Summary Plan

WAA 4000 ENV PLN
CDN/ID 18985408

Environment Plan Summary

Beharra Springs Petroleum Production Operations

Review record (record the last 3 revisions here or the revisions required to achieve current approval version)

Revision	Date	Reason for issue	Reviewer/s	Consolidator	Approver
1	09/10/2020	Approved for use	ZBO	ZBO	KWE
2	23/12/2020	Issued for use	ZBO	ZBO	KWE
3	23/09/2022	Approved for Use	ZBO, RKH, BWI, NCO,	AdV	RKH
3A	09/01/2023	Issued for review	ZBO, RKH	ZBO	RKH-
4	12/01/2023	Approved for Use	ZBO, RKH	ZBO	RKH
5	14/03/2025	Issued for Regulatory Approval	JS	JS	JS

Review due	Review frequency
02/10/2025	5 years

THE THREE WHATS
What can go wrong?
What could cause it to go wrong?
What can I do to prevent it?

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1 Introduction

Beach Energy Resources (Perth Basin) Pty Limited (Beach) is the part owner and operator of the Beharra Springs Gas Facility (the Facility). The Facility comprises of infrastructure contained within Production Licences L11 & L22, Exploration Permit EP320 and Pipeline Licence PL18 and is located within the North Perth Basin, Western Australia (WA). The Beharra springs Facility incorporates the field production wells and flowlines, gas production plant, sales gas pipeline and associated infrastructure. The Facility is located approximately 20 kilometres (km) south of Dongara and 350 km north of Perth (refer to Figure 1)

Development of the Facility is undertaken in accordance with an approved Field Management Plan (CDN/ID14896293), with first production commencing in 1991.

The Facility commercialises gas and condensate extracted from the Gas Fields. Production from the Gas Fields is expected to occur until at least 2035 at an average production rate of 25-28 TJ per day of sales gas and condensate.

1.1 Purpose

The Beharra Springs Petroleum Production Operations Environment Plan (EP and this EP Summary have been prepared to meet the requirements of the *Petroleum and Geothermal Energy Resources Act 1967*, This document provides a public summary of the EP that has been submitted to Department of Mines, Industry Regulation and Safety (DMIRS) for assessment.

1.2 Nominated Operator

Beach Energy (Perth Basin) Pty Limited (ACN 008 432 479) is the nominated operator for the Facility.

The proponent, formally known as Lattice Energy Resources (Perth Basin) Pty Limited (Lattice), is wholly owned by Beach Energy Limited (Beach). Beach acquired Lattice Energy (previously named Origin Energy Resources Limited (Origin)) on 31 January 2018. Given the recent changes to the operating entity, there may be references to 'Origin' or 'Lattice' in material relevant to this document because that material was prepared prior to Beach's change of name, or before Lattice was acquired by Beach.

Contact details for the operator's nominated liaison person are as follows:

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1.3 Scope

The scope of this EP summary covers the operational and maintenance aspects of the Facility, including the Gas Production Plant, Gas Fields, Sales Gas Pipeline and associated infrastructure. Where

activities not covered by the EP are required, a bridging document will be prepared to ensure the environmental impacts and risks associated with the specific activity have been identified.

1.4 Definitions and acronyms

Term	Definition
°C	Degrees Celsius
ALARP	As Low As Reasonably Practicable
AWE	Australian Worldwide Exploration
Beach	Beach Energy Limited
DBCA	Department of Biodiversity, Conservation and Attractions
DFES	Department of Fire and Emergency Services
DWER	Department of Water and Environmental Regulation
EP	Environmental Plan
EP320	Exploration Permit EP320
EPA	Environmental Protection Authority
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act
HSE	Health, Safety and Environment
km	Kilometres
Lattice	Lattice Energy Resources (Perth Basin) Pty Limited
L11	Production Licence L11
L22	Production Licence L22
m	Metre(s)
MEPAU	Mitsui Exploration & Production Australia
OEMS	Operational Excellence Management System
Origin	Origin Energy Resources Limited
PJ	Petajoules
PL	Pipeline licence
PMST	Protected Matters Search Tool
RBS-1	Redback South 1
s	Second(s)
t	Tonne(s)
TJ	TeraJoules
WGS 84	World Geodetic System 1984

