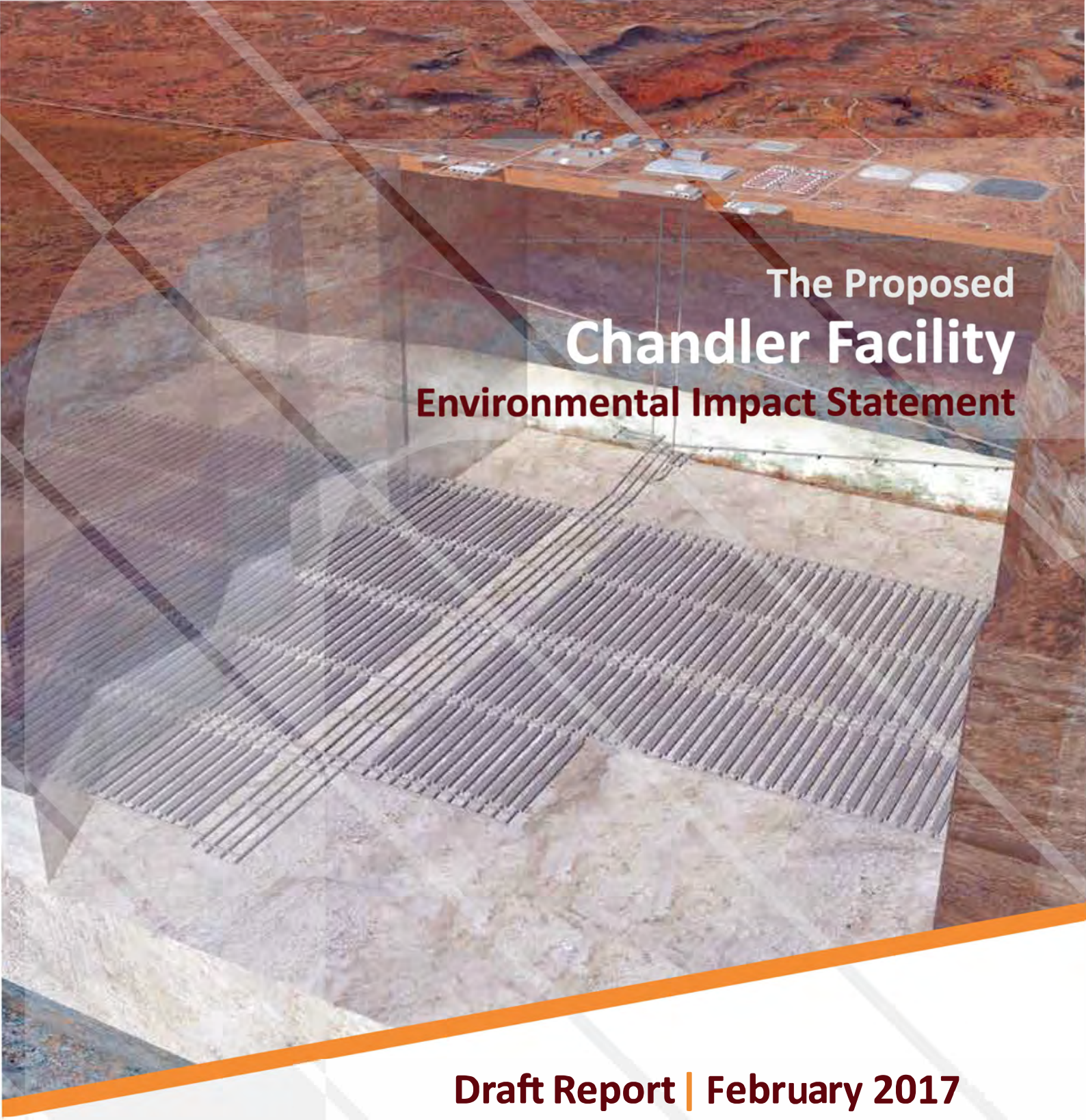


The Proposed
Chandler Facility
Environmental Impact Statement

Draft Report | February 2017

Part I

TELLUS

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CERTIFICATION

Submission of Environmental Impact Assessment

Prepared under Part 3 Sections 18, 18A, 20 and 20A of the *Environment Protection Biodiversity Conservation Act 1999,* under the Northern Territory *Environmental Assessment Act*.

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In respect of: **Project to which the *Environmental Assessment Act* applies**	The Chandler Proposal
Applicant name:	Tellus Holdings Ltd
Applicant address:	Suite 2 Level 10, 151 Castlereagh Street Sydney, NSW 2000
Land to which the proposal seeks approval:	Northern Territory Portion 657 and 810
Environment assessment:	An Environmental Impact Statement is attached
Certificate	I certify that I have prepared the contents of this document and to the best of my knowledge: • It is in accordance with the requirements of the *Environmental Assessment Act* and Environmental Assessment Regulations and Administrative Procedures. • It contains all available information that is relevant to the Environmental Assessment of the proposed development to which it relates. • The information contained in the document is neither false nor misleading.

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ACKNOWLEDGEMENTS

Tellus wishes to thank various community and environment groups, individuals, businesses representatives and government agencies who provided information and dedicated time to discussions that assisted in the preparation of this Environmental Impact Statement.

The study team also wishes to thank all of those who participated in consultation activities conducted during the preparation of the Environmental Impact Statement by email, phone, letter and face to face discussions.

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21	Justification	Tellus Holdings Ltd
22	Conclusion	Tellus Holdings Ltd
23	References	Tellus Holdings Ltd

NOTES ON THE TEXT

Would/will

A determination of the Proposal will only be made after the Environmental Impact Statement has been on public exhibition and submissions considered, the future conditional tense is used throughout this document when describing the Proposal and assessing impacts. The word "would" is therefore used throughout this text in preference to "will".

If all approvals are given for the Proposal to proceed, all "would" references should be interpreted as "will".

The Proposal

The "Chandler Proposal" includes the construction and operation of the proposed Chandler Facility and Apirnta Facility. It also includes the construction and operation of the proposed Chandler Haul Road and Henbury Access Road.

Proposal description

Development and design of the Proposal remains ongoing throughout the preparation of a Bankable Feasibility Study supported by detailed design. Where detailed figures are provided, they represent the conditions assessed as a *'reasonable worst case'* or are provided as estimates where the nature of the chapter supports this.

Where more precise figures are included, for example, in the impact assessment chapters, the purposes of a modelling exercise, they should be taken as more accurate than those provided in the Proposal description.

Whilst these figures remain subject to change throughout the detailed design, any changes are not expected to materially affect the outcome of the environmental impact assessment which is based on a realistic worst case.

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ABBREVIATIONS

AADT	Annual Average Daily Traffic
AAPA	Aboriginal Areas Protection Authority
ABS	Australian Bureau of Statistics
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council guidelines for fresh and marine water quality 2000
ARI	Average recurrence interval
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AS/NZS	Australia and New Zealand Standards
AusRivAs	Australian Rivers Assessment System
AWS	Automatic Weather Station
BFMP	Bushfire Management Plan
BMP	Biodiversity Management Plan
BoM	Bureau of Meteorology
bgl	below ground level
bsl	below sea level
CEC	Cation Exchange Capacity
CHMP	Cultural Heritage Management Plan
CLC	Central Land Council
cm	Centimetre
CO_2	Carbon dioxide
COD	Chemical oxygen demand
DIDO	Drive-in Drive-out
DLPE	Department of Lands Planning and the Environment

DME	Department of Mines and Energy
DO	Dissolved oxygen
DoE	Department of Environment
DoI	Department of Infrastructure
DoT	Department of Transport
EA Act	*Environmental Assessment Act*
EC	Electrical conductivity
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EL	Exploration Licence
EMP	Environmental Management Plan
EOP	Environmental Offset Policy
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPBC Regulation	Environment Protection and Biodiversity Conservation Regulations 2000
ERA	Environmental Risk Assessment
ESD	Ecologically Sustainable Development
EV's	Environmental Values
FIFO	Fly-in Fly-out
FTE	Full Time Equivalent
GHG	Greenhouse Gas
GIS	Geographical Information System
GL	Gigalitres
ha	hectare
ILUA	Indigenous Land Use Agreement
JORC	Joint Ore Reserves Committee

kL	Kilolitres
km	Kilometre
km^2	square kilometres
km/h	Kilometres per hour
km	kilometre
ktpa	Kilo tonnes per annum
L	Litre
LGA	Local Government Area
LoM	Life of Mine
LoS	Level of Service
m	metre
m^2	square metres
m/s	metres per second
m^3/s	cubic metres per second
m^3	cubic metres
MCC	Main Control Centre
MIA	Mine Infrastructure Area
Mitigation	Measures taken to avoid, reduce or limit the significance of adverse environmental impacts
mg	milligram
ML	Mega litres
MLA	Mining Lease Application
mm	millimetres
MMA	Mining Management Act
MMP	Mining Management Plan
MNES	Matters of National Environmental Significance

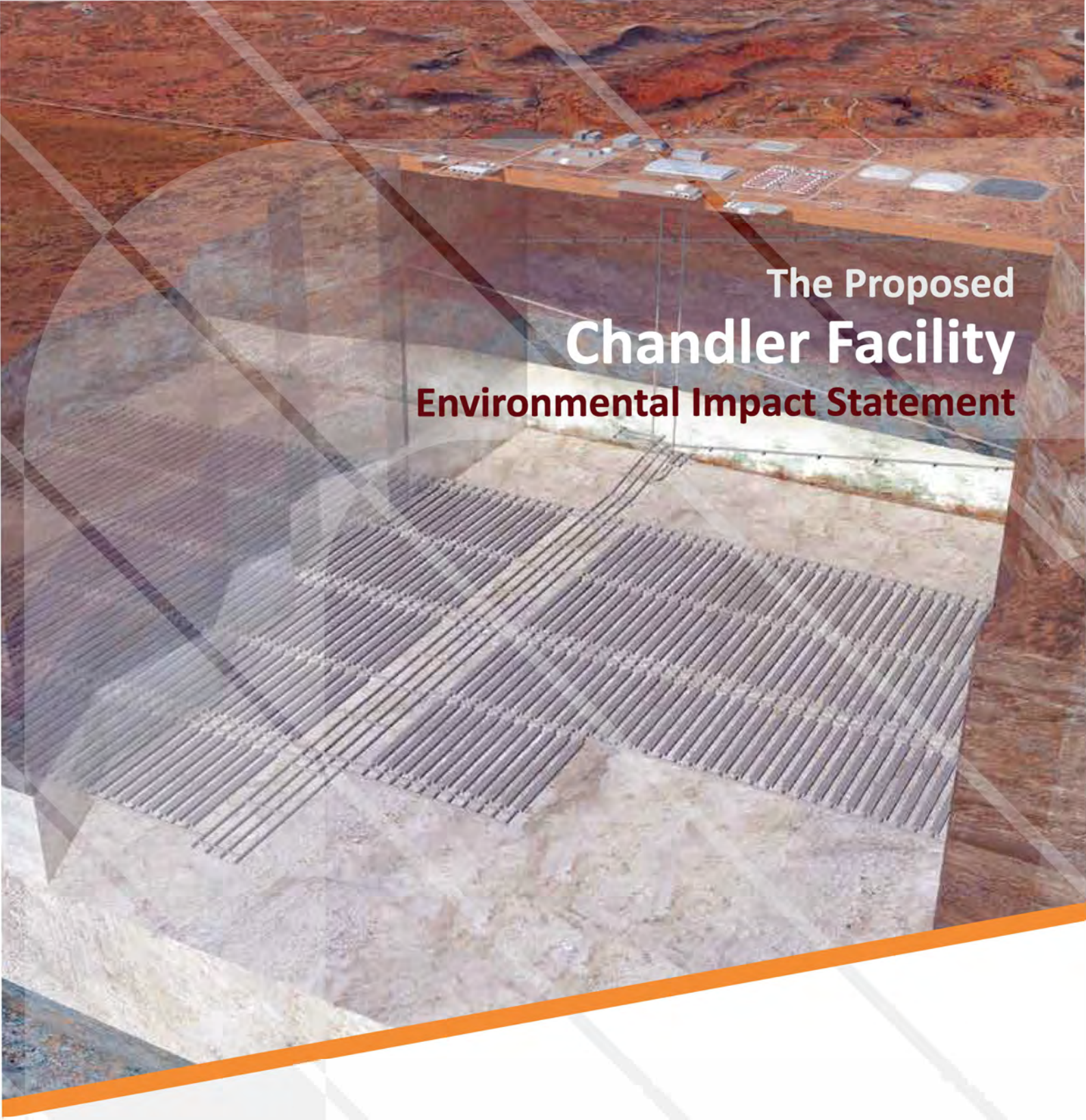
MSDS	Material Safety Data Sheet
MTA	Minerals Title Act
MWh	Megawatt hour
NEPM	National Environmental Protection Measures
NES	National Environmental Significance
NoI	Notice of Intent
NPI	National Pollution Inventory
NT	Northern Territory
NTU	Nephelometric Turbidity Units
NWQMS	National Water Quality Management Strategy
%	percent
p.a.	per annum
PFS	Pre-Feasibility Study
PHA	Preliminary Hazard Analysis
PM_{10}	Particulate matter less than 10 µm
$PM_{2.5}$	Particulate matter less than 2.5 µm
PMF	Probable Maximum Flood
RMP	Risk Management Plan
RCP	Rehabilitation Closure Plan
RoM	Run of Mine
SEMP	Sediment and Erosion Management Plan
SWL	Standing Water Level
t	tonne
TAFE	Technical and Further Education
TDS	Total Dissolved Solids
TEC	Threatened Ecological Communities

Tellus	Tellus Holdings Ltd
ToR	Terms of Reference
tpa	Tonnes per annum
TSP	Total suspended particulates
TSS	Total suspended solids
µg	microgram
µS	micro Siemens
VOIP	Voice Over Internet Protocol
WAC	Waste Acceptance Criteria
WAP	Waste Acceptance Procedure
WHS	*Work Health Safety Act* (NT)
WMP	Water Management Plan
WMP	Waste Management Plan
WMPC Act	*Waste Management Pollution Control Act* (NT)
WZG	Waste Zoning Guide

GLOSSARY

Bilateral assessment	The assessment and approval of a proposed development under both Federal and Territory Governments.
Competent person	A person assessed as competent by the site general manager for the tasks they shall perform and who has acquired, through training, qualification or experience or a combination of those things, the knowledge and skills required to perform the required task competently.
Deep Geological Repository	A deep salt facility used to permanently isolate waste. The geological barrier provides permanent isolation of wastes from the environment over the very long term in accordance with Environmentally Sound Management principles and also creates additional opportunities for the future recovery and recycling of valuable materials from the waste which can re-enter the circular economy.
Development envelope	The spatial extent set for the impact assessment of the Proposal. The development envelope is an area larger than the area required for construction and operation. This approach allows for inevitable changes in Proposal design, particularly during detailed design.
Emission	The release of material into the environment (such as dust or gas).
Greenhouse gases	Gases that accumulate within the Earth's atmosphere (e.g. primarily carbon dioxide and methane) which contribute to global climatic change/global warming (i.e. the 'greenhouse effect').
Hazardous substance	A chemical, substance or material used in the workplace, which has the potential to cause injury or have an adverse effect on a person's health. Hazardous substances are listed in the Code of Practice for Managing Risks of Hazardous Chemicals in the Workplace (Appendix C) and are classified only on the basis of immediate or long term health effects.
Hierarchy of controls	A defined order which is based on effectiveness for implementing controls to mitigate risk (e.g. elimination, substitution, isolation, engineering, administration and personal protective equipment).
Risk	A function of the likelihood and severity of an impact (positive or negative) on public health, safety or the environment.
The Apirnta Facility	The temporary storage and transfer facility for waste materials.

The Chandler Facility	The Chandler salt mine and waste storage and isolation Facility.
The Proposal	The proposed Chandler Facility and Apirnta Facility and all internal access and haul roads.
Waste Acceptance Criteria	The criteria that will be applied for the exclusion or acceptance of certain types of wastes and the requirement for suitable packaging of wastes.



The Proposed

Chandler Facility

Environmental Impact Statement

Executive Summary

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EXECUTIVE SUMMARY

Introduction

Tellus Holdings Ltd (Tellus) propose to construct and operate an underground rock salt mine and complementary storage, recovery and permanent isolation facility (herein referred to as the 'Chandler Facility'). A rail siding and temporary storage and transfer facility (herein referred to as the 'Apirnta Facility') is also proposed. A private haul road linking the two facilities (herein referred to as the 'Chandler Haul Road') would be constructed. A private access road (herein referred to as 'Henbury Access Road'), would be constructed to link the Apirnta Facility with the Stuart Highway. Collectively, the two proposed facilities, the haul and access roads, are referred to as 'the Proposal'.

If approved, the Chandler Facility and the majority of the Chandler Haul Road would be located within a pastoral lease (Maryvale Station). The proposed site approximately 120 kilometres south of Alice Springs and about 25 kilometres by road from the community of Titjikala in the Northern Territory (NT) (refer to Figure ES-1). The Apirnta Facility, Henbury Access Road and a portion of the Chandler Haul Road would be located to the west of the proposed Chandler Facility, also on a pastoral lease (the Henbury Station).

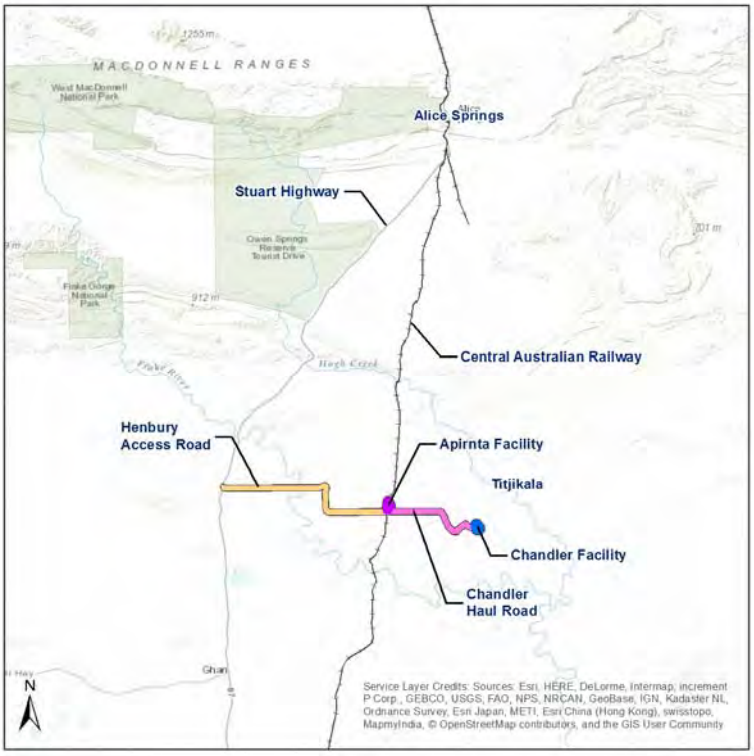


Figure ES-1 Location of the Proposal

This Environmental Impact Statement (EIS) has been prepared by Tellus to support key approvals under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the NT *Mining Management Act* (MM Act), the NT *Environmental Assessment Act* (EA Act) and the NT *Waste Management Pollution Control Act* (WMPC Act) for the construction, operation, and closure and rehabilitation of the Proposal. The EIS has been prepared to address the requirements set out in the *Terms of Reference for the Preparation of an Environmental Impact Statement – Chandler Salt Mine* (the 'Terms of Reference') issued by the NT Environment Protection Authority (NT EPA) on 23 September, 2016, under the EA Act.

The proponent

Tellus is the proponent for the Proposal. Tellus is an infrastructure development company in the business of creating economic, social and environmental value from waste, clay and salt resources. This dual revenue model involves mining the commodities rock salt and kaolin clay in thick dry remote beds which creates world's best practice geological repositories. The voids created by mining are then used to store equipment, archives or waste using a multi barrier system as part of an overall safety case.

Tellus plan to permanently isolate hazardous waste using environmentally sound management principles that protect the environment and human health. Tellus also supports the circular economy using long term storage by placing like-with-like materials for operational safety reasons and to create opportunities for the future recovery of valuable materials.

Tellus' business model mirrors international solutions operating in the United Kingdom, Europe and North America. Tellus is developing the proposed Chandler Facility in the NT (which has been awarded Major Project Status by the NT Government) and also the proposed Sandy Ridge Facility in Western Australia.

The company details are as follows:

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The key contact for the EIS is:

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Email: info@tellusholdings.com
Office: +61 2 8257 3395

Further information regarding the proponent is provided on their website at the following address: www.tellusholdings.com.au

Proposal need

The viability of the proposed Chandler Facility would rely on implementing both aspects of the dual revenue Proposal:

- The salt business.
- The equipment and archives storage business and waste storage, recovery and permanent isolation business in a deep (850 metre) geological repository.

Salt

Salt, or sodium chloride, is a mineral that naturally occurs in our seas and in underground deposits. There are three ways in which salt can be harvested (1) via solar evaporation (2) solution mining and (3) deep underground mining. Salt is one of the most widely used substances on Earth. It has over 14,000 direct and indirect uses. The most familiar use of salt is for food and food processing (both for humans and animals). It is also widely used in the chemical industry for chlor-alkali production and synthetic soda ash production.

World demand for salt is forecast to grow, particularly in Asia. It is estimated that there will be an approximately six million tonne shortfall of salt in the Asian market by 2018. The worldwide demand for salt is expected to be the greatest in the chemical industry (specifically chlor-alkali production) and for other industrial end-uses (for example, salt fluxes used in the smelting and mining industry).

Australia is the sixth largest producer of salt and the largest exporter of salt worldwide. About 60 percent of salt imported to Asia comes from Australia.

In Australia, salt is produced predominantly via solar evaporative salt facilities in Western Australia. Solar evaporation is quite inefficient (about 65 tonnes of sea water is needed to produce one tonne of salt) and time intensive (the process can take between 12 to 18 months).

Heavy rain or cyclones can also disrupt salt production in solar evaporative facilities for months at a time. Solar evaporative salt facilities are also becoming increasingly difficult to obtain planning approval for in Australia due to their negative environmental impacts.

An opportunity exists to meet the growing demand for salt in Asia. This opportunity is the mining of rock salt in the Chandler Formation in the NT. Extensive investigations have proven that billions of tons of salt are contained within the Chandler Formation. Mining this salt could easily be scaled up

to meet the growing supply requirements in Asia. Australia is also considered the gateway to Asia. We are closer than India and Chile who also supply salt to Asia.

Given the specification and quality of the salt within the Chandler Formation, the chlor-alkali industry in China, Japan and Indonesia are considered to present the greatest opportunity for the export of salt from the Proposal (refer to Plate ES-1).



Plate ES-1 Independent salt experts confirm viability of salt within the Chandler Formation suitable for the dual use business model (salt experts from Ercosplan, Germany).

Waste storage, recovery and permanent isolation

The problem

Over the last 20 years, waste production in Australia has grown at six times population growth (ABS 2016). Australians are the second highest emitters of hazardous waste per capita due to the economy being driven largely by mining, oil and gas, and manufacturing. Approximately 10 % of the waste Australian's produce is hazardous. That means approximately six million tonnes per year of known hazardous waste is produced and is growing at approximately 3% per annum. There is also approximately 900 million tonnes of reported legacy waste (hazardous waste generated historically) estimated to be temporarily stored in the NT and across other Australian states and territories.

Traditional re-processing, incineration, treatment before landfilling, storage/disposal into man-made engineered landfill are temporary solutions, often do not extinguish liability, can be very expensive from a full lifecycle perspective, especially if sent overseas, and are not viewed today as world's best practice. Many of these options support the old linear economy of 'use and dispose'. This has created a growing legacy and forecast pool of waste materials which require long term storage, recovery of valuable materials that supports the circular economy or the permanent isolation of hazardous materials using sound environmental management principals. These solutions are not readily available.

Governments have realised or are increasingly realising that the previous widespread use of engineered surface landfills with either no liner, or liners with lifespans of 10 to 30 years as a catch-all solution with no or limited discrimination in waste acceptance has created many contaminated sites that pose environmental hazards and have ongoing remediation requirements.

The degradation of ageing landfill facilities has created significant contamination problems with numerous examples of waste breaching the liners and landfill perimeters and spreading into groundwater aquifers. As a result of this emerging and widespread environmental problem,

governments globally are now banning surface landfill of hazardous waste and are endorsing geological repositories capable of permanently isolating waste from the biosphere as a final solution for end of life hazardous waste disposal as best practice.

The difference between landfills and geological repositories is illustrated in Figure ES-2. The key difference being that even with a well-engineered landfill, the artificial liner usually only isolate hazardous waste for 10- 30 years before degradation of the liner creates a contamination risk, whereas a geological repository is passively safe on a geological timescale. As a result, international regulators are restricting landfill development and their use for most hazardous waste types.

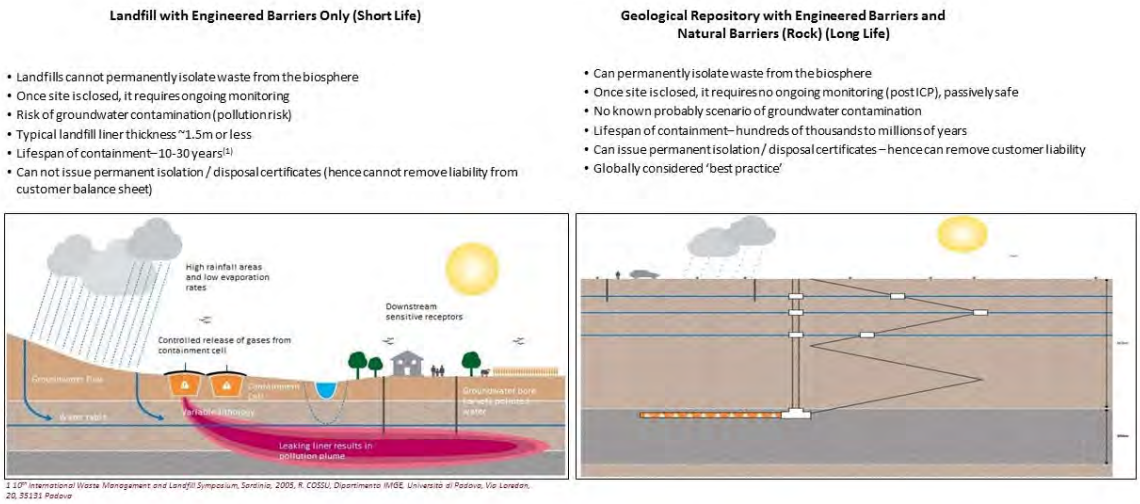


Figure ES-2 Difference between landfill and a geological repository

The solution

There is a need and regulatory obligation to provide for the safe and secure storage, recovery of valuable materials and the permanent isolation of hazardous waste. The solution put forward involves the storage (retrievable) and recovery of valuable materials and the permanent isolation of such wastes in a deep underground geological repository that safeguards human health and the environment from harm over geological time. This can be achieved by applying proven scientific and environmentally sound management principles.

A geological repository is an underground storage or disposal facility of hazardous waste that relies on both a natural geological barrier (e.g. a salt bed) and man-made engineered barriers that both form part of a multibarrier system as part of an overall safety case that is globally recognised for its permanent isolation capabilities. The natural geological barrier isolates waste from the biosphere safely and permanently. Once the repository is closed, it requires very little ongoing monitoring as the geological barrier is passively safe. The lifespan of containment is in the hundreds of thousands to millions of years. As a result, geological repositories that can permanently isolate materials are globally considered 'best practice' for hazardous waste.

The proposed Chandler Facility would be categorised as a deep geological repository. This infrastructure could contribute towards solving the legacy and forecast pool of waste materials in the NT which require long term storage, the recovery of valuable materials that supports the circular economy, or the permanent isolation of hazardous materials using sound environmental management principals. These solutions would become available if the proposed Chandler Facility is approved (approval for a recovery plant that would be accommodated within the proposed technology park would be covered in a separate approval).

The Proposal would operate in an environment that is not constrained by significant social or environmental sensitivities. It would be located in a very remote area - the nearest community is Titjikala, located approximately 25 kilometres by road from the proposed Chandler Facility and the closest regional centre would be Alice Springs located approximately 120 kilometres to the north of the proposed Chandler Facility. It is located in an area that is geologically stable (very low seismicity and no volcanic or tectonic activity). The climate is arid (low rainfall and high evaporation rates).

Groundwater in the area is not connected to groundwater used for domestic purposes (including drinking) by communities in the vicinity of the proposed Chandler Facility. There is also an absence of permanent surface water (indicating that groundwater and surface water systems are not connected). There is a lack of commercial mineral deposits (other than salt) and there is no potential for medium to high agriculture in the vicinity of the Proposal.

Waste hierarchy

There is a clear difference between what is considered best practice for hazardous and non-hazardous wastes. The 'waste hierarchy' methodology suggests the primary focus of waste management should be on reusing, recycling and recovering materials. This methodology is a broadly accepted policy for general (non-hazardous) wastes (refer to Figure ES-3).

A different framework is appropriate for hazardous wastes, which present a danger to health or the environment and, as such, should generally not be re-integrated into manufacturing processes for re-use. With these kinds of wastes, international best practice as reflected in conventions such *as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* ('The Basel Convention') adopt environmentally sound management principles, which focus on the permanent removal of such wastes from the biosphere, and in so doing protect the environment and human health.

One of the advantages of geological repositories is that one can also support the circular economy using long term storage by placing 'like-with-like' materials for operational safety reasons and to create opportunities for the future recovery of valuable materials. The proponent's business model mirrors international solutions operating in the United Kingdom, Europe and North America (refer to Figure ES-3).

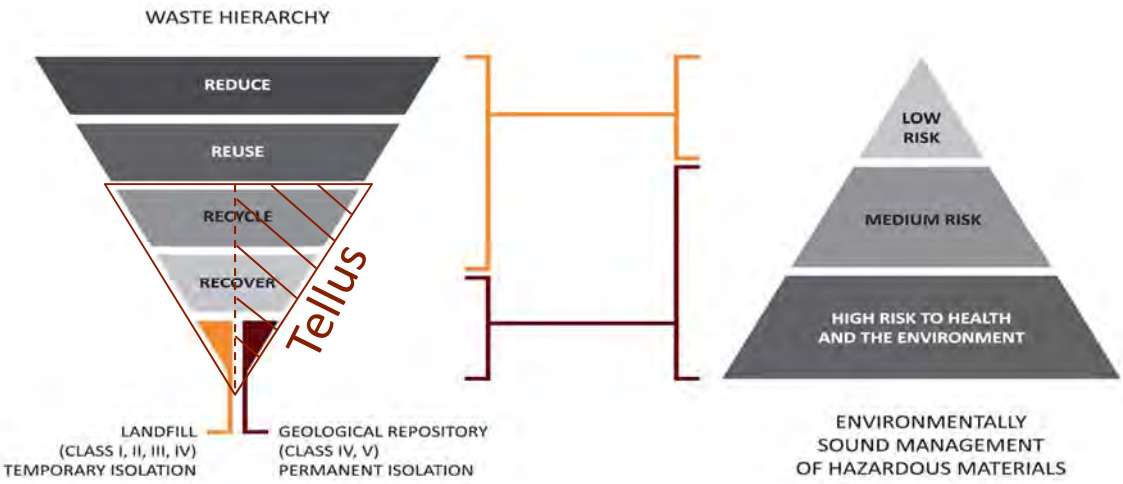


Figure ES-3 The waste hierarchy and the proponent's service offering

Circular economy

One of the advantages of geological repositories is that one can also support the circular economy using long term storage by placing 'like-with-like' materials for operational safety reasons and to create opportunities for the future recovery of valuable materials. The proponent's business model mirrors international solutions operating in the United Kingdom, Europe and North America (refer to Figure ES-4).

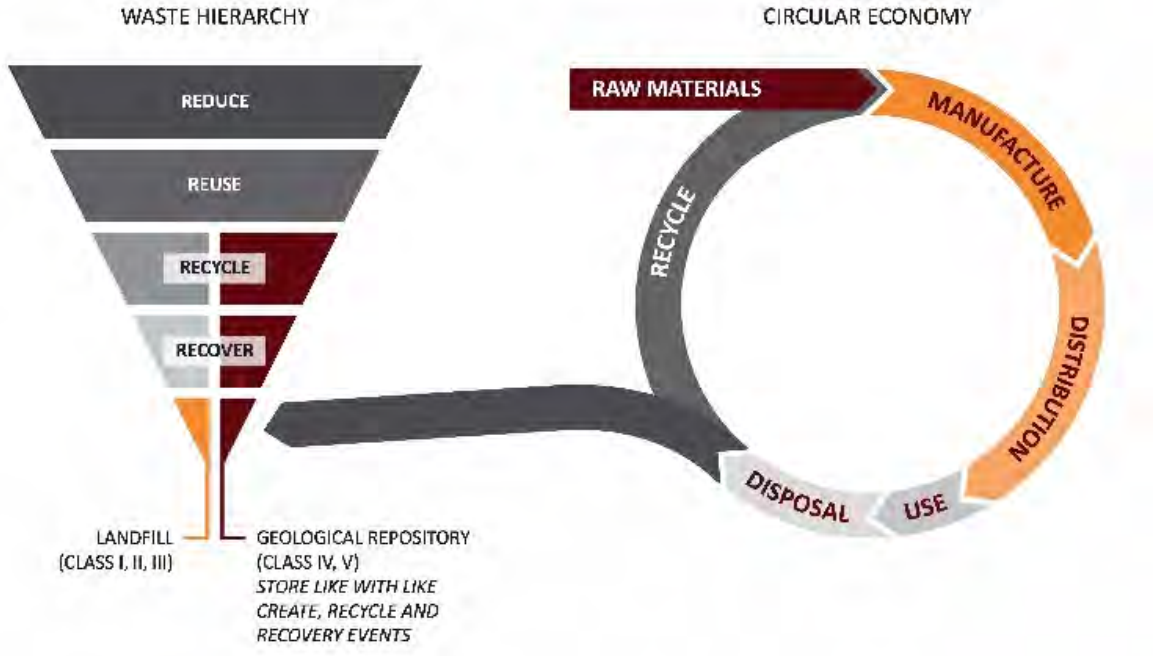


Figure ES-4 Tellus supports the circular economy with the development of the proposed Chandler Facility

Materials and waste accepted (and not accepted) at the proposed Chandler Facility

A range of materials could be safely and securely stored (either temporarily or permanently) inside the void spaces that are left behind from the salt mining operations at the proposed Chandler Facility. The space mined affectively acts as a safe dry underground warehouse in salt. Typical materials that may be stored (and retrieved at a later date) include document archives, film archives, museum artefacts, computer servers, and a host of other valuable documents and equipment.

