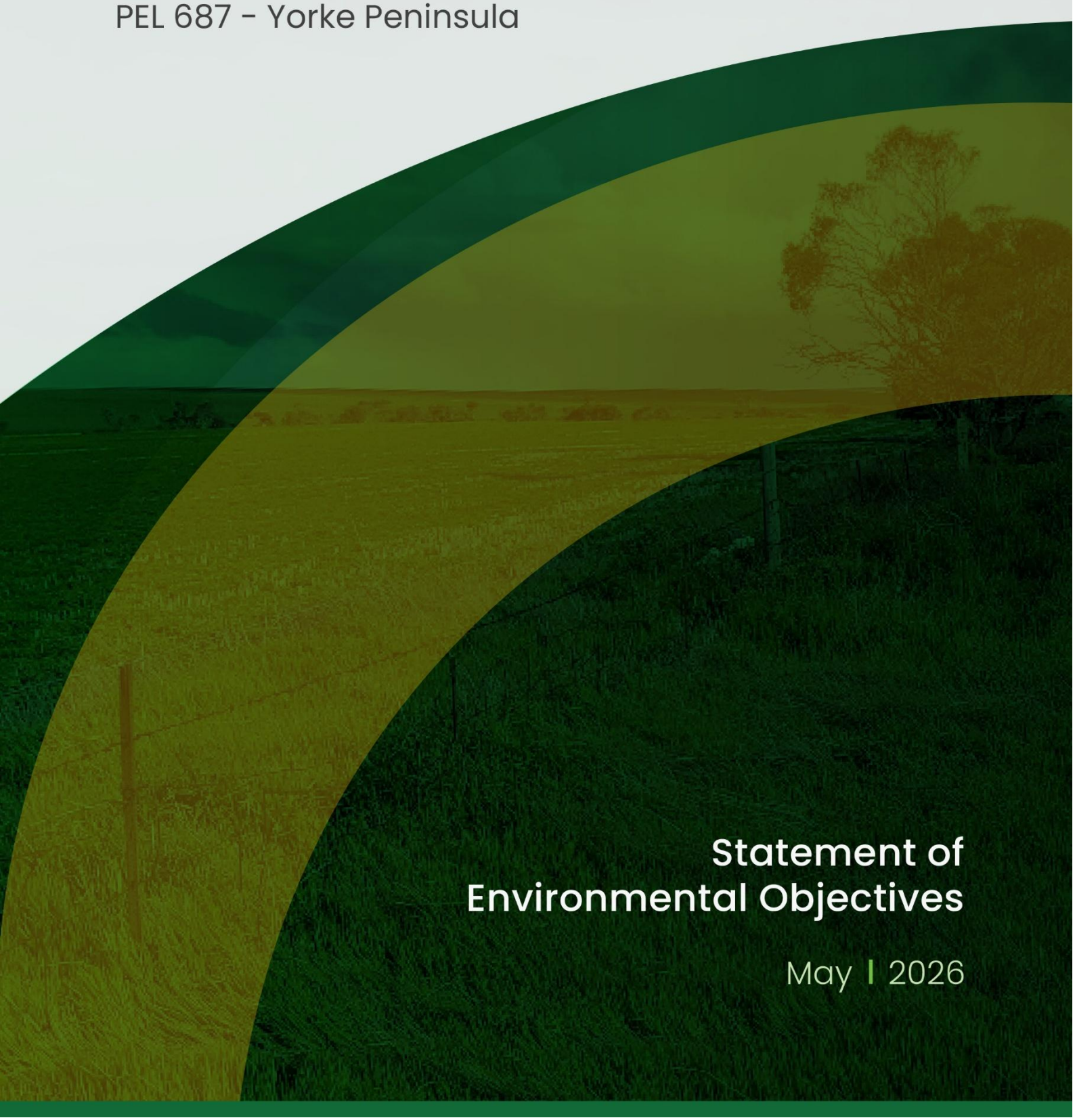
Gold Hydrogen

Groundwater Reinjection for Exploration Well Testing of Ramsay Project Wells

PEL 687 - Yorke Peninsula



Statement of Environmental Objectives

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1. Introduction

Gold Hydrogen Ltd (Gold Hydrogen) is operator and 100% working interest owner of Petroleum Exploration Licence (PEL) 687, which covers large sections of Yorke Peninsula and Kangaroo Island (refer Figure 1-1).