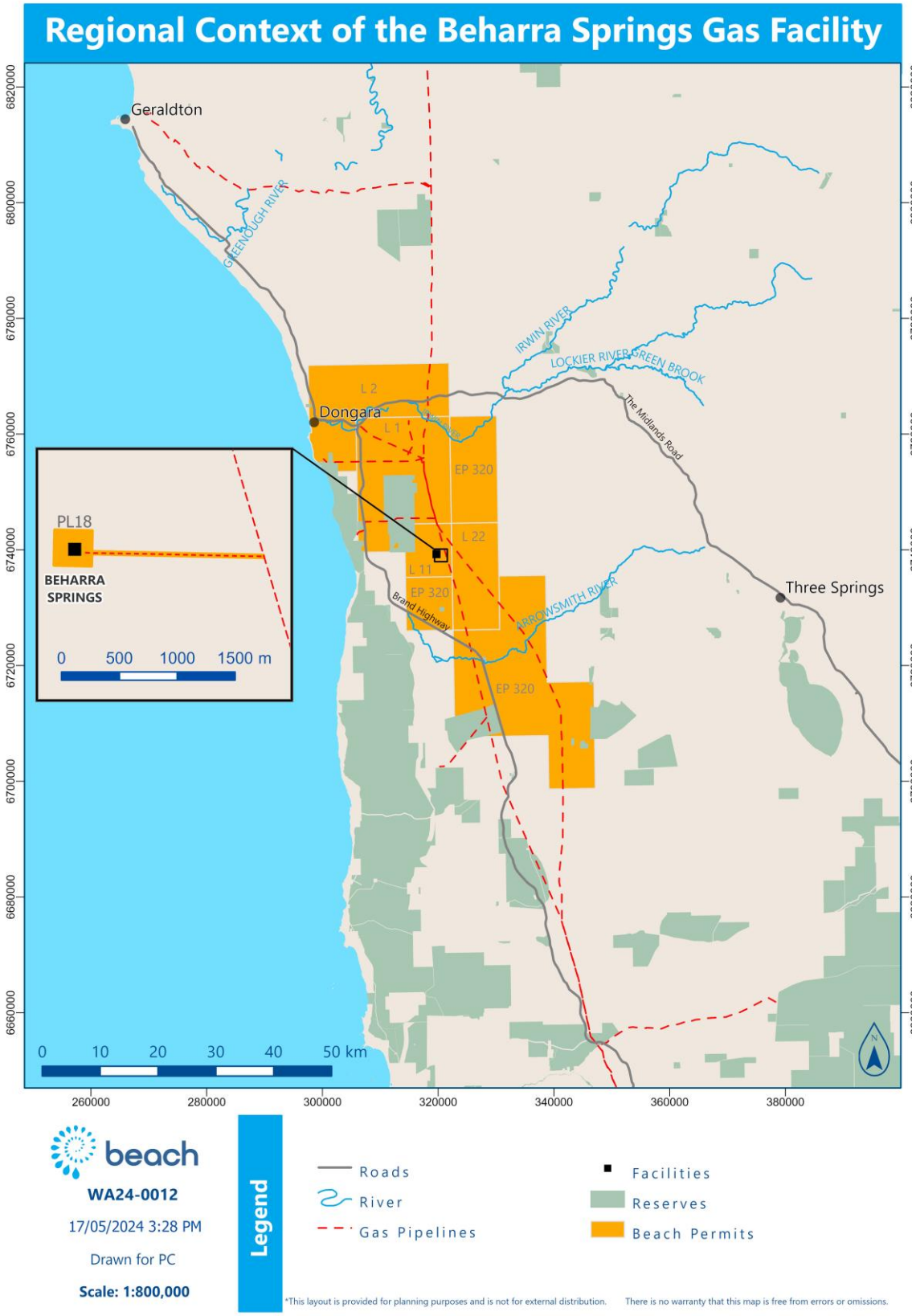
Regional Context of the Beharra Springs Gas Facility
Geraldton
Dongara
Three Springs
GREENOUGH RIVER
IRWIN RIVER
LOCKIER RIVER
GREEN BROOK
The Midlands Road
Brand Highway
ARROWSMITH RIVER
L 2
L 1
L 22
L 11
EP 320
PL18
BEHARRA SPRINGS
0 500 1000 1500 m
0 10 20 30 40 50 km
6820000
6800000
6780000
6760000
6740000
6720000
6700000
6680000
6660000
260000
280000
300000
320000
340000
360000
380000
beach
WA24-0012
17/05/2024 3:28 PM
Drawn for PC
Scale: 1:800,000
Legend
Roads
River
Gas Pipelines
Facilities
Reserves
Beach Permits
*This layout is provided for planning purposes and is not for external distribution.
There is no warranty that this map is free from errors or omissions.

Figure 1: Regional Context of the Beharra Springs Gas Facility

2 Description of the Activity

2.1 Location of Project

The Beharra Springs Gas Facility is located within Production Licence L11, Exploration Permit EP320 and Petroleum Pipeline Licence P18. The Facility is situated in the Shire of Irwin, in the northern Perth Basin, approximately 25 km southeast of Dongara and 350 km north of Perth, as shown in Figure 1. The coordinates of the Facility are approximately -29.46310, 115.14038 (WGS 84).

The Irwin 1 well is located on Lot M361 on Plan 2944 within EP320, approximately 23 km north of the Beharra Springs Facility.

2.2 Facility Timeline

Development of the Facility is summarised in the following Table 1.

Table 1: Summary of the Development of the Beharra Springs Gas Facility

Year	Phase
1990	North Yardanogo 1 and South Yardanogo 1 drilled. Wells were plugged and abandoned in 1991 upon completion of production testing.
1991	Gas Field discovered by Barrack Energy Limited with the drilling of Beharra Springs 1.
1992	Gas Plant constructed and commissioned to process reservoir fluids collected from Gas Field (i.e., Beharra Springs 1 and 2). Sales Gas Pipeline constructed and commissioned to deliver gas from the Gas Production Plant to the Parmelia Pipeline.
1993	Beharra Springs 3 drilled. Nameplate production capacity (PL18) was increased from 19 TJ per day to 25 TJ per day.
1995	The Gas Production Plant was modified with the provision of two identical gas compression units, together with other additions and modifications to enhance existing processing capabilities and to support the operation of the new compressors.
2001	Beharra Springs South 1 exploration well drilled. Plugged and abandoned in May 2002.
2002	Beharra Springs North 1 drilled. Flowline tied into the existing flowline at Beharra Springs 3.
2004	Tarantula 1 and Redback 1 exploration wells drilled.
2005	Tarantula 1 ST1 drilled. Flowline tied into existing flowline at Beharra Springs North 1.
2007	Beharra Springs 4 drilled. Flowline tied into existing flowline from Tarantula 1 ST1.
2009	Redback South 1 (RBS-1) drilled as a side-track from Redback 1 during August and September 2009.
2010	Redback 2 was drilled to assess the prospectivity of the terrace adjacent to, and directly north of, the RBS-1 discovery. Flowline constructed to tie the Redback South 1 and Redback 2 wells into the Gas Production Plant. Wolf 1 well drilled to assess the prospectivity of the Redback Terrace.
2015	Irwin 1 exploration well drilled by AWE. Irwin 1 was shut-in following diagnostic fracture injection test (DFIT) activities to understand the Dongara Sandstone rock properties for fracture modelling. Well activities were managed by AWE (MEPAU) under an approved EP (AWE, 2016).
2016	North Yardanogo 1 and South Yardanogo 1 rehabilitation completed.