A range of hazardous wastes produced mostly by the mining, oil and gas, chemical, manufacturing, agricultural, site remediation, utilities (power, water and waste which also captures household collection) and government (State Emergency Service - man made or natural disaster) industries could be stored either temporarily (until recovery and treatment is possible) or permanently inside the void spaces left from the salt mining operations at the proposed Chandler Facility. These same waste materials could also be stored temporarily at the Apirnta Facility prior to being transported to the Chandler Facility.

Waste Acceptance Criteria (WAC) have been established for the Proposal to determine waste types which could and could not be accepted in order to achieve safe operation and environmental protection in the longer term at the proposed Chandler Facility. The facility has been designed and would be located in a host geological environment that would be capable of storing and disposing of the majority of the NEPM[1] 75 chemical wastes subject to them meeting strict WAC. These criteria were developed following internationally recognised best practice and set out waste characteristics that would be not be suitable for storage or disposal in a geological repository.

Wastes that are gases, highly corrosive, highly oxidising, infectious or uncertified would not be accepted under any circumstances. Wastes that are liquids or sludges, explosive, flammable liquids or solids, self-combusting, generate a gas-air mixture which is toxic or explosive, biodegradable, tyres, could release free liquid or react with the host geology would not normally be accepted unless they could be stabilised, solidified or modified in such a way that they would not affect the operational or post closure safety of the proposed Chandler Facility.

Nuclear and uranium mining waste would not meet the WAC and, therefore, *would not be stored* at either the Chandler Facility or the Apirnta Facility. However almost everything in nature has some small amount of natural radioactivity and processing concentrates it. The proponent is planning to accept Naturally Occurring Radioactive Material (NORM) up to Exemption Level[2] (EW) activity content, which is the lowest activity level on the waste classification scheme. The industries that generate NORM's are usually those that refine raw materials and have a waste by-product that is concentrated. This includes utilities such as water treatment plants, ceramic industry and resource sector refineries. Exempt waste contains such small concentrations of radionuclides that it does not require provisions for radiation protection, irrespective of whether the waste is disposed of in

[1] National Environment Protection (Movement of Controlled Waste between States and Territories) Measure
[2] 2 Classification of Radioactive Waste – RPS20, Schedule 4 of the NDRP (ARPANSA 2010)

conventional landfills or recycled. Such material is exempt from regulatory control and does not require any further consideration from a regulatory control perspective.

A summary of the wastes that would be accepted (and not accepted) at the proposed Chandler Facility is presented in Table ES-1.

Table ES-1 Hazardous waste accepted and not accepted for underground disposal and permanent isolation

Type of hazardous chemical wastes	Accepted on-site for surface storage	Accepted in underground voids
Chemical wastes listed under the National Environment Protection Measures (NEPM) (refer to Schedule A List 1: Waste Categories) and under Schedule 2 of the NT Waste Management and Pollution Control (Administration) Regulations	✓	✓
Liquid and sludges	✓	✓[1]
Explosive wastes	×	×
Flammable liquids or solids	×	×
Self-combusting wastes or wastes that can generate a gas-air mixture which is toxic or explosive	×	×
Highly corrosive or oxidizing	×	×
Gases	×	×
Clinical waste (infectious hospital waste and body parts)	×	×
Municipal solid waste (putrescible household and commercial waste)	×	×
Putrescible waste (household rubbish that can rot)	×	×
Uncertified waste (which cannot be identified or has not undergone characterisation testing)	×	×
Reacts with the repository geology (such as dissolving it or producing a gas)	×	×
NORM[1]	✓	✓
Low level radioactive waste (e.g. smoke detectors, exit signs, industrial gauges and medical isotopes)	×	×
Intermediate level radioactive waste (e.g. reprocessed spent nuclear fuel and components with high levels of radioactivity)	×	×
High level radioactive waste (e.g. from power generation and defense use)	×	×

Note: ✓ = accepted, × = not accepted, ✓[1]= normally excluded but could be used in hydraulic backfill processing. 1. Exemption activity levels defined as per *The National Directory for Radiation Protection, February 2014 (RPS 6).*

Benefits of the Proposal

Proceeding with the Proposal would result in significant social and economic benefits in the NT and within Australia. The Proposal would:

- **Provide an innovative unique dual revenue business in remote Central Australia** -the business would commercialise an industrial bulk commodity (salt) and provides an equipment and archives storage business and a storage, recovery and permanent isolation business for hazardous waste generated in the NT and within Australia.
- **Diversify the economy.** - development of enabling environmental infrastructure which would assist in providing utility support services to other existing and new projects that generate waste as a result of the 'Developing the North' strategy.
- **Major investment in regional Australia** - the capital expenditure is estimated to be around A$676 million (nominal, including finance and contingency) for the Proposal. Around 67 % of all construction costs would be spent in Australia (36% spent in the NT).
- **Boost the economy over the 29-year project life** - on average, there would be spending of just under $81 million per annum to operate the Proposal. Of this, 64 % would be spent in Australia (a total of 52% would be spent in the NT). The site could be expanded for generations.
- **Royalties, taxes and levies** - over the 29-year term could support other parts of the NT and the Australian economy.



Plate ES-2 Tellus has supported indigenous jobs during the development of the EIS and would continue to support indigenous employment through the construction, operation, and closure and rehabilitation of the Proposal.

- **Create training and long term job opportunities** -
    - About 270 jobs during construction (720 jobs during peak build including in-directs).
    - About 150 to 180 full time equivalent workers would be employed during operation. Just over 5,400 full-time equivalent job years would be created over the life of the Proposal, an average of 217 full time equivalent job years per annum.
    - Jobs would be green, sustainable, and generally well paid covering technical (engineering, chemistry, science), commercial (sales, business) and operational skills.
    - Proposed jobs and training programs, such as:
        - 1. Tellus' School to Jobs Program (Annual Schools Tour).
        - 2.Tellus' Pre-employment Training Program ('Getting Job Ready') comprising Tellus' Traineeships Program, Tellus' Apprenticeships Program and Training Accreditation.

- 3. Indigenous Employment Program; comprising a 10 % indigenous employment target as well as other commitments that would benefit local indigenous people such as the sponsorship of sporting and academic programs in the nearby community of Titjikala (refer to Plate ES-2 and Plate ES-3).
- 4.Tellus' Employment Programs and Systems comprising a 'Sisters in Mining' Program; Tellus' Disabled Worker Program, Tellus' Ranger Program and support for Social Enterprises that could generate more jobs.

- **Provide local business support and new business opportunities** - goods and services such as construction and operational materials, food, accommodation, etc. would be sourced from local business, where possible.
- **Fulfil the government's own environmental and waste policy obligations under the following four main regulatory regimes** -
  - Environmental protection regulations (to minimise adverse impacts on the environment and human health and to meet national and international obligations);
    - Meeting NT and national obligations by providing critical infrastructure that can safely store, recover or permanently isolate difficult to manage wastes.
    - The NT EPA's *Waste Management Strategy for the Northern Territory 2015-2022*, the NT Department of the Chief Minister *Framing the Future* and the Australian Government *National Waste Policy*.
    - Meeting international obligations under the Basel Convention (Regulation of Transboundary Movements) and Waigani Convention (Regulation of Exports and Imports) by providing critical infrastructure for our near-neighbors such as the Pacific Islands who do not have suitable infrastructure to manage such wastes. Australia currently exports waste mostly to Europe and Asia and imports small volumes of waste materials mostly from our near neighbors (Pacific Islands). The proponent is not planning on actively marketing this service, but in the event of a man-made or natural disaster, the proposed Chandler Facility would be suitable.
  - Transport of dangerous goods regulations (to prevent accidents and promote safe transport, regulated by national legislation and codes).
  - Work health and safety regulations (hazardous chemical regulations that reduce occupational health and safety risk in the workplace).
  - Product stewardship regulations (the responsible management of products such as waste oil, asbestos, e-waste, tyres, batteries, mercury, medicines).
- **Support the circular economy** - by providing an opportunity for the future potential recovery of valuable materials (that are currently deemed waste). The Proposal could attract new salt and waste recycling and recovery industries to the NT.





Plate ES-3 Tellus would continue to support the local community through construction and operation of the Proposal.

Proposal alternatives

A range of options and alternatives were investigated for the Proposal. All options were based upon the Proposal objective of developing the Chandler salt resource identified in the Joint Ore Resource Committee Resource Statement (2014). The options and alternatives investigated included:

- Not proceeding with the Proposal (the 'do nothing' option).
- Site selection and access alternatives, including:
    - Underground location.
    - Mine entry (portal versus decline).
    - Mine decline route.
    - Underground layout of mine.
    - Aboveground layout of supporting infrastructure.
- Logistics alternatives, including:
    - Location of haul and access roads.
    - Location of storage and transfer facility.
    - Port linkages (Darwin and Adelaide).

Options to optimise ecological sustainability were also investigated. These included:

- Mining methods (solution mining versus room and pillar mining).
- Energy and water supply sources.
- Salt processing (wet versus dry processing, refer to Plate ES-4).

Alternative environmental management measures for key risks were also considered during the development of the Proposal.

The preferred alternatives were chosen based on a number of factors including operational efficiency, safety, capital costs, and the environmental setting of the area.



Plate ES-4 Salt processing pilot - dry optical sorter (left) and optical sorter results (right). A dry optical sorting process was selected as this option requires significantly less land area than wet processing and there is no need for evaporative ponds. Dry optical sorting requires less capital, is efficient, and can be scaled up on demand.

Proposal description

The Proposal includes an underground rock salt mine and a storage, recovery and permanent isolation facility (the Chandler Facility), as well as a supporting surface storage and transfer facility (the Apirnta Facility) and haul and access roads (the Chandler Haul Road and the Henbury Access Road). A description of the facilities and roads is provided below. The Proposal's schedule and workforce accommodation are also explained.

The Chandler Facility

Tellus propose to develop a new underground rock salt mine and complementary storage business with supporting aboveground infrastructure that would export up to 750,000 tonnes of salt product per annum. The facility would also provide for the safe and secure storage, recovery and permanent isolation of up to 400,000 tonnes of waste per annum, although average volumes are expected to be significantly less than this amount (year one 30,000 tonnes, average 340,000 tonnes per annum). The rock salt mine and complementary storage facility is

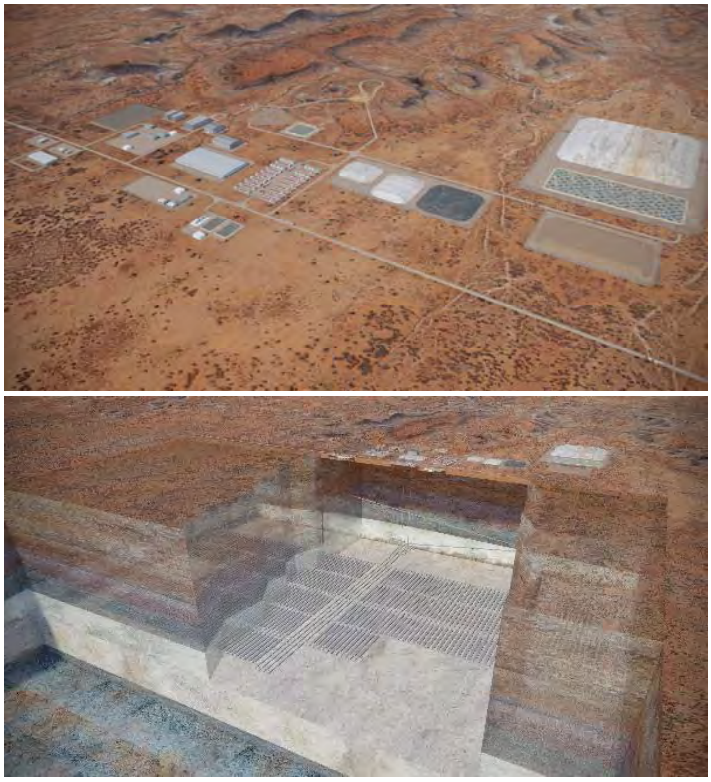


Figure ES-5 The proposed Chandler Facility. Underground infrastructure shown above and aboveground infrastructure shown below.

referred to as the Chandler Facility. A graphical representation of the proposed Chandler Facility is presented Figure ES-5.

Salt mining and storage/permanent isolation of materials

Salt mining activities would involve:

- Deep mining of rock salt using a 'room and pillar' system of mining.
- Transport of salt via shaft hoisting to the surface.
- Stockpiling of rock salt for processing and packaging.
- Transport of rock salt to domestic and overseas market:
    - Domestic market (via road and rail) - road transport via truck on federal and state highways. Rail transport via a proposed new railway siding located at the Apirnta Facility.
    - Overseas market (via rail) - rail transport also via the proposed new railway siding located at the Apirnta Facility, predominantly south to a port facility in Adelaide. From there, rock salt would be shipped to overseas markets predominantly in Asia.

Storage and permanent isolation of materials would involve:

- Transport of materials (equipment, archives, etc.) and waste, predominantly by rail, for receipt and temporary storage at the Apirnta Facility.
- Transfer of materials by truck from the Apirnta Facility to the Chandler Facility via the proposed private Chandler Haul Road.
- Transport of packaged materials via mine access decline or via hydraulic backfill into the voids left from the salt mining operation:
    - Waste would be permanently isolated in line with operational management plans and a strict WAC.
    - Materials such as equipment and archives would be stored separately for future retrieval.
- Once full, sealing the underground voids permanently with engineered barriers.

The facility would be designed and managed to allow for future waste recovery opportunities – that is, wastes would be stored like-with-like and the final disposal locations of the waste would be tracked and logged for future reference. At some point in the future, a technology recovery park would be established to support research and development into ways to release waste materials back into the circular economy.

The salt would be mined from the Chandler Salt Bed which is located approximately 850 metres below the surface. Materials stored within the voids left from the mining operation would be

situated within a salt bed approximately 250-300 metres thick allowing the waste to be permanently removed from the biosphere in a stable and dry environment.

Key infrastructure

The key underground infrastructure at the proposed Chandler Facility would include:

- Underground mine.
- Mine access decline.
- Two ventilation shafts (one allowing for salt hoisting and personnel riding as well as downcast ventilation, and one for upcast ventilation).

The key aboveground infrastructure at the proposed Chandler Facility would include:

- Dry salt processing facilities (salt processing and sales would be deferred for the first five years of salt mining).
- Waste unloading area.
- Waste storage warehouse.
- Surface hydraulic backfill plant and underground reticulation.
- Salt and overburden stockpiles.
- Maintenance buildings.
- Administration buildings.
- Accommodation village.
- Shaft hoist.
- 2 megawatt solar/diesel hybrid power plant.
- Clean and raw water dams.
- Water and sewage treatment.
- Fuel storage facility.
- Utility reticulation.
- A future technology recovery park.

The Apirnta Facility

The Chandler Facility would be supported by a proposed new, off-site rail siding and surface storage and transfer facility referred to as the Apirnta Facility. The purpose of the surface storage and transfer facility would be to provide a licensed facility that safely allows for the temporary storage of waste products prior to being transported by road for storage and/or permanent isolation at the proposed Chandler Facility.

The surface storage and transfer facility would provide for the temporary storage of up to 400,000 tonnes of waste, although average volumes are expected to be significantly less than this amount (year one approximately 30,000 tonnes, average 340,000 tonnes per annum). The waste would be stored either in a warehouse, within an open storage yard or within a liquid storage tank. A graphical representation of the Apirnta Facility is provided in Figure ES-6.

Waste would be brought to the surface storage and transfer facility via rail and offloaded at the new rail siding. The waste would be transported into the surface storage and transfer facility for temporary storage prior to being transported for storage, recovery and/or permanent isolation at the proposed Chandler Facility.

The Apirnta Facility would receive waste materials transported via road and rail from reputable companies licenced to transport dangerous goods. Waste arriving would be inspected, sampled, unloaded and appropriately stored in accordance with appropriate standards, codes and regulations and in line with a strict WAC.



Figure ES-6 The proposed Apirnta Facility. Aerial view (top) and proposed warehouse (bottom).

Waste materials stored in the warehouse would be sealed in storage containers and wrapped in plastic on wooden pallets then stacked in high-bays. The storage yard would be used for the temporary storage of waste materials that would be sealed in shipping containers. The liquid storage tank would be used to store a variety of liquid wastes (refer to Figure ES-7).



Figure ES-7 Materials would be transported 'like with like' in safe containers that meet regulatory standards

The Chandler Haul Road and Henbury Access Road

Haul and access roads would be constructed as part of the Proposal. The proposed private Chandler Haul Road would be approximately 30 kilometres long and would connect the Chandler Facility to the Apirnta Facility. It would provide for the movement of salt from the Chandler Facility to the rail siding at the Apirnta Facility. It would also provide for the movement of waste temporarily stored at the Apirnta Facility to the Chandler Facility.

The proposed private Henbury Access Road would be approximately 60 kilometres long and would connect the Apirnta Facility to the Stuart Highway. It would provide for the movement of workers and delivery vehicles to and from the Stuart Highway to the Apirnta Facility and through to the Chandler Facility. The Henbury Access Road would be constructed once mining operations have begun. During construction, all workers, equipment and delivery vehicles would access the Chandler Facility via the existing Maryvale Road (a public road).

Both roads would be unsealed and designed and constructed to appropriate industry standards and their proposed use.

Schedule

The construction of the Proposal is expected to take three years with a further year for commissioning. Pending planning approval and finance of the Proposal, construction is anticipated to commence in late 2018. An overall Proposal schedule is shown in Figure ES-8.



Figure ES-8 Outline schedule for the Chandler Proposal

Workforce, hours of construction and operation, and worker accommodation

At the peak of construction, it is estimated that there would be 270 direct people working on-site (540 including in-directs). It is estimated that up to 90 people would be required on-site at any one time during operation of the Proposal. Where possible, the proponent has a policy to source and retain local labour and to achieve over time a minimum of 10 % indigenous employment.

The hours of construction would be 12 hours per day, seven days per week (day shift only) with night working proposed as a contingency. Shaft sinking activities are, however, expected to be undertaken 24 hours per day, seven days per week, with three rotating eight hour shifts of approximately 270 employees. The hours of operation would be the same as those for construction, namely 12 hours per day, seven days per week (day shift only).

During the construction stage, around 90 % of employees would operate under fly-in fly-out contract conditions and during the operational stage this would be reduced to nearer 75 % fly-in fly-out with an objective of reducing that ratio over time to attract as many local residents as possible who would drive-in drive-out from Alice Springs and the surrounding area.

An accommodation village has been provisionally positioned approximately two kilometres north of the main aboveground infrastructure at the proposed Chandler Facility. The accommodation village would provide accommodation for up to 165 people during construction and up to 100 people at any one time during operation.

Regulatory framework

The Proposal will require planning approval, licenses and permits from both the Australian Government and from the NT Government. The key approvals and licenses will be sort from:

- The Australian Minister for the Environment under the provisions of the EPBC Act and Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regulations). The EPBC Act and EPBC Regulations are administered by the Commonwealth Department of the Environment and Energy (DoEE).
- The NT Minister for Mines and Energy under the provisions of MM Act and the Mining Management Regulations (MM Regulations). The MM Act and MM Regulations are administered by the NT Department of Primary Industry and Resources (DPIR).
- The NT Minister for the Environment under the following legislation:
    - EA Act and the Environmental Assessment Regulations (EA Regulations) and Environmental Assessment Administrative Procedures (EA Procedures) administered by the NT EPA.
    - WMPC Act and Waste Management Pollution Control Regulations (WMPC Regulations) also administered by the NT EPA.

Overall approval is sought under the EPBC Act and EPBC Regulations (administered by the DoEE) and the EA Act, EA Regulations and EA Procedures (administered by the NT EPA) via a bilateral agreement between the Australian Government and the NT Government. If approved, the salt mining operations would be regulated under the MM Act and MM Regulations administered by the DPIR. The storage, recovery and permanent isolation of waste within the salt mining voids would be regulated under the WMPC Act and WMPC Regulations administered by the NT EPA.

Consultation

The consultation process began in March 2012. The steps involved in the consultation process included the identification of key stakeholders and the development and implementation of a consultation and engagement strategy.

Stakeholders were identified as individuals or organisations that may be interested in or affected by the Proposal. A consultation and engagement strategy was developed to ensure effective and timely consultation activities during the development of the EIS.

Stakeholders were engaged using a range of consultation and communication techniques, including face-to-face meetings, workshops, national and local radio, newspaper and TV interviews, community information sessions, telephone and email communications, as well as media releases and website updates. These were supported by stakeholder feedback mechanisms, including a company-specific email address (refer to Plate ES-5).

Key stakeholders were offered the opportunity to provide feedback and raise issues during the development of the draft EIS. The key stakeholders included government agencies, non-government organisations, industry and business, landholders, Traditional Owners and residents of the surrounding communities.

Early stakeholder consultation helped shape the technical studies for the EIS. Community feedback also influenced the design of the Proposal.

Stakeholder consultation will be ongoing throughout the environmental impact assessment process. If approved, consultation would continue through site preparation and construction and during operation of the Proposal, where information would be provided to stakeholders on a regular basis.



Plate ES-5 Communication tools used during community information sessions

Approach to impact and risk assessment

An environmental risk assessment was undertaken to identify, evaluate and mitigate the potential environmental impacts of the Proposal. As the environmental impact assessment included input from a wide range of technical disciplines, a standardised environmental risk assessment was undertaken to ensure consistency in determining the level of risks.

This standardised approach did not replace the methodologies used by technical disciplines to identify or assess impacts, nor did it replace methods of impact assessment prescribed by existing guidance. Rather, it supplemented the impact assessment by providing clear, more readily comparable conclusions regarding the significance of impacts.

The standardised risk assessment for the Proposal involved:

- Defining the sensitivity of environmental and social values, resources and receptors.
- Describing the potential impacts that may arise as a result of the Proposal.
- Assessing the likelihood of an impact occurring.
- Assessing the probability of an impact occurring.
- Evaluating the consequence of an impact.

- Identifying outline management and/or mitigation measures
- Evaluating the residual impact.
- Assigning an overall risk rating.

The environmental and social systems, resources and receptors potentially affected by the Proposal were defined through desktop-based research, field surveys and preliminary consultation with local communities, regional stakeholders, and with key agencies within the NT Government.

Environmental assessment

The environmental risk assessment combined with the Terms of Reference identified the following key issues for consideration in the EIS:

- Biodiversity.
- Water (groundwater and surface water).
- Historic and cultural heritage.
- Human health and safety.
- Socio-economic.
- Closure and rehabilitation.

Other risks identified as requiring consideration included:

- Air.
- Fire.
- Noise and vibration.
- Visual amenity.
- Public health and food.
- Biting insects.
- Greenhouse gases.

A summary of the environmental assessment is presented below. Various sections of the document have been prepared by external sub consultants and have also been peer reviewed by international experts.

Biodiversity

Extensive biological field surveys have been undertaken within the proposed development footprint and vicinity over the past four years. Sixty-nine sites were surveyed in total. The survey sites were selected to provide a representative sample of the different habitats within the proposed development footprint and vicinity. They were also selected based on the habitat requirements of conservation-significant species predicted to occur within the proposed development footprint or vicinity. The surveys were undertaken over several seasons and in varying weather conditions.

Vegetation communities within the proposed development footprint and vicinity consist of open and sparse shrublands and hummock grassland (refer to Plate ES-6). A range of habitat types support a diverse abundance of arid flora and fauna. A total of 194 plant species and 143 fauna species (25 reptile species, 89 bird species and 29 mammal species) were recorded over the four-years of field surveys. There are no sensitive or significant vegetation communities within the proposed development footprint or vicinity.



Plate ES-6 Sparse shrubland (left) and hummock grassland (right) within the proposed development footprint

Three flora species of conservation significance were recorded during the field surveys within the vicinity of the proposed development footprint. Four conservation-significant species are considered to have a moderate to high likelihood of occurrence within the proposed development footprint or surrounding vicinity. None of the species are listed as either data deficient or near threatened under the NT *Territory Parks and Wildlife Conservation Act* (TPWC Act).

No threatened flora species listed under the TPWC Act and/or EPBC Act have been recorded or are predicted to occur within the proposed development footprint or vicinity.

Six fauna species of conservation significance were recorded during the field surveys (either within the proposed development footprint or vicinity). All of these species are listed as either near threatened or data deficient under the TPWC Act. Secondary signs, such as scratching or burrows, of three threatened fauna species were recorded within the vicinity of the proposed development footprint. These were brush-tailed mulgara (*Dasycercus blythi*), crest-tailed mulgara (*Dasycercus cristicauda*) and southern marsupial mole (*Notoryctes typhlops*) (all listed as vulnerable under the TPWC Act and/or EPBC Act; refer to Plate ES-7). An additional 13 conservation significant species (eight listed as either near threatened or data deficient under the TPWC Act and five threatened species listed under the TPWC Act and/or EPBC Act) are considered to have a low to moderate, moderate, or high likelihood of occurrence within the proposed development footprint or vicinity.

Three migratory bird species were recorded during the field surveys within the proposed development footprint or vicinity. These were sharp-tailed sandpiper (*Calidris acuminata*), rainbow bee-eater (*Merops ornatus*) and marsh sandpiper (*Tringa stagnatilis*). An additional five migratory

species are considered to have a moderate to high likelihood of occurrence within the proposed development footprint or vicinity. All of these species are listed under the EPBC Act.

Construction of the Proposal would result in the removal of approximately 397.5 hectares of vegetation. The removal of this vegetation would result in the loss of fauna habitat. Construction and operation of the Proposal may also result in indirect impacts on biodiversity including impacts associated with fauna displacement, injury or mortality; fauna strike; altered hydrology; potential for contamination, erosion and sedimentation; and increased dust, light, noise and vibration. Indirect impacts may also include the introduction and spread of weeds and invasive species; increased predator species; increased introduced fauna use; and an increased incidence of fire.

In addition, operation of the Proposal may result in potential impacts associated with salt runoff and windblown salt from stockpiles. Potential impacts on biodiversity during closure and rehabilitation of the Proposal would generally be the same as those during construction of the Proposal.

There would be no significant impact on species listed as near threatened or data deficient under the TPWC Act. None of the species are considered to have conservation significance within the proposed development footprint or vicinity, or within the wider locality. All species are locally common with a widespread distribution and there is no critical habitat for any of the species listed as near threatened or data deficient recorded or predicted to occur within the proposed development footprint or vicinity.



Plate ES-7 Southern marsupial mole backfilled tunnels in a mole trench on the bank of the Finke River

The potential for significant impacts on matters of national environmental significance and on state-listed threatened species were assessed in accordance with significant impact guidelines prescribed by the EPBC Act. The results of the assessments concluded that there would be no significant impact on species listed as threatened under the TPWC Act and/or EPBC Act. At present, no biodiversity offsets are deemed necessary as there would be no significant impact to matters of national environmental significance during construction, operation, or closure and rehabilitation of the Proposal.

Additional, targeted surveys would be undertaken prior to construction to confirm the presense/absense of two matters of national environmental significance (threatened species) considered to have a low to moderate likelihood of occurrence within the proposed development fooprint or vicinity. These are Slater's skink (*Liopholis slateri slateri*) and the thick-billed grasswren

(*Amytornis modestus indulkana*). Potential habitat for these species is located within the vicinity of the proposed Henbury Access Road. If these species are found to be present, significant impacts would be avoided through changes to the proposed alignment of the Henbury Access Road. Alternatively, a program of trapping and relocating would be implemented to avoid significant impacts to these species.

Mitigation and management measures would be implemented to reduce the potential impacts on biodiversity during construction, operation, and closure and rehabilitation of the Proposal. These mitigation and management measures include the development of a Biodiversity Management Plan and Bushfire Management Plan. These plans would be incorporated into the Construction Environmental Management Plan (CEMP), Operational Environmental Management Plan (OEMP) and/or Rehabilitation Closure Plan (RCP) for the Proposal.

Groundwater

Baseline research

The groundwater reserves within the development envelope for the Proposal are not within an existing NT Water Control District and is not connected to the Titjikala water bore. The information detailed below explains this.

Extensive hydrogeological (groundwater) investigations have been undertaken within the proposed development footprint between 2015 and 2016. Groundwater monitoring is an essential component in characterising the Proposal area baseline (pre-mining) hydrogeological and hydrological environments. Baseline water level and quality data collected from the various aquifers and watercourses is used to understand flow paths, recharge and discharge characteristics, and groundwater–surface water connectivity. The collection and analysis of field data was used to establish the conceptual (hydrogeological) model (refer to Figure ES-9).

A dedicated groundwater monitoring network for the Proposal was designed and installed in May 2015 to investigate the local groundwater conditions across the proposed development footprint and vicinity. Following installation of the

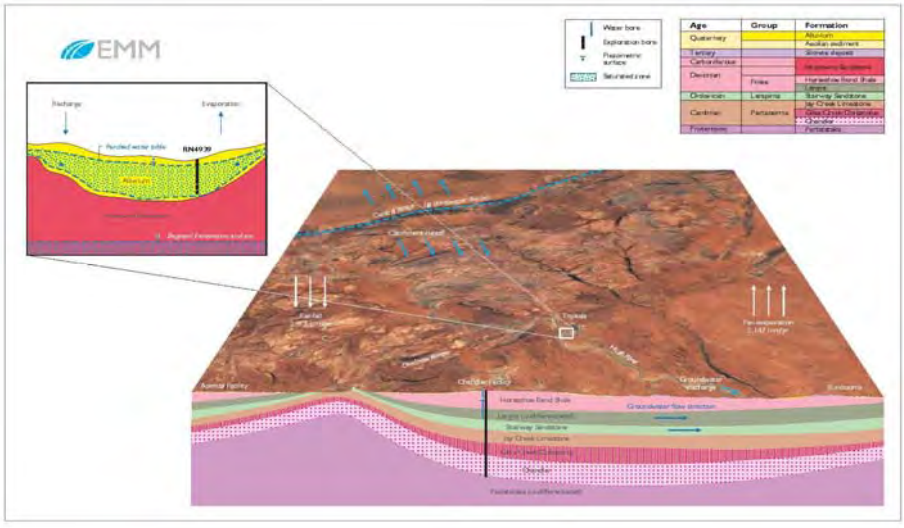
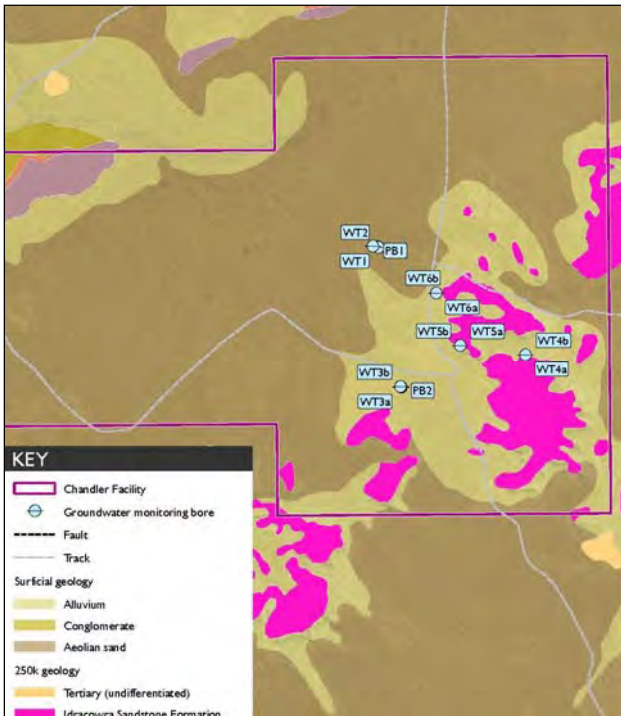


Figure ES-9 Conceptual (hydrogeological) model

network, 18 months of groundwater level monitoring data was collected at monthly intervals including baseline groundwater level and groundwater quality data. Groundwater quality data will continue to be monitored every quarter in 2017.



The existing groundwater monitoring network shown in Figure ES-10:

- Identifies and characterises water bearing units (aquifers) and aquitards in the Chandler Facility area, with focus on characterising groundwater flow and quality within the main groundwater bearing units, the Horseshoe Bend Shale Formation and the Langra Formation, which both overlie the Chandler Formation (salt deposit) by hundreds of metres.
- Provides spatial representation of pressure heads across the Chandler Facility area to investigate potential vertical hydraulic gradients and potential connectivity between water bearing units.

Figure ES-10 Existing groundwater monitoring network

A detailed Water Management Plan has been prepared for the Proposal which outlines future groundwater resource management measures.

Surface geophysical logging and pumping tests were also undertaken within the proposed development footprint (refer to Plate ES-8). Surface geophysical logging (electroseismic and electrotelluric surveying) is used to determine the potential hydraulic conductivity and the groundwater presence and flow potential of geological formations. Pumping tests obtain estimates of aquifer properties including storativity, transmissivity and horizontal hydraulic conductivity. Pumping tests can also provide information on the extent and sustainability of the aquifer and the degree of connection with nearby surface waterbodies, if present.

The Groundwater Assessment includes an impact assessment which uses the conceptual model to assist in the assessment of potential impacts of the Proposal, specifically:

- Impacts from predicted changes in groundwater level and quality of groundwater, surface water, groundwater dependant ecosystems and landholder bores.

- Sources of potential contaminants, mechanisms of their release, pathways for transport, fate of any potentially contaminated waters, and the potential for human and ecological exposure to potential contaminants.

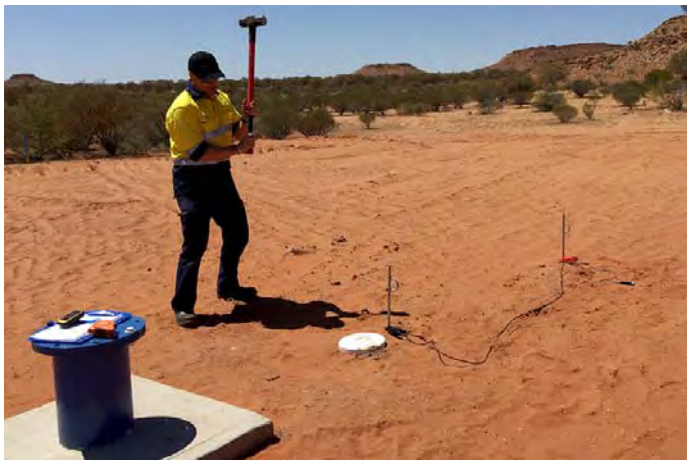


Plate ES-8 Surface geophysical logging within site of the proposed Chandler Facility.

Regional geological setting

The Proposal area lies within the Chandler Syncline sub-basin of the south-eastern extent of the Amadeus Basin. The predominant marine and terrestrial sedimentary sequences that form the Amadeus Basin were deposited about 500 million years ago. The south-eastern extent of the Amadeus Basin abuts the Pedirka Basin about 80 kilometres south-east of the Proposal area. The land surface is structurally controlled to the north, east and west by a series of extensive Palaeozoic orogenies including Precambrian intrusive and metamorphic rocks, while alluvial sediments dominate low lying areas.

