenue	Wyndham Street, Roma	Maranoa Regional Council
602612	Warroo Shire Hall	cnr Cordelia and William Streets, Surat	Maranoa Regional Council

2.4. Air

1. *Confirm whether there are any point source air emissions as part of the proposal. If so:*
    a. *describe the release including location and expected air emissions (quality, concentrations, flow rate, frequency of release)*
    b. *the impact on the environmental values of air*
    c. *proposed mitigation practices.*

Response

1. There will be no fixed emission sources on PL1059 such as compressor stations, flares or generator sets.

2.5. Land

1. *The proposed activities include irrigation using produced water. Describe whether the proposed irrigation water quality release limits are in line with the most recent Australian and New Zealand Environment and Conservation Council limits and if not provide additional justification for these limits.*
2. *Confirm how the limits for E.coli and Electrical Conductivity were reached for proposed Schedule A, Table 3 – Treated Sewage Effluent Standards for Dust Suppression, Construction and Operational Purposes.*
3. *Section 10.3.2 of Attachment 2 states that residual drilling material is proposed to be disposed of by mix-bury-cover where appropriate. Please describe the mix-bury cover method which ensures environmental values are protected.*

Response

1. No irrigation using produced water would occur on PL1059 as part of the proposed activity. Water produced from PL1059 activities will be blended, stored and/or treated with produced water from other Santos GLNG operations on existing Santos GLNG tenements. This water will then be irrigated. Irrigation activities in the Arcadia Valley are currently undertaken in accordance with the relevant End of Waste code and a certified Resource Monitoring and Management Plan (RMMP). Should new or existing irrigation activities within the Fairview Arcadia Project Area change to being completed under the Environmental Authority, then the produced water will be managed:
    a) to meet the specific release limits and monitoring requirements set out in condition C9 and C10 of EPPG00928713; or
    b) in accordance with an irrigation report and monitoring program as per Condition C10;
2. The limits for E.coli and Electrical Conductivity for proposed Schedule A were based on the limits with Part B of Fairview Arcadia Project Area (FAPA) EA EPPG00928713 at the time of drafting the application. Since then the FAPA EA has been amended. Santos is now seeking conditions consistent with the current version of EA EPPG00928713. The amended proposed conditions are included in Appendix B, and include:

    C14 Treated sewage effluent may only be used for dust suppression and construction purposes provided that:

    a) access by the general public can be restricted while effluent is in use ;

b) *on local government controlled roads, written approval from the relevant Local Government has been given to the holder of this environmental authority; and*

c) *the treated sewage effluent quality:*

i. *is monitored at the location and frequency specified in Schedule C, Table 3 Treated Sewage Effluent Standards for Dust Suppression and Construction Purposes; and*

ii. *meets the release limits for each quality characteristic specified in Schedule C, Table 3 Treated Sewage Effluent Standards for Dust Suppression and Construction Purposes*

Schedule C, Table 1 - Treated Sewage Effluent Standards for Dust Suppression and Construction Purposes

Quality Characteristic	Sampling and *In situ* Measurement Point Location	Limit type	Release Limit	Frequency
pH	Standpipe from the sewage treatment works	Range	6.0 to 8.5	Monthly
5-day Biochemical Oxygen Demand (BOD)		Median	20 mg/L	
Electrical Conductivity		Maximum	1600 uS/cm	
Total Suspended Solids		Maximum	30 mg/L	
E. coli		80th percentile based on at least 5 samples with not less than 30 minutes between samples	<100 cfu per 100 mL	
		Maximum	1000 cfu per 100mL	

The justification for use of the above standards is provided in the application to amend FAPA EA EPPG00928713 submitted to the Department on 7 February 2020 (application reference APP0050079). For ease of reference, please refer to Appendix D.

3. Residual drilling materials will either be disposed of lawfully off site or on-site in accordance with proposed EA conditions being sought as part of this application. That is Santos will ensure that the residual drilling material will meet the approved quality criteria prescribed in EA condition (ie part (a) of the proposed condition) or alternatively, and depending upon the characteristics of the residual drilling materials, they will be addressed and managed via other methods. Under this scenario the activity would be undertaken pursuant to part (b) of the proposed condition whereby the method and quality would be certified by a suitably qualified third party to not result in environmental harm. The proposed conditions are consistent with the streamlined model conditions for petroleum activities as per the below.