Year	Phase
2017	Evaporation pond 2 and separator system upgraded and commissioned.
2019	Beharra Springs Deep 1 lease pad constructed in May 2019. Beharra Springs Deep 1 flow test confirms presence of high quality Kingia Sandstone reservoir in October 2019. Beach engaged with the relevant regulatory authorities and followed the EP review and revision process provided in Section 5.2.2, prior to acceptance of handover and operatorship of Irwin 1 from Mitsui to Beach.
2020	Beharra Springs Deep 1 well completed. Flowline constructed to tie Beharra Springs Deep 1 into the Gas Production Plant.
2021	Beharra Springs Deep 1 flowline commissioned.
2022	Trigg 1, Trigg North 1, Trigg Northwest 1, Tarantula Deep 1, Redback Deep 1, Beharra Springs Deep 2 and Beharra Springs Deep 3 are planned to be drilled (under separate EP(s)). Future management of the wells during a care and maintenance phase to be covered under this EP. Abandonment of Beharra Springs 1, Beharra Springs 2 and Beharra Springs 4.
2023	Commencement of evaporation Pond 1 re-servicing and refurbishment.
2024	Completion of evaporation Pond 1 re-servicing and refurbishment.

2.3 Activity Description

The Beharra Springs Gas Field collects reservoir fluids from a hydrocarbon column located in the Late Permian Wagina Formation. The collected reservoir fluids are processed by the Gas Production Plant. The processed gas (Sales Gas) exiting the Gas Production Plant is then piped via the Sales Gas Pipeline to the Parmelia Pipeline for transmission to customers in the south-west of WA.

The Facility is comprised of:

- Gas Field, incorporating wells Beharra Springs Deep 1, Beharra Springs 1, Beharra Springs 2, Beharra Springs 3, Beharra Springs 4; Beharra Springs North 1, Tarantula 1 ST1, Redback South 1, Redback 2, Wolf 1 and Irwin-1
- Flowlines, transporting well stream fluids from the producing wells to the Gas Production Plant
- Gas Production Plant which incorporates gas compression, gas pre-treatment, carbon dioxide removal and hydrogen sulphide removal facilities, produced water separation and collection
- Sales Gas Pipeline
- Associated infrastructure including (but not limited to) evaporation pond/s, Condensate Storage and Load Out Facility, Power Generation Plant, storage tanks and accommodation and workshop buildings.

The Facility is designed to operate 365 days per year, 24 hours per day. Operation of the Gas Production Plant is controlled locally. Overall management of the Facility is overseen from the Beach offices, with visits to the site by support staff as required.

2.3.1.1 Chemical Disclosure

Under the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012 operators of petroleum facilities are required to disclose products, additives, chemicals and other substances that may be used by the operator for drilling, hydraulic fracturing or other 'in-wellbore' petroleum related activities.

No such products, additives, chemicals and other substances are currently used for daily in-wellbore activities at the Facility. If any products, chemicals or substances are required to be used in the future, these will be disclosed to the regulator prior to use occurring.

2.4 Overview of Activities

2.4.1 Routine Activities

Routine activities associated with the operation and maintenance of the Facility include:

- gas production plant inspections, monitoring and general maintenance such as repairing or replacing worn or malfunctioning equipment, painting and cleaning equipment
- well site inspections, monitoring, servicing, testing and general maintenance such as repairing or replacing worn or malfunctioning equipment, painting, cleaning equipment and management of waste (e.g., sampling, assessment and disposal of residual cuttings / sludge)
- pipeline inspections, integrity testing and maintenance
- evaporation pond inspections, integrity testing and maintenance (including repair of small tears/defects)
- access road, pipeline/flowline right of way, well lease and production plant lease pad maintenance
- hydrostatic testing of flowlines and pipework (in accordance with relevant Australian Standards, regulatory guidelines and approvals)
- injection of chemicals (at selected wells) to control potential for hydrate formation and to provide corrosion protection of pipelines. Injection occurs at the wellhead into the production fluid stream (not downhole)
- flaring and venting
- fabric maintenance (painting and insulation works)
- completing small modifications to plant and piping that are on a like for like basis
- progressive rehabilitation of construction areas and right of ways
- firebreak and vegetation maintenance
- environmental monitoring and emissions monitoring.

2.4.2 Planned Major Maintenance Activities

In addition to routine activities, planned major maintenance activities are undertaken as required and include:

- well workovers, wireline and intervention
- pigging of the Sales Gas Pipeline and infield flowlines
- shutdown of the Facility for major maintenance campaigns
- removal and replacement of filter and catalyst media within process vessels and equipment
- direct inspection of the Beharra Springs flowlines and sales gas pipeline
- coating repair, maintenance and/or replacement of the Beharra Springs flowlines and sales gas pipeline
- catalyst change outs.

During periods where part or all the Facility is shutdown, routine inspection and maintenance activities will still be undertaken as described in Section 2.4.1.

2.4.3 Non-routine Activities

Non-routine activities associated with the operation and maintenance of the Facility may include:

- installation of new groundwater monitoring bores
- soil sampling
- remediation of contaminated soils
- replacement of evaporation pond liner
- repair and validation of pond liner
- installation of a new flowline
- installing new processes or plant/equipment that is not like for like or routine during plant maintenance and shutdowns
- removal of windblown sand from operational evaporation pond footprint and/or condensate/methanol tank bunded area.

2.5 Decommissioning, Reinstatement and Rehabilitation

Once the Beharra Springs Gas Facility reaches the end of its operational life, Beach Energy will decommission the plant and infrastructure, including associated well field and pipelines, reinstate and

rehabilitate the site. These activities will be conducted under a separate EP that will be provided to DMIRS for acceptance.

The high level reinstatement and rehabilitation objective is to return the land back to a condition that is consistent with the adjacent land and to a condition suitable for the land use at the time of site reinstatement. Specifically, the reinstatement and rehabilitation objectives are to:

- provide a stable soil profile that is similar to the pre-existing land surface and closely resembles the original landform. This includes ensuring that the newly created landform will not erode and will not impede surface water flows
- provide a cover of native plant species that is consistent with the vegetation immediately adjacent to the clearing and that provides for stabilisation of the soil surface and provision of habitat for fauna and flora species, and ensure that weed species cover in the rehabilitated areas is minimised.

2.6 Facility Life and Closure

The estimated remaining operational life of the Facility at current production rates and with current reserves is approximately 10 years. Any changes to production rates or further hydrocarbon discoveries may reduce or extend the operational life of the Facility.

Given the Facility is still in production phase, with at least 10 years of operational life remaining, no detailed decommissioning or closure planning has been completed, and few proposed decommissioning activities for the infrastructure listed in this EP are scheduled to occur within the 5-year in-force period of the EP. Beach Energy will engage with relevant stakeholders prior to the facility "ceasing operations" or entering a care and maintenance phase prior to decommissioning.