The Amadeus Basin comprises a series of synclinal sub-basins defined by numerous folds and thrust belts. The three predominant sub-basins are: the Northern Amadeus Sub-basin; the Orange Creek Syncline; and the Chandler Syncline. The Proposal lies within the southern-most Chandler Syncline sub-basin.

Local geological setting

The Proposal targets the Chandler Formation, a unit of the Pertaoorrta Group of Cambrian age (485-541 million years old) within the Chandler Syncline of the southern Amadeus Basin. Despite the complex history of the Amadeus Basin, the strata in the area of the Proposal are relatively flat lying and continuous.

The geological structure in the area of the Proposal has been investigated by some 2D seismic coverage in the area (reprocessed as part of the Tellus investigations), and sampled by four deep boreholes and nine shallower boreholes. The four deep boreholes reach the Chandler Formation; two were drilled by Tellus (CH001A and CH003), and two are pre-existing oil exploration wells (Mt Charlotte No. 1 and Magee). CH001A lies at the northern margin of the underground footprint of the facility, while the other boreholes are outside the Chandler Facility footprint. Both CH001A and CH003 were drilled to the base of the salt for site investigation purposes.

The Chandler Formation, shown in Figure ES-11, is encountered between 755 and 811 metres below ground level, and is up to 275 metres in thickness (Tellus exploration borehole CH001A). It occurs as an extensive evaporite unit comprising anhydritic siltstone to 825 metres and halite below that.

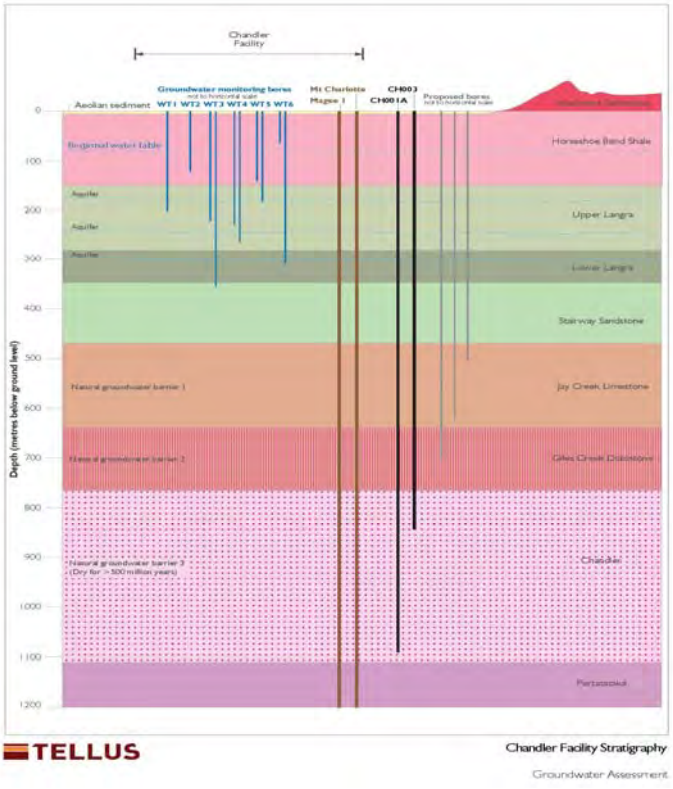


Figure ES-11 Geology at Chandler; existing and proposed groundwater bores; known aquifers and natural geological barriers.

The Chandler Formation is encountered between 755 and 811 metres below ground level, and is up to 275 metres in thickness (Tellus exploration borehole CH001A). It occurs as an extensive evaporite unit comprising anhydritic siltstone to 825 metres and halite below that. Core from boreholes CH001A and CH003 show the salt to be almost pure halite (yellow to red brown, transparent and glassy) with very few marly beds (siltstone and claystone) or other impurities.

The Chandler Facility would be located in the upper part of the Chandler salt formation. The upper halite bed in borehole CH001A is present in the depth interval 825 metres to 861 metres.

Overlying the Chandler Formation are deposits of siltstones and sandstones associated with the Pertaoorrta Group (Giles Creek Formation and Jay Creek Sandstone Formation), Larapinta Group (Stairway Sandstone Formation), Finke Group (Horseshoe Bend Shale Formation and Langra Formation) and the Idracowra Sandstone Formation. Exploration drilling has characterised the overlying geological formations as follows (from shallow to deep):

- **Idracowra Sandstone Formation**: a kaolinitic sandstone that caps the Maryvale Hills across the Chandler Facility area and has a maximum thickness of 40 metres.
- **Horseshoe Bend Shale Formation**: a massive, red brown siltstone/very fine grained, soft to firm quartz sandstone with moderate mica. Contains occasional beds (up to 1 m thick) of light brown, fine grained sandstone.
- **Langra Formation:** subdivided into three members: the upper, a very fine to coarse light brown sandstone; middle, a mottled red brown siltstone; and lower, a pale brown to orange very fine to fine sandstone with interbedded siltstone. The base of Langra formation is approximately 340 m below ground level.

- **Stairway Sandstone:** a white coarse to medium grained sandstone with interbedded siltstone and minor shale. The base of the Stairway Sandstone is approximately 500 metres below ground level.
- **Jay Creek Sandstone Formation:** comprises upper layers of siltstone with thin interbeds of dolomite and minor fine grained sandstone, and lower layers of shale, and laminated claystone and siltstone. The base of the Jay Creek Formation is approximately 770 metres below ground level.
- **Giles Creek Dolomite Formation**: a fine-grained, massive, yellow-brown dolomitic limestone unit, with minor shale bands.

Underlying the Chandler Formation is the Pertatataka Formation, a siltstone and shale formation with lenses of sandstone, dolomite, limestone and conglomerate.

Regional groundwater setting

There are three main groundwater system types associated with the central and south-eastern NT within the Amadeus Basin, the:

- Mereenie Aquifer System.
- Fractured rock groundwater systems.
- Near surface sediment groundwater systems.

Mereenie Aquifer System

In the northern-central part of the Amadeus Basin, near Alice Springs, broad folds define three key aquifer systems, the Hermannsberg Sandstone, Mereenie Sandstone and the Pacoota Sandstone systems. These aquifers are collectively termed the Mereenie Aquifer System

Fractured rock groundwater systems

South of the Orange Creek Syncline and the Central Ridge, a series of intense folding and faulting generated by the James Ranges and Ollife Range has given rise to the deposition of a series of fractured rock systems, including those within the Chandler Syncline.

Groundwater within the fractured rock systems is unlikely to be extensive. Localised faulting and the deposition of claystones and siltstones form leaky aquitards throughout the area are likely to have resulted in the development of less extensive and more localised groundwater systems. Groundwater storage and flow within these localised systems is likely to be restricted by their thickness and the permeability of the geology. Recharge is thought to occur through infiltration of overlying alluvial stream beds during flood events however, the reduced permeability influenced by the claystone aquitards is likely to restrict recharge to these deeper systems.

Water quality within the localised groundwater systems is highly variable and generally considered to be brackish to saline (>1,500 mg/L). The limited recharge and low permeability of the system is

thought to contribute to long groundwater residence times, greater mineralisation of the local groundwater systems, and therefore reduced water quality.

Near surface sediment groundwater systems

The local near-surface sediment groundwater systems support the various ephemeral surface drainage features bisecting the Proposal. These surface drainage channels incise the bedrock, allowing sediment to partly fill the channel void and provide a medium for groundwater storage and flow.

The main developed alluvial systems located across the south-eastern extent of the Amadeus Basin are associated with the Hugh River and Finke River. Recharge to these shallow systems primarily occurs during major flooding events.

Based on calibration with bore log data, modelling results indicate there are three main aquifer zones within the saturated thickness of the upper and lower Langra Formations. These occur predominately between 140 and 350 metres below ground level, with minor small perched groundwater systems existing above the regional water table (inferred to be approximately 90 metres below ground level).

Local groundwater setting

Proposal groundwater monitoring bores targeted the fractured sandstone aquifer present across the south-east of the Amadeus Basin. During the Proposal groundwater drilling campaign, inflows were first intersected in the Horseshoe Bend Shale Formation between 80 and 100 metres below ground level. Subsequent groundwater level monitoring has seen a rise in groundwater levels by up to 25 metres from the water intersections observed during drilling.

Groundwater flow is interpreted to be via fracture flow (secondary porosity), although some limited groundwater flow through primary porosity may also occur. Borehole water intersections in the relatively shallow Horseshoe Band Shale Formation were comparable and ranged from 0.2 to 2 litres per second (L/s). The highest yields were observed in the north-western extent of the Proposal.

The next unit encountered was the Langra Formation, which exhibited a larger range of borehole water intersections, more typical of fractured rock groundwater flow. The average water yield for the upper Langra Formation was 4.2 L/s, the middle Langra Formation was 7.5 L/s and the lower Langra Formation was 11 L/s.

A constant rate pumping test was conducted at bore Production Bore 1, in the upper Langra Formation. The low pumping rate achieved (4 L/s) and the limited extent of drawdown (as observed at monitoring bore WT1) indicates that the local groundwater system is likely to have a low transmissivity and a limited extent.

Water yields for the next unit, the Stairway Sandstone, were recorded at two bores (between 15 and 20 L/s). Water yields observed during drilling typically over-estimate the sustainable yield from the

Formation. A potential sustainable groundwater yield associated with the Stairway Sandstone is therefore likely to be significantly less and likely no greater than 5 L/s.

The Jay Creek Formation exhibits the potential for groundwater presence within the upper sequences of the Formation, as defined through the estimated porosity measurements of 30 % observed at the Mt Charlotte 1 exploratory bore. The Jay Creek Formation transitions into a calcareous dolomitic unit toward its basal extent, where it overlies the Giles Creek Formation. Groundwater potential is negligible within the extent of this unit, given its massive nature and the limited fracture potential.

The Chandler Formation halite deposit is hydro-geologically isolated from the overlying groundwater systems described above.

Groundwater recharge and discharge

The main groundwater flow mechanism for the fractured sandstone aquifer is considered to be rainfall recharge to the west and north-west of the Chandler Facility. This creates opportunities for lateral flows in the Horseshoe Bend Shale overlying the Chandler deposit.

As monthly average evaporation exceeds monthly average rainfall by up to 11 times, recharge is event-based and episodic, occurring only during high rainfall events that cause flooding of the overlying local alluvial groundwater systems adjacent to watercourses.

However, across the mine infrastructure area, groundwater level changes were observed to be muted or negligible in response to rainfall as indicated by observations and records at each groundwater monitoring bore.

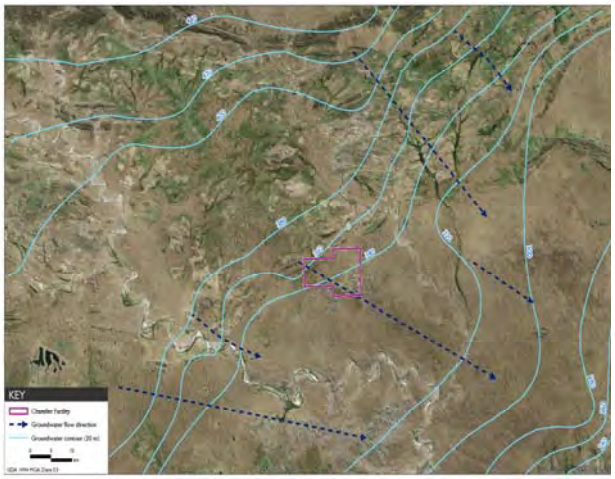


Figure ES-12 Groundwater flows in a southeast direction at Chandler

The groundwater flow direction at the Horseshoe Bend Spring location (some 8 kilometres to the south-east) is oriented west/east. However, the flow from the Proposal area is oriented north-west/-south-east (refer to Figure ES-12). This indicates that groundwater discharges at the Horseshoe Bend spring area are likely to be sourced from a separate groundwater system to the south of the Finke River.

Groundwater quality

The groundwater quality results are reasonably comparable between the different target Formations. The groundwater is slightly alkaline (averaging pH 8) and saline (electrical conductivity ranged between 12,600 and 21,000 microSeimens per centimetre (µS/cm)).

The water type at all locations was dominated by sodium and chloride, with minor calcium and sulfate ions. Total iron and zinc measurements were typically two to three orders of magnitude higher than the other total metal analytes.

Regional water quality monitoring conducted by the NT Government indicates that salinity is comparable (i.e. moderately saline) for other monitoring locations targeting the Langra Formation. Regional mean electrical conductivity (11,307 µS/cm) is slightly lower than observed within the proposed Chandler Facility area but remains within a saline category.

Regional monitoring in the Stairway Sandstone, underlying the Langra Formation, has comparable pH and electrical conductivity results (mean electrical conductivity: 16,578 µS/cm) to the Langra Formation at the Chandler Facility. Regional water type for the Langra Formation and Stairway Sandstone is also dominated by sodium and chloride. The water is generally suitable only for industrial uses.

It is important to note that:

- All the aquifers (Horseshoe Bend Shale, Upper Langra, Lower Langra and Stairway Sandstone) contain water with salinity significantly in excess of the salinity of potable water. Were water from these aquifers to be used for human consumption it would need to be diluted to < 1000 mg/L and more likely < 600 mg/L.
- The highest known salinity groundwater occurs in the Stairway Sandstone (~15,000 mg/L). The Jay Creek Formation (~40,000 mg/L) and the underlying Gillen Member (~ 318,000 mg/L).
- The highest salinities are all less than any water that is saturated with respect to (in equilibrium with) halite. Such a water at 25 °C would have a TDS of about 360,000 mg/L.

If any of these groundwater's were to be used in future for human consumption or for agriculture, they would need to be diluted significantly on account of their high salinity. This dilution would also reduce the concentrations of any contaminants that could potentially mobilise in the groundwater systems through construction, operational, or post closure activities.

Water use – Alice Springs and landholder bores

The Proposal is not located within the Alice Springs groundwater supply (Roe Creek) which is approximately 100 kilometres north of the Proposals.

Local land holder bore fields are located within the Orange Creek Syncline and target the Mereenie Aquifer System which is distinctly separate to the Chandler Syncline system.

Elsewhere, closer to the Proposal and within the south-east extent of the Amadeus Basin, numerous landholder bores target the shallow near-surface sediment groundwater systems along the Finke and Hugh Rivers. Other bores target deeper groundwater within the Idracowra and Stairway Sandstone.

In total, 36 landholder production bores were identified within the 25 kilometre buffer (including the Titjikala bore) and 193 were identified within the 75 kilometre buffer.

What will groundwater be used for?

Groundwater would service the following primary activities:

- Raw water supply for dust suppression along the haul road and access road.
- Potable water supply for mine workers.
- Building and operating the Apirnta Facility.
- Building and operating the Chandler Facility

What are the potential risks to groundwater?

During construction and operation of the proposal, the potential risks on groundwater include the potential for over abstraction of local groundwater reserves leading to drawdown of other groundwater bores, contamination of aquifers, and changes to groundwater dependent ecosystems.

Impacts are minor, with only minor localised drawdown predicted as a result of extraction from these bores (i.e. 0.2 metres drawdown within one kilometre of a bore pumping at 2 L/s).

The saline groundwater quality within the Chandler Syncline differs markedly from the potable water quality reported for the Mereenie Aquifer System (MAS) about 100 kilometres north within the Northern Amadeus Basin (the MAS is utilised for the Alice Springs Water Supply).

The Chandler Syncline is a separate groundwater system entirely, given that the MAS units occur within the Northern Amadeus sub-basin and Orange Creek Syncline, but do not occur within the Chandler Syncline. The evidence presented in the EIS confirms that the Chandler Syncline is distinct and separate from the MAS in terms of geological structure, lithological units, groundwater flow properties, hydraulic gradients and water chemistry. Therefore, water resource impacts to the Alice Springs water supply bore fields (Roe Creek borefield and Rocky Hill borefield) arising from Proposal-related dewatering and/or groundwater abstraction is not expected.

Water quality within shallow alluvial groundwater accessed by landholder bores to the north and west of the Chandler Facility, particularly at Titjikala can be characterised as potable. Whereas groundwater quality observed within the Horseshoe Bend Shale and Langra local groundwater systems are poor and equivalent to seawater.

As shown in Figure ES-13, the Proposal would not target storage within the alluvium. Mining and groundwater abstraction would target the deeper groundwater systems, and therefore, impacts on riparian vegetation or groundwater dependent ecosystems is highly unlikely.

Contamination of groundwater arising from the storage of waste in the underground repository has been quantitatively assessed during operation and post-closure. The assessments conclude there is no credible risk of contamination to the upper groundwater lenses and aquifer in the Langra Formation.

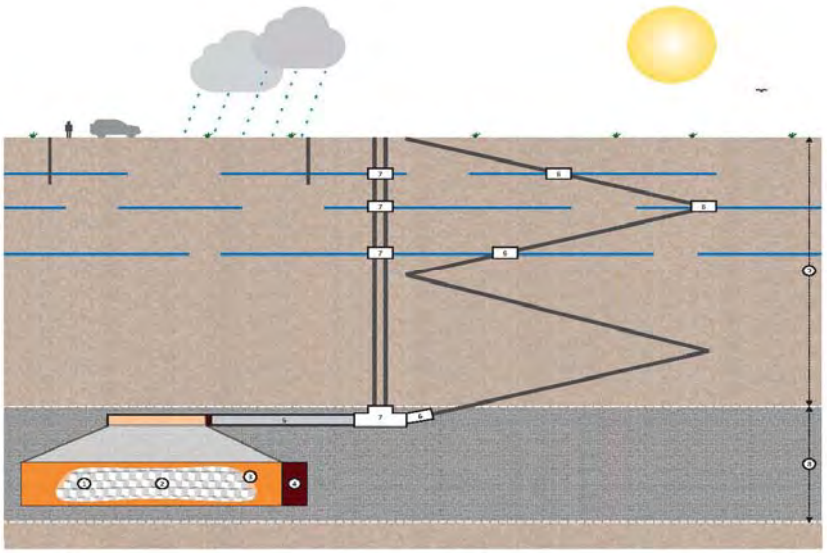


Figure ES-13 Location of storage, recovery and permanent isolation rooms in the

Contamination of groundwater arising from the storage of waste in the underground repository is unlikely to pose a groundwater contamination risk given the natural impermeability of the Chandler Formation halite resource. As shown in Figure ES-13, the depth of the proposed Chandler salt mine and deep geological repository in comparison to known groundwater systems provides approximately 450 metres of vertical separation comprising low permeability overburden material between the waste repository and the nearest overlying groundwater system

During construction and operation, it is anticipated that geophysical surveying will be used to identify faults/features of interest up to several hundred metres ahead of and prior to excavation with the mine layout subsequently adjusted to avoid such structures. The Proposal is not expected to be intersected by any geological faults or features that could be a pre-existing pathway to the overlying formations or groundwater resources.

Risks during post closure

The potential for indirect impacts on groundwater during closure and rehabilitation have been quantitatively assessed by Quintessa and Atkins. Calculations were undertaken for periods of up to one million years. The assessment provides confidence that, for the proposed categories of wastes and with appropriate facility design, there will be no significant risks arising from the Proposal in terms of environmental safety or risks to groundwater resources on a local or regional basis during post closure.

Groundwater mitigation and management

To ensure the sustainable use of existing and future local and regional groundwater reserves, the proponent would apply for water abstraction licences and permits under the *Water Act.*

During construction, the risk assessment identified potential impacts from accidental spills and/or leaks from drilling machinery. These types of impacts could unintentionally contaminate groundwater resources during the construction of mine shafts and the decline. To avoid and minimise these risks, the drilling program would implement shaft sealing techniques as shown in Figure ES-14.

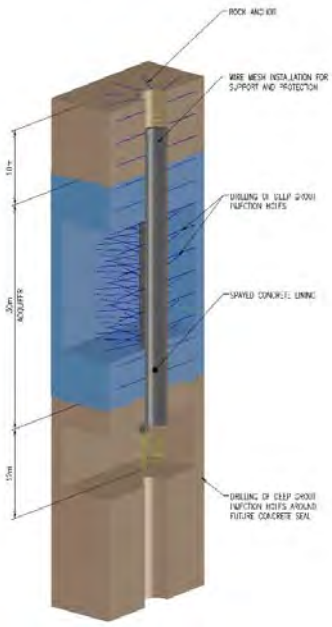


Figure ES-14 Groundwater seals and plugs

A draft Water Management Plan is included in this EIS which includes a detailed a groundwater monitoring plan for the life of the Proposal. In addition, during construction and operation, it is planned that geophysical surveying will be used to identify faults/features of interest up to several hundred metres ahead of and prior to excavation with the mine layout subsequently adjusted to avoid such structures.

Surface water

Baseline research

The Proposal occurs within an arid environment. Rainfall occurs periodically and, as a result, drainage lines such as gullies, creeks and rivers within the study area are generally dry for most of the year. In fact, the long term average annual rainfall within the proposed development footprint and vicinity is approximately 204 millimetres. The annual average evaporation is approximately 3,147 millimetres. This means evaporation is about 15 times greater than the annual average rainfall.

The major surface water features within the vicinity of the proposed development footprint are the Hugh River (located approximately 20 kilometres to the north-east of the proposed Chandler Facility) and the Finke River (located approximately 17 kilometres {at the nearest point} to the south of the proposed Chandler Facility). Both rivers are ephemeral. This means they remain dry for long periods of time with infrequent high flows during major storm events. Small flow events occur once or twice a year, often only resulting in a section of each river flowing (refer to Plate ES-9).

Several ephemeral drainage lines are present within the proposed development footprint. The only permanent waterbody within the proposed development footprint is a farm dam used for livestock watering (Halfway Dam). Halfway Dam is located within the footprint of the proposed mine infrastructure area at the Chandler Facility.

Extensive surface water investigations have been undertaken within the proposed development footprint since 2013. The purpose of the investigations was to describe and monitor baseline surface water characteristics (flow direction and speeds as well as the duration of flood events) associated within the development footprints of the proposed Chandler and Apirnta Facilities. Generally, flows are not connected to either the Hugh or Finke Rivers. Flow rates are low and water does not pond in low lying areas for too long because of high evaporation rates.



Plate ES-9 The Finke River shortly after a minor flow event

Geomorphological surveys and sediment sampling was undertaken at waterbodies both within and down gradient of the proposed development footprint and where land permissions could be obtained. Seven sites were selected where existing hydrographic stations were established or where hydrographic stations are proposed in the near-future. The surveys were undertaken to provide a snapshot various channel types and to characterise the main watercourses within the proposed development footprint and vicinity. Sediment sampling included testing of electrical conductivity, pH, dissolved oxygen, total dissolved solids, total suspended solids, nitrates, metals, moisture content, particle size distribution and total organic carbon.

The surface water quality samples were assessed against the trigger levels for freshwater aquatic ecosystem protection and primary industries livestock protection set out in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000). The results of water quality sampling within the proposed development footprint and wider region indicate that surface water is generally suitable for aquatic ecosystem protection, but may have adverse effects for livestock production due to the level of nitrates and/or metals in the water.

In addition to the above, soil erosion modelling, flood modelling, and storm profiling was undertaken in order to assess potential impacts during construction, operation, and closure and rehabilitation of the Proposal.

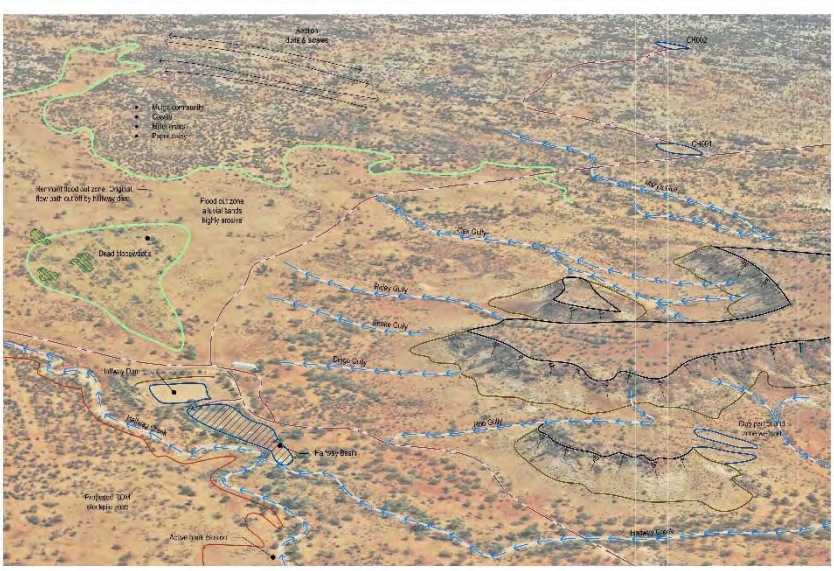


Figure ES-15 Conceptual surface water model at Chandler

A site conceptual surface water model was generated using aerial photography to show the characteristics of surface water patterns within the proposed mine infrastructure area (refer to Figure ES-15).

Potential impacts on surface water

Potential direct impacts on surface water during construction, operation, and closure and rehabilitation include those primarily associated with erosion (through exposed soils and stockpiled materials). There would be no perceptible change to hydrology for the following reasons:

- **Chandler Facility**. Surface water flowing through the proposed facility would drain towards a flat washout area to the north, towards the Charlotte Range. The water would pond in this washout area where the majority of the water would be lost through evaporation and infiltration. Surface water runoff is not expected to reach the Hugh River. In addition, the proposed facility (including the accommodation village) and catchments upstream of the proposed facility only represent 10% of the catchment draining through the Charlotte Range towards the Hugh River and the community of Titjikala.
- **Chandler Haul Road and Apirnta Facility**. Surface water flowing across the proposed haul road and through the proposed storage and transfer facility would drain to the south-west, towards Charlotte Range. Though the haul road would be less impervious than the existing track, the area would be insignificant when compared to the areas of contributing catchments. In addition, runoff from the proposed Apirnta facility would be collected, treated, and reused on-site for various purposes (e.g. dust suppression, vehicle washdown, ablutions). It is, therefore, not anticipated that there would be any perceivable increase in flow or volume of water draining through the Charlotte Range towards the Finke River.

Potential indirect impacts on surface water during construction, operation, and closure and rehabilitation include flooding and contamination of surface water from accidental spills. These

potential indirect impacts are easily managed through standard construction and operation sediment and erosion management measures.

Proposed mitigation and management

Mitigation and management measures would be implemented to reduce the potential impacts on surface water during construction, operation, and closure and rehabilitation of the Proposal. These measures would include installing erosion and sediment control measures around exposed surfaces and stockpiles; retaining large mature trees and shrubs, where possible; and ensuring that hazardous materials (including waste brought to site) is stored within bunded areas sufficient to hold 110 % of the material.

Drainage channels would be formalised to divert/convey flood flows from upstream catchments past both the proposed Chandler Facility and Apirnta Facility. Culverts or causeways (as appropriate) would also be incorporated into the design of the proposed Henbury Access Road and Chandler Haul Road. Infrastructure would not be placed within watercourses or drainage depressions and clearing or disturbance to watercourses or drainage depressions would be avoided (where possible). These measures (among others) would be included in a draft Water Management Plan that would be prepared and incorporated into the CEMP, the OEMP and/or the RCP for the Proposal.

The monitoring of baseline surface water conditions will continue during the public exhibition of the EIS. The proponent is committed to continuing field investigations through the detailed design, construction, operation, and closure and rehabilitation phases of the Proposal.

The surface water management system at Chandler and Apirnta would be designed to:

- Segregate different water sources and different water qualities, (i.e. raw water from the groundwater inflows/abstracted groundwater, sediment-laden water).
- Capture and contain mine affected water[3] and prevent discharge to receiving surface water environments.
- Ensure unused abstracted saline groundwater is contained and evaporated rather than discharged to surface water environments.
- Capture and segregate runoff from the following locations:
    - processing area.
    - salt overburden stockpiles.
    - topsoil and subsoil stockpiles.

[3] *Note – mine affected water relates to water encountered during construction of the mine decline and/or shafts. The mine operation will be undertaken in a dry environment.*

- other disturbed areas.

- Divert clean runoff away from areas disturbed by mining activities to minimise the volume of mine affected water.
- Manage sediment laden water in accordance with an erosion and sediment control plan that would be part of the water management plan, which will include the capture and treatment of sediment laden water in sediment dams.
- Reuse and recycle water in mining operations.
- Include contingency measures to accommodate either a surplus or deficit of site water.
- Communicate with key stakeholders (i.e. DENR, NT EPA, landholders, other users).

Historic and cultural heritage

The methodology for the historic and cultural heritage impact assessment included consultation, a database and literature review, the development of predictive models, field surveys and assessments of significance. The field surveys consisted of both pedestrian transects and slow moving vehicle transects. Eighty-five transects were conducted totalling approximately 83.9 kilometres.

No historic places were recorded within or in the vicinity of the proposed development footprint during the field surveys. One historic item was, however, recorded. This was a Bells brand tin matchbox, located outside of the proposed development footprint.

A range of archaeological site types including artefact scatters, knapping floors, ochre and stone quarries were recorded within and in the vicinity of the proposed development footprint during the field surveys (refer to Plate ES-10). Fifty-one sites were recorded (of which 30 were a part of eight larger site complexes). In addition, nine background scatters and 26 isolated finds were also recorded.



Plate ES-10 Retouched/grinding implement, ground and pitted surface (left), other side (middle), retouch/use-wear along edges (right)

No historic items would be impacted during construction or operation of the Proposal. With regards to archaeological material, a minimum of three site complexes, 11 individual sites, three background scatters and 11 isolated finds would be directly impacted during the construction of the Proposal. In addition, two site complexes, four individual sites, three background scatters and six isolated finds may be vulnerable to disturbance during construction given their close proximity to the proposed

development footprint. The risk of adverse impacts to cultural heritage would be low during operation and closure and rehabilitation of the Proposal.

Additional surveys of areas that would be impacted but have not yet been surveyed and which have a moderate to high probability of containing archaeological material (e.g. sections of the proposed Chandler Haul Road and the eastern end of the proposed Henbury Access Road) would be undertaken prior to construction.

Appropriate consent would be obtained for all sites that would be directly impacted or vulnerable to disturbance (and that require protective measures). Consent would be obtained from the NT Heritage Branch under section 72 of the NT *Heritage Act*. Additional mitigation and management measures to conserve cultural heritage values would be included in a Cultural Heritage Management Plan. This plan would be incorporated into the CEMP, OEMP and/or RCP for the Proposal.

Sacred sites have been identified within the proposed development footprint by the Central Land Council and the Aboriginal Areas Protection Authority. These sites would be managed in accordance with the conditions of an Aboriginal Areas Protection Authority Certificate and in accordance with an Indigenous Land Use Agreement.

Human health and safety

They key risks on human health and safety without mitigation or management measures in place were identified as being the transport and handling of hazardous waste; fire; and working underground. These activities/situations may result in injury, illness or possibly death.

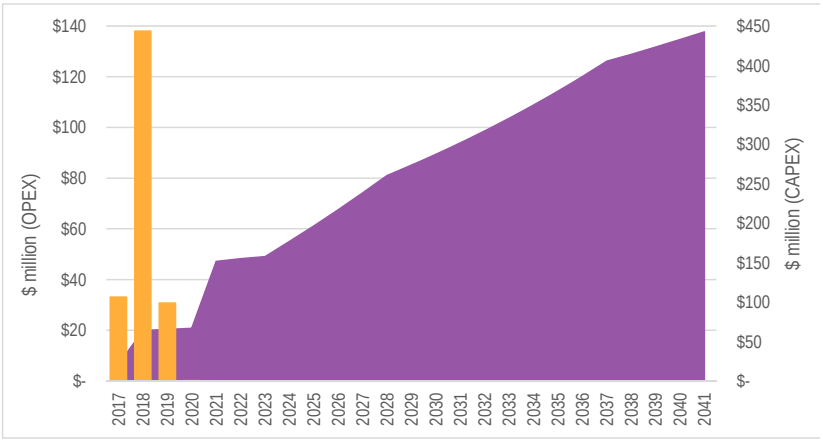
Mitigation and management measures would be implemented to reduce human health impacts during both construction, operation, and closure and rehabilitation of the Proposal. This would include the development of a detailed Safety Case and Operating Strategy (which would include a Waste Acceptance Procedure [WAP], Waste Acceptance Criteria [WAC], Waste Zoning Guide [WZG], a Traffic Management Plan, Air Quality Management Plan, Drug and Alcohol Management Plan, among others). These plans and procedures would be developed with reference to applicable legislation and regulations (NT and Australian). The implementation of these plans and procedures would minimise the risk of adverse impacts to human health to as low as reasonably achievable.

Economic and social

There would be a significant economic and social benefits to the economy of the local region, the NT and to the economy of Australia as a result of the Proposal.

The capital expenditure is estimated to be around A$676 million (nominal, including finance and contingency) for the Proposal. The construction period would have a high local content - around 67% of all construction costs would be spent in Australia (36 % spent in the NT). It is expected that up to 1,299 full time equivalent workers would be employed across all facets of the Proposal (all sourced from within Australia). Around 477 workers (or 37 % of the construction workforce) would be sourced from the local region. In total, 72 % of the construction workforce would be sourced from the NT with the remaining 28 % sourced from the rest of Australia.

On average, there would be spending of just under $81 million per annum to operate the Proposal (refer to Figure ES-16). Of this, 64 % would be spent in Australia (a total of 52 % would be spent in the NT, 32 % of which would be spent in the local region).



Note: Orange represents capital expenditure (CAPEX), purple represents operational expenditure (OPEX).

Figure ES-16 Capital and operational expenditure on the Proposal

The local region would benefit significantly from the Proposal. Around $118 million of capital expenditure would be spent in the region during construction and an average of $26 million per annum in operation. Local employment would receive a boost with 477 construction workers would be required and an average of 90 full time equivalent workers per annum in operation peaking at about 180.

The gross domestic product of Australia would rise by about $4.1 billion or an average of $166 million each year over the life of the Proposal. Most of this impact would be realised in the NT (the majority of which in the local region). About $3.6 billion (or an average of $144 million per year) would be added to the gross state product of the NT over the life of the Proposal. This would result in a significant annual contribution to the gross state product of the NT and is equivalent to around 0.6 % of the current gross state product of $23.1 billion.

Almost $3.4 billion would be contributed to the real incomes of Australians over the life of the Proposal. This includes an increase of $440 million to real incomes in the NT. The contribution to the local region would be higher at $475 million for the life of the Proposal.

During steady state operations, it is expected that up to 180 full time equivalent workers would be employed by the Proposal (refer to Figure ES-17). Just over 5,400 full time equivalent job years would be created over the life of the Proposal. This is an average of 217 full time equivalent job years per annum. The Proposal would deliver long term job creation in Australia, particularly in the NT where most of the job creation would be realised. An estimated 3,665 full time equivalent job

years would be created in the NT over the life of the Proposal. This is equivalent to an average of 71 full time equivalent job years per annum.