Residual drilling material can only be disposed of on-site:

a) by mix-bury-cover method if the residual drilling material meets the approved quality criteria; or

b) *if it is certified by a suitably qualified third party as being of acceptable quality for disposal to land by the proposed method and that environmental harm will not result from the proposed disposal.*

Compliance with these methodologies will minimise the potential for contamination of land or water associated with on-site disposal via considerations such as appropriate liners, depth of cover and mixing at ratios appropriate to meet criteria for reuse, burial or other land application. Where criteria cannot be achieved, the drilling material will be disposed of at a suitably licensed facility.

The streamlined model conditions were developed with input from the (former) Department of Environment and Heritage Protection, APPEA, technical experts and industry representatives in 2013 as part of the streamlined model condition project for the petroleum industry. If the activities are undertaken in accordance with streamlined model conditions (proposed blueprint conditions I4-I6) 'residual drilling material', then the materials have already been risk assessed and considered by the Department to be managed appropriately.

The ability to safely manage residual drilling material on-site results in reduced volumes of waste going to landfill. This is preferred in accordance with the waste management hierarchy under the *Waste Reduction and Recycling Act 2011*.

2.6. Biodiversity

Appendix D Towrie MSES – Ecological Report (11 December 2020) provides only a significant residual impact assessment of wildlife species known to occur in the project area that are also not a matter of national environmental significance.

1. *Provide confirmation on whether all Matters of State Environmental Significance (MSES) (excluding the echidna and golden tailed gecko) were referred to the Department of Agriculture, Water and the Environment (the Commonwealth) for assessment under the* Environment Protection and Biodiversity Conservation Act 1999 *(EPBC Act) or whether they were self-assessed against the Commonwealth guidelines.*

2. *A significant residual impact assessment must be completed for all MSES that were not referred to the Commonwealth for assessment under the EPBC Act.*

   A significant residual impact assessment for MSES species likely and potentially occurring in the project area must be completed and include:

   a. *Glossy Ibis (*Plegadis falcinellus*)*
   b. *Rufous fantail (*Rhipidura rufifrons*)*
   c. *Oriental cuckoo (*Cuculus optatus*)*
   d. *Satin flycatcher (*Myiagra cyanoleuca*)*

e. *Latham's snipe (*Gallinaho hardwickii*)*

f. *Fork-tailed swift (*Apus pacificus*)*

3. *Approximately 343.83 ha of potential habitat for the short-beaked echidna (*Tachyglossus aculeatus*) is expected to be impacted by the proposed activity. This is considered a significant quantity of habitat. Describe what measures including management practices that will be in place/implemented to prevent impacts on the breeding, feeding and nesting sites of the short-beaked echidna.*

Response

1. All MSES species with the potential or likely to occur on PL1059, other than the short-beaked echidna and golden-tailed gecko, are also MNES and have been referred to the Commonwealth for assessment under the EPBC Act (EPBC 2021/ 8979).
2. The EPBC referral (2021/ 8979) included an assessment of the impacts to each species referred (including all of the migratory species listed above), including risk assessments and assessments of significance where a risk of significant impact existed. The assessment concluded that the proposed activities were unlikely to result in a significant impact to MNES.
3. While 343.83 ha of habitat for the short-beaked echidna may be impacted on, the majority of the tenure (approximately 8,417 ha) was mapped as habitat for this species due to its broad habitat requirements. The potential worst-case area of impact only constitutes around 4% of available habitat in the tenure. A significant residual impact (SRI) assessment carried out for the short-beaked echidna (included in Appendix F of the MSES Report attached to the EA Application Supporting Information) indicated that the proposed activity is unlikely to have a SRI on this species. Mitigation measures outlined in section 5.3 of the EA Application Supporting Information will ensure impacts on the short-beaked echidna are avoided as much as practicable and managed/minimised where avoidance is not possible.

2.7. Waste

Provide information on:

1. *The maximum capacity, surface area and depth of low hazard dams.*
2. *Description of the purpose of the proposed low hazard dams for instance aggregation dams, permeate dam, production evaporation dam.*
3. *Description of any liners and leak detection systems to be implemented for low hazard dams.*
4. *The application proposes release of hydrostatic test water and contaminants from low point drains.*

    a. *Describe the 'designated release area' for low point drains proposed in condition C5 including the surface area. Section 3.3 page 19 of the guideline: Application*

requirements for petroleum activities (EM705) states that an application for low point drains should:

i. *include monitoring provisions to ensure that any waste water release via low point drains meets required quantity and quality standards and that adverse impacts to soil quality and vegetation do not occur.*

ii. *Water quality for low point drains should be derived from irrigation trigger values from the ANZECC and AMRCANZ Water Quality Guidelines. What is the expected water quality of releases via low point drains?*