At the time of writing the EP, and consistent with recent guidance (DMIRS, 2022), Beach Energy have considered end of field life decommissioning and closure expectations in its current decommissioning, site reinstatement and rehabilitation objectives,

3 Existing Environment

3.1 Regional Landform and Climate

The Facility is in the coastal highlands of the Mid West region of WA within the Lesueur Sandplain subregion of the Geraldton Sandplains Bioregion. The Geraldton Sandplains Bioregion (Interim Biogeographic Regionalisation for Australia, Version 7) is composed mainly of proteaceous scrub-heaths, rich in endemics, on the sandy earths of an extensive, undulating, lateritic sandplain mantling Permian to Cretaceous strata. The region is typically low lying and gently undulating (ANRA, 2008). The Facility relief ranges between 10 m and 50 m AHD.

The regional climate region is classified as dry Mediterranean with cool wet winters and hot dry summers. Mean monthly temperature and rainfall data from the Eneabba meteorological station (008225), which commenced observations during 1964, are presented in Figure 2.

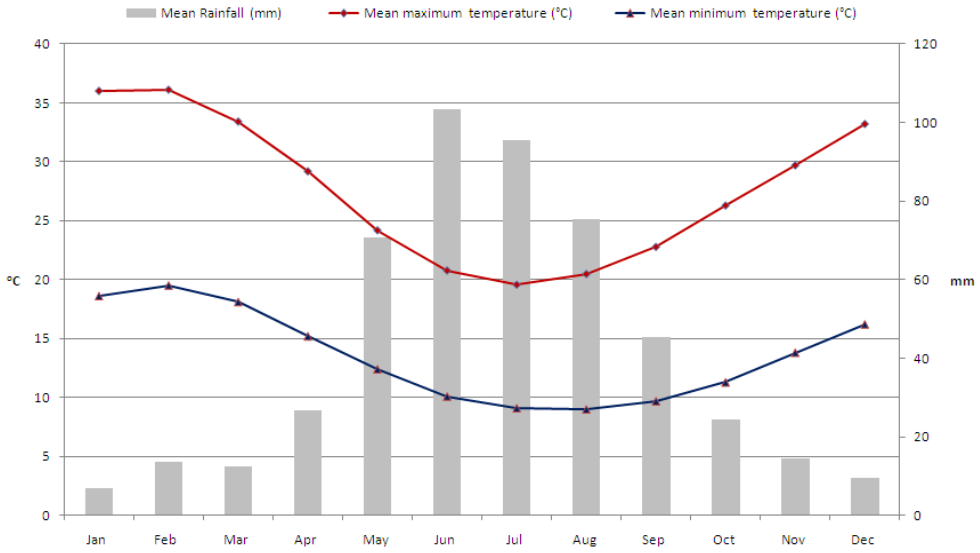

Figure 2: Summary of Meteorological Data for Eneabba

A strong south-west sea breeze is a part of summer weather conditions. The winds arrive between 10:00 am and 12:00 pm and can reach 30 knots. The winds during the winter months are more variable and influenced by the cold fronts coming in from the Indian Ocean (BOM, 2022).

3.2 Geology and Soils

The Facility lies within the sedimentary Perth Basin. This basin lies onshore and offshore, and extends for about 700 km along the southern portion of the west coast of Western Australia. The basin is bounded to the east by the Darling Fault, which extends the full length of the basin. The onshore portion of the basin averages 65 km in width and extends from the southern coast to Geraldton in the north. The dominant feature in the northern section of the Perth Basin is the Dandaragan Trough, in which up to 20 km of sediments have been deposited.

3.2.1 Geomorphology

The Facility is situated in the geomorphic unit 'Eneabba Plain' (Playford *et al.*, 1976). This unit is a low-lying area between the Spearwood Dune System and the Gingin Scarp. The Plain is restricted to the

area north of Cockleshell Gully. The plain consists of a series of shoreline, lagoon and dune deposits of early Pleistocene to possibly late Tertiary age, which locally have high concentrations of heavy minerals. These deposits are associated with a series of low alluvial fans fronting the Gingin Scarp (Playford *et al.* 1976). The streams have ill-defined channels and form ephemeral lakes.

3.2.2 Soils

The Facility is situated in the northern Agricultural Region of West Midlands and the soil-landscape zone is 'Geraldton Coastal' code 221(Schoknecht *et al.*, 2004). This soil landscape zone is characterised by low hills of Tamala limestone and recent calcareous and siliceous dunes with alluvial plains and sand sheets. Soils are mainly shallow and deep sands with some Loamy and Sandy earths.

The soil systems within L11 and EP320 are classified as:

- Tamala South Subsystem 3 (221TA_3): Low hills with relict dunes and some limestone outcrop; Deep and shallow yellow sand over limestone
- Correy 4 Subsystem (221Cy_4): Alluvial fans and dunes outwashed from scarp; pale and yellow deep sands
- Tamala South 7 Subsystem (221Ta_7): Level to gently undulating sandplain; Yellow deep sand.

3.3 Hydrology

3.3.1 Surface Water and Drainage

The Facility is situated in the Arrowsmith River surface water sub-catchment of the West Midlands Region (DoW, 2017). This sub-catchment is 183,326 ha and predominately flows in east to west direction into the Dandaragan Plateau across the Urella Fault. The Arrowsmith Region has a well developed dendritic drainage system which discharges into swamps and lakes of the interdunal depressions of the Eneabba Plain (Earth Tech, 2002).

The closest rivers to the Facility are the Irwin River and the Arrowsmith River. The Irwin River drains the Lockier River, Sand Plain Creek and numerous other smaller and intermittent drainage lines, prior to entering the Indian Ocean at Dongara. The poorly defined drainage lines of the Arrowsmith River flow in a westerly direction to the south of L11 prior to turning north-west to enter the terminal swamps and lakes of the Arrowsmith Lake area.

3.3.2 Groundwater

The larger aquifers located beneath the Arrowsmith Surface catchment Management Zone are the Leederville-Parmelia and Yarragadee Aquifers and the smaller aquifers include the Cattamarra and Eneabba-Lesueur Aquifers which are located west of the catchment (Earth Tech, 2002).