Almost $1.9 billion in direct and indirect taxation would be paid over the life of the Proposal (or an average of around $75 million each year). The majority of this taxation would be in the form of company taxes paid by the proponent as well as other personal and company income taxes paid to the Federal Government. In total, the NT is likely to receive $34 million in payroll taxes as a result of direct and indirect state revenues from the Proposal, or an average of $1.4 million per annum.



Figure ES-17 Direct employment during construction (top) and operation (bottom) of the Proposal

In addition to the modelled economic benefits, there would be other benefits (particularly to the local region) during construction and operation of the Proposal These benefits include the creation of new employment opportunities for local job seekers and new business opportunities for businesses wishing to support the Proposal. These opportunities would assist in retaining and attracting people to the local region and particularly to the town of Alice Springs. This would aid in addressing the current population decline in the local region and in Alice Springs.

Indigenous people would have a number of opportunities as a result of the Proposal. The proponent has set a target of 6 to 10 % indigenous employment as well as other commitments that would benefit local indigenous people such as the sponsorship of sporting and academic programs in the nearby community of Titjikala. Land use agreements are currently under negotiation with the government and with the Central Land Council. It is anticipated that the land use agreements would generate a range of potential opportunities for businesses in the local region and in the NT in the areas of agribusiness, tourism and conservation including ranger services and cultural and traditional tourism ventures. There would also be financial commitments to local Aboriginal groups under the *Native Title Act 1993.*

Closure and rehabilitation

Potential impacts during closure and rehabilitation include failure of the mine rooms; failure of the mine entry seals; infiltration of water into the mine rooms and the generation of leachate; surface remediation fails resulting in vegetation not growing and unable to support a functioning ecosystem; fauna not returning and a functioning ecosystem is not achieved.

A RCP would be implemented in order to avoid or reduce the potential impacts associated with closure and rehabilitation of the Proposal. The RCP would contain closure objectives, indicative completion criteria and key measurement tools. The measurement tools would include (but would not be limited to):

- Visual inspections.
- Revegetation monitoring.
- Erosion monitoring.
- Surface water and groundwater monitoring.
- Unauthorised access monitoring.

Based on the results of the monitoring, remedial actions would be evaluated and implemented (if required).

Surface monuments would be installed after closure and rehabilitation of the proposed Chandler Facility (refer to Plate ES-11). The purpose of the monuments would be to identify the isolation/disposal area located approximately 800 metres below the surface.



Plate ES- 11 Example of surface monument indicating a change in land use

Other risks

Other risks assessed included air, fire, noise and vibration, visual amenity, public health and food, biting insects, and greenhouse gases. A summary of these risks is presented below.

Air

Dust and odour/gases may be generated during construction, operation, and closure and rehabilitation of the Proposal. Activities that may result in dust include vegetation clearing and topsoil removal and the movement of plant and equipment on unpaved surfaces. Salt mining (particulate emissions) and combustion gases from local power generation (diesel engines) also have the potential to affect local air quality. The accidental loss of containment of salt or hazardous waste

may also result in air quality and human health impacts. These impacts would, however, be limited due to the lack of sensitive receivers within the vicinity of the proposed development footprint.

Mitigation and management measures would be implemented to reduce the potential for air quality and human health impacts during construction, operation, and closure and rehabilitation of the Proposal. Measures to control dust would include wet suppression, suspending excavation activities during high wind events, revegetating disturbed areas as soon as practicable, implementing vehicle speed restrictions on un-paved roads, daily on-site and off-site inspections in addition to a program of dust monitoring at strategic locations (for example, at the proposed Chandler Facility, Apirnta Facility, and within the community of Titjikala).

To reduce particulate emissions from the mine surface operations, salt stockpiles would be treated with a range of controls including windbreaks, shaping and profiling, and the rehabilitation of sandstone, shale, limestone and topsoil stockpiles would be implemented. Emissions from diesel engines would be minimised through adherence with international emission standards (specifically those developed by the United States EPA).

To reduce the risk of loss of containment of waste materials, containers would be handled on a strict one-at-a-time basis and the removal of containers from trucks would be performed in appropriately bunded areas to minimise the surface area of spills and to enable efficient clean-up of any spilled material. Load restrictions would be implemented for all trucks delivering waste materials to the site and a collision avoidance system would be developed to prevent potential accidents.

Specific mitigation measures would be developed for the potential loss of containment at Orange Creek, the Desert Oaks Motel, Stuart Wells and at the proposed Apirnta Facility. These mitigation measures would include a pre-prepared management response plan, restrictive speed limits and the provision of spill kits at each location.

These mitigation and management measures would be incorporated into an Air Quality Management Plan and Operating Strategy that would be included in the CEMP, OEMP and/or RCP for the Proposal.

Fire

Hazards associated with bushfire could occur during the construction, operation and closure and rehabilitation phases of the Proposal. If a bushfire were to occur, people, assets and the environment would likely be impacted.

Mitigation and management measures would be implemented to reduce the potential for bushfires during construction, operation, and closure and rehabilitation of the Proposal. These mitigation measures would include the creation of fire breaks (designed around prevailing wind directions, highest wind speeds and vegetation types), the preparation of a fire risk maps and firefighting training for personnel. The measures would be incorporated into a Bushfire Management Plan that would be included in the CEMP, OEMP and/or RCP for the Proposal.

Noise and vibration

Activities that would generate noise and vibration include:

- Rock blasting associated with the construction of the decline portal and tunnel at the proposed Chandler Facility. Rock blasting would generate noise in addition to ground vibration.
- Mechanical equipment and plant associated mainly with construction of the Proposal. Some equipment would also be used during the operation and closure and rehabilitation phases of the Proposal. This equipment would generate noise.
- Truck movements during the construction, operation, and closure and rehabilitation phases of the Proposal. Truck movements would generate noise and minor, localised ground vibration.

The nearest residents (the community of Titjikala) are located approximately 25 kilometres to the north-east of the proposed Chandler Facility and approximately 56 kilometres from the Apirnta Facility. Noise or vibration from the activities described above would not be audible at these distances.

A Noise Management Plan would be prepared and incorporated into the CEMP, OEMP and/or RCP for the Proposal. The primary purpose of the plan would be to safeguard workers from occupational noise. The Noise Management Plan would be prepared in accordance with the NT *Work Health Safety Act*.

Visual amenity

It is possible that transient views of the proposed Apirnta Facility could be seen from within a train travelling north or south along the Central Australian Railway during construction, operation, and closure and rehabilitation of the Proposal. These views would be of a short duration and likely screened by existing vegetation. Therefore, the visual impacts are considered to be minor. Mitigation and management measures would be implemented to reduce these potential impacts.

None of the proposed infrastructure would be visible from Maryvale Homestead, the community of Titjikala, Chambers Pillar, Chambers Pillar Historical Reserve, Idracowra Homestead, Henbury Homestead or Palmer Valley Homestead during construction, operation or during closure and rehabilitation of the Proposal. This would be due to the distance of the sensitive visual receptors from the proposed infrastructure and due to intervening topography that blocks views from the sensitive visual receptors to the proposed infrastructure (predominantly, Charlotte Range and the Maryvale Hills).

The proposed above ground infrastructure would be long term features within the existing landscape. Without appropriate landscape and visual amenity mitigation in place, a high visual impact on the existing landscape character and visual amenity of the area is likely. Landscape mitigation and management measures would be implemented to minimise these impacts. These measures would also mitigate visual impacts that could apply to cultural heritage.



These measures would include utilising the existing landscape to screen infrastructure or planting native and endemic trees and shrubs to screen infrastructure; utilising external building finishes and colours that blend with the colours of the surrounding landscape; and erecting boundary fences that are simple, non-reflective and have a high degree of transparency. These mitigation and management measures would be incorporated into a Landscape Concept Plan that would be prepared as part of the detailed design of the Proposal.

Public health and food

The Proposal would be designed, constructed and operated in accordance with the requirements set out in the NT Department of Health – Environmental Health *Environmental Fact Sheet No. 700: Requirements for Mining and Construction Projects* (2014a). The requirements for food safety, staff accommodation and sanitary facilities, on-site wastewater disposal, trade waste pre-treatment devices, potable water supply, bores, fuel storage, public health nuisance abatement, occupational health and safety and environmental management plan would be adhered to.

Biting insects

The presence of biting insects within the proposed development footprint and vicinity is highly variable and dependent on breeding conditions determined by warm seasonal rainfall. The existing surface hydrology of the proposed development footprint and vicinity consists of ephemeral watercourses, claypans, swamps and a purpose-built pastoral dam called Halfway Dam.

A number of mosquito species, several of which have the potential to cause discomfort and others that have the potential to carry disease, are likely to occur within the proposed development footprint or vicinity.

Activities associated with the construction, operation, and closure and rehabilitation of the Proposal have the potential to effect and possibly increase the mosquito population within the proposed development footprint and vicinity through the development of favourable breeding environments.

Mitigation and management measures would be incorporated into a Biting Insect Management Plan to prevent an increase in biting insects within the proposed development footprint and vicinity and to protect personnel during construction, operation, and closure and rehabilitation of the Proposal. The Biting Insect Management Plan would be incorporated into the CEMP, OEMP and/or RCP for the Proposal.

Greenhouse gases

Construction, operation, and closure and rehabilitation activities would generate both direct greenhouse gas emissions (e.g. via land clearance, fuel combustion) and indirect greenhouse gas emissions (e.g. via the extraction and processing of fuels). Greenhouse gas emissions have been calculated for each activity and are provided as annual total emissions during the construction and operational phases of the Proposal (emissions generated during closure and rehabilitation are expected to be similar to those generated during construction).

Direct emissions during construction were calculated to be 13,205 t CO_2-e per year with over half of emissions due to land clearance activities. During operation, direct emissions are calculated to be 104,310 t CO_2-e per year. Indirect emissions are calculated to be minor during construction (155 t CO_2-e per year) with emissions during operation anticipated to be 5,351 t CO_2-e per year.

The estimates indicate that the Proposal would contribute less than 1% of the total greenhouse gas emissions in the NT, and 0.02 % of the total greenhouse gas emissions in Australia (when compared to a base year of 2014).

A number of sustainability measures would be incorporated into the design, construction and operation of the Proposal. For example, solar energy would be used to supplement the power requirements of the proposed Chandler Facility and Apirnta Facility (a two megawatt solar farm would be installed at the Chandler Facility). These measures would ensure that greenhouse gas emissions are minimised to the maximum extent possible.

Environmental management

The environmental assessment has indicated that the Proposal would result in environmental impacts during construction, operation, closure and rehabilitation. A range of management plans, protocols and procedures to manage the environmental impacts of the Proposal would be implemented.

A CEMP, OEMP and a RCP would be prepared and implemented for the Proposal. The plans would include:

- Environmental objectives and performance targets for construction, operation, and closure and rehabilitation.
- Required statutory and other obligations, including consents, licences, approvals and voluntary agreements.
- Management policies, procedures and review processes to assess the implementation of environmental management practices and the environmental performance of the Proposal against the objectives and targets.
- Requirements and guidelines for management in accordance with:
    - Conditions of consent for the Proposal.
    - Mitigation measures specified by this environmental assessment.
    - Relevant construction management guidelines.
- Requirements in relation to incorporating environmental protection measures and instructions in all relevant standard operating procedures and emergency response procedures.
- Specific procedures, including monitoring, as defined by the environmental assessment and the conditions of consent.

- Roles and responsibilities of all personnel and contractors to be employed on-site.
- Procedures for complaints handling and ongoing communication with the community.
- Environmental sub-plans.
- Incident response procedure.
- Monitoring and auditing program.

An environmental monitoring program would be implemented that enables auditing of mitigation measures to ensure they achieve their objectives and to facilitate modification, where necessary. An environmental monitoring program would be established for both the construction and operational phase of the Proposal.

An environmental monitoring program enables auditing of mitigation measures to ensure they achieve their objectives and to facilitate modification, where necessary. An environmental monitoring program would be established for the construction, operation, and closure and rehabilitation phases of the Proposal. Monitoring requirements would be listed within the CEMP, OEMP and RCP.

Environmental management information and data would be stored in Tellus' existing Environmental Management System (EMS). The Tellus EMS is accredited to Australian and New Zealand Standards (AS/NZS) ISO 14001:2004 EMS. It is regularly audited internally, and annually audited by an external party.

Justification and conclusion

The Proposal is considered to be justified because it:

- Responds to a recognised need and is consistent with state and national waste management strategies.
- Provides a number of social and economic benefits including opportunities for long-term, full time employment.
- Would not result in significant effects on the environment.
- Is consistent with the principles of ecologically sustainable development.

Proceeding with the Proposal would result in significant social and economic benefits in the NT and within Australia. The Proposal would:

- **Provide an innovative unique dual revenue business in remote Central Australia** -the business would commercialise an industrial bulk commodity (salt) and provides an equipment and archives storage business and a storage, recovery and permanent isolation business for hazardous waste generated in the NT and within Australia.
- **Diversify the economy.** - development of enabling environmental infrastructure which would assist in providing utility support services to other existing and new projects that generate waste as a result of the 'Developing the North' strategy.
- **Major investment in regional Australia** - the capital expenditure is estimated to be around A$676 million (nominal, including finance and contingency) for the Proposal. Around 67 % of all construction costs would be spent in Australia (36% spent in the NT).
- **Boost the economy over the 29-year project life** - on average, there would be spending of just under $81 million per annum to operate the Proposal. Of this, 64 % would be spent in Australia (a total of 52% would be spent in the NT). The site could be expanded for generations.
- **Royalties, taxes and levies** - over the 29-year term could support other parts of the NT and the Australian economy.
- **Create training and long term job opportunities** -
    - About 270 jobs during construction (720 jobs during peak build including in-directs).
    - About 150 to 180 full time equivalent workers would be employed during operation. Just over 5,400 full-time equivalent job years would be created over the life of the Proposal, an average of 217 full time equivalent job years per annum.
    - Jobs would be green, sustainable, and generally well paid covering technical (engineering, chemistry, science), commercial (sales, business) and operational skills.
    - Proposed jobs and training programs, such as:
        - 1. Tellus' School to Jobs Program (Annual Schools Tour).

- 2.Tellus' Pre-employment Training Program ('Getting Job Ready') comprising Tellus' Traineeships Program, Tellus' Apprenticeships Program and Training Accreditation.
- 3. Indigenous Employment Program; comprising a 10 % indigenous employment target as well as other commitments that would benefit local indigenous people such as the sponsorship of sporting and academic programs in the nearby community of Titjikala.
- 4.Tellus' Employment Programs and Systems comprising a 'Sisters in Mining' Program; Tellus' Disabled Worker Program, Tellus' Ranger Program and support for Social Enterprises that could generate more jobs.

- **Provide local business support and new business opportunities** - goods and services such as construction and operational materials, food, accommodation, etc. would be sourced from local business, where possible.
- **Fulfil the government's own environmental and waste policy obligations under the following four main regulatory regimes** -
  - Environmental protection regulations (to minimise adverse impacts on the environment and human health and to meet national and international obligations);
    - Meeting NT and national obligations by providing critical infrastructure that can safely store, recover or permanently isolate difficult to manage wastes.
    - The NT EPA's *Waste Management Strategy for the Northern Territory 2015-2022*, the NT Department of the Chief Minister *Framing the Future* and the Australian Government *National Waste Policy*.
    - Meeting international obligations under the Basel Convention (Regulation of Transboundary Movements) and Waigani Convention (Regulation of Exports and Imports) by providing critical infrastructure for our near-neighbors such as the Pacific Islands who do not have suitable infrastructure to manage such wastes. Australia currently exports waste mostly to Europe and Asia and imports small volumes of waste materials mostly from our near neighbors (Pacific Islands). The proponent is not planning on actively marketing this service, but in the event of a man-made or natural disaster, the proposed Chandler Facility would be suitable.
  - Transport of dangerous goods regulations (to prevent accidents and promote safe transport, regulated by national legislation and codes).
  - Work health and safety regulations (hazardous chemical regulations that reduce occupational health and safety risk in the workplace).
  - Product stewardship regulations (the responsible management of products such as waste oil, asbestos, e-waste, tyres, batteries, mercury, medicines).

- **Support the circular economy** - by providing an opportunity for the future potential recovery of valuable materials (that are currently deemed waste). The Proposal could attract new salt and waste recycling and recovery industries to the NT.

Investigations were undertaken to assess the potential environmental impacts during construction, operation and closure and rehabilitation of the Proposal. These included specialist studies of biodiversity, groundwater, surface water, historic and cultural heritage, social, economic, air quality (including a greenhouse gas assessment and risks to human health) and noise and vibration. These studies were undertaken in accordance with relevant environmental legislation, guidelines and procedures established by regulatory agencies.

Based on the findings of the environmental investigations, there would be some adverse impacts on the environment. Mitigation measures that would be implemented during construction, operation and closure and rehabilitation have been proposed to avoid (eliminate) or reduce these impacts. The environmental performance of the Proposal would be managed through the implementation of CEMP, OEMP and RCP. This would also help to ensure compliance with relevant legislation and any conditions of approval. Based on this environmental impact assessment, it is considered that the long term operational benefits of the Proposal would outweigh the minor adverse effects of the Proposal.

Accessing the EIS

The draft EIS is available for public comment from **Saturday 18 February to Friday 31 March 2017**.

The proposal has been referred to the Australian Government Department of the Environment and Energy and determined to be a controlled action under the *Environment and Biodiversity Conservation Act 1999* (EPBC Act) (reference number EPBC 2012/6684). The controlling provisions under the EPBC Act are listed threatened species and communities (Sections 18 and 18A) and listed migratory species (Sections 20 and 20A). The Australian Government has accredited the assessment process under the Northern Territory *Environmental Assessment Act* for the purposes of assessing the proposal under the EPBC Act.

Copies of the draft EIS may be viewed and downloaded from the NT EPA webpage www.nt.gov.au/environment or the Tellus Holdings Ltd webpage www.tellusholdings.com

Hard copies of the draft EIS are available for viewing at the following locations:

- NT EPA, Level 1, 16 Parap Road, Parap.
- Mines and Energy Information Centre, Department of Primary Industry and Resources, 3rd Floor, Paspalis Centrepoint, 48 Smith Street Mall, Darwin.
- Northern Territory Library, Parliament House, Darwin.
- Environment Centre Northern Territory, Unit 3, 98 Woods St, Darwin.
- Arid Lands Environment Centre, 90 Gap Rd, Alice Springs.
- Central Land Council, 27 Stuart Hwy Alice Springs.

A CD copy of the draft EIS may be obtained by contacting Tellus Holdings Ltd on (02) 8257 3395 or info@tellusholdings.com

Interested persons and organsiations wishing to comment on the draft EIS for the Chandler Facility are invited to make written submissions on or before 31 March, 2017. Submissions can be emailed to eia.ntepa@nt.gov.au or posted to:

Environmental Assessments
Northern Territory Environment Protection Authority
GPO Box 3675, Darwin NT 0801

How to lodge a submission

A properly made submission should:

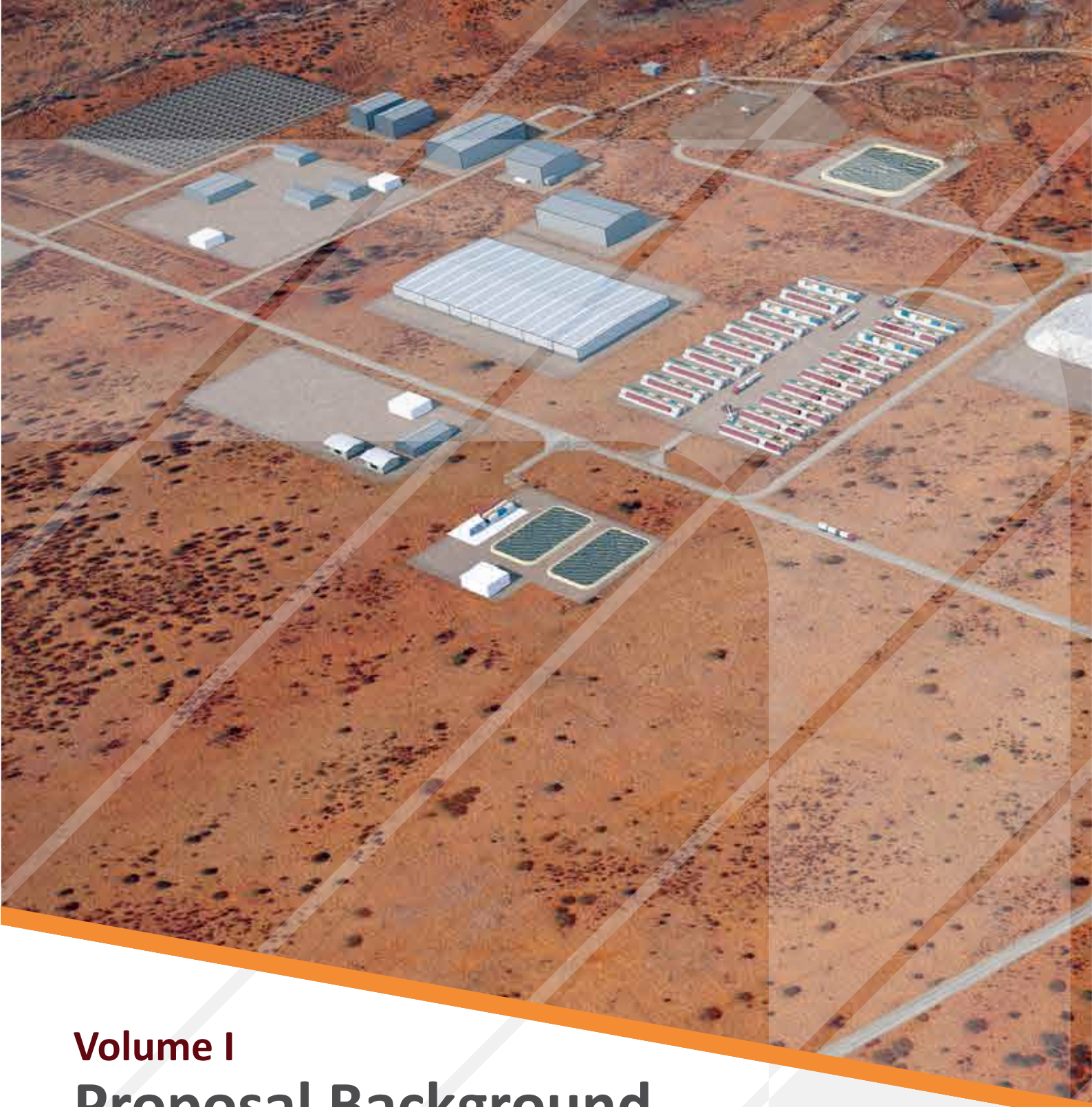
- Be in writing and received on or before the last day of the submission period.
- Be signed by each person who makes the submission.
- State the name and address of each person who makes the submission.
- Sate the grounds of the submission and the facts and circumstances relied on to support those grounds.
- Clearly state the matter(s) of concern or interest and list points to help with clarity.
- Reference the relevant section(s) of the EIS.
- Ensure the submission is legible.

What happens to my submission?

Your comments or submissions on the Proposal and supporting EIS are received by the NT EPA during the formal EIS public exhibition period. They are collated and issued to the proponent (Tellus). All comments and submissions received by the NT EPA will be addressed in a separate Supplementary EIS document.



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Volume I

Proposal Background

TELLUS



Part A
Introduction and Assessment Framework

1 INTRODUCTION

1.1 Overview

Tellus Holdings Ltd (Tellus) is an infrastructure project development company in the business of creating economic, social and environmental value from waste, clay and salt resources. This dual revenue model involves mining the commodities rock salt and kaolin clay in thick dry remote beds which creates world's best practice geological repositories. The voids created by mining are then used to store equipment, archives or waste using a multi barrier system as part of an overall safety case.

Tellus (also referred to as 'the proponent') propose to construct and operate an underground rock salt mine and storage, recovery and permanent isolation facility (herein referred to as the 'Chandler Facility'). A rail siding and temporary surface storage and transfer facility (herein referred to as the 'Apirnta Facility') is also proposed. A private haul road linking the two facilities (herein referred to as the 'Chandler Haul Road') would be constructed. A private access road (herein referred to as 'Henbury Access Road'), would be constructed to link the proposed Apirnta Facility with the Stuart Highway. Collectively, the two proposed facilities and the haul and access roads are referred to as 'the Proposal'.

If approved, the Chandler Facility and the majority of the Chandler Haul Road would be located within a pastoral lease (Maryvale Station) approximately 120 kilometres south of Alice Springs and about 25 kilometres by road from the community of Titjikala in the Northern Territory (NT) (refer to Section 1.3). The Apirnta Facility, Henbury Access Road and a portion of the Chandler Haul Road would be located to the west of the proposed Chandler Facility, also on a pastoral lease (Henbury Station).

This Environmental Impact Statement (EIS) has been prepared by Tellus to support key approvals under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the NT *Mining Management Act* (MM Act), the NT *Environmental Assessment Act* (EA Act) and the NT *Waste Management Pollution Control Act* (WMPC Act) for the construction, operation, and closure and decommissioning of the Proposal. The EIS has been prepared to address the requirements set out in the *Terms of Reference for the Preparation of an Environmental Impact Statement – Chandler Salt Mine* (the 'Terms of Reference') issued by the NT Environment Protection Authority (NT EPA) on 23 September, 2016, under the EA Act.

A copy of the Terms of Reference is provided in Appendix A. A table that lists the requirements as set out in the Terms of Reference with a reference to the chapter/section of the EIS that deals with that requirement is also presented in Appendix A.

A list of people involved in the preparation of the EIS is provided in Appendix B.

1.2 Objectives of the Proposal

There are two primary objectives of the Proposal. These are:

1. To mine rock salt for industrial and edible uses that would be exported to Asia, with some salt available for use in Australia.
2. The void spaces left from the salt mining operations, would be used to store equipment and archives and also store, recover or permanently isolate hazardous waste materials.

The concept of underground mining and using the voids created by the mining operations for storage is not new. The use of underground salt mines for the storage of equipment, archives and waste has been widely accepted in many countries as a preferred medium for the storage, recovery and permanent isolation of materials. Similar salt mine and complementary storage facilities operate safely in Europe, the United Kingdom, the United States and Canada.

1.2.1 Salt mining and processing

The Chandler Formation contains world class deposits of naturally occurring halite (sodium chloride or rock salt). The salt beds would be mined and used for various industrial applications (for example, chloralkali and synthetic soda ash production) and for human consumption (food or food processing).

With an expected initial mine life of about 25 years of full operations, the resource could possibly support Australia's longest life mine as evidenced in Europe where salt mines with similar resources have been mined for hundreds of years. There is growing demand (particularly in Asia) for salt and associated minerals (for example, magnesium) and a constrained supply.

1.2.2 Storage of materials (equipment, archives, etc.) and storage, recovery and permanent isolation of hazardous waste materials

A range of materials could be safely and securely stored (either temporarily or permanently) inside the void spaces that are left behind from the salt mining operations at the proposed Chandler Facility. The space mined affectively acts as a safe dry underground warehouse in salt. Typical materials that may be stored (and retrieved at a later date) include document archives, film archives, museum artefacts, computer servers, and a host of other valuable documents and equipment.

A range of hazardous wastes produced mostly by the mining, oil and gas, chemical, manufacturing, agricultural, site remediation, utilities (power, water and waste which also captures household collection) and government (State Emergency Service - man made or natural disaster) industries could be stored either temporarily (until recovery and treatment is possible) or permanently inside the void spaces left from the salt mining operations at the proposed Chandler Facility. These same waste materials could also be stored temporarily at the Apirnta Facility prior to being transported to the Chandler Facility.

Waste Acceptance Criteria (WAC) have been established for the Proposal to determine waste types which could and could not be accepted in order to achieve safe operation and environmental protection in the longer term at the proposed Chandler Facility. The facility has been designed and

would be located in a host geological environment that would be capable of storing and disposing of the majority of the NEPM[4] 75 chemical wastes subject to them meeting strict WAC. These criteria were developed following internationally recognised best practice and set out waste characteristics that would be not be suitable for storage or disposal in a geological repository.

Wastes that are gases, highly corrosive, highly oxidising, infectious or uncertified would not be accepted under any circumstances. Wastes that are liquids or sludges, explosive, flammable liquids or solids, self-combusting, generate a gas-air mixture which is toxic or explosive, biodegradable, tyres, could release free liquid or react with the host geology would not normally be accepted unless they could be stabilised, solidified or modified in such a way that they would not affect the operational or post closure safety of the proposed Chandler Facility.

Nuclear and uranium mining waste would not meet the WAC and, therefore, *would not be stored* at either the Chandler Facility or the Apirnta Facility. However almost everything in nature has some small amount of natural radioactivity and processing concentrates it. The proponent is planning to accept Naturally Occurring Radioactive Material (NORM) up to Exemption Level[5] (EW) activity content, which is the lowest activity level on the waste classification scheme.

The industries that generate NORM are usually those that refine raw materials and have a waste by-product that is concentrated. This includes utilities such as water treatment plants, ceramic industry and resource sector refineries. Exempt waste contains such small concentrations of radionuclides that it does not require provisions for radiation protection, irrespective of whether the waste is disposed of in conventional landfills or recycled. Such material is exempt from regulatory control and does not require any further consideration from a regulatory control perspective.

Typical waste types accepted (and not accepted) at both facilities are listed in Table 1-1 with further detail provided in Chapter 3.

[4] National Environment Protection (Movement of Controlled Waste between States and Territories) Measure
[5] 2 Classification of Radioactive Waste – RPS20, Schedule 4 of the NDRP (ARPANSA 2010)

Table 1-1 Hazardous waste accepted and not accepted for underground storage, disposal and permanent isolation

Type of hazardous chemical wastes	Accepted on-site for surface storage[1]	Accepted in underground voids[1]
Chemical wastes listed under the National Environment Protection Measures (NEPM) (refer to Schedule A List 1: Waste Categories) and under Schedule 2 of the NT Waste Management and Pollution Control (Administration) Regulations	✓	✓
Liquid and sludges	✓	✓[1]
Explosive wastes	×	×
Flammable liquids or solids	×	×
Self-combusting wastes or wastes that can generate a gas-air mixture which is toxic or explosive	×	×
Highly corrosive or oxidizing	×	×
Gases	×	×
Clinical waste (infectious hospital waste and body parts)	×	×
Municipal solid waste (putrescible household and commercial waste)	×	×
Putrescible waste (household rubbish that can rot)	×	×
Uncertified waste (which cannot be identified or has not undergone characterisation testing)	×	×
Reacts with the repository geology (such as dissolving it or producing a gas)	×	×
NORM[2]	✓	✓
Low level radioactive waste (e.g. smoke detectors, exit signs, industrial gauges and medical isotopes)	×	×
Intermediate level radioactive waste (e.g. reprocessed spent nuclear fuel and components with high levels of radioactivity)	×	×
High level radioactive waste (e.g. from power generation and defense use)	×	×

Note: ✓ = accepted, × = not accepted, ✓[1]= normally excluded but could be used in hydraulic backfill processing. [2] Exemption activity levels defined as per *The National Directory for Radiation Protection, February 2014 (RPS 6).*

1.3 Location of the Proposal

The proposed Chandler Facility would be located within NT Mineral Lease (ML) 30612.

The proposed Chandler Facility and most of the Chandler Haul Road would be located within Maryvale Station (NT Portion 810), approximately 120 kilometres south of Alice Springs and 25 kilometres by road from the community of Titjikala. The proposed Apirnta Facility, Henbury Access Road and a portion of the Chandler Haul Road would be located within Henbury Station (NT Portion 657), to the west of the proposed Chandler Facility (refer to Figure 1-1).

Land within Maryvale Station and Henbury Station is pastoral lease land governed under the NT *Pastoral Land Act.* As such, land within Maryvale Station and Henbury Station is used for pastoral activities (specifically for grazing cattle).

The closest community to the proposed Chandler Facility is the community of Titjikala. Titjikala has a population of approximately 250-300 residents, the majority of which are Aboriginal whose primary language is Luritja, Arrernte or Pitjantjatjara. Other larger communities surrounding the Proposal include Amoonguna to the north, Santa Teresa to the east, Finke to the south, Imanpa to the south-west and Orange Creek to the north-west. All of these communities are located within the MacDonnell Regional Council Local Government Area.

The Hugh River is located approximately 20 kilometres to the north-east of the proposed Chandler Facility and the Finke River is located approximately 25 kilometres to the south of the proposed Chandler Facility (refer to Figure 1-1). Chambers Pillar and the Chambers Pillar Nature Reserve are located approximately 30 kilometres to the west and the Rainbow Valley Nature Reserve is located approximately 54 kilometres to the north of the proposed Chandler Facility.

The Central Australian Railway is located approximately 30 kilometres to the west of the proposed Chandler Facility. The proposed Apirnta Facility would be located adjacent to the Central Australian Railway (refer to Figure 1-1). The Stuart Highway is located approximately 60 kilometres to the west of the proposed Apirnta Facility and 90 kilometres to the west of the proposed Chandler Facility.

ORANGE CREEK HOMESTEAD
Rainbow Valley Conservation Reserve
JAMES RANGES
PWERTE MARNTE MARNTE
WALKABOUT BORE
OAK VALLEY
MOUNT PEACHY
PWERTENTYE
HUGH RIVER STOCK ROUTE
MALONEY CREEK
HUGH RIVER
CHANDLER RANGE
OLIFFE RANGE
MARYVALE ROAD
Henbury Meteorites Conservation Reserve
HENBURY HOMESTEAD
GUMTREE HILLS
BACON RANGE
RODINGA
HENBURY METEORITE CRATERS
ERNEST GILES ROAD
FINKE RIVER
CENTRAL AUSTRALIAN RAILWAY
HUGH RIVER
Stuart Highway
STUART HIGHWAY
Henbury Access Road
MARYVALE HOMESTEAD
TITJIKALA
CHAMBERS PILLAR ROAD
Access to Titjikala and Chambers Pillar Road
Apirnta Facility
Accomodation village
Chandler Haul Road
SEYMOUR RANGE
PALMER VALLEY HOMESTEAD
Chandler Bore Field
MARYVALE HILLS
CHARLOTTE RANGE
Chandler Facility
HUGH RIVER
Chambers Pillar Historical Reserve
PALMER RIVER
FINKE RIVER
IDRACOWRA HOMESTEAD
HUGH RIVER

CHEWINGS RANGE
WIGLEY GORGE
Alice Springs
MACDONNELL
TODD PLAIN
WEST WATERHOUSE
STUART HIGHWAY
MARYVALE ROAD
OORAMINNA RANGE
DINGO GAS FIELD
Central Australian Railway
OAK VALLEY
TRAIN HILLS
BACON RANGE
RODINGA
Proposed development footprint
CHARLOTTE RANGE

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Document Path: C:\GIS_SSIMaps\Chandler_ProjectLocation_SMA.mxd

N

5.5 2.75 0 5.5 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Railways
- Existing road
- Existing track
- Watercourse
- Homestead location
- ML30612
- Henbury Access Road
- Chandler Haul Road
- Access road to Titjikala
- Chandler Facility
- Apirnta Facility
- Accomodation village
- Proposed bore field

Figure 1-1
Regional location of the Proposal

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1.4 Key features of the Proposal

The Proposal includes an underground rock salt mine and a storage, recovery and permanent isolation facility (the Chandler Facility), as well as a supporting rail siding and surface storage and transfer facility (the Apirnta Facility) and haul and access roads (the Chandler Haul Road and the Henbury Access Road). A description of the facilities and roads is provided below. Further detail is provided in Chapter 3.