Gold Hydrogen is exploring for natural hydrogen and helium generated from geological processes occurring in parts of the Earth's crust. As a replacement for carbon-based fuels, naturally occurring hydrogen (also known as 'gold' or 'white' hydrogen) offers significant cost and emissions advantages relative to other sources of hydrogen production, with the potential to be a clean, low-cost energy source into the future.

Gold Hydrogen drilled and tested two exploration wells in late 2023 and early 2024 (Ramsay-1 and Ramsay-2) and reported finds of natural hydrogen and helium in these wells. Additional exploration wells are planned to be drilled and tested from late 2025 to evaluate the hydrogen and helium resource potential of the Ramsay Project (refer Figure 1-2 for the general location of the Ramsay Project).

As some of the hydrogen and helium resources may be entrained or dissolved in water trapped in underground reservoirs, the exploration well testing program will require pumping groundwater from the geological formations being tested to the surface to recover the hydrogen and helium gases.

Groundwater pumped to the surface during the testing is proposed to be transported through temporary pipelines to the Ramsay-1 site and reinjected in the Ramsay-1 well.

Exploration for natural hydrogen is regulated under the *Energy Resources Act 2000* (ER Act) and must be undertaken under an approved Statement of Environmental Objectives (SEO). Gold Hydrogen's existing drilling and well testing Environmental Impact Report (EIR) and SEO (Gold Hydrogen 2023a and 2023b), covers exploration well testing activities, however these documents do not cover reinjection of groundwater.

This SEO has been prepared to cover groundwater reinjection activities carried out as part of exploration well testing. It is designed to operate in conjunction with the existing drilling and well testing EIR and SEO (Gold Hydrogen 2023a and 2023b).

1.1. Background

This document has been prepared to meet the requirements for preparation of a Statement of Environmental Objectives (SEO) set out in Sections 99 and 100 of the *Energy Resources Act 2000* (ER Act) and Regulation 12 of the *Energy Resources Regulations 2013* (ER Regulations).

The intent of the SEO is to outline the environmental objectives to which the regulated activities will conform. The SEO also sets out the assessment and leading performance criteria to be applied to determine whether the objectives have been achieved. The immediately reportable and reportable incidents that will apply to the activities are also defined in the SEO (refer Section 3).

The objectives of this SEO have been developed on the basis of the information provided in the Environmental Impact Report (EIR) (Gold Hydrogen 2026) and are in keeping with the objectives of the ER Act.

'Environment' is broadly defined in the ER Act to include:

- land, air, water (including both surface and underground water and sea water), organisms, ecosystems, flora and fauna

- buildings, structures and other forms of infrastructure and cultural artefacts
- existing and potential land use
- public health, safety or amenity
- the heritage, aesthetic or cultural values of an area
- the economic or social impact on an area.

1.2. Scope

This SEO covers groundwater reinjection activities that are undertaken as part of exploration well testing for the Ramsay Project within Petroleum Exploration Licence (PEL) 687 on Yorke Peninsula. These activities are described in the EIR (Gold Hydrogen 2026).

The scope of this SEO is limited to activities related to groundwater reinjection for exploration well testing that are outside the coverage of the existing drilling and well testing EIR and SEO (Gold Hydrogen 2023a and 2023b). These activities are:

- temporary pipelines to transport groundwater to the reinjection well
- downhole reinjection of groundwater (into Ramsay-1).

The following natural hydrogen exploration activities undertaken by Gold Hydrogen are outside the scope of this document, as they are addressed in Gold Hydrogen's existing SEOs for drilling and well testing (Gold Hydrogen 2023b) and low impact on-road geophysical activities (Gold Hydrogen 2024):

- well site and access track construction
- drilling, well completions and workovers
- well testing, including equipment at well sites such as pumps, separator tanks, storage tanks and gas vents
- restoration of well sites and access tracks
- geophysical surveys and investigations
- supporting activities and infrastructure.

The coverage of this SEO is limited to groundwater reinjection for exploration and appraisal well testing only. It does not cover groundwater reinjection for any possible future hydrogen or helium production operations.