3.3.3 Surficial Aquifer

The groundwater monitoring wells at the gas production plant are installed in the surficial aquifer which is predominately sand. Groundwater monitoring events conducted by ERM and Senversa show standing water levels ranging from 10.99 mbgs and 15.82 mbgs (ERM, 2016; Senversa, 2017 and Senversa, 2018) equivalent to an elevation of between 26.34 to 26.9m AHD.

Historically, minor detectable concentrations of petroleum hydrocarbons have been recorded down gradient of the evaporation ponds (GW5). In April 2017, a detailed site investigation was completed at the Facility (Senversa, 2017) and found:

- groundwater impacts at the site are limited to minor TRH concentrations represented by GW5 (in duplicate sample but not primary or triplicate sample), down gradient of Evaporation Pond 2 and GW11, immediately adjacent to the American Petroleum Institute infrastructure. TRH concentrations in groundwater are deemed unlikely to pose an unacceptable risk to ecological or human receptors at the Site based on (1) comparison with Tier 1 screening criteria, (2) spatial distribution of the monitoring well network confirming the absence of groundwater contamination and (3) broader weight of evidence including consideration of source-receptor pathways under current and ongoing use as an oil and gas plant.

- silica gel clean up analysis has indicated that the hydrocarbons in groundwater at the two locations, comprises polar metabolites derived from the degradation/ weathering of fuels (via sequential oxidative reactions) and/or non-petroleum sources such as vegetable oils and fatty acids. In addition, there is evidence to suggest that natural attenuation of TRH is occurring at the Site via aerobic and anaerobic degradation processes. It is considered likely that nitrate detected above background levels but below Tier 1 screening criteria is contributing to hydrocarbon natural attenuation as a dominant electron acceptor.

3.3.4 Yarragadee Aquifer

The major aquifer which underlies the Facility is the Yarragadee Aquifer. The formation is multi-layered with groundwater occurring within beds of fine to course-grained sandstone confined between thick sequences of shale and siltstone. The water table is fairly deep ranging up to as much as 150 m below the surface. The water table comes to the ground surface in the Hill River valley where the aquifer is artesian around Hill River Spring. Springs, swamps and lakes such as Beharra Spring are areas of evaporative discharge (Earth Tech, 2002).

3.3.5 Superficial Aquifer

The superficial aquifer on the Swan Coastal Plain consists of Quaternary and late Tertiary sediments which extend from Geraldton in the north to Busselton in the south. There are several principal formations within this aquifer including the Tamala Limestone. The aquifer consists mainly of quartz sands, calcareous sands and limestone in the Tamala Limestone. The groundwater level is close to the surface in the south and in the centre but may be as much as 60 m below the surface, below the crests of the Tamala Limestone dunes along the coast. The average salinity is 4,224 mg/L and is hypersaline underneath the coastal lakes in the Perth area. The aquifer is developed for the Perth water supply but it is not a significant aquifer in the Dongara to Geraldton area where the groundwater salinity is generally non-potable (ANRA, 2008).

Shallow groundwater lenses are located within the Tamala Limestone forming an unconfined aquifer in which the groundwater in mainly recharged from local rainfall (IRC Environment, 2004).

3.4 Vegetation

The vegetation system present in the Beharra Springs area is the Eridoon system. A vegetation system consists of a particular series of plant communities recurring in sequence and mosaic pattern linked to topographical, pedological and /or geological features (Beard, 1976).

The Eridoon system occupies "a flat coastal plain between the coastal limestone deposits and the Pleistocene shoreline". On the plains and slopes of dunes the vegetation consists of scattered *Eucalyptus todtiana* and other small trees, an open layer of tall shrubs and a closed heath layer of small shrubs, usually dominated by *Conospermum spp.* On the sandhills the tree layer disappears and *Banksia hookeriana* and *Xylomelum angustifolium* become dominant. In winter wet depressions, the height of the heath reduces to 30 cm with scattered *Xanthorrhoea spp*., while in wet areas *Melaleuca thyoides* and *Melaleuca lanceolata* to *Melaleuca rhaphiophylla* dominate. Occasionally these areas also have *Casuarina obesa* and *Eucalyptus camaldulensis* (Beard, 1976).

3.4.1 Environmentally Sensitive Areas

The nearest designated ESA is located approximately 6.5 km to the South of the Facility that is associated with the EPA Redbook Recommended Conservation Reserves.

The nearest Threatened species *Paracaleana dixonii* (WA rank – Vulnerable [VU]) is approximately 2.6 km south-east of the Redback South 1 well.

3.4.2 Ecological Communities

The dominant vegetation communities within L11 are described below (WEC, 2009a). Several other woodland and thicket communities are also present:

- Floristic community type (FCT) 4a – Species rich Woodlands and Heaths on grey sand in the eastern portion of the Eneabba sandplain. Common species in FCT 4a include *Conospermum boreale* subsp. *boreale*, *Ecdeiocolea monostachya*, *Eremaea beaufortioides*, *Hakea polyanthema* (P3) and *Banksia candolleana*

- FCT 3b – Low Woodland to Thicket of Banksia attenuata and B. menziesii over mixed shrubs dominated by myrtaceous species on brown or yellow sand on lower to mid slopes and plains.

Five threatened and two priority ecological communities occur in the Geraldton Sandplains Bioregion as listed below. None of these endangered ecological communities are known to occur within L11. No ecological communities listed under the Environment Protection and Biodiversity Conservation Act (EPBC Act) occur within the region.

3.4.3 Significant Flora Species

3.4.3.1 Threatened Flora

A search of previously conducted ecological surveys and the Department of Biodiversity, Conservation and Attractions's (DBCA) NatureMap database (accessed 25 October 2017) for a 10 km buffer around the gas production facility returned records for two Threatened species:

- *Calectasia cyanea* (Blue Tinsel Lily) WA rank – Critically Endangered [CR])

- *Paracaleana dixonii* (WA rank – VU)

Recent site surveys and rehabilitation inspections undertaken by Mattiske (2017, 2018 and 2021) did not identify any Threatened at new well sites or at sites undergoing rehabilitation.