1.4.1 Chandler Facility

Tellus propose to develop a new underground rock salt mine and complementary storage business with supporting aboveground infrastructure that would export up to 750,000 tonnes of salt product per annum. The facility would also provide for the safe and secure storage, recovery and permanent isolation of up to 400,000 tonnes of waste per annum, although average volumes are expected to be significantly less than this amount (year 1one 30,000 tonnes, average 340,000 tonnes per annum). The rock salt mine and complementary storage facility is referred to as the Chandler Facility. A graphical representation of the proposed Chandler Facility is provided in Figure 1-2.



Figure 1-2 The proposed Chandler Facility. Aboveground infrastructure shown above and underground infrastructure shown below

Salt mining and storage/permanent isolation of materials

Salt mining activities would involve:

- Deep mining of rock salt using a 'room and pillar' system of mining.
- Transport of salt via shaft hoisting to the surface.
- Stockpiling of rock salt for processing and packaging.
- Transport of rock salt to domestic and overseas market:
    - Domestic market (via road and rail) - road transport via truck on federal and state highways. Rail transport via a proposed new railway siding located at the Apirnta Facility.

- Overseas market (via rail) - rail transport also via the proposed new railway siding located at the Apirnta Facility, predominantly south to a port facility in Adelaide. From there, rock salt would be shipped to overseas markets predominantly in Asia.

Storage, recovery and permanent isolation of materials would involve:

- Transport of materials (equipment, archives, etc.) and waste, predominantly by rail, for receipt and temporary storage at the Apirnta Facility.
- Transfer of materials by truck from the Apirnta Facility to the Chandler Facility via the proposed Chandler Haul Road.
- Transport of packaged materials via mine access decline or via hydraulic backfill into the voids created by the salt mining operation:
  - Waste would be permanently isolated in line with operational management plans and a strict Waste Acceptance Criteria (WAC).
  - Materials such as equipment and archives would be stored separately for future retrieval.
- Once full, sealing the underground voids permanently with an engineered barrier.

The facility would be designed and managed to allow for future waste recovery opportunities, that is, wastes would be stored like-with-like and the final disposal locations of all waste would be tracked and logged for future reference. At some point in the future, a technology recovery park would be established to support research and development into ways to release waste materials back into the circular economy. This would be subject to separate regulatory approvals.

The salt would be mined from the Chandler Salt Bed which is located approximately 850 metres below the surface. Materials stored within the voids left from the mining operation would be situated within a salt bed approximately 250 to 300 metres thick allowing the waste to be permanently removed from the biosphere in a stable and dry environment.

Key infrastructure

The key underground infrastructure at the proposed Chandler Facility would include:

- Underground mine.
- Mine access decline.
- Two ventilation shafts (one allowing for salt hoisting and personnel riding as well as downcast ventilation, and one for upcast ventilation).

The key aboveground infrastructure at the proposed Chandler Facility would include:

- Salt processing facilities.
- Waste unloading area.
- Waste storage warehouse.
- Vertical shaft headframe.
- Surface hydraulic backfill plant and underground reticulation.
- Salt and overburden stockpiles.
- Maintenance buildings.
- Administration building.

- Worker accommodation.
- Solar/diesel hybrid power plant.
- Clean and raw water dams.
- Water and sewage treatment.
- Fuel storage facility.
- Utility reticulation.
- Internal roads.
- Compressor building.
- Bore field.
- A future technology recovery park.

1.4.2 Apirnta Facility

The Chandler Facility would be supported by a proposed new, off-site rail siding and surface storage and transfer facility referred to as the Apirnta Facility. The Apirnta Facility would include two key pieces of infrastructure:

1. A rail siding approximately two kilometres in length.
2. A laydown area that would support the temporary storage of waste.

The purpose of the surface storage and transfer facility would be to provide a licensed facility that safely allows for the temporary storage of waste products prior to being transported by road for storage and/or permanent isolation at the proposed Chandler Facility.

The surface storage and transfer facility would provide for the temporary storage of up to 400,000 tonnes of waste per annum, although average volumes are expected to be significantly less than this amount (year one 30,000 tonnes, average 340,000 tonnes per annum), although average volumes are expected to be less than this amount. The waste would be stored either in a warehouse, within an open storage yard or within a liquid storage tank. A graphical representation of the proposed Apirnta Facility is provided in Figure 1-3.

Temporary storage

The proposed surface storage and transfer facility would receive waste materials transported, predominantly by rail, from reputable companies licenced to transport dangerous goods. Waste arriving would be inspected, sampled, unloaded and appropriately stored in line with a strict WAC (refer to Appendix C) and in accordance with appropriate standards, codes and regulations.



Figure 1-3 The proposed Apirnta Facility. Aerial view (top) and proposed warehouse (bottom)

Waste materials stored in the warehouse would be sealed in storage containers and wrapped in plastic on wooden pallets and stacked in high-bays. The storage yard would be used for the temporary storage of waste materials that would be sealed in shipping containers. The liquid storage tank would be used to store a variety of liquid wastes.

Key infrastructure

The key infrastructure at the proposed Apirnta Facility would include:

- Rail siding and laydown area.
- Storage areas for dry and solid waste materials; a steel-framed warehouse and open storage yard.
- A liquid storage tank to store a variety of liquid wastes.
- A quarantine zone.
- Laboratory, office and maintenance and storage shed.
- Internal roads and car parking.
- Loading bay, weighbridge and vehicle washdown facility.
- Truck driver amenities.
- Security gates, fencing, cameras and lighting.
- Bunding and stormwater drainage.
- Electricity, water and sewerage services.

1.4.3 The Chandler Haul Road and Henbury Access Road

Haul and access roads would be constructed as part of the Proposal. The proposed Chandler Haul Road would be approximately 30 kilometres long and would connect the Chandler Facility to the Apirnta Facility. It would provide for the movement of salt from the Chandler Facility to the rail siding at the Apirnta Facility. It would also provide for the movement of waste temporarily stored at the Apirnta Facility to the Chandler Facility.

The proposed Henbury Access Road would be approximately 60 kilometres long and would connect the Apirnta Facility to the Stuart Highway. It would provide for the movement of workers and delivery vehicles to and from the Stuart Highway to the Apirnta Facility and through to the Chandler Facility. The Henbury Access Road would be constructed once mining operations have begun. During construction, all workers, equipment and delivery vehicles would access the Chandler Facility via the existing Maryvale Road (a public road).

Both roads would be unsealed and designed and constructed to appropriate industry standards and their proposed use.

1.5 The proponent

Tellus is the proponent for the Proposal. Tellus is an infrastructure development company in the business of creating economic, social and environmental value from salt, clay and waste resources. The dual revenue model for the Proposal involves mining rock salt in a remote arid area which creates excellent opportunities for world's best practice in deep geological repositories. The voids created by mining are then used to store equipment, archives or waste using a multi barrier system as part of an overall safety case.

Tellus plan to permanently isolate hazardous waste using environmentally sound management principles that protect the environment and human health. Tellus also supports the circular economy using long term storage by placing like-with-like materials for operational safety reasons and to create opportunities for the future recovery of valuable materials.

Tellus' business model mirrors international solutions operating in the United Kingdom, Europe and North America. Tellus is developing the proposed Chandler Facility in the NT (which has been awarded Major Project Status by the NT Government) and also the proposed Sandy Ridge Facility in Western Australia.

The company details are as follows:

Tellus Holdings Ltd
Suite 2, Level 10
151 Castlereagh Street
Sydney NSW 2000.
ABN 97 138 119 829

The key contact for the EIS is:

Mr Richard Phillips
Environment and Approvals Manager
Tellus Holdings Ltd
Email: info@tellusholdings.com
Office: +61 2 8257 3395

Further information regarding the proponent is provided on their website at the following address: www.tellusholdings.com.au.The proponent's environmental record is provided in Appendix D.

1.6 Background

Investigations into the possibility of a salt mine and complementary storage business within Australia have been undertaken by the proponent since 2010. A summary of these investigations is presented in Table 1-2.

Table 1-2 Summary of investigations undertaken by the proponent (2010-2016)

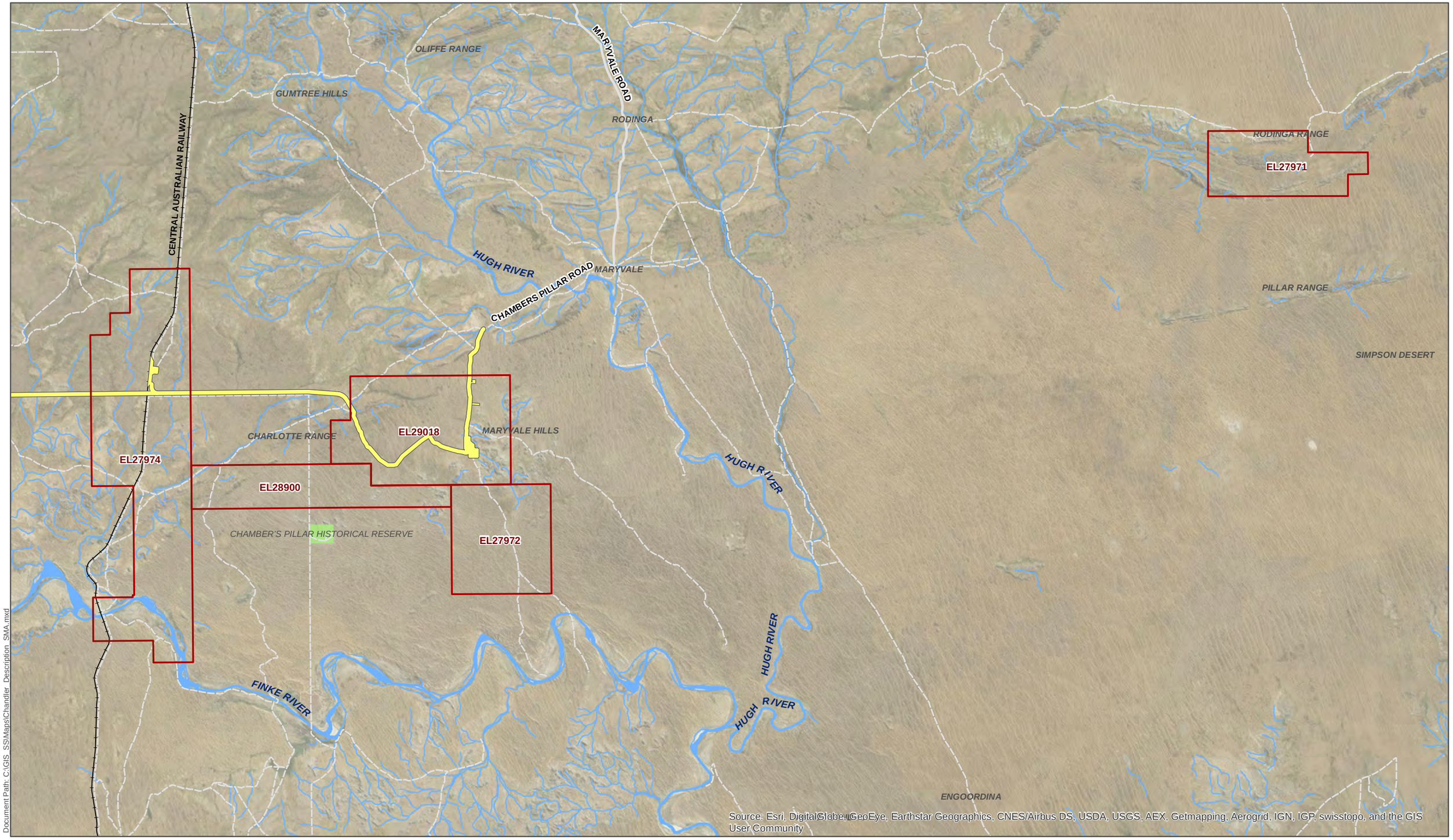
Exploration and mineral leases/licences	Year	Resource and environmental baseline studies
Proponent applies for, and is granted, five exploration licences (or tenements)	2010	Regional desktop assessment undertaken of provinces on a geological basin level across Australia. Amadeus Basin located in central Australia identified as the most appropriate geological resource for a salt mine and complementary waste storage, recovery and permanent isolation business.
	2011	Nine sites investigated within the Amadeus Basin. Three suitable sites shortlisted and investigated within Charlotte North, all located within the Chandler Formation.
Proponent applies for four additional exploration licenses. **Proponent relinquishes two tenements and partially relinquishes one.**	2012	• Charlotte North selected as preferred location, Mt Charlotte as alternate location. • Prefeasibility baseline studies begin including aerial surveys, a soils assessment, geological and geotechnical assessments, biodiversity surveys and a high level visual impact assessment within Charlotte North. • Findings and conclusions of study used by integrated team of experts to prepare a site-specific geological drilling program.
	2013	• Seasonal ecological field surveys commence in the vicinity of the proposed Chandler Facility. • Soil surveys commence across the proposed mine infrastructure area and haul roads.
Proponent partially relinquishes four tenements.	2014	• Geological drilling commences. Deep core holes are drilled to a depth of approximately 1,084 metres. Chandler Formation is intersected at approximately 772 and 825 metres below ground level. • Information is compiled into a resource statement compliant with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC). • Water quality stations are constructed upstream and downstream of the proposed Chandler Facility. Water quality monitoring commences.

Exploration and mineral leases/licences	Year	Resource and environmental baseline studies
Proponent lodges a Mineral Lease Application (MLA 30612) for Charlotte North.	2015	• Detailed water drilling program commences over three months to improve the understanding of groundwater conditions in the vicinity of the proposed Chandler Facility. • Baseline studies continue including land and aerial surveys, seasonal biodiversity surveys, cultural heritage surveys (involving traditional land owners), visual assessments. • Seasonal ecological field surveys extend to the proposed Chandler Haul Road, Apirnta Facility and Henbury Access Road. • Chandler's two pilot projects (USA - wet processing and Germany -dry processing) and marketing of the product in Asia to date has demonstrated a high-grade salt deposit.
Proponent relinquishes two tenements.	2016	• Baseline studies continue including air quality, human health, surface water, groundwater, cultural heritage, soils, biodiversity, economic and social impact studies. • Updated prefeasibility study is undertaken to identify the preliminary infrastructure requirements, mining methods, production schedule, mining hazards and legislative environmental requirements for commercialising the Proposal.

Details of the current tenements are provided Table 1-3. The location of the tenements is shown in Figure 1-4.

Table 1-3 The proponent's current tenements within the NT

Tenure	Name	Effective date	Expiry date	Sub blocks	Status
EL 29018	Charlotte North	12-Apr-12	11-Apr-18	41	Grant
EL 27972	Mt Charlotte	20-Oct-10	Renewal pending	25	Renewal pending
EL 27971	Bluebush	20-Oct-10	Renewal pending	20	Renewal pending
EL 27974	Central Railroad	20-Oct-10	Renewal pending	72	Renewal pending
EL 28900	Eastern railroad	05-Mar-12	04-Mar-18	22	Grant
ML30612	Chandler	-	-	9978 ha	Application



Document Path: C:\GIS_SSI\Maps\Chandler_Description_SMA.mxd

N

4 2 0 4 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Mineral titles exploration license - granted (Tellus Holdings Ltd)
- Existing road
- Existing track
- Watercourse

Figure 1-4
The proponent's tenements within the NT

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1.7 Overview of approvals and environmental impact assessment process

An overview of the approval requirements and environmental assessment process is provided below.

1.7.1 Approval requirements

The Proposal will require planning approval, licenses and permits from both the Australian Government and from the NT Government (refer to Chapter 4 for more information on the approvals pathway).

The key approvals and licenses will be sort from:

- The Australian Minister for the Environment under the provisions of the EPBC Act and Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regulations). The EPBC Act and EPBC Regulations are administered by the Commonwealth Department of the Environment and Energy (DoEE).
- The NT Minister for Mines and Energy under the provisions of MM Act and the Mining Management Regulations (MM Regulations). The MM Act and MM Regulations are administered by the NT Department of Primary Industry and Resources (DPIR).
- The NT Minister for the Environment under the following legislation:
    - EA Act and the Environmental Assessment Regulations (EA Regulations) and Environmental Assessment Administrative Procedures (EA Procedures) administered by the NT EPA.
    - WMPC Act and Waste Management Pollution Control Regulations (WMPC Regulations) also administered by the NT EPA.

Overall approval is sought under the EPBC Act and EPBC Regulations (administered by the DoEE) and the EA Act, EA Regulations and EA Procedures (administered by the NT EPA) via a bilateral agreement between the Australian Government and the NT Government. If approved, the salt mining operations would be regulated under the MM Act and MM Regulations administered by the DPIR. The storage, recovery and permanent isolation of waste within the salt mining voids would be regulated under the WMPC Act and WMPC Regulations administered by the NT EPA.

1.7.2 Environmental impact assessment process

In November 2012, a Notice of Intent for the Proposal was submitted to the NT EPA. In March 2013, the NT EPA determined that the Proposal required assessment under the EA Act at the level of an EIS. *Final Guidelines for the Preparation of an Environmental Impact Statement* (referred to as the 'EIS Guidelines') were issued by the NT EPA on 19 July, 2013. A period of three years was set to submit the EIS.

The Proposal was also referred to the DoEE in December 2012 due to the potential for the proposed action (the Proposal) to have a significant impact on Matters of National Environmental Significance (MNES). In February 2013, the DoEE determined that the proposed action was a controlled action and required assessment under the EPBC Act. The controlling provision was listed threatened species and communities (sections 18 and 18A of the EPBC Act). The DoEE also determined that the Proposal will be assessed by accredited assessment at the level of an EIS under the EA Act.

In September 2014, the Proposal was awarded "Major Project Status" by the NT Government.

In April 2016, both the NT EPA and DoEE were notified that changes had been made to the Proposal. The changes involved the removal of some previously proposed infrastructure (mine site surface processing plant; airstrip; specialty salt processing and packing plant with training school and visitor centre; crystallisation and evaporative ponds; wet processing of salt; and storage and transfer facilities in Darwin and Alice Springs) reducing the footprint of the Proposal.

The changes also involved a change to, or addition of, the following infrastructure:

- Change of access from the Stuart Highway to the proposed rail siding (and proposed Apirnta Facility). Rather than using Maryvale Road, an existing access road located on the Henbury Station would be upgraded and used as the primary access road to the Apirnta Facility from the Stuart Highway (the Henbury Access Road). This change in access was made due to significant health and safety concerns regarding the use of Maryvale Road.
- Change to storage processing (in addition to the emplacement of solid wastes, it is proposed to permanently isolate some waste types by hydraulic backfill).
- Addition of a helicopter pad (a helicopter pad would be constructed in lieu of the previously proposed airstrip).
- Addition of a surface storage and transfer facility located adjacent to the proposed rail siding (the Apirnta Facility) capable of storing approximately 400,000 tonnes of waste.

In May 2016, the NT EPA determined that the changes to the Proposal were broadly allowed for by the EIS Guidelines issued in July 2013. Several additional matters pertaining to the proposed hydraulic backfilling method, the rail siding and the Apirnta Facility were, however, required to be addressed. This decision was supported by the DoEE in June 2016.

In June 2016, an extension was requested on the timeframe for submitting the EIS. This extension was granted with the proviso that new guidelines (now referred to as 'terms of reference') would be issued and subject to public exhibition. In September 2016, the *Terms of Reference for the Preparation of an Environmental Impact Statement – Chandler Salt Mine* (the 'Terms of Reference') were issued by the NT EPA (refer to Appendix A).

Once submitted to the NT EPA, the draft EIS will be advertised for public comment and circulated to the relevant government advisory bodies for review for a minimum of 28 days. Comments will be forwarded by the NT EPA to the proponent. The proponent will then be required to prepare a Supplement to the draft EIS addressing the comments. The Supplement to the draft EIS will be

submitted to the NT EPA and then circulated to government and advisory bodies for review and comment within 14 days. During the first 21 days from the receipt of the Supplement to the draft EIS, the NT EPA may call for further information from the proponent.

Assuming no further information is requested, an Assessment Report is prepared by the NT EPA for the Responsible Minister for a decision under the EA Act within 35 days of receiving the Supplement to the draft EIS. The NT EPA also provides a copy of the Assessment Report to the Australian Minister for the Environment for a decision under the EPBC Act on MNES.

1.8 Purpose and structure of this environmental impact assessment

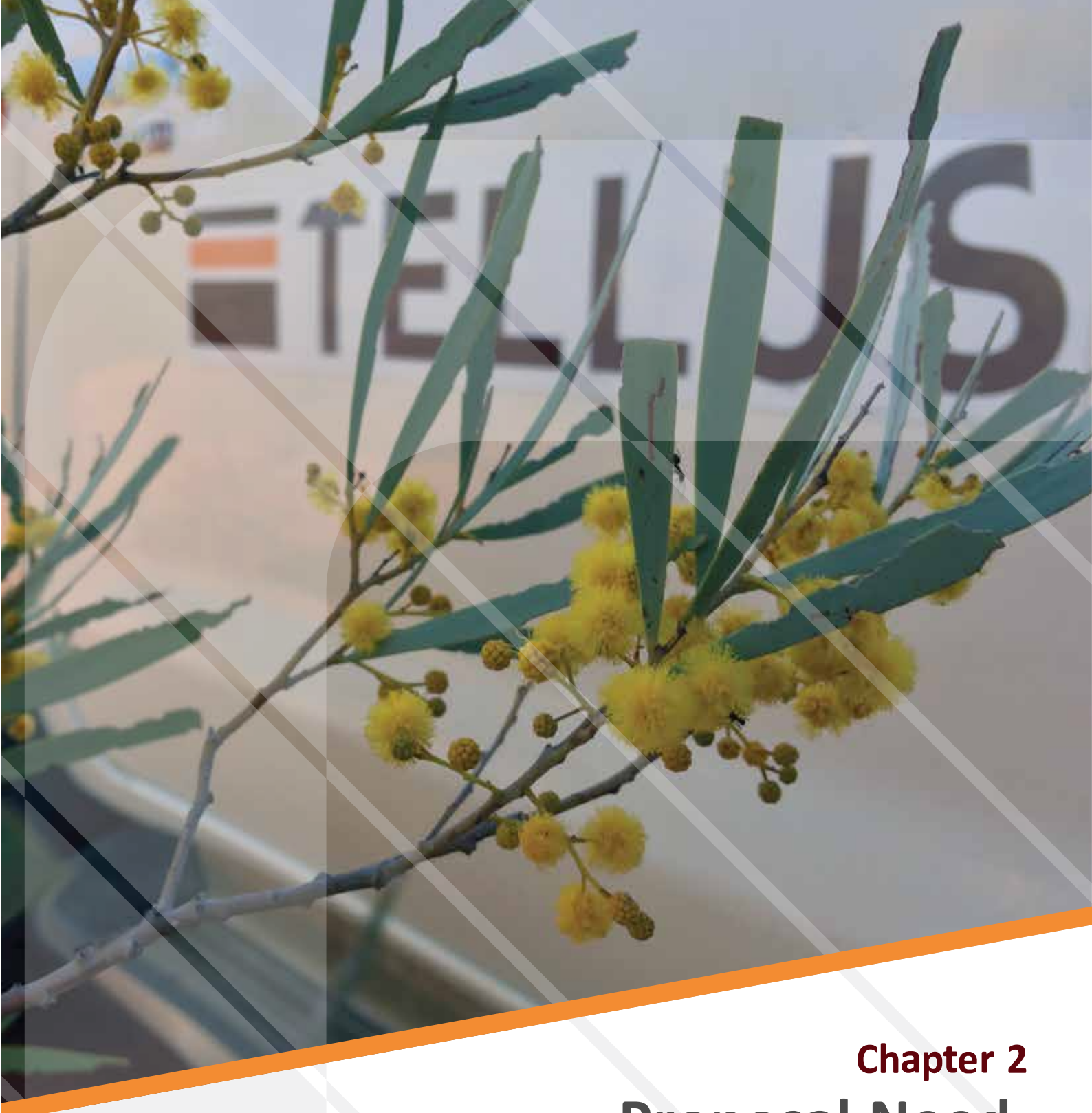
This document includes a detailed consideration of the environmental, social and economic consequences of the Proposal. It is presented in seven volumes, as described in Table 1-4. Various sections of the document have been prepared by external sub consultants and have also been peer reviewed by international experts. A list of contributors is provided after the table of contents.

Table 1-4 Document structure

Volume	Scope
Executive Summary	The executive summary provides an overview of all aspects of the environmental impact assessment for the Proposal.
Volume I – Background	Volume I provides the context to the Proposal. It includes three parts: • Part A – Introduction o Chapter 1. Introduction o Chapter 2. Proposal Need, Alternatives and Benefits • Part B – Proposal Description o Chapter 3. Proposal Description
Volume II – Approvals and Stakeholder Engagement	Volume II provides information regarding the approvals required for the Proposal. It also outlines the stakeholder engagement and consultation undertaken during the preparation of the EIS. It includes one part: • Part C – Regulatory Framework and Engagement o Chapter 4. Approvals Pathway o Chapter 5. Stakeholder Engagement and Consultation
Volume III – Environmental Impact Assessment	Volume III provides a detailed environmental impact assessment of the Proposal. It includes three parts: • Part D – Approach to Impact Assessment o Chapter 6. Environmental Risk Assessment • Part E – Environmental Assessment o Chapter 7 Biodiversity o Chapter 8 Groundwater o Chapter 9 Surface Water o Chapter 10 Historic and Cultural Heritage o Chapter 11 Human Health and Safety

Volume	Scope
	o Chapter 12. Economic and Social o Chapter 13. Closure and Rehabilitation • Part F – Assessment of Other Issues o Chapter 14 Bushfire o Chapter 15 Air Quality o Chapter 16. Noise and Vibration o Chapter 17 Visual Amenity o Chapter 18 Other Risks o Chapter 19 Cumulative Impacts
Volume IV – Health, Safety and Environmental Management	Volume IV provides details regarding the environmental management of the Proposal. It includes one part: • Part G – Environmental Management o Chapter 20 Environmental Management
Volume V – Proposal Justification and Conclusion	Volume V presents the justification for undertaking the Proposal and the conclusion of the environmental impact assessment of the Proposal. It includes one part: • Part H – Justification and Conclusion o Chapter 21 Justification o Chapter 22 Conclusion and Recommendations
Volume VI – References	Volume VI presents a list of references cited within the EIS. It includes one part: • Part I – References o Chapter 23. References
Volume VII – Appendices	The appendices contain information related to the environmental impact assessment including detailed specialist studies that have been completed to inform the consideration of impacts as part of the environmental assessment process. The appendices include: • Appendix A: Terms of Reference

Volume	Scope
	• Appendix B: Study Team • Appendix C: Waste Acceptance Documentation • Appendix D: Proponent Environmental Record • Appendix E: Soils Report • Appendix F: Listed Waste Inventory • Appendix G: Waste Management Plan • Appendix H: Risk Assessments • Appendix I Hydraulic Backfill Report • Appendix J: Rehabilitation and Closure Plan • Appendix K: Geological and Geotechnical Assessment • Appendix L: Outline Sedimentation and Erosion Management Plan • Appendix M: Outline Environmental Management Plan • Appendix N: Risk Matrix • Appendix O: Biodiversity Assessment • Appendix P: Groundwater Assessment • Appendix Q: Outline Water Management Plan • Appendix R: Surface Water Assessment • Appendix S: Historic and Cultural Heritage Assessment • Appendix T: Outline Emergency Response Management Plan • Appendix U: Economic and Social Impact Assessment • Appendix V: Social Impact Management Plan • Appendix W: Draft Bushfire Management Plan • Appendix X: Air Quality Risk Assessment



Chapter 2

Proposal Need, Alternatives and Benefits

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2 PROPOSAL ALTERNATIVES, NEED AND BENEFITS

2.1 Introduction

This chapter presents the strategic need for the Proposal and the feasible alternatives that were investigated during the development of the Proposal. This chapter also outlines potential benefits to the NT and to Australia that would result during construction and operation of the Proposal.

2.2 Strategic need for the Proposal

The worldwide need for salt is examined as is the need for a safe and secure storage facility for both hazardous and intractable waste and for other valuable materials (such as document archives, film archives, museum artefacts, computer servers, and a host of other valuable documents and equipment) in Australia.

2.2.1 Need for salt

What is salt, how is it harvested and what is it used for?

Salt, or sodium chloride, is a mineral that naturally occurs in our seas and in underground deposits. It is a chemical compound with the formula NaCl. For every gram of salt, almost 40% is sodium (Na) and just over 60% is chlorine (Cl).

There are three ways in which salt can be harvested - via solar evaporation, solution mining and deep underground mining:

- **Solar evaporation -** salt is harvested via solar evaporation from seawater or salt lakes. The wind and sun evaporate the water from shallow pools, leaving the salt behind. The salt is usually harvested once every 12 to 18 months when it reaches a specific thickness. After harvest, the salt is washed, drained, cleaned and refined. Only areas with low annual rainfall and high evaporation rates can have successful solar evaporation facilities. Worldwide, approximately 40 % of salt is produced via solar evaporation (Roskill 2014).
- **Solution mining -** salt is extracted from salt beds or domes via solution mining. In solution mining, wells are erected over salt beds or domes and water is injected to dissolve the salt. The salt solution (or brine) is then pumped out. The brine is treated to remove minerals and pumped into vacuum pans (sealed containers in which the brine is boiled and then evaporated until the salt is left behind). The salt is then dried and refined. Worldwide, approximately 34 % of salt is produced via solution mining (Roskill 2014).
- **Deep underground mining -** deep underground mining for salt is much like mining for any other mineral. Typically, the salt exists as deposits in ancient underground seabeds which became buried through tectonic changes over millions of years. Many salt mines use the room and pillar system of mining whereby shafts are sunk down to the floor of the mine, and rooms are carefully constructed by drilling, cutting and blasting between the shafts. After the salt is removed and crushed, a conveyor hauls it to the surface. Worldwide, approximately 26 % of salt is produced via deep shaft mining (Roskill 2014).

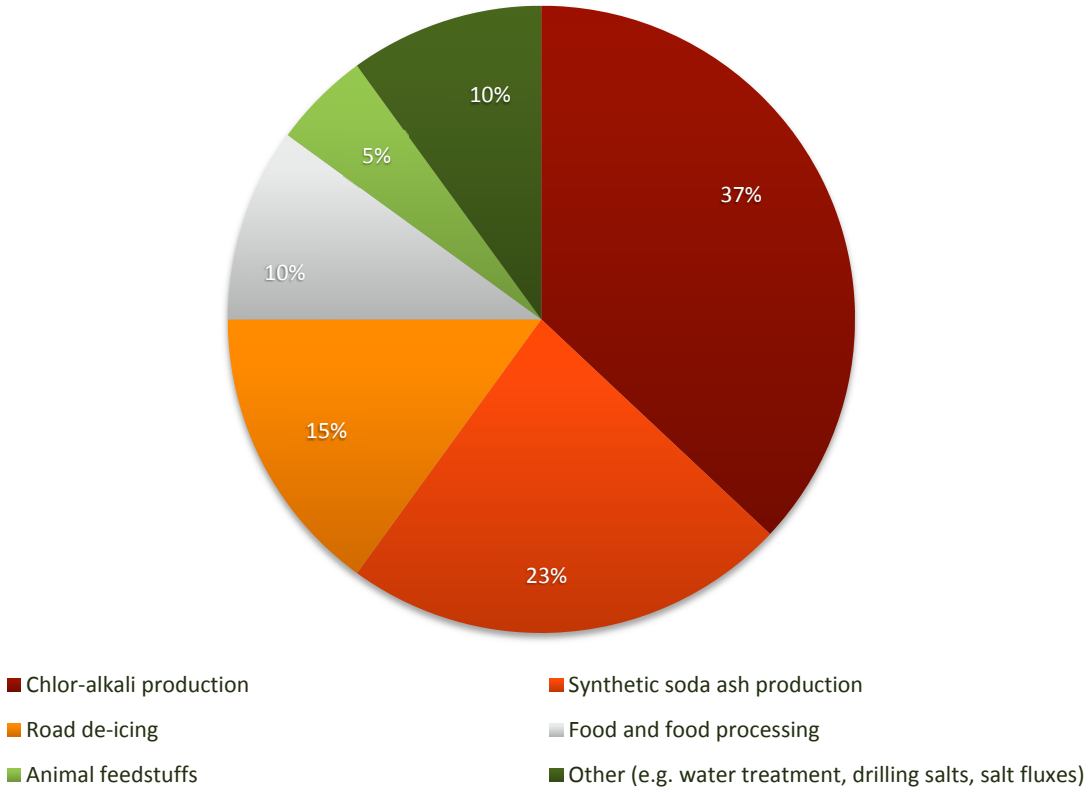
Salt is one of the most widely used substances on Earth. It has over 14,000 direct and indirect uses. The most familiar use of salt is for food and food processing (both for humans and animals). It is widely used in the chemical industry for chlor-alkali production and synthetic soda ash production.

In cold northern hemisphere countries, salt is used extensively as a de-icing agent on roads. Other industrial uses of salt include drilling salts used in the oil and gas industry and salt fluxes used in the smelting and mining industries.