1.2.1. Geographical area and exclusions

This SEO covers downhole reinjection into Ramsay-1 and temporary pipelines within a short distance of the Ramsay-1 well.

Gold Hydrogen's drilling and well testing EIR (Gold Hydrogen 2023a) identifies areas that would specifically be avoided by Gold Hydrogen's exploration activities. These areas, which are listed below, are also excluded from the scope of this SEO:

- the portion of PEL 687 located on Kangaroo Island
- activities in reserves established under the *National Parks and Wildlife Act 1972* or exploration activities immediately adjacent to a Marine Park established under the *Marine Parks Act 2007*

- activities in mining production tenement regulation areas identified in Schedule 14 of the *Planning, Development and Infrastructure (General) Regulations 2017*[1]
- Wardang Island Indigenous Protected Area
- Native Vegetation Heritage Agreement areas
- land where access has not been agreed with the landowner
- land in close proximity to towns or sensitive receptors
- areas of high-quality native vegetation
- significant wetland areas
- areas of identified cultural heritage significance.

[1] Mining Production Tenement Regulation Areas (MPTRA) incorporate the coastline and several other areas on Yorke Peninsula. The *Planning Development and Infrastructure Act 2016* requires referral of new SEOs (and mining production tenement applications) for activities in MPTRAs to the Planning Minister for advice. These areas have not been identified by Gold Hydrogen for exploration drilling and testing and have been excluded from the scope to simplify the SEO approval process.

Figure 1-1: Location of PEL 687 on Yorke Peninsula

Price
Balgowan
Maitland
Ardrossan
Port Victoria
Port Julia
Port Rickaby
Curramulka
Minlaton
Port Vincent
Hardwicke Bay
Stansbury
Corny Point
Point Turton
Warooka
Wool Bay
Yorketown
Coobowie
Edithburgh
Port Moorowie
Marion Bay

Legend
- Towns
- State Maintained Roads
- Roads
- PEL 687 Boundary
- NPW Act 1972 Reserved Area
- Wetlands
- Indigenous Protected Areas

N

0 25 50 km

Figure 1-2: Location of the Ramsay Project
Adelaide
Yorke Hwy
Maitland Rd
Yorketown Rd
Minlaton
Port Vincent Rd
Ramsay 3
Ramsay 5
Ramsay 4
Ramsay (CP)
Port Vincent
St Vincent Hwy
Harry Butler Rd
Minlaton Rd
Minlacowie (CP)
Stansbury
Legend
Towns
Watercourse
Minor roads
State maintained roads
Waterbodies
National Parks
PEL 687
Wells
Ramsay 1
Ramsay 2
Ramsay well location
JBS&G
Kilometres
0
2
4
N

2. Environmental Objectives and Assessment Criteria

Regulation 12(3) of the ER Regulations requires an SEO to include:

- objectives that relate to dealing with the impacts on various elements of the environment associated with undertaking the relevant regulated activity (i.e. the activities proposed in the EIR and subsequently approved)
- criteria to be applied to determine whether the stated environmental objective has been achieved in a particular case.

2.1. Objectives

Potential environmental impacts of groundwater reinjection for exploration well testing of Ramsay Project wells, and environmental objectives that relate to these impacts, have been identified in the EIR (Gold Hydrogen 2026).

These environmental objectives are set out in Table 2-1

2.2. Assessment Criteria

The environmental objectives identified above are subject to an assessment to measure the level of achievement. Regulation 12(4) sets out the criteria for assessment required to be incorporated in the SEO:

- a description of the objective to be measured and the manner and form of the measurement to be used
- the locations where the relevant measurements are to be taken, or how such locations are to be determined
- the frequency of any measurement or monitoring
- any background or control data that is to be used, or the manner in which such data is to be obtained
- how the achievement of a relevant objective is to be determined (with consideration being given to any inherent errors of measurement)
- if required by the Minister - provisions with respect to assessing the ongoing fitness for purpose of management systems, facilities, plant, equipment, machinery or other infrastructure and
- may include provisions relating to -
    - the gathering of information and the conduct and timing of studies
    - the conduct and timing of management system audits.

The assessment criteria for each objective are set out in Table 2-1.