An EPBC Protected Matters Search Tool (PMST) report for a 10 km buffer around the gas production facility identified additional threatened plant species which may occur or are likely to occur. These species are also listed in Table 2.

3.4.4 Priority Flora

A search of previously conducted ecological surveys and the NatureMap database (accessed 25 October 2017) for a 10 km buffer around the Gas Production Facility provided records for 28 priority flora, as listed in Table 2.

Table 2: Significant Flora Species Known or with Potential to Occur within the Beharra Springs Gas Facility

Species	**Conservation Status**	
	Federal	**WA**
Recorded within a 10 km radius of the Gas Production Plant (NatureMap, 2017 or site surveys)		
Calectasia cyanea	CR	T
Paracaleana dixonii	EN	T
Lasiopetalum ogilvieanum		P1
Stylidium carnosum subsp. narrow leaves (J.A. Wege 490)		P1
Verticordia luteola var. rosea		P1
Acacia vittata		P2
Calectasia palustris		P2
Comesperma griffinii		P2
Comesperma rhadinocarpum		P2
Persoonia filiformis		P2
Schoenus sp. *Eneabba* (F.Obbens & C. Godden I154)		P2
Banksia fraseri var. crebra		P3
Beyeria gardneri		P3
Eremaea acutifolia		P3
Guichenotia alba		P3
Hemiandra sp. Eneabba (H. Demarz 3687)		P3
Hypocalymma gardneri	EN	P3
Mesomelaena stygia subsp.deflexa		P3
Persoonia chapmaniana		P3
Persoonia rudis		P3
Stylidium drummondianum		P3
Verticordia luteola var. luteola		P3
Banksia elegans		P4
Banksia scabrella		P4
Calytrix chrysantha		P4

Species	Conservation Status	
	Federal	**WA**
Eucalyptus macrocarpa subsp. elachantha		P4
Eucalyptus zopherophloia		P4
Stawellia dimorphantha		P4
Schoenus griffinianus		P4
Thysanotus glaucus		P4
Potential to occur within a 10 km radius of the Gas Production Plant (EPBC protected matters search)		
Andersonia gracilis	EN	T
Conostylis dielsii subsp. teres	EN	T
Conostylis micrantha	EN	T
Daviesia speciosa	EN	T
Eucalyptus crispata	VU	T
Eucalyptus leprophloia	EN	T
Hemiandra gardneri	EN	T
Leucopogon obtectus	EN	T
Paraceleana dixonii	EN	T
Thelymitra stellata	EN	T
Wurmbea tubulosa	EN	T

3.5 Weeds and Pathogens

The surveys undertaken (Hart, Simpson and Associates, 2000; WEC, 2004a; Mattiske, 2017) have recorded four weeds within the Facility being the South African marigold (*Ursinia anthemoides*), Capeweed (*Arctotheca calendula*), Paterson's curse (*Echium plantagineum*) and Smooth catsear (*Hypochaeris glabra*). Of these four weed species, only one, Paterson's curse, is a declared pest under the *Biosecurity and Agriculture Management Act 2007* (DPIRD, 2017).

Surveys undertaken at the Facility in 2018 and 2021 (Mattiske, 2018a and 2021) identified a number of introduced species as being recorded within 10 km of the facility:

- Stinkwort (*Dittrichia graveolens*)
- Pimpernel (*Lysimachia arvensis*)
- Common Sowthistle (*Sonchus oleraceus*)
- Strawberry Clover (*Trifolium fragiferum*)
- Cape Bluebell (*Wahlenbergia capensis*)
- Zed weed (*Zaluzianskya divaricata*)
- Maltese Cockspur (*Centaurea melitensis*),

- *Centaurium tenuiflorum*,
- Strapwort (*Corrigiola litoralis*),
- Waterbuttons (*Cotula coronopifolia*),
- Geraldton Carnation Weed (*Euphorbia terracina*),
- Small Goosegrass (*Galium murale*)
- Black Berry Nightshade (*Solanum nigrum*)

None of these species are declared pest organisms pursuant to section 22 of the BAM Act (DPIRD, 2017), or listed as Weeds of National Significance (WONS).

Previous PMST reports have identified three weeds of national significance (WONS) as likely to occur within 10 km radius of the Gas Production Plant being: A*sparagus asparagoides* (Bridal creeper)*; Lycium ferocissimum* (African Boxthorn, Boxthorn)*;* and *Tamarix aphylla* (Athel Pine, Athel tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar).

Dieback (*Phytophthora cinnamomi*) infestations, a soil borne pathogen, have been recorded in the wider area but not within the vicinity of the Gas Production Plant and Gas Field. One infestation is located on private property and the other is in a gravel pit at the end of Mt Adams Road (HSA, 2003a). The environmental conditions surrounding the Facility such as low rainfall, sandy calcareous soils which provide good water drainage and unsuitable pH reduces the risk of dieback infestation.

3.6 Fauna

3.6.1.1 Significant Fauna Species

A search of previously conducted fauna surveys and the DBCA Nature Map database (2017) for a 10 km buffer around the Gas Production Plant returned records for one threatened and one priority fauna species as listed in Table 3 below.

The EPBC Act PMST (2022) conducted for the Facility identified four listed threatened species (3 birds and 1 mammal) and two listed migratory species as known or likely to occur within a 10 km buffer around the Gas Production Plant. The results of this search are summarised in Table 3 below.

Table 3 Significant Fauna Species Known or Likely to Occur within 10 km of the Beharra Springs Facility

Species	**Conservation Status**	
	Federal	**WA**
Recorded within a 10 km radius of the Gas Production Plant (NatureMap, 2017)		
Calyptorhynchus latirostris (Carnaby's Black-Cockatoo)	EN	EN
Notamacropus irma (Western Brush Wallaby)		P4
Potential to occur within a 10 km radius of the Gas Production Plant (EPBC protected matters search)		
Listed Threatened Birds		
Zana latirostris listed as *Calyptorhynchus latirostris* (Carnaby's Black-Cockatoo, Short-billed Black-cockatoo)	EN	EN

Species	Conservation Status	
	Federal	**WA**
Falco hypoleucos (Grey Falcon)	VU	VU
Leipoa ocellata (Malleefowl)	VU, MI	VU
Listed Threatened Mammals		
Dasyurus geoffroii (Western Quoll)	VU	VU
Listed Migratory Birds		
Apus pacificus (Fork-tailed Swift)	MI	MI
Pandion haliaetus	MI	

The ecological survey undertaken by Hart, Simpson and Associates (2000) noted that the area provides a relatively simple fauna habitat of a low but dense and diverse heath dominated by shrubs of the *Proteaceae, Myrtaceae* and *Epacridaceae* and perennial herbs such as sedges. There are a few small emergent trees but due to frequent fires there are almost no logs or tree hollows.