Global salt supply

According to a 2014 report prepared by Roskill, salt has greater than 14,000 commercial applications globally. As shown in Figure 2-1, approximately 80 % of salt is consumed across four main markets. These include:

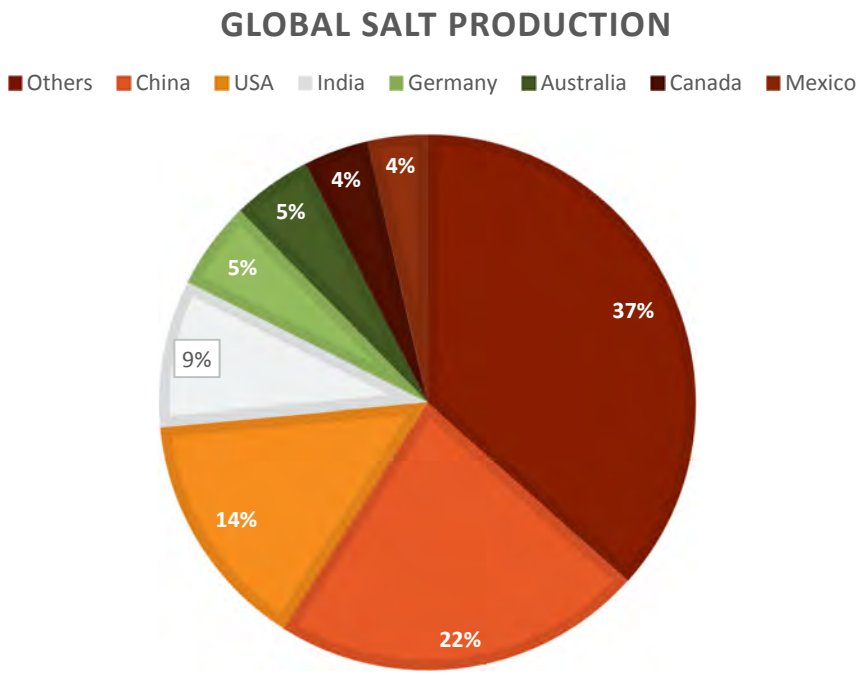
- Chloralkali production.
- Synthetic soda ash production.
- Road de-icing.
- Food/food processing.



Source: Roskill, 2014

Figure 2-1 Global uses of salt

Over 110 countries produce salt. Seven leading producing countries, each with output of over 10 million tonnes per year account for almost 65 % of the world total (refer to Figure 2-2). Australia is the only country with predominantly export-oriented production. Mexico is the second largest exporter of salt, shipping around 80 % of its output while Canada and Germany export around 40 % and 15 % of their production respectively. India is becoming one of the leading salt exporting countries with shipments growing by 32 % per year from 2007 to 2013.



Source: Roskill, 2014

Figure 2-2 Global salt production by leading countries in 2012

Over 100 countries produce salt, but seven countries (each with an output of more than 10 million tonnes per year) account for over 60 % of the world's total salt production. The world's leading companies who are the highest producers of salt are shown in Figure 2-3.

China overtook the United States to become the largest producer of salt in 2006, producing approximately 62 million tonnes. Despite producing vast quantities of salt, both China and the United States are still net importers of salt. The three next-largest producers (India, Germany and Canada) export about 15 to 30 % of salt produced, while Australia is almost totally export-oriented.

With estimated output of 13.3 Mt in 2012, Oceania (essentially Australia) accounted for 4.8 % of world salt production (refer to Figure 2-3). Exports, mainly to China, Japan, Taiwan, South Korea, and Indonesia, on average account for over 90 % of Australian salt production (Roskill 2014). Production mainly comes from solar salt operations in Western Australia, where the combination of a hot dry climate, modern infrastructure and proximity to Asian markets has encouraged development of a significant salt industry.

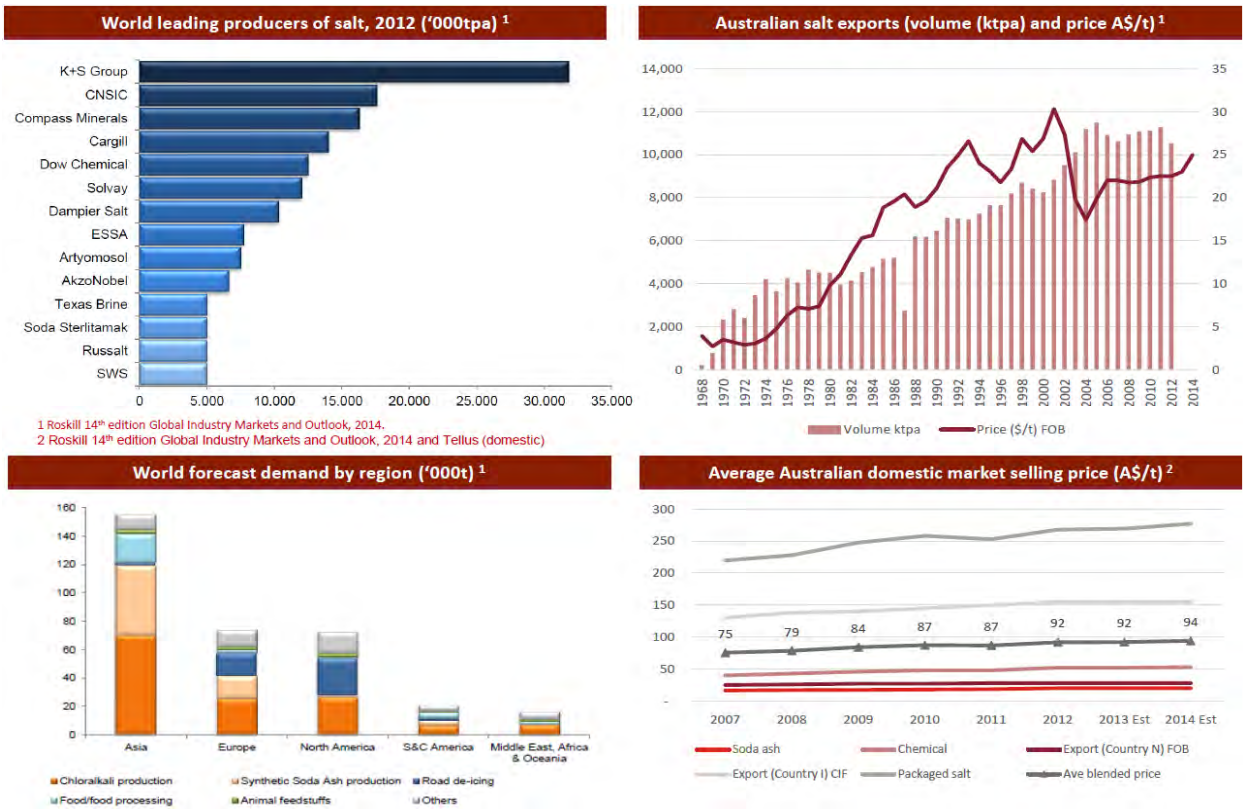


Figure 2-3: Salt industry trends

Global demand

World demand for salt is forecast to grow by 3 % per year through to 2018. World capacity is estimated at 400 million tonnes per year with China accounting for a quarter. Global demand for salt was approximately 278 million tonnes in 2012 (Roskill 2014). It is estimated that this demand will increase (by 53 million tonnes) to 330 million tonnes in 2018 (a growth of approximately 3%).

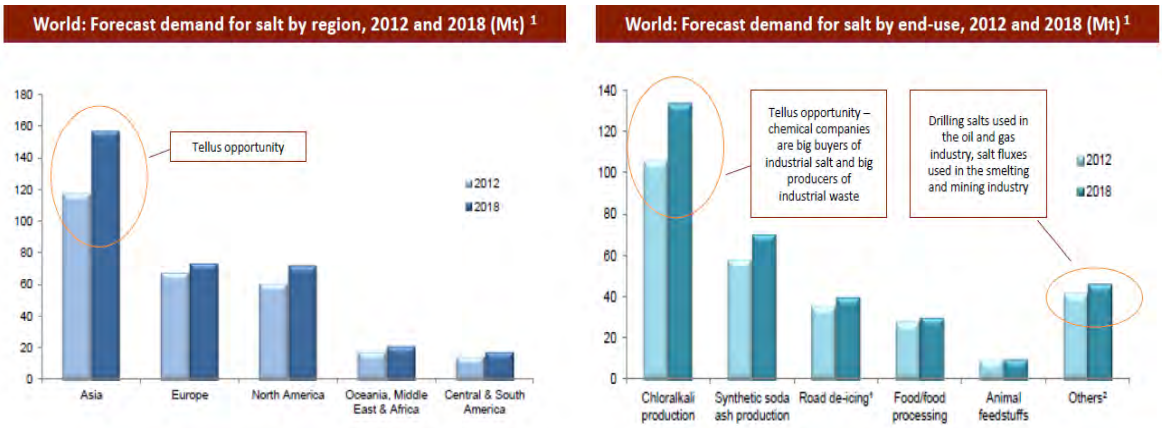
Asian demand for salt was about 117 million tonnes in 2012. It is estimated that this demand will increase (by 39 million tonnes) to 156 million tonnes in 2018, a growth of about 5 % per annum (Roskill 2014). Based on these estimates, Asia is forecast to account for almost 75 % of the worldwide growth in demand for salt from 2012 to 2018 (refer to Figure 2-4).

The worldwide demand for salt is expected to be the greatest in the chemical industry (specifically chlor-alkali production) and for other industrial end-uses. These include drilling salts used in the oil and gas industry and salt fluxes used in the smelting and mining industry (refer to Figure 2-4).

Projected world demand of around 330Mt in 2018 would exceed estimated demand in 2013 by more than 40 million tonnes. Asia is forecast to account for more than two-thirds of this growth, with China alone accounting for half.

Most of the production increase will come from technology improvements and modernisation of harvesting techniques. As shown in Figure 2-4, a growing share of Chinese consumption will be supplied by imports suitable for the chemical industry. Leading exporting countries such as Mexico, Chile, India and Australia are expanding (Roskill 2014).

Rock salt in Asia is mined primarily in China, Pakistan, Thailand and Uzbekistan, but Asian buyers of high grade salts are concerned about the quality and reliability of supply.



Source: Adapted from Roskill, 2014

Figure 2-4 Salt trends and opportunities for the proponent and the Proposal

Domestic salt market

In Australia, over 95 % of salt is produced via solar evaporation of sea water in coastal ponds. Australia is the sixth largest producer of salt and the largest exporter of salt worldwide (about 60 percent of salt imported to Asia comes from Australia). Approximately 90 % (13.2 million tonnes) of salt produced in Australia in 2012 was exported. Most of this salt was used in the chloro-alkali industry (95 %). Approximately 0.7-1.0 million tonnes of salt produced in Australia is used for domestic purposes (Roskill 2014).

Challenges and opportunities in the salt market

Through desktop research, industry consultation, and domestic and international site visits, the proponent has developed a high level of understanding of both the international and domestic salt demand and supply forecasts. A summary of the current salt market, the challenges and opportunities in the salt market and how these challenges and opportunities relate to the Proposal is provided in Table 2-1.

Given the specification and quality of the proponent's salt within the Chandler Formation, the chlor-alkali industry in China, Japan and Indonesia are considered to present the greatest opportunity for the export of salt from the Proposal.

Table 2-1 Challenges and opportunities in the salt market

Current situation	Challenges and opportunities	Competitive advantage of the Proposal
• Asia consumes about 42 % of the global supply of salt. Demand for salt is growing at 3-5 % per annum in Asia. • Australia is the largest external supplier of salt to Asia (about 60% of salt imported to Asia comes from Australia). However, Australia is near production capacity. It is becoming increasingly difficult to secure approvals for new solar evaporative salt projects in Australia (there have been three recent failed applications 2.5 Mtpa, 3- 4 Mtpa and approximately 1 Mtpa). • Australia produces approximately 13,2 million tonnes of salt per annum predominantly via solar evaporative salt facilities in Western Australia. • In Australia and Asia, salt is produced predominantly via solar evaporative salt facilities – heavy rain can disrupt salt production in solar evaporative facilities for months at a time. This process is also quite inefficient (about 65 tonnes of sea water is needed to produce one tonne of salt) and time intensive (the process can take between 12-18 months).	• There is growing concern by Asian salt buyers about reliable supply, quality and price pressure. • There is an approximate six million tonne shortfall of salt expected in the Asian market by 2018. • To meet this shortfall, up to 47,000 hectares of new solar evaporative salt facilities would be required along environmentally sensitive coastal areas (worldwide). • There are production constraints, however. It is becoming increasingly difficult to obtain approval for new coastal solar evaporative salt facilities due to their environmental impact. • There are new markets in Asia and growing demand from existing markets, but growing supply pressures. • An opportunity exists to meet the growing demand for salt in Asia. This opportunity is deep mining of rock salt in the Chandler Formation in the NT. Currently, no deep rock salt mining exists in Australia.	• Unlike solar evaporative salt facilities which are located in environmentally sensitive coastal areas and, are becoming increasingly difficult to obtain planning approval for, the Proposal will have a relatively small surface footprint and is located in semi-arid zone, in a geographically and tectonically stable area. • Extensive investigations have proven that billions of tons of salt are contained within the Chandler Formation. Mining this salt could easily be scaled up to meet the growing supply requirements in Asia. • Core testing shows high grade salt is available to be mined for the growing edible and industrial salt market in Asia. • Existing logistics infrastructure is in place and has spare capacity. The Adelaide/Darwin Railway Line is located adjacent to the proposed Apirnta Facility and would be used to transport salt from the proposed Chandler Facility to port facilities in Adelaide. • Australia is a gateway to Asia. We are closer than India and Chile who supply salt to Asia.

Growing Asian demand for salt is driving long term supply requirements and pricing upwards. There is a potential shortfall in meeting the demand for high quality salt for the Asia which currently rests at 6 million tonnes by 2018 (Roskill 2014).

Australia exports salt mostly to China (24.5 %), Japan (21 %) and Taiwan (18 %). China and Japan are the proponent's target markets. For example:

- China is losing approximately one million tonnes per annum of coastal salt production due to urbanisation, importing about 7.5million tonnes in 2013.
- In 2012, Japan imported 7.4 million tonnes per annum of salt. About 13 % of this demand was met from Japanese production, 45 % was imported from Mexico (by Mitsubishi), and 34 % from Australia (by Mitsui/Dampier).

2.2.1 Need for a safe and secure storage facility for waste materials

The problem

Over the last 20 years, waste production in Australia has grown at six times population growth (ABS 2016). Australians are the second highest emitters of hazardous waste per capita due to the economy being driven largely by mining, oil and gas, and manufacturing. Approximately 10 % of the waste Australian's produce is hazardous. That means approximately six million tonnes per year of known hazardous waste is produced and is growing at approximately 3% per annum. There is also approximately 900 million tonnes of reported legacy waste (hazardous waste generated historically) estimated to be temporarily stored in the NT and across other Australian states and territories.

Traditional re-processing, incineration, treatment before landfilling, storage/disposal into man-made engineered landfill are temporary solutions, often do not extinguish liability, can be very expensive from a full lifecycle perspective, especially if sent overseas, and are not viewed today as world's best practice. Many of these options support the old linear economy of 'use and dispose'. This has created a growing legacy and forecast pool of waste materials which require long term storage, recovery of valuable materials that supports the circular economy or the permanent isolation of hazardous materials using sound environmental management principals. These solutions are not readily available.

Governments have realised or are increasingly realising that the previous widespread use of engineered surface landfills with either no liner, or liners with lifespans of 10 to 30 years as a catch-all solution with no or limited discrimination in waste acceptance has created many contaminated sites that pose environmental hazards and have ongoing remediation requirements.

The degradation of ageing landfill facilities has created significant contamination problems with numerous examples of waste breaching the liners and landfill perimeters and spreading into groundwater aquifers. As a result of this emerging and widespread environmental problem, governments globally are now banning surface landfill of hazardous waste and are endorsing geological repositories capable of permanently isolating waste from the biosphere as a final solution for end of life hazardous waste disposal as best practice.

The difference between landfills and geological repositories is illustrated in Figure 2-5. The key difference being that even with a well-engineered landfill, the artificial liner usually only isolate hazardous waste for 10- 30 years before degradation of the liner creates a contamination risk, whereas a geological repository is passively safe on a geological timescale. As a result, international regulators are restricting landfill development and their use for most hazardous waste types.

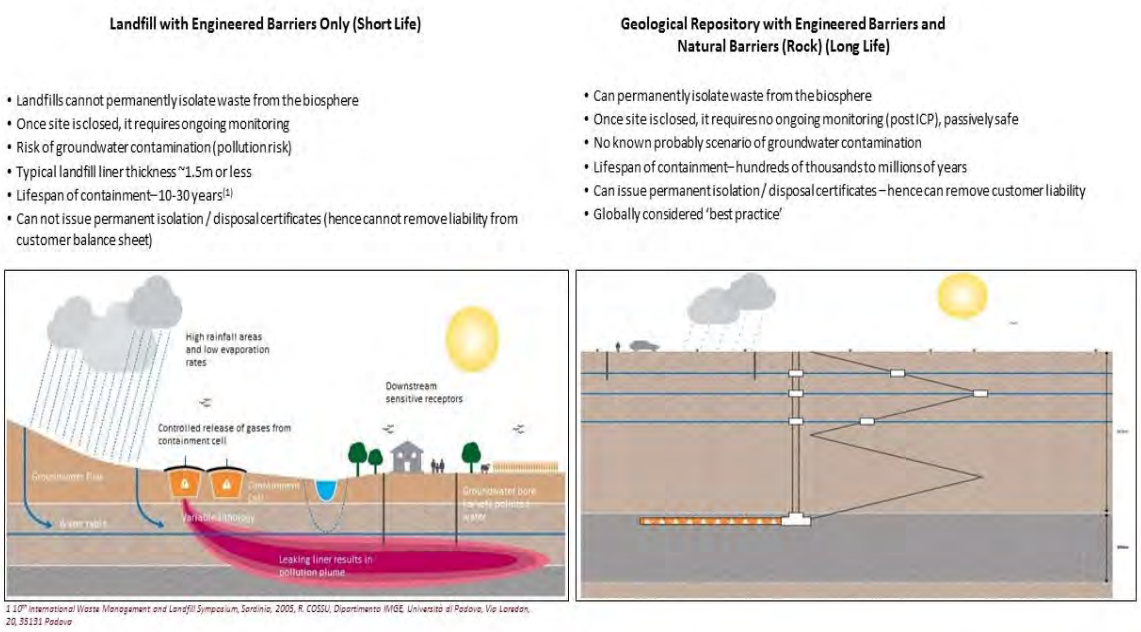


Figure 2-5 Difference between landfill and a geological repository

The solution

There is a need and regulatory obligation to provide for the safe and secure storage, recovery of valuable materials and the permanent isolation of hazardous waste. The solution put forward involves the storage (retrievable) and recovery of valuable materials and the permanent isolation of such wastes in a deep underground geological repository that safeguards human health and the environment from harm over geological time. This can be achieved by applying proven scientific and environmentally sound management principles.

A geological repository is an underground storage or disposal facility of hazardous waste that relies on both a natural geological barrier (e.g. a salt bed) and man-made engineered barriers that both form part of a multibarrier system as part of an overall safety case that is globally recognised for its permanent isolation capabilities. The natural geological barrier isolates waste from the biosphere safely and permanently. Once the repository is closed, it requires very little ongoing monitoring as the geological barrier is passively safe. The lifespan of containment is in the hundreds of thousands to millions of years. As a result, geological repositories that can permanently isolate materials are globally considered 'best practice' for hazardous waste.

The proposed Chandler Facility would be categorised as a deep geological repository. This infrastructure could contribute towards solving the legacy and forecast pool of waste materials in the NT which require long term storage, the recovery of valuable materials that supports the circular economy, or the permanent isolation of hazardous materials using sound environmental management principals. These solutions would become available if the proposed Chandler Facility is approved (approval for a recovery plant that would be accommodated within the proposed technology park would be covered in a separate approval).

The Proposal would operate in an environment that is not constrained by significant social or environmental sensitivities. It would be located in a very remote area - the nearest community is Titjikala, located approximately 25 kilometres by road from the proposed Chandler Facility and the closest regional centre would be Alice Springs located approximately 120 kilometres to the north of the proposed Chandler Facility. It is located in an area that is geologically stable (very low seismicity and no volcanic or tectonic activity). The climate is arid (low rainfall and high evaporation rates).

Groundwater in the area is not connected to groundwater used for domestic purposes (including drinking) by communities in the vicinity of the proposed Chandler Facility. There is also an absence of permanent surface water (indicating that groundwater and surface water systems are not connected). There is a lack of commercial mineral deposits (other than salt) and there is no potential for medium to high agriculture in the vicinity of the Proposal.

Waste hierarchy

There is a clear difference between what is considered best practice for hazardous and non-hazardous wastes. The 'waste hierarchy' methodology suggests the primary focus of waste management should be on reusing, recycling and recovering materials. This methodology is a broadly accepted policy for general (non-hazardous) wastes (refer to Figure 2-6).

A different framework is appropriate for hazardous wastes, which present a danger to health or the environment and, as such, should generally not be re-integrated into manufacturing processes for re-use. With these kinds of wastes, international best practice as reflected in conventions such *as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal* ('The Basel Convention') adopt environmentally sound management principles, which focus on the permanent removal of such wastes from the biosphere, and in so doing protect the environment and human health.

One of the advantages of geological repositories is that one can also support the circular economy using long term storage by placing 'like-with-like' materials for operational safety reasons and to create opportunities for the future recovery of valuable materials. The proponent's business model mirrors international solutions operating in the United Kingdom, Europe and North America (refer to Figure 2-6).

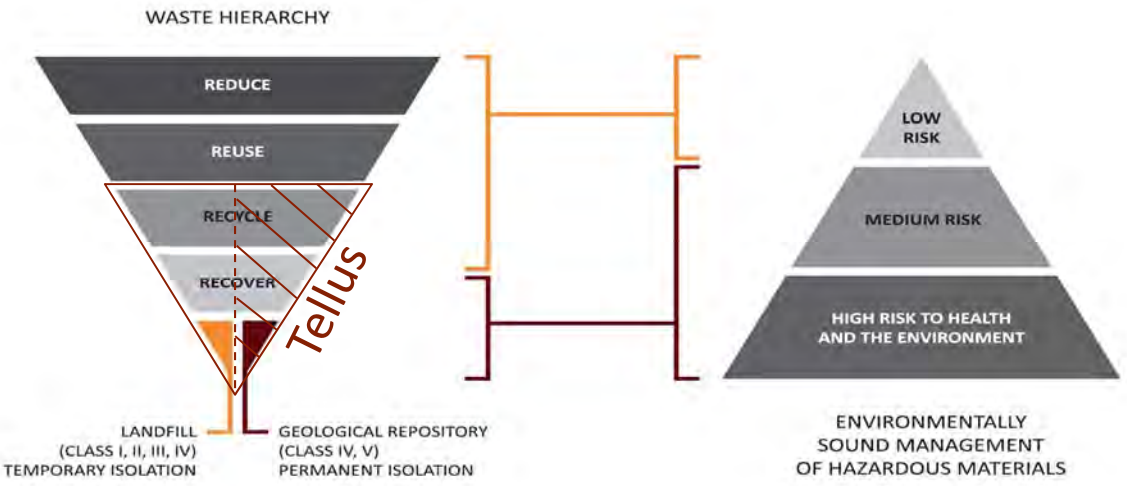


Figure 2-6 The waste hierarchy and the proponent's service offering

Waste classifications in Australia and the Northern Territory

A hazardous waste, as defined in the Australian Government's *National Waste Policy: Less waste, more resources (2009)*, is a substance or object that exhibits hazardous characteristics, is no longer fit for its intended use and requires disposal.

The term 'hazardous waste' is widely used in the community and is taken to mean the wastes that states and territories (the jurisdictions) regulate as requiring particularly high levels of management and control.

The jurisdictions use varied terminology to describe these wastes, reflecting the fact that some are controlled not because they are hazardous in the normal sense of the word, but rather because they pose risks to public amenity (e.g. through odour). All of these wastes are nevertheless considered to be hazardous wastes within the scope of this report, noting that the design of the proposed Chandler Facility is geared towards those wastes deemed to be at the more intractable end of the traditional waste hierarchy spectrum.

States and territories variously describe these waste types as *controlled, trackable, prescribed, listed* or *regulated* wastes. Most jurisdictions operate a tracking system under the National Environmental Protection Measures to ensure that hazardous waste is appropriately managed. These tracking systems generate data that is as a key source in compiling and reporting Australia's annual arisings of hazardous waste.

There are four waste classifications in the NT as per the *Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory* (NT EPA 2003). These are:

- **Domestic garbage.** This includes wastes generated from household sources (and may include hazardous or putrescible waste).
- **Hazardous waste**. This includes any waste containing significant quantities of a substance which may present a danger to the life or health of living organisms when released into the environment. These wastes may both include medical and radioactive wastes.
- **Clinical waste.** This includes waste that which has the potential to cause sharps injury, infection or public offence, and includes sharps, human tissue waste, laboratory waste, animal waste resulting from medical, dental or veterinary research or treatment that has the potential to cause disease.
- **Putrescible waste**. This includes organic wastes capable of decomposition by micro-organisms.

The main waste-generating sectors identified within Australia (ASCEND 2015) are:

- Chemical trading companies.
- Waste companies.
- Mining companies.
- Hydrocarbons (e.g. oil and gas industry).
- Environmental engineering companies.
- Federal government (in terms of obtaining waste that is usually exported overseas and assisting with disposal of wastes during disaster events [e.g. oil spill]).
- Other wastes.

These sectors would be the sources of wastes likely to be disposed of at the proposed Chandler Facility (refer to Figure 2-7).

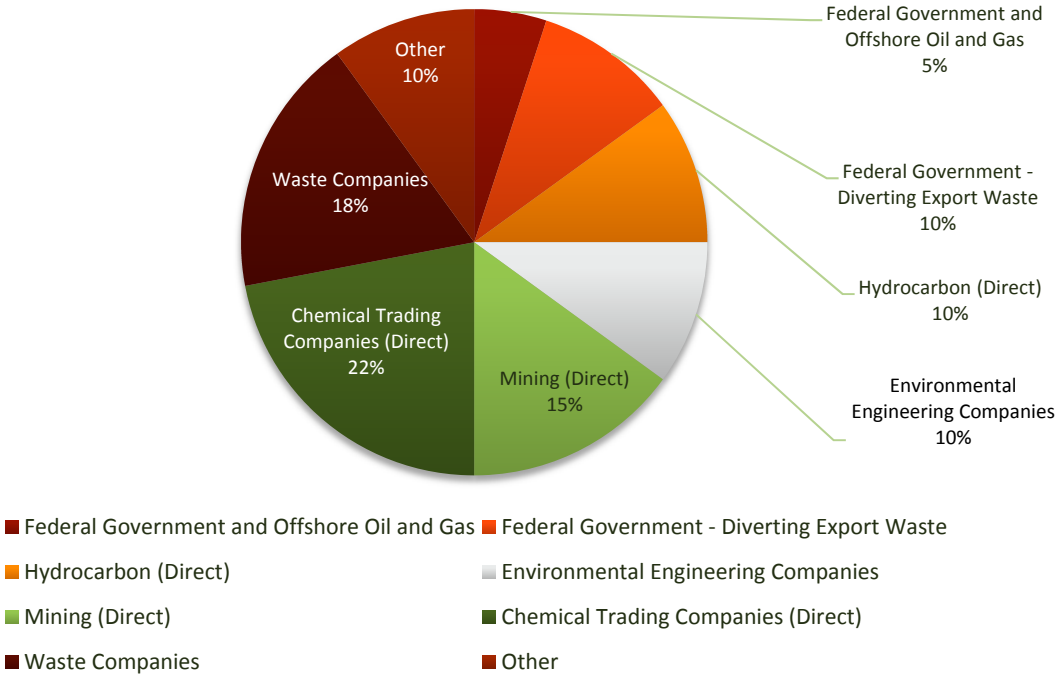


Figure 2-7 Waste sources by sector

Existing waste volumes in Australia

Australia produces approximately six million tonnes per annum of known hazardous waste (KMH Environmental 2013). Of this, the NT produces approximately 0.9 million tonnes per annum of reported hazardous waste (ASCEND 2015). A market overview of hazardous waste in Australia is provided in Table 2-2.

Table 2-2 Australian waste and hazardous waste market summary

Category	Market overview
Sustainability	• Australia is one of the highest emitters of hazardous waste on a per capita basis • Over the last 20 years, waste production in Australia has grown at six times population growth
Market size – volume (Mt)	• Australia produces approximately 53.3 Mt of multiple waste material • Approximately 11% (5.9 Mtpa) hazardous waste gets produced annually • Approximately 900 Mt of reported legacy waste stockpiles
Market size value (A$)	• Approximately $14.2 billion Australian waste market • Approximately $2.4 billion existing / reported hazardous waste market • Approximately 50,000 + jobs, growth sector, relatively recession proof
Growth (%)	Approximately 3.0 – 4.0 % per annum
Legacy	Significant volumes currently stored around Australia in temporary facilities – this leads to significant liability exposures.

Mt – million tonnes

Mtpa – million tonnes per annum

Controlled waste[6] transported domestically between states and territories amounted to approximately 188,000 tonnes during 2009 and 2010, declining to 179,000 tonnes for 2010 – 11. These wastes consisted primarily of inorganic chemicals, oils, soil/sludge, acids, alkalis, and putrescible/organics (Australian Bureau of Statistics [ABS] 2013).

Legacy waste refers to those hazardous wastes that exist from previous historical activities. Table 2-3 presents legacy waste volumes in Australia for a range of waste types including spent pot liner, fly ash, muds and hazardous wastes.

Estimates of existing stockpiles of these legacy wastes, and potential annual additions to them each year. This shows that if legacy wastes began to move off the sites produced, then the total market for hazardous wastes in Australia would grow 7-fold to 38 million tonnes.

Table 2-3 Estimated legacy waste volumes in Australia (tonnes)

Legacy waste categories in Australia	Annual production (Mt)	Historical stockpile (Mt)	Source/comment
SPL (stockpiled)[1]	-	785,000	Market movement for 'annual generation' of spent pot liner is approximately 115,000 tonnes (ASCEND 2015). Blue Environment Pty Ltd (2015) quotes current Australian stockpiles of 900,000 tonnes. 'Historical stockpile quantity of 0.8 Mt' is calculated as 'total stockpile minus 'annual production.
Fly ash (stockpiled)[2]	6,600,000	400,000,000	Ash Development Association of Australia (2014)
Red mud[3]	26,000,000	500,000,000	ASCEND (2015)
Reported hazardous	5,500,000	-	ASCEND (2015)
TOTAL[4]	**38,000,000**	**900,000,000**	

1. *SPL: 'Annual generation' of 115,000 t included in ASCEND market estimates. Blue Environment et al[6] quotes current Australian stockpiles of 900,000 t. 'Historical stockpile quantity' calculated as Total Stockpile minus Annual generation.*
2. *Figures quoted from: Ash Development Association of Australia (2014) Annual membership survey results 2013, HBM Group Pty Ltd, Wollongong, available from: http://www.adaa.asn.au/uploads/default/files/adaa_mship_report_2013.pdf.*
3. *Figures extrapolated from: EnviroRad Services (2005). A Report prepared for the Radiation Health and Safety Advisory Council. Naturally Occurring Radioactive Materials (NORM) in Australian Industries - Review of Current Inventories and Future Generation: http://www.arpansa.gov.au/pubs/norm/cooper_norm.pdf.*
4. *Rounded to 2 significant figures.*

[6] Controlled waste means any matter that is within the definition of waste in the National Environmental Protection Measure for the *Movement of Controlled Waste between States and Territories*.

The proponent has researched the domestic hazardous waste market since 2012 and has determined the highest potential customer by volume is the chemical trading sector (refer to Figure 2-7). This sector is closely followed by waste companies and the mining sector. The remainder of the market in domestic hazardous waste generation is made of environmental engineering firms as well as government / research sectors. Hazardous waste volumes reported by the States or Territories which could be received at the proposed Chandler Facility is listed in Figure 2-8.

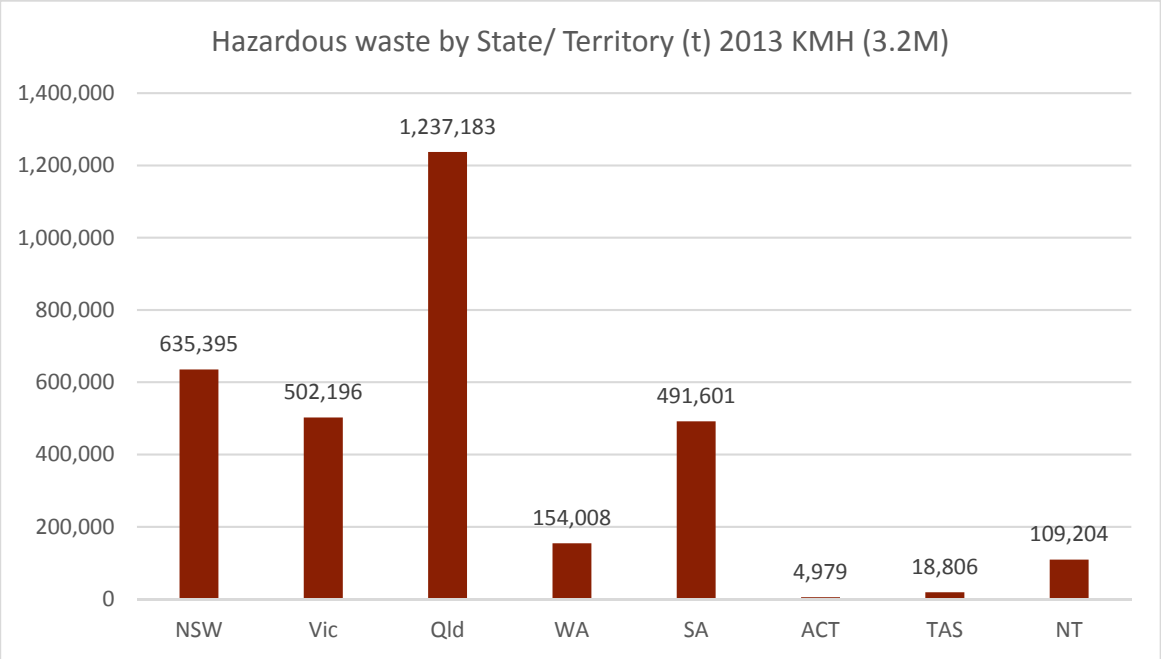


Figure 2-8 Hazardous waste volumes by State or Territory in Australia

Predicted waste volume trends in Australia

The *Hazardous Waste Infrastructure Needs and Capacity Assessment* (Blue Environment Pty Ltd 2015) projected waste volume growth for 29 waste groups individually over 20 years in Australia. Projections from the waste groups varied from a shrinkage (of -3% per annum) to exponential growth (of 10 % per annum), with the majority growing at an overall average volume growth of (3 % per annum). Related market intelligence reports carried out by IBIS World (ASCEND 2015) estimate the following:

- Waste treatment and storage service in Australia is expected to grow 3.7 % from 2016 to 2021.
- Waste remediation and materials recovery service is expected to grow 4.1 % from 2016 to 2021.
- Hazardous waste hauling in Australia is expected to grow 4 % from 2015 to 2020.

Figure 2-9 presents projected waste volumes in the hazardous waste market between 2014 and 2034. The figure shows that in 2016, Australia produces approximately six million tonnes of hazardous waste. By 2034, that volume is anticipated to rise to 10 million tonnes. The Proposal will assist in the management of a small percentage of the projected hazardous waste market within Australia and overseas. Of the total volume produced per annum in

Australia, the proponent forecast capacity volume of the total hazardous waste volume shown in Figure 2-9.