Response

1. As discussed under 2.1 of this Response to Information Request, the only structures that could be considered 'low hazard dams' proposed would be drilling sumps/pits on well leases. These are unlikely to be required based on the preferred sumpless drilling techniques typically used for coal seam gas drilling. If required, they would have a capacity of less than 0.2 ML and would be contained entirely on the well lease. The surface area and depth would depend on the configuration of the well lease during construction.
2. If required, the sumps/pits would be used to temporarily store drilling fluids, muds or cuttings during construction of the well.
3. Pits/sumps would be clay or plastic lined.
4. *Hydrotesting*

   Gathering systems in PL1059 will be predominantly tested pneumatically. Hydrotesting will only be undertaken in rare circumstances. Should hydrotesting be necessary, hydrotest water will either be captured for offsite disposal, or will be of a quality and quantity to meet the objectives of the proposed condition – that is, the water will be released in a manner that ensures:

   a. Vegetation is not damaged;
   b. soil quality is not adversely impacted;
   c. there is no surface ponding or runoff beyond the designated release area;
   d. there is no aerosols or odours;
   e. deep drainage below the root zone of any vegetation is minimised;
   f. the quality of shallow aquifers is not adversely affected.

   Low Point Drains

   Water released from low point drains is collected moisture entrained in the gas stream in gas gathering lines. This water 'drops out' of the gas as the gas moves through the gas gathering network. Pressures and temperatures reduce, causing water vapour to condense and form

liquid droplets (condensate) in the gas gathering network. This water naturally accumulates at low points along gathering lines via gravity. To ensure the efficient operation of gas flowlines, it is important to remove any water that accumulates within the gathering line.

Low point drains will be designed to direct water from LPDs to a shallow, subsurface pit filled with rocks or gravel to achieve the required environmental outcomes in the proposed EA condition C6. This design was considered appropriate and fit for purpose due to the low volumes of water produced by LPDs; and it would mitigate potential for vegetation damage, impacts to soils, surface ponding or runoff, aerosols or odours. LPDs are also fenced to prevent access and potential damage, primarily from livestock. The image below shows an example low point drain release. This gravel area would be what is considered the 'designated release area'.

On certified organic properties or where water quality is consistently of poor quality, low point drains will instead be fitted with Intermediate Bulk Containers (IBCs) to capture the water. Water will then be collected via trucks as required and transported off-site for disposal. This is done by exception as it increases trucks movements on third party owned properties and on community roads. Drains can also be difficult to access, requiring additional tracks to be constructed across the gas field.

The water released from low points drains is typically of good quality. An analysis of water quality data from low point drains across Fairview and Arcadia shows:

(a) 93% of electrical conductivity (EC) not exceeding 3,000µS/cm

(b) 12.5% of sodium adsorption ratio (SAR) not exceeding 8

(c) 90% of pH (field) between 6.0 and 9.0

(d) heavy metals (measured as total) meet the respective short term trigger value (STV) 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:

i. 100% of Aluminium below STV

ii. 100% of Arsenic below STV

iii. 100% of Beryllium below STV

iv. 84% of Boron below 'very sensitive' STV and 100% below 'moderately tolerant' crop STV as per Table 9.2.18

v. 100% of Cadmium below STV

vi. 100% of Cobalt below STV

vii. 100% of Copper below STV

viii. 87% of Fluoride below STV

ix. 78% of Iron below STV

x. 100% of Lead below STV

xi. 100% of Manganese below STV

xii. 100% of Mercury below STV

xiii. 100% of Molybdenum below STV

xiv. 100% of Nickel below STV

xv. 100% of Selenium below STV

xvi. 100% of Uranium below STV

xvii. 100% of Vanadium below STV

xviii. 98% of Zinc below STV.

It should be noted that the following set of assumptions were used to calculate the ANZECC STV contaminant loading rates resulting from irrigation:

- annual application of irrigation water is 1000 mm (or 1000L per m^2);
- inorganic contaminants are retained in the top 150 mm of the soil profile;
- irrigation will continue on an annual basis for a maximum of 20 years; and
- soil bulk density is 1300 kg/m^3.

The consistent release of maximum concentration values of contaminants in water at 1000L/m^2 over 20 years are circumstances that simply are not applicable to water releases from LPDs, and therefore the water quality presented above is considered adequate for the

infrequent and small volumes of water being released to sub-soils via the rock-lined pit. 93% of release volumes from LPDs in FAPA were reported to be < 1000L and 80% reported to be < 125L from over 4000 release records. The frequency and number of measured releases is low (typically < 20 (or < 2% of LPDs) per month).