3.7 Socio-economic Environment

3.7.1 Land Use and Economic Environment

The major land uses in the region are grazing of native pastures in the north and in the south a mixture of grazing and cropping of cereals. The areas surrounding the Facility are favoured areas for honey production and wildflower picking. While commercial flower harvesting is not permitted within nature reserves and national parks, there are extensive areas surrounding the Yardanogo Nature Reserve where this occurs. The favoured species are the Acorn (or Hooker's) and Banksia (*Banksia hookeriana*), with picking taking place from June to September (DBCA, 2018).

Oil and gas exploration and production has occurred extensively in the area. These receptors are not considered overly sensitive to the emissions and discharges associated with the BSGF. There are no residential premises within 15 km of the BSGF. Consequently, Oil and Gas facilities have been identified as the closest receptor to the facility thus are the focus of interactions under the EP.

In addition to oil and gas, the industries contributing to the economic development of the Shire include mineral sands, Rock Lobster and aquaculture (abalone), olive growing and production and general farming.

3.8 Natural Heritage

One nominated Natural Heritage Property, the Beekeepers-Lesueur-Coomallo Area and Nambung National Park, is within a 10 km radius of the Gas Production Plant, but outside of L11. The nominated status indicates that the Australian Government has prepared a nomination for the property and presented it to the World Heritage Committee for assessment. The property is under assessment by the World Heritage Committee and its associated professional organisations.

The basis of the nomination is that the complex sand plain or heath shrub vegetation within the property has plant species richness unequalled by most other vegetation types in the world, except the fynbos of southern Africa and some tropical rainforests.

One nature reserve listed on the Register of the National Estate, the Arrowsmith Lake Area, is within a 10 km radius of the Gas Production Plant.

The Yardanogo Nature Reserve, which is not listed on the Register of the National Estate, intersects L11.

3.9 Indigenous and Non-Indigenous Cultural Heritage

No cultural heritage sites listed on the Register of the National Estate occur within L11 (DPLH, 2017).

3.9.1 Native Title

A search of the National Native Title Tribunal database (http://www.ntv.nntt.gov.au/ntv.asp) on 05 September 2019 reveals one accepted registered Native Title Claim relevant to the Facility being the Southern Yamatiji People application (WC2017/002).

3.9.2 Ethnology

In April, May and November 2001, an ethnographic survey was completed for the area associated with the Hibbertia 3D and Ularino 2D seismic programs which included the Facility.

The ethnographic survey involved searches of ethnographic databases, consultation with the relevant Aboriginal community and field survey. Consultation revealed that the Ejarno Spring (10 km north north-west of the project area) and the chain of smaller springs stretching southward to the Beharra Spring are places of Aboriginal significance to the Moore River (Mogumber) group (O'Connor, 2001).

An Aboriginal heritage survey of the Irwin-1 well site was conducted in May 2014 (R&E O'Conner Pty Ltd, 2014). The survey concluded that there were no Aboriginal heritage sites within or in close proximity to the drilling targets.

3.9.3 Archaeology

Previous archaeological studies within petroleum production licence L11 by Quartermaine Consultants involved searches of the state Aboriginal archaeological site register (maintained by the Department of Indigenous Affairs, DIA) and field surveys.

No Aboriginal archaeological sites were recorded within petroleum production licence L11.

4 Environmental Management Strategies

A risk assessment of the aspects that will and may occur during operations was undertaken using Beaches risk assessment methodology which follows Australian Standard AS/NZS ISO 31000:2009: Risk management – Principles and guidelines. Hazards and their associated aspects and their associated management and mitigation measures are detailed below in Table 4.

Table 4: Summary of Environmental Hazards and their associated Aspects and Management and Mitigation Measures

Aspect	Hazard	Management and Mitigation Measures
Physical Interaction – Soil and Vegetation	• Spread non-indigenous species (weed / pathogens) • Unintentional clearing of native vegetation • Damage heritage sites / artefacts • Inadequate site reinstatement	• Demarcation of clearing area • Soil (and vegetation stockpiling) • Construction fill verified as having low weed / dieback risk • Weed / dieback management requirements • Ongoing Weed Management • Native Vegetation Clearing Permit (NVCP) • Consultation • Heritage artefact identification procedure
Atmospheric Emissions	• Disturbance to sensitive fauna / relevant stakeholders • Climate Change	• Planned emissions are monitored and reported • Complaints Management System • NGERS reporting
Extraction of Groundwater	• Damage to vegetation due to drawdown of shallow groundwater	• Ground water licences • Meter calibration and monitoring
Physical Interaction – Fauna	• Injury or fatality to terrestrial fauna	• Fauna exclusion and egress • Speed limits
Fire	• habitat and vegetation loss, • fauna injury / fatality • contamination (in the event petroleum facilities are damaged)	• Hot works exemption • Permit to Work (PTW) • Fire Detection System • Emergency Response Plan • Fire breaks
Erosion / Contamination from Surface Water	• Unplanned disturbance to vegetation / soil contamination	• Health, Safety and Environment (HSE) Inspection • Evaporation Pond Design • Monitoring of Rehabilitation
Accidental Release – Liquid and Solid Waste	• Environmental pollution and fauna attraction and/or injury (solid waste)	• Appropriate rubbish bins and waste segregation • Appropriately licensed waste contractor