2.3. Leading Performance Criteria

Leading performance criteria have been provided for each impact event. These criteria are intended to give early warning that a control measure may fail or is failing, and that the environmental objective or relevant assessment criteria is at risk of not being achieved, allowing time to respond accordingly. Relevant leading performance criteria for each objective are set out in Table 2-1.

2.4. Guide to How Objectives Can be Achieved

The 'Guide to How Objectives Can be Achieved' column in Table 2-1 provides a reference to the relevant impact identification number and impact event in the EIR (refer Sections 5.2 to 5.8 of the EIR) which provides details of the control measures to be implemented to meet the environmental objective.

The 'Guide to How Objectives Can be Achieved' column is provided to demonstrate that appropriate controls and systems are in place to achieve a specific objective and/or assessment criteria and is not a legislative requirement (refer DEM 2024).

Table 2-1: Environmental objectives, assessment criteria and leading performance criteria

Environmental objective and assessment criteria	Leading performance criteria	Guide to how objectives can be achieved / control measures
Objective 1: No impact to existing groundwater users and the value of groundwater resources		
Records of sampling undertaken in accordance with groundwater monitoring plan (approved for use by DEM) demonstrate no adverse impact to water quality in aquifers accessed by groundwater users (e.g. less than 100 m depth) as a result of groundwater reinjection activities. Well integrity monitoring program (e.g. through well logs or pressure measurements / testing) demonstrate appropriate barriers exist to protect aquifer systems above the Ramsay-1 surface casing shoe at 218 m. Reinjection activities undertaken in accordance with water affecting activities permit under the *Landscape South Australia Act 2019*	Monitoring of groundwater reinjection demonstrates maximum injection pressure not exceeded. Downhole monitoring of reinjection demonstrates flow to formations below depth of the Ramsay-1 surface casing shoe at 218 m. If well integrity monitoring identifies potential issues, risk assessment undertaken to identify hazards / scenarios, and mitigation controls implemented where appropriate to reduce or monitor risk. Groundwater monitoring plan for reinjection activities approved for use by DEM. Groundwater monitoring plan to include monitoring locations, depths and frequencies; sampling methods and analytes; methods for defining baseline conditions, measurable indicators and response thresholds; tiered management responses and a Trigger Action Response Plan (TARP).	Refer GRO01 (Reinjection reduces groundwater quality (increased salinity) for existing groundwater users)
Records of well integrity monitoring program (e.g. through well logs or pressure measurements / testing) demonstrate appropriate barriers exist to protect aquifer systems above the Ramsay-1 surface casing shoe at 218 m. Reinjection activities undertaken in accordance with water affecting activities permit under the *Landscape South Australia Act 2019*	Monitoring of groundwater reinjection demonstrates maximum injection pressure not exceeded. Downhole monitoring of reinjection demonstrates flow to formations below depth of the Ramsay-1 surface casing shoe at 218 m. If well integrity monitoring identifies potential issues, risk assessment undertaken to identify hazards / scenarios, and mitigation controls implemented where appropriate to reduce or monitor risk.	Refer GRO02 (Reinjection results in reduced groundwater quality (increased salinity) in receiving groundwater) Refer GRO03 (Injection well integrity failure results in increased salinity in shallower aquifers and impact to existing groundwater users)
Objective 2: No significant changes in soil quality as a result of activities		
Records of audits/inspections demonstrate that any escape of saline groundwater is immediately contained, and clean-up actions initiated. Records of audits/inspections and/or incident management system demonstrate no adverse impact to land use or native vegetation and native fauna outside well sites due to an escape of saline water.	Inspections demonstrate no evidence of spills or leaks of as a result of activities. Personnel trained in spill response procedures. Appropriate spill response equipment is available on site.	Refer SOI01 (Spills of saline water result in deterioration of soil and/or shallow groundwater quality)