The orange line in Figure 2-9 shows that despite a predicted increase of hazardous waste over the next 20 years, the Proposal is seeking approval for, a ceiling of 400,000 tonnes (capacity) of hazardous waste per annum, although average volumes are expected to be significantly less than this amount (year one 30,000 tonnes, average 340,000 tonnes per annum). Approval of the Chandler Facility, would not increase production of hazardous waste in Australia but go a long way to assisting in a legacy and forecast production waste management issue.



Figure 2-9 Market volume waste assumptions versus total market (excluding legacy waste)

How waste is currently managed in Australia

Sustainable waste management practices in Australia align with the traditional waste management hierarchy of waste avoidance – re-use – recycle, the hierarchy is shown in Figure 2-10 and outlines the options available in waste management.

Waste that cannot be readily reused or recycled is generally disposed of at landfills and landfills are given a category according to what type of materials they can accept. The categories range from Class I (suitable for inert landfill which is generally non-hazardous and stable) to Class V (intractable waste that is a problem to manage due to its toxicity or chemical or physical characteristics).

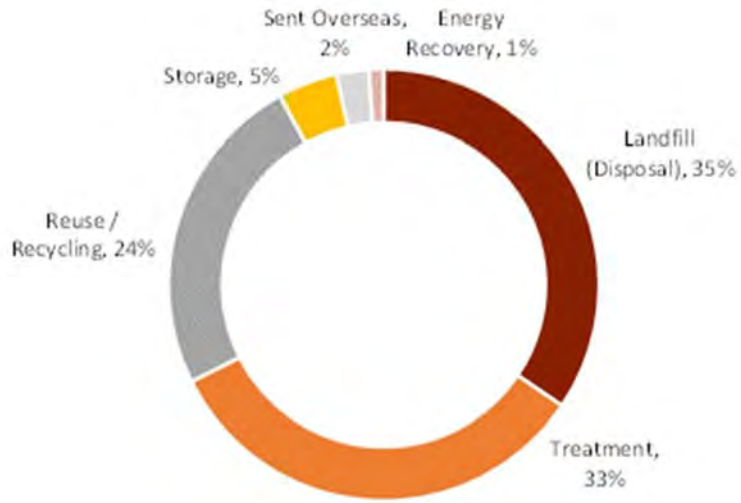


Figure 2-10 Waste treatment and disposal options

As discussed above, hazardous waste is defined as waste that poses a threat or risk to public health, safety or the environment and includes substances which are toxic, infectious, mutagenic, carcinogenic, teratogenic, explosive, flammable, corrosive, oxidising and radioactive (WasteNet 2016). Hazardous waste requires disposal at facilities categorised as Class IV. Many of these facilities are located in less than ideal locations and rely on man-made and maintained structures for their integrity, thus compromising their capability to isolate wastes from the environment. Moreover, they regularly end up in general landfill due to incorrect disposal by the user of the hazardous waste.

Intractable waste is defined as waste which is a management problem by virtue of its chemical or physical characteristics which make it difficult to dispose of or treat safely (WasteNet 2016). Intractable waste requires disposal at facilities categorised as Class V. There is a lack of facilities categorised as Class V in Australia. The only Class V facility is the Mt Walton East Intractable Waste Disposal Facility (IWDF) in Western Australia. The proponent currently project manages the Mt Walton East IWDF under a separate entity named ClayVault WA (50/50 joint venture). The Mt Walton East IWDF is currently under care and maintenance and has not had a waste campaign since 2008. Owing to a lack of appropriate Class V facilities within Australia, many intractable wastes are either stockpiled, exported overseas at great costs or disposed of inappropriately.

Governments and improved standards are driving changes to hazardous waste management in Australia, with legislative and environmental management practice changes being implemented nationwide. For example, fly ash and used tires are no longer being accepted at conventional landfills, and waste-to-energy projects that allow for energy recovery are likely to produce some level of bottom-ash which cannot be landfilled. Some changes are also being driven by corporate accounting standards, with waste producing companies now looking to find methods of sustainable waste disposal with reduction or removal of contingent liabilities.

Need for a safe and secure storage facility for hazardous waste materials

There is a need and obligation to provide for the safe and secure storage of both hazardous and intractable waste generated in Australia. As a first-world, developed country we have an obligation to offer world-class storage and isolation solutions for waste produced not only domestically but for waste produced by our near-neighbours (as per our commitments as a signatory to the Basel and Waigani Conventions).

The proponent recognises there is an opportunity to provide a unique service to both government and industry in the storage and isolation of wastes that cannot be further reduced, reused, recycled or recovered. The types of wastes that fall into this category are generally classified as hazardous or intractable wastes which, as discussed above, are categorised as high risk waste to human health and/or the environment. These wastes require environmentally sound management techniques to permanently isolate them without increasing risk to humans and the environment.

The proposed Chandler Facility would provide for the safe and secure , recovery or permanent isolation of waste in a deep underground geological repository within a stable geological formation (it would meet both international and national industry requirements for a deep geological repository[7]).

Isolation would be provided by a combination of engineered and natural barriers (rock and salt) and no obligation to actively maintain the facilities would be passed on to future generations (refer to Figure 2-11). Deep rock salt repositories have very high integrity for waste disposal, due to the inert nature of the salt and its geological plasticity (salt will creep over time, effectively self-healing which contributes to the passively safety case advantage of geological repositories).

A typical room sized cavity dug into an underground salt strata will shrink at a rate of about 10 to 15 centimetres per year (Atkins 2015) or one to 1.5 metres over 10 years. Over time, any material inside the room will become encapsulated within the salt strata. A detailed post-closure safety assessment of the proposed Chandler Facility, which modelled containment performance of high hazard chemical waste, concluded a strong safety case with complete containment performance into geological time, well beyond the sorts of timeframes that are commonly measured against typical landfills (refer to Chapter 21).

[7] *Australian Radiation Protection and Nuclear Safety Agency – Expectations Guideline*

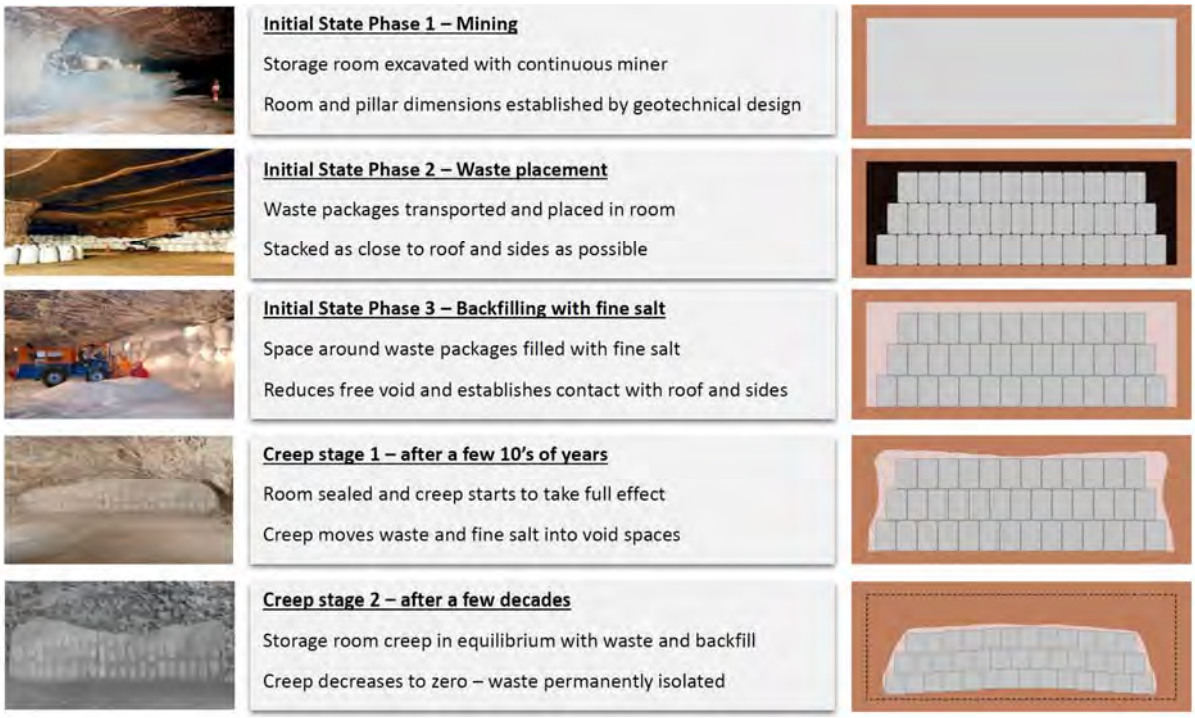


Figure 2-11 By using engineered and natural salt barriers the waste becomes permanently isolated

The Chandler Facility offers an opportunity to provide an economically and practically accessible end point solution for hazardous and intractable waste storage and isolation in Australia (a solution that is currently being successfully utilised in the United Kingdom, Europe, the United States and Canada).

The proposed Chandler Facility would have a licenced capacity to store up to 400,000 tonnes per annum, although average volumes are expected to be significantly less than this amount (year one 30,000 tonnes, average 340,000 tonnes per annum). The current market analysis suggests the volumes and sources of waste would be provided from the following and as shown in Figure 2-12.

- Chemical trading companies which represent 22 % of the market.
- Waste companies which represent 18 % of the market.
- Mining companies which represent 15 % of the market.
- A combined total of representing 35 % of the market, would be sourced across environmental engineering companies, hydrocarbon (oil and gas) industry.
- The remaining 'other' volume of waste (9,400 tonnes per annum), representing 10% of the market, would be sourced from state or local governments (asbestos), heavy industry and construction companies.

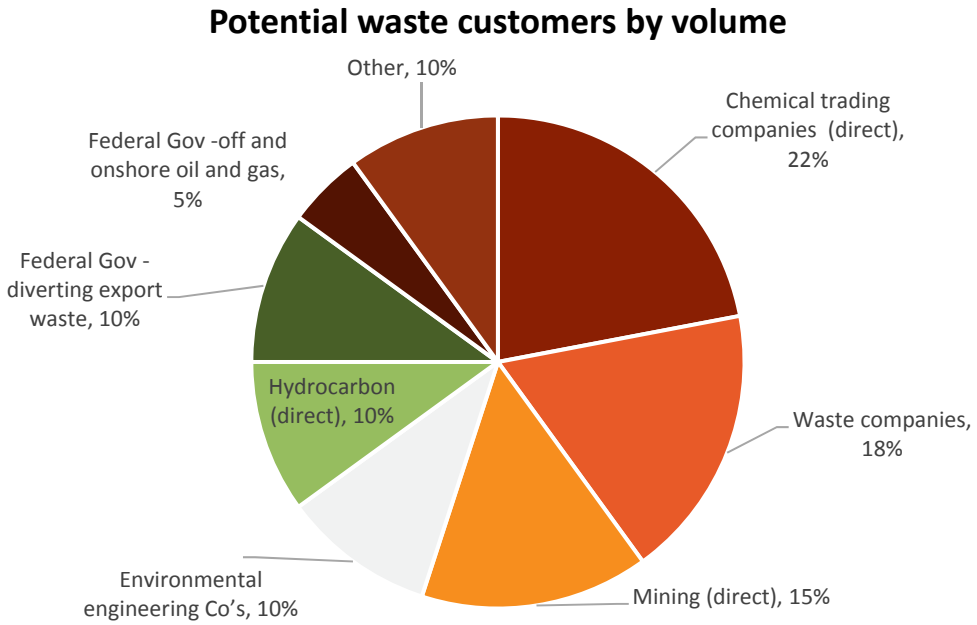


Figure 2-12 Potential waste customers by volume

Over the 25 year underground life of the Proposal, the volume of waste requiring long-term safe and secure storage or permanent isolation would vary due to:

- Advances in resource recovery technology.
- Industry and consumer behaviour in waste management.
- Fluctuation in market conditions and subsequent increase or decrease in major projects, resulting in a subsequent decrease or increase of waste generated.
- Frequency of state and national emergency events (e.g. man-made).
- Population growth. Infrastructure Australia (2015) suggests that the population of Australia will be 30.5 million people in 2031, a growth of 8.2 million or 36.5 % from 2011. Over the last 20 years, waste production in Australia has grown at six times population growth.

2.2.2 Need for a safe and secure storage facility for other materials

The Proposal offers governments and the waste industry a long term, environmentally safe, and cost effective option, to temporarily or permanently store a range of other materials, not just hazardous waste. These include:

- The storage of government or private archives/documentation and libraries.
- High value artworks and pieces of cultural significance.
- Bullion and estate jewellery.
- High value equipment.
- Electronic storage devices (CD, DVD, video tape, hard drives and microfiche).
- Customs and exercise captured items.

2.3 Proposal alternatives

This section presents the range of options and alternatives that were investigated for the Proposal. These include:

- Not proceeding with the Proposal.
- An alternative site selection and access assessment.
- Mine access options to optimise ecological sustainability.
- The consideration of alternative environmental management measures.
- Alternatives at a national, NT, regional and local scale.
- A comparison of short and long-term advantages and disadvantages of the alternatives.

2.3.1 Not proceeding with the Proposal

The consequences of not proceeding with the Proposal would mean that the associated economic and environmental benefits would be foregone. Not proceeding with the Proposal would result in the following:

- Up to 12.5 million tonnes of high grade salt for export to Asia and the domestic market would not be produced.
- Up to 10 million tonnes of hazardous wastes would be either exported overseas or stored inappropriately in locations across Australia, awaiting an appropriate long-term storage solution.
- Loss of capital expenditure during construction of the mine worth $676 million.
- Loss of expenditure during operation of the mine worth $3 billion.
- Loss of 270 construction jobs (540 indirect jobs).
- Loss of 180 operational jobs.
- Loss of business opportunities for local and regional suppliers.

- Loss of taxes, royalties and levies over the life of the Proposal to the Commonwealth and NT governments.

2.3.2 Site selection and access alternatives

Selecting a preferred site

Tellus is committed to developing the Proposal in a responsible manner, giving due consideration to the environment, society, stakeholders and staff, safety, clients, company shareholders and the Board. Tellus is hence developing the project through a staged gate process, within a capital investment framework, which increases in rigor and detail as each gate is passed through. Figure 2-13 outlines this framework and process.

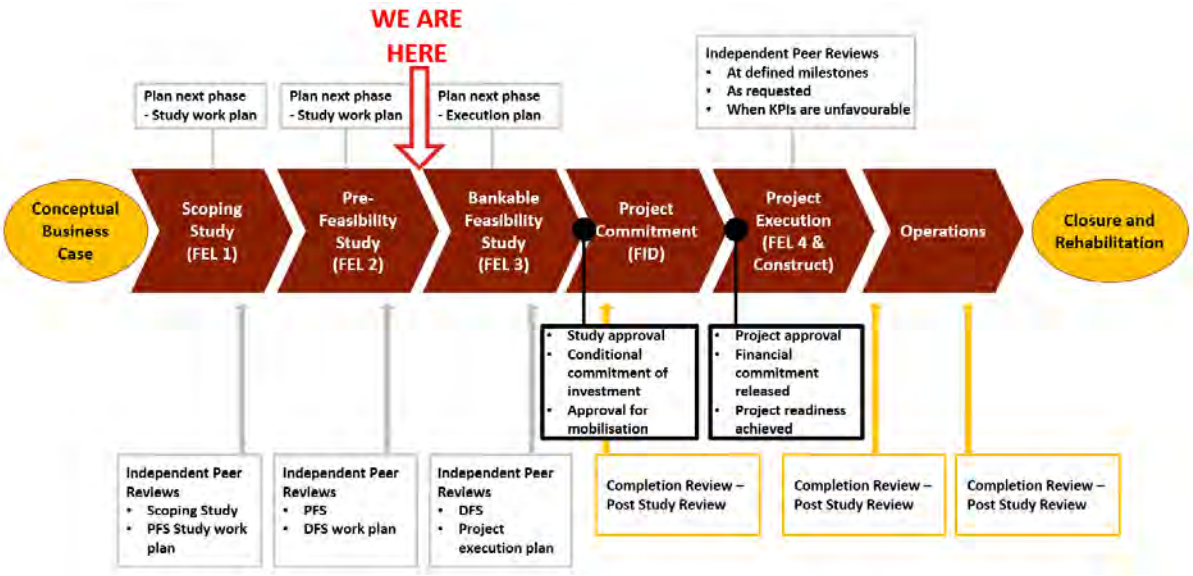


Figure 2-13 Illustrative example of stage gate feasibility study framework

To date, Tellus has undertaken two phases of study; the initial scoping study and the pre-feasibility study. As the studies progressed, project definition has improved. The studies have included a detailed site selection process to identify and refine suitable sites for the proposed Facility. The next stage is to complete a bankable feasibility study to confirm design assumption and apply a higher degree of engineering.

The site selection process for the three pre-development phases are listed in Table 2-5.

The final stage of project execution which includes final detailed design would be undertaken subject to planning approvals and financial commitment in place.

Table 2-4 Tellus' three phase site selection process

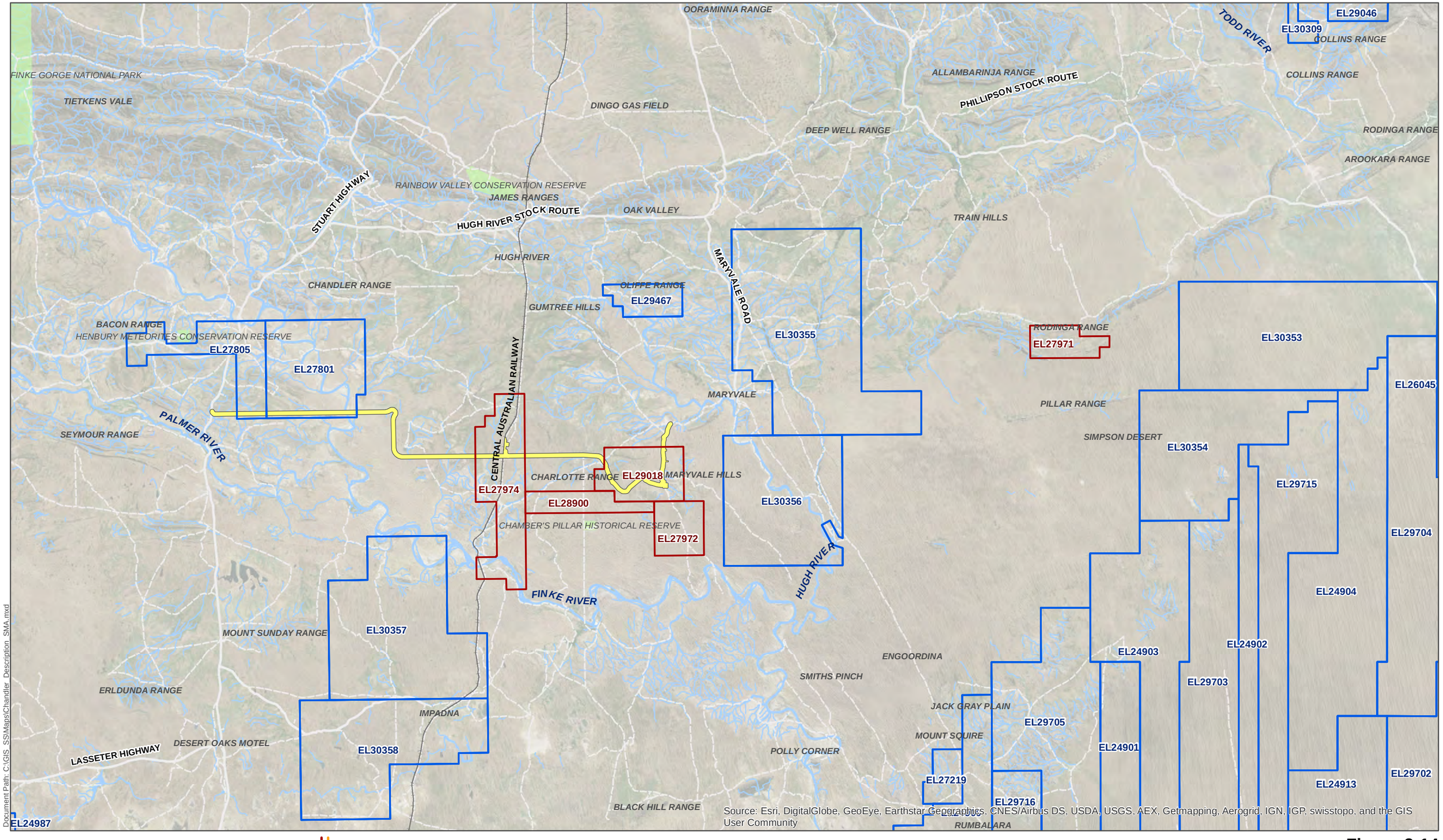
Phase 1 - Desktop study	Phase 2 - Pre-feasibility study	Phase 3 – Bankable feasibility study
• Prepare a methodology to identify suitable sites. • Assemble relevant digital information at a basin and regional scale. • Categorise all information to indicate suitability in terms of the selection criteria. • Apply the methodology and demonstrate its use. • Identify potentially suitable basins. • Identify potentially suitable areas at a regional scale and shortlist potentially suitable target sites and alternatives. • Conduct reconnaissance field surveys over suitable areas. • Assemble a fatal flaw checklist/ exclusion criteria & identify areas with flaws and exclude them.	• Assemble more detailed information. • Refine or re-apply the methodology. • Conduct detailed field investigation of suitable target areas. • Conduct detailed field studies including drilling and surface monitoring. • Identify the site potentially most suitable. • Continue identifying fatal flaws and exclude them. • Prepare a report for select community stakeholder comment with description of the Proposal and alternative sites.	• Conduct detailed field investigation of preferred location. • Conduct detailed field studies including drilling and surface monitoring over preferred location. • Prepare supplementary environment and/or engineering reports (where required).

In 2010, the proponent reviewed several regional geological areas within Australia and selected the Amadeus Basin, NT as a suitable basin for further evaluation. A selection criteria was developed and undertaken at a regional scale and assessed using available data, against a range of categories (refer to Table 2-6).

Five areas were viewed as potentially suitable, one as intermediate potential and two defined as being unsuitable or unknown, the location of sites are shown in Figure 2-14. The areas that were identified as being most prospective were Charlotte North (preferred location) and the Mt Charlotte site (alternative site). The location of the preferred sites are shown in Figure 2-15. More detailed studies were then undertaken to confirm suitability and allowed further predevelopment investigations to take place.

Table 2-5 Regional site and target selection criteria

Category		Mt Charlotte	ELA North	ELA East	Eastern railroad	ELA South	Railroad	Ooramina	Bluebush
3	Site Selection	S	S	S	S	I	U	U	S
4	Ownership, legal permitting and contractual	S	S	S	S	S	I	I	I
5	Market analysis and logistics	I	I	I	I	I	S	I	I
6	Geology, mineral resource potential & hydrology	S	S	S			U		
7	Predevelopment – exploration	S	S	S	S	S	S	S	S
8	Development – mining	S	S	S	S	S	S	S	S
9	Salt processing	S	S	S	S	S	S	S	S
1	Storage processing	S	S	S	S	S	S	S	S
1	Infrastructure	I	I	I	I	I	S	U	I
1	Health and safety	S	S	S	S	S	S	S	S
1	Environment and community	S	S	S	S	S	S	S	S
1	Cost estimates	I	I	I	I	I	I	I	I
1	Implementation - Human Resources	I	I	I	I	I	I	I	I
1	Implementation - Contracting strategy,	S	S	S	S	S	S	S	S
1	Work program	S	S	S	S	S	S	S	S
1	Financial analysis	I	I/P	P	P	P	P	P	P
1	Risk analysis (Business and Safety);	S	S	S	I	I	S	I	S
Understanding level of knowledge		I		I	I	I	I	U	U
Ranking S = Suitable P = Potential I = Intermediate U = Unsuitable		S	S	S	S	I	U	U	S



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Document Path: C:\GIS_SS\Maps\Chandler_Description_SMA.mxd

N

8 4 0 8 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

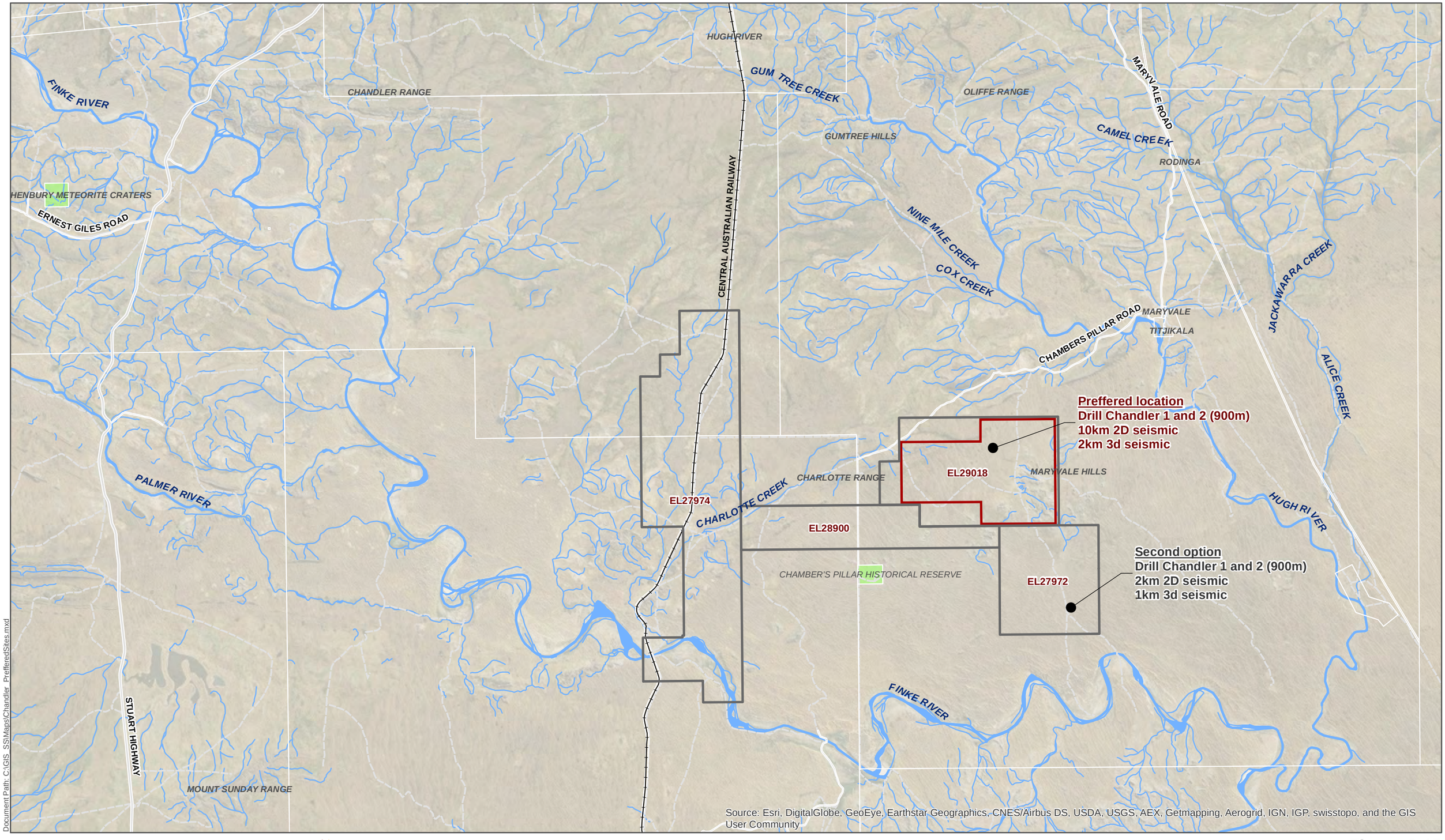
- Proposed development footprint
- Existing road
- Existing track
- Watercourse
- Mineral titles exploration license - granted (Tellus Holdings Ltd)
- Mineral titles exploration license - granted

Figure 2-14
Location of prospective sites on a regional level

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Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Railways
- Existing road
- Existing track
- Watercourse
- ML30612
- Mineral titles exploration license - granted (Tellus Holdings Ltd)

Figure 2-15
Location of preferred sites

TELLUS

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Underground location

The Chandler salt formation is an extensive flat lying salt bed at a depth of approximately 800m. The mineable horizon is not constrained in extent and therefore the underground mine location is able to be influenced by other factors such as most suitable mine entry location.

To locate the proposed underground salt mine, the following considerations were assessed:

- Availability of existing data such as seismic lines, oil wells and existing groundwater bores.
- Depth to salt.
- Thickness of the salt formation.
- The extent (length and width) and continuity of the salt formation.
- Salt quality of identified mining horizons.
- Suitable mine entry (portal) locations.
- Suitable ventilation and egress shaft locations.
- Alignment of decline.

Mine entry (portal)

Five potential mine entry points for access by a decline (access tunnel) were chosen and individually assessed against a range of criteria which included environmental, engineering and economic factors. Three potential sites were selected on the slopes of local hills. A further two locations were selected within low lying, flat areas.

For each location, consideration was also given to the proximity of existing stock / farm tracks and the Central Australian Railway (Adelaide to Darwin). Consultations with Traditional Owners and the Central Land Council were undertaken to determine areas of cultural importance or sensitivity.

Mine decline route

Studies were undertaken to determine how best to link the portal entrance to the salt mine. Alignments of the proposed decline route assessed previous seismic data and drill hole core data for information on the potential presence of groundwater, gas, fractures and rock types.

The pre-feasibility study and value engineering studies, recommended a decline as the primary mechanism to access the salt beds. In addition, two large diameter raise bored shafts were recommended for egress and ventilation.

Decline access has the best fit to a set of benefit criteria and weightings selected by Tellus and industry experts. Decline access is considered technically feasible with no fatal flaws having been accepted as a viable option in a number of independent studies commissioned by Tellus.

The pre-feasibility study assessed multiple underground access options for the proposed Chandler Facility. Weightings across financial, environmental and social were applied. The decline option was the preferred option over a shaft option. In addition to the decline, the Proposal would also be serviced by two shafts at five metre internal, finished diameter (5.5 metre excavated diameter). Each shaft would be developed by raise boring in a staged manner as the decline is advanced. The

downcast shaft (intake air) would also be used for salt hoisting and personnel riding, its total depth would be approximately 820 metres.

Underground layout

The overall layout of the proposed underground mine design was influenced by a number of factors including:

- Location of decline, ventilation and egress shafts.
- Underground access road configuration.
- Selected mining equipment (e.g. cutting height of continuous miner, width of machinery).
- Effect of salt creep over time.

The mine layout has been developed covering the planned 25 year underground life of mine and the underground footprint is approximately 3,200 metres x 1,500 metres or 480 hectares. More detail is provided in Chapter 3.

Aboveground layout

During the preparation of the draft EIS and pre-feasibility studies, site conditions, known environmental constraints and the result of value engineering studies were used to refine conceptual design drawings of the Proposal

2.3.3 Logistics alternatives

Access roads

If approved, access to the proposed Chandler Facility during construction would be via a public road named Maryvale Road. The Maryvale Road is predominantly an unsealed dirt road and is approximately 120 kilometres from Alice Springs to Maryvale store and the Community of Titjikala (refer to Figure 1-1).

A new private road, approximately five kilometres north of the Maryvale store, was originally put forward as an option to by-pass Maryvale store and the Titjikala community. However, after further desktop and field investigation, this option was rejected on the grounds of potential environmental constraints.

During the 2015 groundwater drilling program, a car accident occurred along the Maryvale Road. Following the incident, a decision was made to seek an alternate access route to the Chandler Facility for the operation of the Proposal.

Three existing access tracks across the Maryvale Station and Henbury leading to the Stuart Highway were identified and labelled A, B and C. A desktop environmental and engineering constraints assessment for each potential access route was then undertaken.

A Geographic Information System (GIS) was the tool used to identify potential constraints including but not limited to surface water features, clay pans, large stands of open woodland, sand dunes, rocky outcrops and gully erosion. Conversely, the GIS was also used to identify areas of potential opportunities including flat low lying areas void of gully erosion or areas potentially sensitive to high ecological value.

Following further on-site consultation with representatives from the Commonwealth Department of the Environment, the proponent selected option C as the preferred (long-term) access route. Option C was the preferred option because it would:

- Be constructed within an existing dirt road access corridor.
- Avoid isolating existing ecological communities on the Maryvale Station and Henbury Station.
- Avoid large scale disturbance to existing cattle grazing activities.
- Avoid items of cultural heritage importance.
- Minimise disturbance to riparian vegetation along significant drainage lines.
- Minimise the permanent removal of existing terrestrial vegetation.
- Allow for the construction of appropriate downstream sediment and erosion control measures.

Following the selection of the alternate access route, detailed environmental site investigations were undertaken over a 12-month period. The specialist biodiversity and cultural heritage field investigations included participation from local ecological consultants and Traditional Owners.

The studies carried out along the 60-kilometre access track assisted the proponent to confirm baseline environmental conditions. Cultural heritage, surface water, soil and biodiversity constraints were identified, mapped and have been discussed in the appropriate impact assessment chapters of this EIS. In addition, this information will be used to minimise potential impacts to these elements during the detailed engineering design process. The results were also presented to affected pastoralists as part of the EIS consultation process.

Port linkages

Depending on the equipment used for transport from Chandler, there may be a requirement for portside storage of bulk salt. Both Darwin and Adelaide ports have infrastructure for bulk loading of vessels, however in order to store bulk salt in large quantities, there would be a need for a salt bunker or silo storage (similar to a grain bunker/silo).

Initial research suggests finding existing infrastructure to accommodate the required construction and operation workforce would be difficult and this would require significant investment, particularly given portside property is costed at a premium. Open air storage of salt in Darwin, given its cyclonic climate is also foreseen as not viable.

These challenges were a large factor in pursuing a containerised export option in the pre-feasibility study. Ultimately the modelling aims to provide the most economic method to move the salt from the proposed Chandler Facility to port, with the least amount of capital required. In lieu of finding suitable existing bulk infrastructure to export salt, a containerised solution for transport and temporary storage of salt is the preferred option.

2.3.1 Options to optimise ecological sustainability for the Proposal

Solution mining versus room and pillar mining

In solution mining, holes are drilled and lined from the surface down to a rock salt formation. Water is then pumped into the holes under pressure to dissolve the underground salt and form brine, which can be recovered by pumping. Salt can then be extracted from the brine.

This method would require significant volumes of groundwater to be used in the process. Significant volumes of brine waste would also be generated.

Traditional room and pillar salt mining would avoid having to use large volumes of groundwater. By avoiding brine waste management, the surface disturbance footprint within the Chandler Facility was significantly reduced.