Low point drains will be frequently inspected by operational staff as part of routine infrastructure care and maintenance. Santos will also conduct specific visual inspections to assess:

- evidence of ponding / pooling of water
- potential evidence of runoff
- soil dispersion and potential evidence of impacts to surface soils
- potential evidence of stressed vegetation

Where visual inspections indicate a potential impact, soil, water and/or vegetation sampling will be carried out as necessary and the issue rectified by the means necessary. For example, the addition of soil amendments such as gypsum.

2.8. Produced water

1. *The application states that produced water will be sent to PL421 for storage and management as authorised under EPPG00928713 however there does not appear to be a water treatment facility authorised within PL421 under this EA. Please confirm whether produced water will be transported and managed under the water treatment facilities authorised under EPPG00928713 which are located in PL100 and PL232 or at a separate water treatment facility.*
2. *Provide additional information on the proposed management of produced water including:*
    a. *Expected volume to be transferred to adjacent water facilities*
    b. *Expected volume to be released to the environment within neighbouring tenures and the location of the release*
    c. *expected volume to be used onsite for beneficial reuse*
    d. *expected volume of CSG water following treatment*
    e. *expected volume of concentrated waste streams including brine from the activity*
    f. *predicted volumes of treated CSG water to be reused/recycled, disposed of or released into the environment.*
3. *Describe how the application meets priority 1 and 2 of both the prioritisation hierarchy for managing and using CSG water and the prioritisation for managing saline waste as detailed in the Coal Seam Gas Water Management Policy 2012.*

4. *Appendix E – Towrie Water Resources Assessment (October 2020) states that brine will be stored in a regulated brine storage facility where natural evaporation of the residual water in the brine will occur over time to concentrate the brine. Provide a description on the general design of this 'brine storage facility' for instance is it similar to an evaporation dam or a tank (open or closed system). If this is an 'evaporation dam', provide information that address the relevant legislative requirements and section 3.7 of the guideline: Application requirements for petroleum activities (EM705).*

Response

1. EA EPPG00928713 authorises water treatment in PL421.Refer to Schedule A - Table 1.
2. Produced water will predominantly be transferred off PL1059 for management using existing and operational infrastructure authorised under the Fairview Arcadia EA. Produced water management has been developed to meet the requirements of the *CSG Water Management Policy* (DEHP 2012) and to maximise the beneficial use of produced water.

   Santos' strategy for produced water management is based on the *CSG Water Management Policy* prioritisation hierarchy (DEHP 2012). In the Arcadia Valley, Santos is beneficially re-using 100% of produced water generated for use in the gas field (e.g. dust suppression, construction, drilling etc) or for irrigation. A portion of produced water must be treated to achieve suitably water quality, however raw water is blended with desalinated water to reduce the requirement to desalinate all water, and therefore reduce the generation of brine. The prioritisation hierarchy for managing and using CSG water is:

   - Priority 1 – CSG water is used for a purpose that is beneficial to one or more of the following:
     - The environment;
     - Existing or new water users; and/or
     - Existing or new water-dependent industries.
   - Priority 2 – After feasible beneficial use options have been considered, treating and disposing CSG water in a way that firstly avoids, and then minimises and mitigates, impacts on environmental values.

   Figure 1 presents the indicative water management process for the proposed activities. It includes well water gathering and onsite use within PL1059, with treatment and beneficial reuse off PL1059.