Environmental objective and assessment criteria	Leading performance criteria	Guide to how objectives can be achieved / control measures
Objective 3: No significant adverse impacts to surface water and shallow groundwater quality		
Records of audits/inspections and/or incident management system demonstrate no unauthorised discharge or escape of saline groundwater to surface and/or groundwater.	Inspections demonstrate no evidence of spills or leaks of as a result of activities. Personnel trained in spill response procedures. Appropriate spill response equipment is available on site.	Refer SOI01 (Spills of saline water result in deterioration of soil and/or shallow groundwater quality) Refer SUR01 (Spills of saline water result in deterioration of surface water quality.)
Objective 4: No clearance of native vegetation or disturbance to native fauna unless prior approval under the relevant legislation is obtained		
Ecological assessment by appropriately trained and experienced personnel undertaken to determine biodiversity values and to identify and avoid any areas of sensitivity or 'no-go' areas. If vegetation clearance is required, records demonstrate that necessary approvals under the Native Vegetation Act have been obtained and any 'significant environmental benefit' obligation has been satisfied in accordance with NVC (2025). Records (e.g. ecological assessments) demonstrate no listed threatened and/or migratory species will be significantly impacted (unless appropriate approval has been obtained) and that high quality or significant[2] remnant vegetation will not be cleared. Records of audits/inspections demonstrate there has been no unauthorised clearing of native vegetation. Records (e.g. ecological assessments) demonstrate that disturbance to fauna has been considered and measures implemented to minimise it where appropriate.	Pipeline route selection and micro-siting avoids or minimises native vegetation impacts and avoids any threatened flora species.	Refer FLO01 (Vegetation disturbance for pipeline installation or removal results in a loss of native vegetation and biodiversity)

[2] Significant in this context includes listed plant species, listed communities or important fauna habitat. Site specific assessment by an appropriately qualified specialist would be used to determine whether any native vegetation proposed to be cleared constitutes large trees, high quality vegetation or significant vegetation

Environmental objective and assessment criteria	Leading performance criteria	Guide to how objectives can be achieved / control measures
Objective 5: No damage, disturbance or interference to Aboriginal heritage		
Records of audits/inspections demonstrate that damage, disturbance or interference to any Aboriginal sites, objects and remains (all as defined under the *Aboriginal Heritage Act 1988*) is avoided unless authorisation has been obtained under the *Aboriginal Heritage Act 1988.* Any Aboriginal heritage sites, objects and remains discovered during operations have been appropriately reported and responded to, consistent with the *Aboriginal Heritage Act 1988* and the *Coroners Act 2003.* Records demonstrate that works have stopped in the vicinity of a discovery of Aboriginal heritage.	Records demonstrate that consultation has been carried out with the Narungga Nation Aboriginal Corporation regarding proposed reinjection activities and the level of risk of damage to Aboriginal heritage from new ground disturbing activities, and a cultural heritage survey carried out where required. In the event the conditions[3] of a cultural heritage clearance are not complied with, the incident is appropriately reported[4], investigated and remediated in consultation with the relevant Aboriginal heritage organisations, including Native Title groups, Recognised Aboriginal Representative Bodies (RARBs), Aboriginal heritage associations, Traditional Owners and AAR.	Refer HER01 (Pipeline installation or removal results in damage or loss of Aboriginal heritage)
Objective 6: No injuries, deaths or health impacts to the public or third parties from regulated activities that could have been reasonably prevented by the operator		
Any notifiable incidents (as per s35 of the *Work Health and Safety Act 2012*) involving the public investigated by a suitably qualified independent third party and the results of the investigation show that the accident could not have been reasonably prevented by the operator.	Documentation indicates reinjection infrastructure and pipelines designed and operated in accordance with relevant standards. Safety audits are undertaken and any identified additional actions that could be reasonably implemented to reduce the risks to the public are implemented.	Refer PUB01 (Reinjection activities and associated infrastructure (e.g. pressurised piping) increase public safety hazard.)
Objective 7: Minimise disturbance to landowners and land use		
Records of audits/inspections demonstrate no adverse impact (outside agreed disturbance / compensation areas) on land use as a result of activities. Records demonstrate timely consultation and notification of proposed activities with relevant landowners and directly affected stakeholders. Landowner / stakeholder complaints are documented and reasonable steps taken to resolve them can be demonstrated.	Adverse impacts of accidental or unforeseen disturbance to infrastructure or land use resolved to the reasonable satisfaction of the landowner.	Refer SOC01 (Presence of pipeline disrupts landholder infrastructure or activities)

[3] Note that cultural heritage clearances are not defined under or referenced by the *Aboriginal Heritage Act 1988* and cannot ever authorise impacts to Aboriginal heritage.