Aspect	Hazard	Management and Mitigation Measures
	• Environmental pollution and contamination of soil / groundwater (liquid waste)	• Waste Register • Soil sampling
Accidental Release – Asset Integrity	• Contamination of soil / groundwater • Contamination and subsequent toxic effects to vegetation and fauna • Contamination of surface waters	• Well Management Plan (WMP) • Pipeline Integrity Management Plan • Safety Management System (SMS) • Bulk storage tank certification • Secondary containment requirements for chemical and hazardous liquid materials • Hydrostatic testing • Groundwater monitoring • Inspection • Evaporation Pond Integrity Testing • Oil Spill Contingency Plan • Emergency Response Plan
Accidental Release – Hydrocarbon Release During Transfer	• Contamination of soil / groundwater • Contamination and subsequent toxic effects to vegetation and fauna • Contamination of surface waters	• Bulk transfer procedure • On-site vehicle / equipment refuelling procedure • Groundwater monitoring • Oil Spill Contingency Plan • Emergency Response Plan
Accidental Release – Hydrocarbon/Chemical Handling and Storage	• Contamination of soil / groundwater • Contamination of surface waters	• Secondary containment requirements for chemical and hazardous liquid materials • Transport of Dangerous Goods • Groundwater monitoring • Oil Spill Contingency Plan • Emergency Response Plan

5 Implementation Strategy

To meet the requirements of Regulation 15(1) of the Petroleum and Geothermal Energy Resources (Environment) Regulations 2012, Implementation Strategy for the EP, this Section describes the implementation strategy – the systems, practices, and procedures used to ensure that the environmental impacts and risks of the activities are continuously reduced to 'As Low As Reasonably Practicable' (ALARP), and the environmental performance objectives and standards detailed in the EP are achieved.

5.1 Management System Overview

The Beach Energy company-wide Operations Excellence Management System (OEMS) and is comprised of three tiers of documentation as follows:

- **Health & Safety, Environment and Risk Management Policies** – Defines the strategic objectives for the effective control of and continuing improvement to health, safety, and environmental issues throughout operations

- **OEMS Elements** – The OEMS is comprised of 11 Elements which interpret, support and detail the intent and performance requirements of the Policies and form the basis for development and application of the OEMS Standards implemented throughout the organisation

- **OEMS Standards -** The 30 OEMS Standards detail minimum requirements, the responsibilities and the business guidance that is needed to implement the Policies and inform ongoing development of site specific processes and procedures. A Standard is either implemented as the guiding document or (where further information about the implementation process is required at a Divisional or Business level) or a regional or site specific procedure is developed to detail application of the Standard. It should be noted, that as the OEMS encompasses business requirements outside of health and safety requirements, this document refers to the relevant standards specific to HSE topics. It should be noted, that not all the OEMS Standards are explicitly relied upon for control of HSE risks as they are intended to cover some core business processes.

- Asset level procedures.

An OEMS Manual (CDN/ID 18985300) has been developed that links these tiers of documentation and site-specific procedures that are in place to manage potential impacts and risks for the Facility to ALARP.

5.2 Monitoring

Key monitoring and inspections undertaken at the Facility to ensure effective environmental management and early detection of any detrimental impacts to environmental values are:

- Groundwater monitoring of eleven bores located at the Facility, in accordance with the Environmental Licence L8385/2009 (administered by the Department of Water and Environmental Regulation [DWER]) and the Groundwater Monitoring Plan for the Beharra Springs Gas Facility

- Rehabilitation monitoring of disturbed areas in accordance with relevant clearing permits

- Area based routine inspections (Self Area Management – SAM - checklists).

5.2.1 Emissions and Discharges

The atmospheric emissions and discharges are calculated given the low risk to environment. Calculated emissions are reported under the requirements of the *National Greenhouse and Energy Reporting Act 2007* (NGER Act), the National Pollutant Inventory (NPI), the Environmental Licence (L8385/2009) and Section 5.2 of this EP summary.

Monitoring of any unplanned or non-routine emissions and/or discharges (e.g., release from evaporation pond) will be managed as part of the incident management or emergency response procedures, or if identified during the risk assessment process (either as a control measure or risk treatment plan).

5.2.2 Review

5.2.2.1 Revision and Approval of the EP

The Petroleum and Geothermal Energy Resources (Environment) Regulations 2012 and the Petroleum Pipelines (Environment) Regulations 2012 requires that a revision of the EP is submitted for approval:

- before the commencement of (Regulation 18(1)):
    - any new activity or
    - any significant modification of, significant change in, or significant new stage of, an existing activity that is not provided for in the EP
- before or as soon as practicable after (Regulation 18(2)):
    - a change in the instrument holder for, or operator of the activity or
    - the occurrence of any (or series of) new or significant increase in an existing environmental impact or risk.
- At the direction of the Minister (Regulation 19)
- At least 14 days before the end of each 5-year period (Regulation 20).

The most appropriate form for a revision (e.g., revised EP, bridging document or written notification) will be chosen based on consultation with key regulatory stakeholders (e.g., DMIRS) and DMIRS guidance.

5.3 Consultation

Minimising and mitigating the potential impacts associated with the Facility is assisted by the engagement of key stakeholders (including relevant authorities, interested persons and organisations) to ensure all issues are identified and addressed. Consultation has been undertaken with the relevant stakeholders to address the relevant issues and implement the required management measures.

Key stakeholders for the Facility and the types of consultation undertaken are summarised in Table 5. Given the remote nature of the Facility and the surrounding land is typically unallocated crown land and reserves, the identified stakeholders tenure consists of key regulatory authorities, and operational companies within the area that are either directly impacted by operations.

Table 5: Identified stakeholders for the Facility

Stakeholder	Location	Contact type
Tronox	Coolgaroo Mine – Brand Highway	Regular discussions regarding access and activity on tenure
AWE	Pye Road and Brand Highway	Regular discussions regarding process and activity on tenure – JV partner
DMIRS - Safety	Perth	Scheduled meetings/Reporting
DMIRS - Environment	Perth	Site updates/Reporting
DMIRS - Tenures	Perth	Licence updates
DWER	Perth	Site updates/Reporting
DWER	Geraldton	Site updates/Reporting
Shire of Irwin	Dongara	Site updates/Reporting
DFES	Dongara	Site updates

Beach will continue to engage with identified key stakeholders throughout the operational life of the Facility.

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7 Document information and history

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Document history

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0	01/09/2020	Issued for use	-	-	John Peel
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