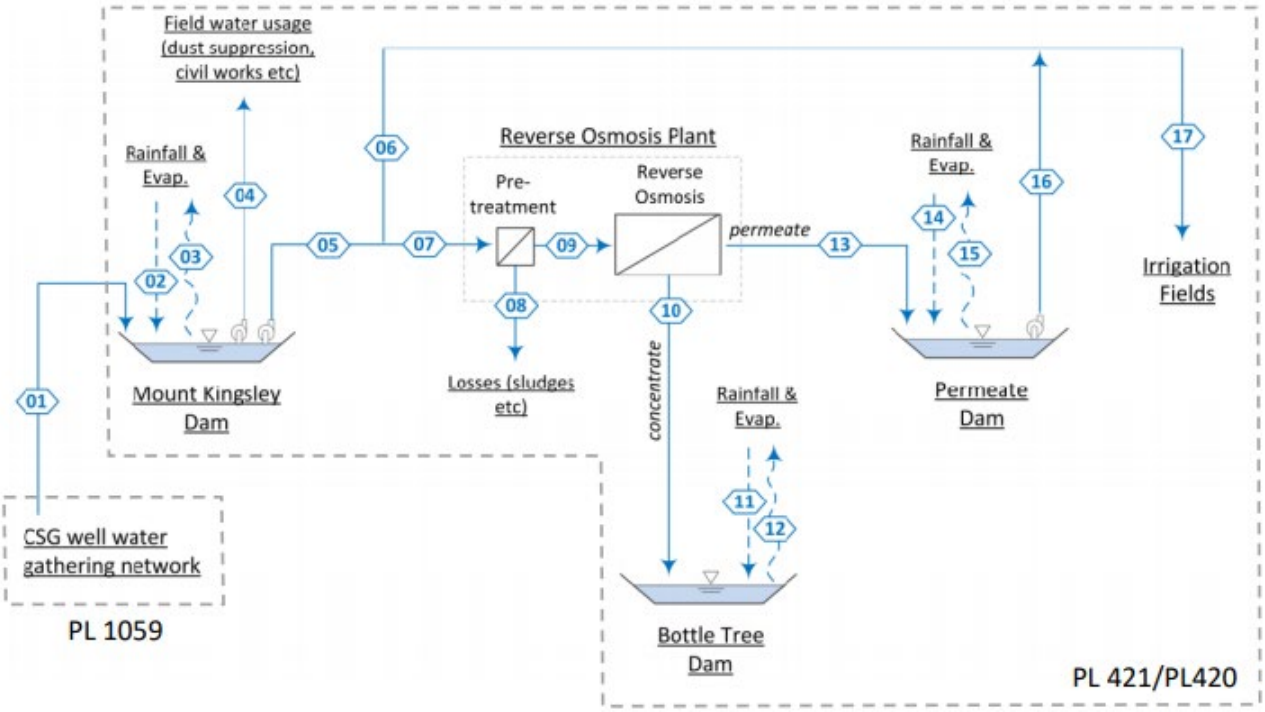

Figure 1 **Produced water process flow diagram**

3. The majority of produced water from PL1059 will be transferred to existing water management facilities on PL421. The peak water production for the project is predicted to occur in Year 7 of the project with a peak rate of 2.2 ML/day.

   All water transferred to PL421 would be managed in accordance with the conditions of EA EPPG00928713. Water from PL1059 will be mixed with produced water generated under the FAPA EA and managed in accordance with existing practices. As previously mentioned this includes beneficial reuse for irrigation and other onsite activities.

   Produced water would not be stored on PL1059 prior to transfer to adjacent tenures. Only produced water intended to be beneficially reused on PL1059 (for uses such as construction water and drilling and completions) would be stored on PL1059 in tanks where the water is of an appropriate quality.

   It is unknown how much produced water would be beneficially reused on site as this will depend on site conditions, water quality, availability of alternative water sources and landholder preferences. All produced water beneficially reused on site would be done so in accordance with EA conditions or the end of waste code.

   No produced water would be treated on PL1059. All produced water (other than minor volumes to be beneficially reused on site) would be transferred to adjoining tenures for management (including potential treatment).

No brine or other concentrated waste streams would be generated, stored or otherwise managed on PL1059 as part of the project. These waste streams would be generated and managed on adjoining tenures authorised under existing approvals.

4. As described in the EA Application Supporting Information and throughout this document, produced water from the tenure will preferentially be beneficially reused on adjoining tenures for:

    a. construction activities

    b. drilling and completions

    c. dust suppression

    d. irrigation

    e. as well as on PL1059 for construction activities and drilling and completions.

    This will benefit existing water users including industry and agricultural users.

    Treating and disposing produced water will occur only if there is no opportunity for the above beneficial reuses.

5. No brine would be generated or stored on PL1059 as part of the proposed activity. Santos has a number of existing, approved regulated brine storage facilities in Arcadia and Fairview which could be used to store brine that eventuates from the off-tenure treatment of produced water originating from PL1059. These storage facilities are open ponds that are designed, constructed and operated with the following controls:

    a. mandatory hydraulic performance engineering standards as defined by the Queensland Government to manage containment

    b. leak detection systems and/or seepage monitoring bores to demonstrate containment and reduce the risk of seepage to groundwater and the surface environment

    c. annual engineering inspections by the Registered Engineer Practicing in Queensland to demonstrate that the pond is performing as designed

    d. maximum operating limits and mandatory reporting limits to manage the risk of overtopping.

Appendix A – Notice of Information Request

Appendix B – Amended proposed conditions

Appendix C – Map of sensitive receptors

Appendix D – Application (APP0050079) to amend FAPA EA EPPG00928713 submitted to the Department on 7 February 2020