[4] This may include compliance with reporting obligations pursuant to s.20 of the *Aboriginal Heritage Act 1988.*

Environmental objective and assessment criteria	Leading performance criteria	Guide to how objectives can be achieved / control measures
Objective 8: No introduction or spread of weeds, pest animals and pathogens as a consequence of regulated activities		
Records of audits/inspections demonstrate that the presence of weeds, pest animals or pathogens is consistent with or better than pre-disturbance conditions and adjacent land or where this is not the case, a management plan is implemented promptly. Declared plants occurring as a result of regulated activities are reported and managed in accordance with the *Landscape South Australia Act 2019* and applicable Landscape plans.	Records demonstrate that all equipment and vehicles are inspected, and cleaned where required, before arrival at the site.	Refer SOC02 (Introduction and spread of weed(s), pest(s) and/or pathogen(s) impacts land use or native vegetation)
Objective 9: Rehabilitate land adversely affected by regulated activities		
Records of audits / inspections demonstrate that land has been appropriately rehabilitated, including removal of surface structures and waste, re-contouring of the ground surface and revegetating (where required) consistent with pre-existing conditions (unless alternative agreement is reached with the regulator and landowner). Records demonstrate no reasonable landowner complaints regarding rehabilitation of land are left unresolved.	Rehabilitation of disturbed areas to be approved by the landowner or in accordance with landowner's wishes.	Refer SOC01 (Presence of pipeline disrupts landholder infrastructure or activities)

3. Reporting

3.1. Incident definitions

Section 100 of the ER Act requires an SEO to set out 'immediately reportable' and 'reportable' incidents (both within the meaning of section 85 of the ER Act).

Immediately reportable incidents

Section 85(3) of the ER Act defines an immediately reportable incident as:

- an incident arising from activities conducted under a licence specified in the relevant statement of environmental objectives to be an immediately reportable incident; or
- any other matter brought within the ambit of this definition by the ER Regulations.

Reportable incident

Section 85(3) of the ER Act defines a reportable incident as:

- an incident (not being an immediately reportable incident) arising from activities conducted under a licence specified in the relevant statement of environmental objectives to be a reportable incident
- any other matter brought within the ambit of this definition by the ER Regulations.

Regulation 32(1) of the ER Regulations classifies the following as reportable incidents:

- an escape of a regulated substance, a processed substance, a chemical or a fuel that affects an area that has not been specifically designed to contain such an escape
- an incident identified as a reportable incident under the relevant statement of environmental objectives.

Table 3-1 identifies the potential immediately reportable and reportable incidents relevant to groundwater reinjection exploration well testing activities.

Table 3-1: Incident definitions for immediately reportable and reportable incidents

Immediately reportable incident	Reportable incident
1. A person is seriously injured[1] or killed. 2. An imminent risk to public health or safety arises. 3. Serious environmental damage occurs or an imminent risk of serious environmental damage arises. For example: a. Damage, disturbance or interference to sites of cultural and / or heritage significance without appropriate authorisations[2]. b. An escape of a regulated substance, processed substance, a chemical or a fuel to a water body, or to land in a place where it is reasonably likely to enter a water body by seepage or infiltration, or onto land that affects the health of native flora and fauna species[3]. c. Identification of cross flows between aquifers in natural hydraulic isolation, or uncontrolled flows to the surface. d. Any well incident or failure that threatens or poses an imminent risk to safety or a risk of serious damage to environmental values whether or not those values are referred to in State or Commonwealth legislation. e. Detection of a declared weed, animal / plant pathogen or plant pest species that has been introduced or spread as a direct result of activities. f. Any removal of rare, vulnerable or endangered flora and fauna or threatened ecological community without appropriate permits and approvals[4]. g. Any significant alteration of hydrology that affects a significant wetland area. 4. A regulated activity[5] being undertaken in manner that involved or will involve a serious risk to the health or safety of a person emanating from an immediate or imminent exposure to a hazard[6]. 5. An uncontrolled release resulting in the activation of emergency response and / or evacuation procedures of an area in or adjacent to the release, and / or fire or explosion.	1. An escape of a regulated substance[7], processed substance, a chemical or a fuel that affects an area that has not been specifically designed to contain such an escape[8] (other than an immediately reportable incident). 2. An event that has the potential to compromise the physical integrity of an asset or facility. For example: ○ An unapproved excursion outside of critical design or operating conditions / parameters. ○ Identification of a critical barrier failure that could lead to the potential for cross flows between aquifers in natural hydraulic isolation, or uncontrolled flows to the surface. ○ Failure of a critical procedural control in place to reduce a credible threat to low or as low as reasonably practicable (ALARP)[9]. 3. Malfunction or failure of critical plant or equipment that had (or still has) potential to cause a serious incident. 4. Unresolved reasonable complaints from stakeholders regarding operations. 5. Any event where an incursion outside a culturally cleared area has occurred or the conditions[10] of a cultural heritage clearance have not been complied with (other than a serious incident).

[1] As per the definition in Section 36 of the *Work Health and Safety Act 2012*.
[2] Pursuant to *Aboriginal Heritage Act 1988* and *Heritage Places Act 1993*.
[3] For reporting purposes, the assessment of 'reasonably likely to enter a water body by seepage or infiltration' may require further intrusive assessment. Should delineation of the extent of the release not be achieved within one week of becoming aware of the incident, DEM will be notified of the incident and the proposed site investigation methodology, including timeframes.
[4] Pursuant to *Native Vegetation Act 1991* (flora) and *National Parks and Wildlife Act 1972* (fauna).
[5] Regulated activity as defined in Section 10 of the *Energy Resources Act 2000*.
[6] Resulting in the issuing of a prohibition notice by SafeWork SA pursuant to Section 195 of the *Work Health and Safety Act 2012*.
[7] As defined in Section 4 of the *Energy Resources Act 2000*.
[8] An area assigned during a Hazard and Operability Process (HAZOP) study as a hazardous area for the purpose of gas venting, and designed as such, is considered to be an area specifically designed to contain a gas escape.
[9] As per the Safety Management System process articulated in AS 2885.1-2012, or similar risk assessment process.
[10] Note: Cultural heritage clearances are not defined under or referenced by the *Aboriginal Heritage Act 1988* and cannot ever authorise impacts to Aboriginal heritage.

3.2. Reporting Requirements

3.2.1. Reporting under the ER Act

Immediately reportable incidents must initially be reported to the Minister within 24 hours after the licensee becomes aware of the occurrence of the incident, as described in Section 85 of the ER Act and ER Regulation 32. A written report on the incident must be provided in accordance with Regulation 32 within 3 months of the occurrence of the incident or a period specified by the Minister.

Reportable Incidents must be reported to the Minister on a quarterly basis within 1 month after the end of each quarter, as per ER Regulation 32.

3.2.2. Reporting to the Environment Protection Authority

Where applicable, incidents causing or threatening serious or material environmental harm under the *Environment Protection Act 1993* (EP Act) must be reported to the EPA in accordance with section 83 of the EP Act.

The EP Act and its reporting obligations do not apply to:

- exploration activity undertaken under the ER Act; or
- wastes produced in the course of an activity (not being a prescribed activity of environmental significance) authorised by a licence under the ER Act when produced and disposed of to land within the area of the licence.

3.2.3. Reporting to SafeWork SA

Notifiable incidents (i.e. death, serious injury or illness, or dangerous incidents) must be reported to SafeWork SA in accordance with Part 3 of the *Work Health and Safety Act 2012*.

4. List of Abbreviations

Abbreviation	Definition
AAR	Aboriginal Affairs and Reconciliation, Attorney General's Department (South Australia)
ALARP	as low as reasonably practicable
DEM	Department for Energy and Mining (regulator of the Energy Resources Act)
EIR	Environmental Impact Report prepared in accordance with Section 97 of the *Energy Resources Act 2000* and Regulation 10.
EPA	Environment Protection Authority
ER Act	*Energy Resources Act 2000*
ER Regulations	*Energy Resources Regulations 2013*
minimise	To reduce as far as reasonably practical, considering all other factors e.g. requirements for safe operations and accessibility
MPTRA	Mining production tenement regulation areas
NVC	Native Vegetation Council
PEL	Petroleum Exploration Licence
SEO	Statement of Environmental Objectives prepared in accordance with Section 99 and 100 of the *Energy Resources Act 2000* and Regulation 12.
TARP	Trigger Action Response Plan

5. References

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