Energy sources

The proposed Chandler Facility is very remote and is not serviced by any forms of existing infrastructure other than the Maryvale Road, site access track and a small exploration camp. Hence, the site needs to be completely self-sufficient for power generation, accommodation, potable and other water, sewerage treatment and communications. The PFS activities included preliminary design and both capital and operating cost determination for all infrastructure and service items. Further details on sources of energy and associated infrastructure are described in Chapter 3.

Salt mineral processing

Wet and dry salt processing methods including the need for large evaporation ponds were assessed during preparation of the PFS and the EIS. The benefits and adverse effects of both alternatives are discussed in Table 2-8.

2.3.2 Consideration of alternative environmental management measures for key risks

A range of environmental risk scenarios were tabled during an environmental risk workshop. The Proposal's description (refer to Chapter 3) was used as the basis of the assessment and used to identify possible risks that may have a likelihood of occurring during the Proposal lifecycle. During the workshop, identified risks were assigned a likelihood and consequence, and given a risk ranking. Following a ranking of risks, attendees in the workshop then considered appropriate management measures to complete the pre-mitigated risk assessment (refer to Chapter 6).

Post management residual risks were then reviewed. Where residual risks were ranked as being extreme or high (e.g. key risks), alternative environmental or engineering management measures were discussed by attendees in the workshop.

The following factors were discussed for key residual risks:

- Best practice techniques in similar dual business models that currently operate in Europe and North America.
- Changes to design elements for above and below ground infrastructure.

- Consultation with pastoralists and Traditional Owners of the land.
- Additional environmental field investigations.
- The proponents Environmental Management System.

The above steps allowed the design and EIS team to consider viable Proposal alternatives that have assisted in addressing potential long-term adverse effects and seeking ways to maximise potential short or long-term beneficial effects. These are discussed in more detail in Section 2.3.3.

2.3.3 Adverse and beneficial effects of alternatives at national, Territory, regional and local levels

Table 2-6 lists alternatives that were considered significant by the proponent for the Proposal. It provides an overview of whether the alternatives considered, and then rejected or selected for the Proposal were considered as having an adverse or beneficial effect[8].

Three levels of significance are required to be addressed in the Terms of Reference, namely national, NT and local. In addition, the Proposal included international and regional aspects, as these were deemed to be relevant by the proponent in the context of the Terms of Reference. Where appropriate, comments on the nature of the effects in relation to the Proposal are provided in

Part D of the EIS provides further detail on the beneficial and/or adverse effects of the Proposal including, where appropriate, a description of the effect over the short, medium or long-term.

[8] *For the purpose of assessing 'effect' against considered alternatives, environmental, social and economic criteria were selected as being the most appropriate criteria.*

Table 2-6 Alternatives considered throughout the development of the Proposal

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
Do nothing option	R		×	✓	✓	✓	✓	The do nothing option would fail to achieve the net beneficial effect of providing salt to the international and domestic market for which there is demand (refer to Section 2.2.1). In addition, the do nothing option would not provide the opportunity and long-term beneficial effect of assisting Australia, and other developing nations in the Pacific region, with a long-term solution to the management of hazardous waste that adopts best practice techniques adopted in Europe and Norther America and carried out using environmentally sound management (ESM) practices.
Salt mine only option	R		×					This option would provide salt to the international and domestic market for which there is demand (refer to Section 2.2.1). However, it would not achieve the intended objective of a dual business stream.
Store and permanently isolate waste only option	R		×					This option would provide a long-term solution to the management of hazardous waste that adopts best practice techniques adopted in Europe and Norther America and carried out using ESM practices. However, it would not achieve the intended objective of a dual business stream.

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
Store and permanently isolate waste in salt	S	✓			✓	✓	✓	This option would meet best practice techniques adopted in Europe and Northern America and carried out using ESM.
Store and permanently isolate waste in silt/clay	R		×				✓	This option has merit. However, too much scientific uncertainty exists surrounding potential pathways that could lead to potential groundwater contamination. Based on the precautionary scientific principle, this option was not carried forward into the EIS.
Darwin (East Arm) Storage and Transfer Facility	R		×			✓	✓	This option was the proponents original option for temporary storage of waste materials and salt export. Due to further logistical studies, the proponent decided to centralise the storage and transfer facility to a location closer to the Chandler Facility. Whilst proposal logistics would improve over the long-term, relocating the storage and transfer facility meant a loss of local jobs and investment in the Darwin region.
Brewer Estate (Alice Springs) Storage and Transfer Facility	R		×			✓	✓	In January 2016, the proponent selected the Brewer Estate as the preferred regional location for a storage and transfer facility. Subject to further appraisal and value engineering studies completed, the proponent decided to look at another location and much closer to the proposed Chandler Facility. Whilst proposal logistics would improve over the long-term, relocating the storage and transfer facility

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
								meant a loss of local jobs and investment in the Alice Springs region.
Apirnta Facility	S	✓		✓	✓	✓	✓	This option would provide long-term beneficial logistic effects, create long-term regional and local jobs and due to its remote location, would provide for the safe temporary storage of waste materials before being transported to the proposed Chandler Facility. In addition, the proposed Apirnta Facility would be a central point of receipt and temporary storage for both international and national wastes[9].
Australian network of remote storage and transfer facilities (using a contractual arrangement with a tier one logistics firm)	S	✓			✓	✓	✓	Using a tier one logistics firm to temporarily store and transport hazardous waste materials safeguards the transport of these waste types within the NT and interstate. A tier one logistics firm would be selected who operate and are proven transporters of hazardous wastes and dangerous goods under relevant Commonwealth legislation and Australian Codes of Practice. This approach should provide regulators within the NT and other jurisdictions that the proponent is aware of what measures need to be taken to safely transport hazardous and/or dangerous goods to its proposed facilities.

[9]*Approval for the acceptance of international wastes are being sought under international conventions which the Australian Government is a signatory to. Refer to Chapter 4 for more detail.*

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
Transport of salt and waste materials by road only	R		×			✓	✓	During the risk assessments undertaken during the preparation of the EIS (refer to Chapter 6 for more information), this alternative option was ranked with an extreme risk even after management measures were considered. Consequently, it was removed as a viable alternative and no further consideration was given in the EIA process. This alternative option was not carried into the EIS for assessment.
Transport of salt and waste materials by rail only	R		×		✓			This alternative option, whilst a safer one than the road only option, would not achieve the logistic objectives for the transport of salt from the Chandler Facility to port or, waste materials from the Apirnta Facility to the Chandler Facility. This alternative option was not carried into the EIS for assessment.
Transport of salt and waste materials using a combination of road and rail haulage.	S	✓			✓	✓	✓	This alternative option would achieve the logistic objectives for the transport of salt and wastes between the proposed Apirnta and Chandler Facilities. For these reasons, it was the preferred alternative for Proposal logistics.
Rail siding location	S	✓				✓	✓	Potential beneficial effects associated with the rail siding may apply to local landowner on the Henbury Estate. These potential beneficial effects would be investigated during detailed design.
Salt processing (wet)	R		×				✓	This option would have an 11 hectare footprint. It would also require significant volumes of groundwater. Following the

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
								results of tests undertaken on the halite (salt) from the Chandler Formation, the method of wet processing was not considered necessary. In addition, and to improve the Proposal's ecological sustainable footprint, this alternative option for salt processing was no longer considered viable.
Salt processing (dry)	S	✓					✓	Dry salt processing was the preferred alternative and it would avoid the loss of up to 11 hectares of local plant and fauna habitat as well as items considered culturally sensitive.
Hydraulic backfill	S	✓					✓	This alternative method of waste emplacement would make better use of void space in the excavated salt rooms. This method would also assist in the management of hazardous liquid wastes, both incoming and generated during operation. For example, contaminated surface waters collected in sediment traps from hardstand areas within the mine infrastructure area could be used within the hydraulic backfill process.
Darwin Port (salt export)	R		×			✓	✓	Proposal feasibility studies considered this alternative port site as economically unfeasible. The decision to not use Darwin Port may have resulted in a loss of local jobs and revenue for the NT Government.
Adelaide Port (salt export)	S	✓			✓		✓	Proposal feasibility studies considered this alternative port site as economically feasible. The decision to use a Port in

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
								Adelaide may contribute to local jobs and revenue for the South Australian Government.
Maryvale Road access (construction only)	S	✓				✓	✓	This alternative option for site access is only a medium term access option. Owing to concerns the proponent has with respect to the structural integrity and safety of the (public) Maryvale Road, it would only utilise it during the construction of the Proposal. The use of the road would potentially bring business to the Maryvale Store which is considered a beneficial effect over the 4 year construction period.
Maryvale Road access (operation)	R		×					As stated above, this option, over the life of the 25 year mine, is not considered a viable option based on health and safety reasons.
Proposed Henbury Access Road (construction access)	R		×			✓	✓	This alternative option is considered to be a safer option that the Maryvale Road alternative because it is a private road. However, owing to economic constraints at this stage of the Proposal, the upgrade of the existing (private) Henbury access road is not yet feasible. This means a loss of potential local and regional jobs.
Proposed Henbury Access Road Option A (operation access)	R		×				✓	Owing to biodiversity and land use identified in desktop, field work and, during consultation with the Department of Environment, this alternative route for operational access was screened out of the EIA process.

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
Proposed Henbury Access Road Option B (operation access)	R		×				✓	Owing to biodiversity, soils and land use constraints identified in desktop, field work and, during consultation with the Department of Environment, this alternative route for operational access was screened out of the EIA process.
Proposed Henbury Access Road Option C (operation access)	S	✓					✓	This alternative option for operational access was screened in to the EIA process because it represented the alternative with the least environmental impact to local and regional biodiversity and land use. The location of this existing access (dirt/gravel) road meant local plant communities would not be isolated as a result of constructing a new road. In addition, this access road would be a private road, it is a safer alternative option over the long-term bringing beneficial health and safety effects to local and regional workers.
Internal haul road from Chandler Facility to Apirnta Facility	S	✓					✓	An alternative option was considered which would have involved bisecting an area of open woodland consisting of mulga and supporting understorey plant communities. This option also would have involved construction through a significant sand dune system. Instead of bisecting pristine plant communities, the preferred alternative was to use an existing and disturbed property access track thus avoiding adverse biodiversity impacts.
Decline access to salt horizon	S	✓	×				✓	The decline alternative option considered to reach the salt formation was assessed

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
								against environmental, social and economic criteria. It was the preferred alternative. This option would result in higher greenhouse gas emissions over the long-term compared with a shaft option. However, favourable proposal economics meant this option was the preferred option. Greenhouse gas emissions associated with this option are addressed in Section 18.3. In addition, the waste rock spoil generated from construction of the decline would be re-used in the construction of the Chandler Haul Road and eventually, for the Henbury Access Road.
Shaft access to salt horizon	R	✓	×				✓	Shaft access to the salt formation was considered. It would be marginally more expensive compared to the decline alternative. It would result in fewer greenhouse gas emissions and less waste rock spoil. However, having less waste rock spoil may have meant hauling spoil material over long distances to meet the demand required for internal, access and haul road construction.
Airstrip location	S	✓					✓	A range of options were considered for an airstrip. The final decision was to utilise an area of the proposed Chandler Haul Road. The proposed haul road would involve upgrading an existing property access (dirt/gravel) road. By doing this, land disturbance would be avoided which

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
								results in a beneficial effect for the Proposal.
Fly in – fly out direct to Chandler Facility	R		×				✓	This alternative option was screened out of the EIA process because it would not contribute to the growth of local and regional communities.
Drive in – drive out to Chandler Facility	S	✓					✓	This alternative was considered appropriate during construction and operation of the Proposal. It would allow staff to return to their families after their shifts (e.g. 9 days on 5 off) were completed. It is proposed to bus staff to the Proposal site which would assist in reducing the long-term ecological footprint of the Proposal.
Accommodation (Alice Springs only)	R		×				✓	This alternative was not considered appropriate due to the requirement of needing staff on-site during operations, the distance is too far to consider daily drive in and out.
Accommodation (Chandler Facility)	S	✓					✓	This alternative was considered more appropriate because it would provide benefit to day and night shift workers.
Borrow pits	S	✓					✓	Existing borrow pits are located along the Maryvale Road. Where possible, these pits would be utilised in the early periods of construction to avoid further land take and disturbance. This is considered a beneficial effect for local plant and fauna populations.
Mine waste rock	S	✓					✓	During construction of the decline, mine waste rock would be brought to the surface

Alternative considered	Rejected or selected	Beneficial effect	Adverse effect	Level at which effect applies				Comment
				International	National	Territory	Local/regional	
								and stockpiled. The alternative option considered was to re-use this material in the construction of haul and access roads. This approach would avoid the requirement of hauling spoil long distances to be used in road construction. The geology of the Chandler includes a large section of clay material.
Groundwater bore field	S	✓					✓	Careful site selection that has been based on non-intrusive groundwater research (refer to Chapter 8 for more information) allowed the proponent to select a site that would provide raw water to both the proposed accommodation village and Chandler Facility. The same non-intrusive technique would be used to search for potential groundwater near the Apirnta Facility and along the proposed haul road and access road.

2.3.4 The comparison of short and long-term advantages and disadvantages of the alternatives

Table 2-7 provides a comparison of short and long-term advantages and disadvantages of alternative options considered for the Proposal. Comments provided in Table 2-9 against each alternative considered explain the nature of short or long-term effects and their advantages or disadvantages.

Table 2-7 Comparison of alternatives against short or long-term advantages and disadvantages

Alternative considered	Short-term	Long-term	Advantage	Disadvantage
Do nothing option		✓		×
Salt mine only option		✓		×
Store and permanently isolate waste only option		✓		×
Store and permanently isolate waste in salt mine		✓	✓	
Store and permanently isolate waste in silt/clay	✓			×
Darwin (East Arm) storage and transfer facility		✓		×
Brewer Estate (Alice Springs) storage and transfer facility		✓		×
Apirnta storage and transfer Facility		✓	✓	
Australian network of remote storage and transfer facilities (using a contractual arrangement with a tier one logistics firm)		✓	✓	
Transport of salt and waste materials by road only	✓			×
Transport of salt and waste materials by rail only	✓			×
Transport of salt and waste materials using a combination of road and rail haulage		✓	✓	
Rail siding location		✓	✓	
Salt processing (wet)		✓		×
Salt processing (dry)	✓	✓	✓	
Hydraulic backfill		✓	✓	
Darwin Port (salt export)		✓		×
Adelaide Port (salt export)		✓	✓	
Maryvale Road access (construction only)	✓		✓	
Maryvale Road access (operation)		✓		×
Proposed Henbury Access Road (construction access)	✓			×
Proposed Henbury Access Road Option A (operation access)		✓		×
Proposed Henbury Access Road Option B (operation access)		✓		×
Proposed Henbury Access Road Option C (operation access)		✓	✓	
Internal haul road from Chandler Facility to Apirnta Facility		✓	✓	
Decline access to salt horizon		✓	✓	×
Shaft access to salt horizon		✓	✓	×
Airstrip location		✓	✓	
Fly in – fly out direct to Chandler Facility		✓		×
Drive in – drive out to Chandler Facility		✓	✓	

Alternative considered	Short-term	Long-term	Advantage	Disadvantage
Accommodation (Alice Springs only)		✓		×
Accommodation (Chandler Facility)		✓	✓	
Borrow pits	✓		✓	
Mine waste rock		✓	✓	
Groundwater bore field		✓	✓	

2.4 Proposal benefits

The Proposal would result in positive environmental, social and economic benefits to the NT and Australia. These benefits include:

Proceeding with the Proposal would result in significant social and economic benefits in the NT and within Australia. The Proposal would:

- **Provide an innovative unique dual revenue business in remote Central Australia** -the business would commercialise an industrial bulk commodity (salt) and provides an equipment and archives storage business and a storage, recovery and permanent isolation business for hazardous waste generated in the NT and within Australia.
- **Diversify the economy.** - development of enabling environmental infrastructure which would assist in providing utility support services to other existing and new projects that generate waste as a result of the 'Developing the North' strategy.
- **Major investment in regional Australia** - the capital expenditure is estimated to be around A$676 million (nominal, including finance and contingency) for the Proposal. Around 67 % of all construction costs would be spent in Australia (36% spent in the NT).
- **Boost the economy over the 29-year project life** - on average, there would be spending of just under $81 million per annum to operate the Proposal. Of this, 64 % would be spent in Australia (a total of 52% would be spent in the NT). The site could be expanded for generations.
- **Royalties, taxes and levies** - over the 29-year term could support other parts of the NT and the Australian economy.
- **Create training and long term job opportunities** -
    - About 270 jobs during construction (720 jobs during peak build including in-directs).



Plate 2-1 Tellus has supported indigenous jobs during the development of the EIS and would continue to support indigenous employment through the construction, operation, and closure and rehabilitation of the Proposal.

- About 150 to 180 full time equivalent workers would be employed during operation. Just over 5,400 full-time equivalent job years would be created over the life of the Proposal, an average of 217 full time equivalent job years per annum.
- Jobs would be green, sustainable, and generally well paid covering technical (engineering, chemistry, science), commercial (sales, business) and operational skills.
- Proposed jobs and training programs, such as:
    - 1. Tellus' School to Jobs Program (Annual Schools Tour).
    - 2.Tellus' Pre-employment Training Program ('Getting Job Ready') comprising Tellus' Traineeships Program, Tellus' Apprenticeships Program and Training Accreditation.
    - 3. Indigenous Employment Program; comprising a 10 % indigenous employment target as well as other commitments that would benefit local indigenous people such as the sponsorship of sporting and academic programs in the nearby community of Titjikala (refer to Plate 2-1 and Plate 2-2).
    - 4.Tellus' Employment Programs and Systems comprising a 'Sisters in Mining' Program; Tellus' Disabled Worker Program, Tellus' Ranger Program and support for Social Enterprises that could generate more jobs.

- **Provide local business support and new business opportunities** - goods and services such as construction and operational materials, food, accommodation, etc. would be sourced from local business, where possible.
- **Fulfil the government's own environmental and waste policy obligations under the following four main regulatory regimes** -
    - Environmental protection regulations (to minimise adverse impacts on the environment and human health and to meet national and international obligations);
        - Meeting NT and national obligations by providing critical infrastructure that can safely store, recover or permanently isolate difficult to manage wastes.
        - The NT EPA's *Waste Management Strategy for the Northern Territory 2015-2022*, the NT Department of the Chief Minister *Framing the Future* and the Australian Government *National Waste Policy*.
        - Meeting international obligations under the Basel Convention (Regulation of Transboundary Movements) and Waigani Convention (Regulation of Exports and Imports) by providing critical infrastructure for our near-neighbors such as the Pacific Islands who do not have suitable infrastructure to manage such wastes. Australia currently exports waste mostly to Europe and Asia and imports small volumes of waste materials mostly from our near neighbors (Pacific Islands). The proponent is not planning on actively

marketing this service, but in the event of a man-made or natural disaster, the proposed Chandler Facility would be suitable.

- Transport of dangerous goods regulations (to prevent accidents and promote safe transport, regulated by national legislation and codes).
- Work health and safety regulations (hazardous chemical regulations that reduce occupational health and safety risk in the workplace).
- Product stewardship regulations (the responsible management of products such as waste oil, asbestos, e-waste, tyres, batteries, mercury, medicines).

- **Support the circular economy** - by providing an opportunity for the future potential recovery of valuable materials (that are currently deemed waste). The Proposal could attract new salt and waste recycling and recovery industries to the NT.





Plate 2-2 Tellus would continue to support the local community through construction and operation of the Proposal

The Proposal reflects opportunities to develop the regional NT area not only as a mining area but also to diversify the economy by supporting innovative environmental utility businesses that can bring significant investment, increase trade, provide long-term jobs and provide enabling infrastructure services to the mining, oil and gas, manufacturing and agricultural industry.

The lack of hazardous waste disposal operations in the NT and Australia means there is a demand for a deep geological repository to manage such wastes in an environmentally sound way and supports the circular economy (refer to Figure 2-16).

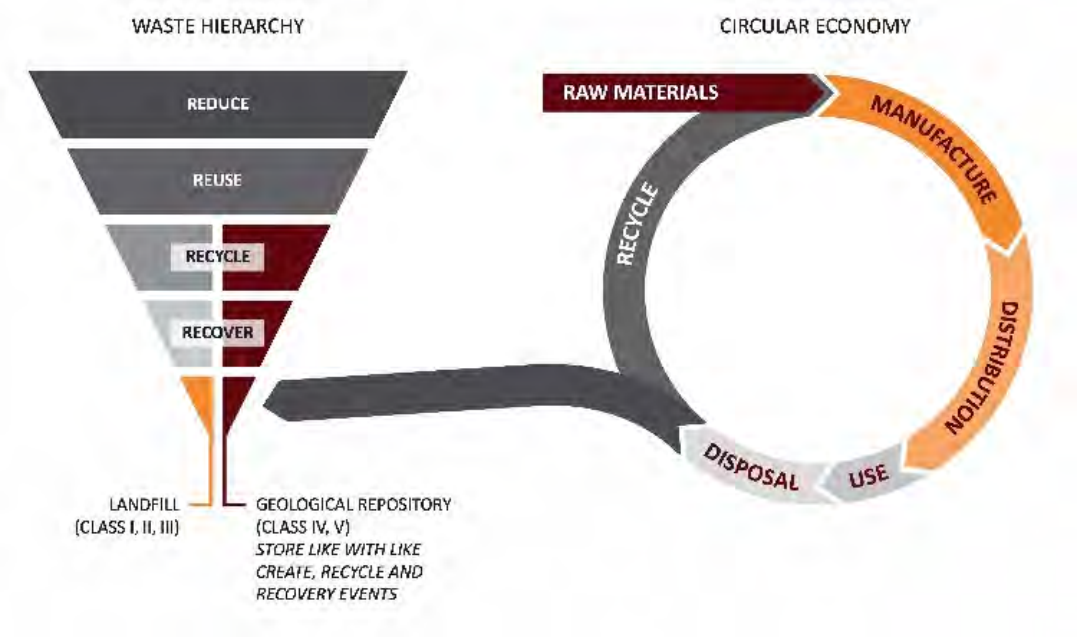
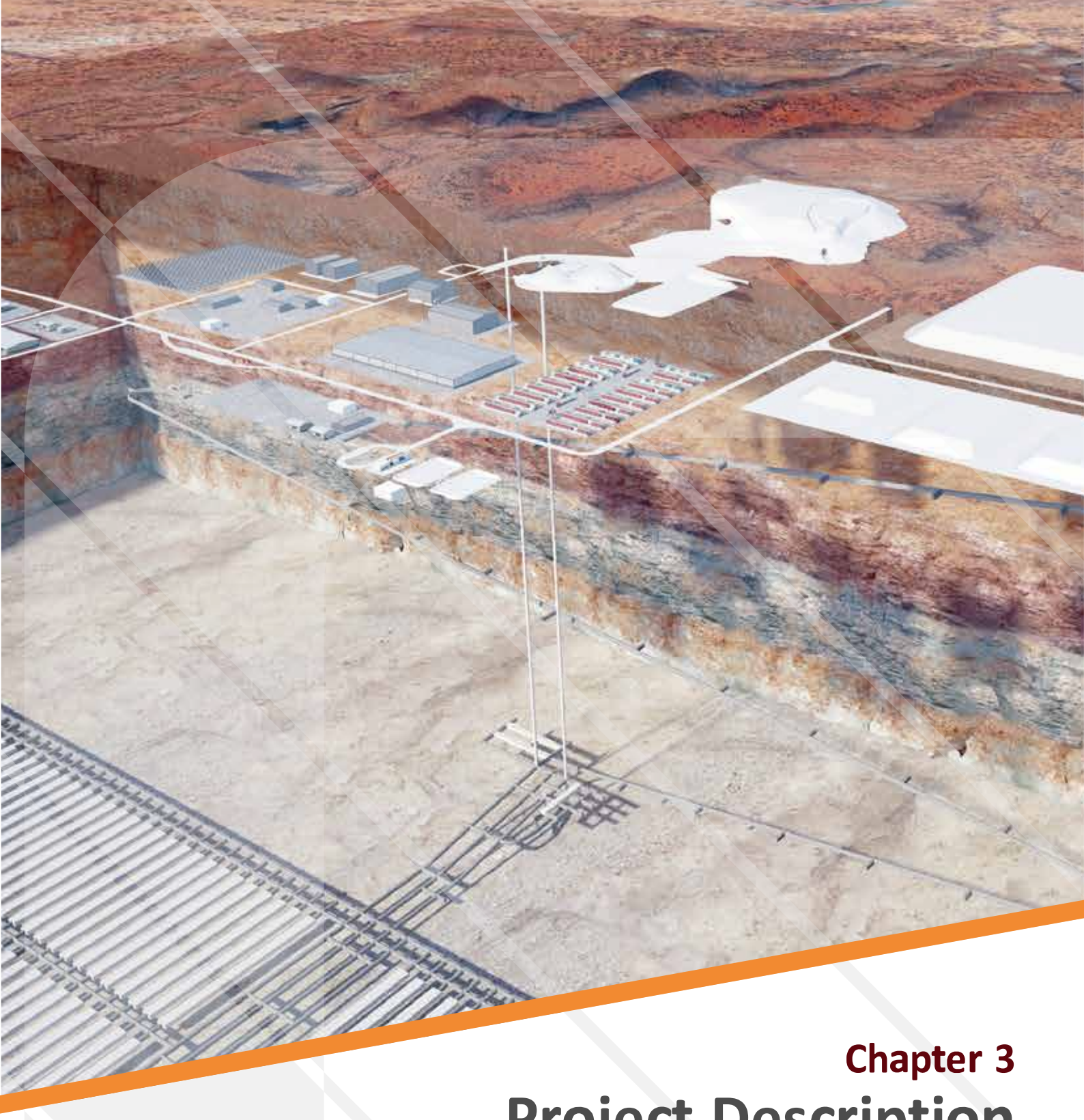


Figure 2-16 Proposal benefits associated with environmentally sound management



Part B

Proposal Details and Engagement



Chapter 3
Project Description

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3 PROPOSAL DESCRIPTION

3.1 Proposal overview

3.1.1 Introduction

Tellus propose to construct and operate an underground rock salt mine and storage, recovery and permanent isolation facility (the 'Chandler Facility'). A rail siding and temporary surface storage and transfer facility (the 'Apirnta Facility') is also proposed. A private haul road linking the two facilities (the 'Chandler Haul Road') would be constructed. A private access road (the 'Henbury Access Road'), would be constructed to link the proposed Apirnta Facility with the Stuart Highway. Collectively, the two proposed facilities and the haul and access roads are referred to as 'the Proposal'.

The proposed Chandler Facility and the majority of the Chandler Haul Road would be located within a pastoral lease (Maryvale Station) approximately 120 kilometres south of Alice Springs (refer to Figure 1-1). The proposed Apirnta Facility, Henbury Access Road and a portion of the Chandler Haul Road would be located to the west of the proposed Chandler Facility, also on a pastoral lease (Henbury Station) (refer to Figure 1-1).

Salt mining activities would involve:

- Deep mining of rock salt using a 'room and pillar' system of mining.
- Transport of salt via shaft hoisting to the surface.
- Stockpiling of rock salt for processing and packaging.
- Transport of rock salt to domestic and overseas market:
    - Domestic market (via road and rail) - road transport via truck on federal and state highways. Rail transport via a proposed new railway siding located at the Apirnta Facility.
    - Overseas market (via rail) - rail transport also via the proposed new railway siding located at the Apirnta Facility, predominantly south to a port facility in Adelaide. From there, rock salt would be shipped to overseas markets predominantly in Asia.

Storage, recovery and permanent isolation of materials would involve:

- Transport of materials (equipment, archives, etc.) and waste, predominantly by rail, for receipt and temporary storage at the Apirnta Facility.
- Transfer of materials by truck from the Apirnta Facility to the Chandler Facility via the proposed Chandler Haul Road.
- Transport of packaged materials via mine access decline or via hydraulic backfill into the voids created by the salt mining operation:



- Waste would be permanently isolated in line with operational management plans and a strict Waste Acceptance Criteria (WAC).
- Materials such as equipment and archives would be stored separately for future retrieval.

- Once full, sealing the underground voids permanently with an engineered barrier.

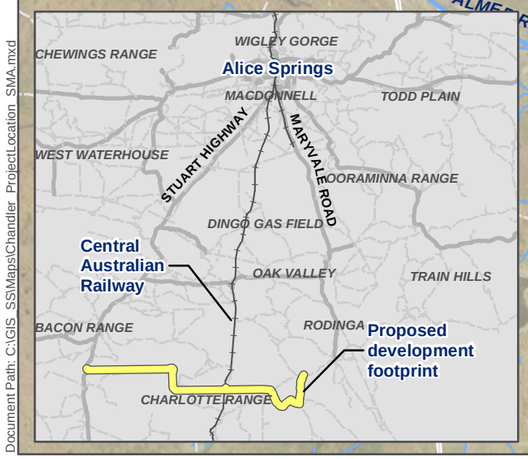
The salt would be mined from the Chandler Salt Bed which is located approximately 850 metres below the surface. Materials stored within the voids left from the mining operation would be situated within a salt bed approximately 200 to 300 metres thick allowing the waste to be permanently removed from the biosphere in a stable and dry environment.

The key components of the Proposal are described in Section 3.1.2 and shown in Figure 3-1.

The overarching concept and dual revenue business model is discussed in Section 0. The proposed Chandler Facility is described in Section 3.3, Section 3.4 and Section 3.5. The proposed Apirnta Facility is described in Section 3.6, Section 3.7 and Section 3.8. Logistics are described in Section 3.9. The proposed Henbury Access Road and Chandler Haul Road are discussed in Section 3.10. Closure, decommissioning and rehabilitation of the Proposal is described in Section 3.11, Section 3.12 and Section 3.13, respectively. Post closure is discussed in Section 3.14.

Water, and utilities and services are discussed in Section 3.15 and Section 3.16.

ORANGE CREEK HOMESTEAD
Rainbow Valley Conservation Reserve
JAMES RANGES
PWERTE MARNTE MARNTE
WALKABOUT BORE
OAK VALLEY
MOUNT PEACHY
PWERTENTYE
HUGH RIVER STOCK ROUTE
MALONEY CREEK
HUGH RIVER
CHANDLER RANGE
OLIFFE RANGE
MARYVALE ROAD
Henbury Meteorites Conservation Reserve
HENBURY HOMESTEAD
GUMTREE HILLS
BACON RANGE
RODINGA
HENBURY METEORITE CRATERS
ERNEST GILES ROAD
FINKE RIVER
CENTRAL AUSTRALIAN RAILWAY
HUGH RIVER
Stuart Highway
STUART HIGHWAY
Henbury Access Road
MARYVALE HOMESTEAD
TITJIKALA
CHAMBERS PILLAR ROAD
Access to Titjikala and Chambers Pillar Road
Apirnta Facility
Accomodation village
Chandler Haul Road
SEYMOUR RANGE
PALMER VALLEY HOMESTEAD
Chandler Bore Field
MARYVALE HILLS
CHARLOTTE RANGE
Chandler Facility
HUGH RIVER
PALMER RIVER
Chambers Pillar Historical Reserve
FINKE RIVER
IDRACOWRA HOMESTEAD
HUGH RIVER



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Document Path: C:\GIS_SSIMaps\Chandler_ProjectLocation_SMA.mxd

N

5.5 2.75 0 5.5 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Railways
- Existing road
- Existing track
- Watercourse
- Homestead location
- ML30612
- Henbury Access Road
- Chandler Haul Road
- Access road to Titjikala
- Chandler Facility
- Apirnta Facility
- Accomodation village
- Proposed bore field

Figure 3-1
Key Proposal components

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3.1.2 Key characteristics of the Proposal

The key characteristics of the Proposal are presented in Table 3-1.

Table 3-1 Key characteristics of the Proposal

Characteristic	Description
Property	NT Portion 810 and NT Portion 657
Registered use	Pastoral (cattle grazing)
Planned use	• Salt mining of an average of 750,000 tonnes per annum with salt processing deferred for the first five years of mining operations. • The storage, recovery and permanent isolation of up to 400,000 tonnes of waste per annum (year one 30,000 tonnes, average 340,000 tonnes per annum).
Planned life	Four years of construction plus 25 years of operation
Capital expenditure	$566 million (direct and indirect); $676 million (nominal, including finance and contingency)
Employment	
Construction	270 workers (peak manning)
Operation	150-180 workers
Surface footprint disturbance	
Chandler Facility	113 hectares
Apirnta Facility	30 hectares
Proposed mining area (underground footprint)	361 hectares
Operations	
Salt production (export)	750,000 tonnes per annum (tpa) from year six of mining operations.
Waste storage[10]	400,000 tonnes per annum waste sales (year one 30,000 tonnes, average 340,000 tonnes per annum).

3.1.3 Timing

The overall timing of the Proposal is presented in Figure 3-2. If approved, enabling/construction works would commence in late 2018. The mining of salt is scheduled to commence in late 2021. The emplacement of waste would not occur until enough salt has been mined to allow for the first emplacement of wastes. The emplacement of waste would likely occur in 2022.

[10] *Refer to Appendix F for the proponents proposed listed waste inventory*



Figure 3-2 Key milestones for the Proposal

3.1.4 Land tenure

The proposed Chandler Facility and most of the Chandler Haul Road would be located within Maryvale Station (NT Portion 810). The proposed Apirnta Facility, Henbury Access Road and a portion of the Chandler Haul Road would be located within Henbury Station (NT Portion 657) (refer to Figure 1-1). Land within Maryvale Station and Henbury Station is pastoral lease land governed under the NT *Pastoral Land Act.*

The proponent originally applied for and was granted nine mineral exploration licenses covering a total area of approximately 1,432 square kilometres. The proponent subsequently relinquished ground in accordance with the MT Act and currently holds five exploration licences and one mineral lease under application, as listed in Table 3-2.

Table 3-2 The proponent's current tenements within the NT

Tenure	Name	Effective date	Expiry date	Sub blocks	Status
EL 29018	Charlotte North	12-Apr-12	11-Apr-18	41	Grant
EL 27972	Mt Charlotte	20-Oct-10	Renewal pending	25	Renewal pending
EL 27971	Bluebush	20-Oct-10	Renewal pending	20	Renewal pending
EL 27974	Central Railroad	20-Oct-10	Renewal pending	72	Renewal pending
EL 28900	Eastern railroad	05-Mar-12	04-Mar-18	22	Grant
ML30612	Chandler	-	-	9978 ha	Application

The proposed Chandler Facility would be located within ML 30612. All proposed construction, operation, closure and rehabilitation activities associated within ML 30612 would require tenure approval. Detailed discussion of tenure requirements are contained within Chapter 4.

3.2 Proposal concept

3.2.1 Overview

The proposed Chandler Facility would function as an underground rock salt mine and a storage, recovery and permanent isolation facility. The proposed dual revenue business model is shown conceptually in Figure 3-3. The steps depicted in Figure 3-3 are discussed in further detail in Section 3.6.4 and Section 3.6.5.

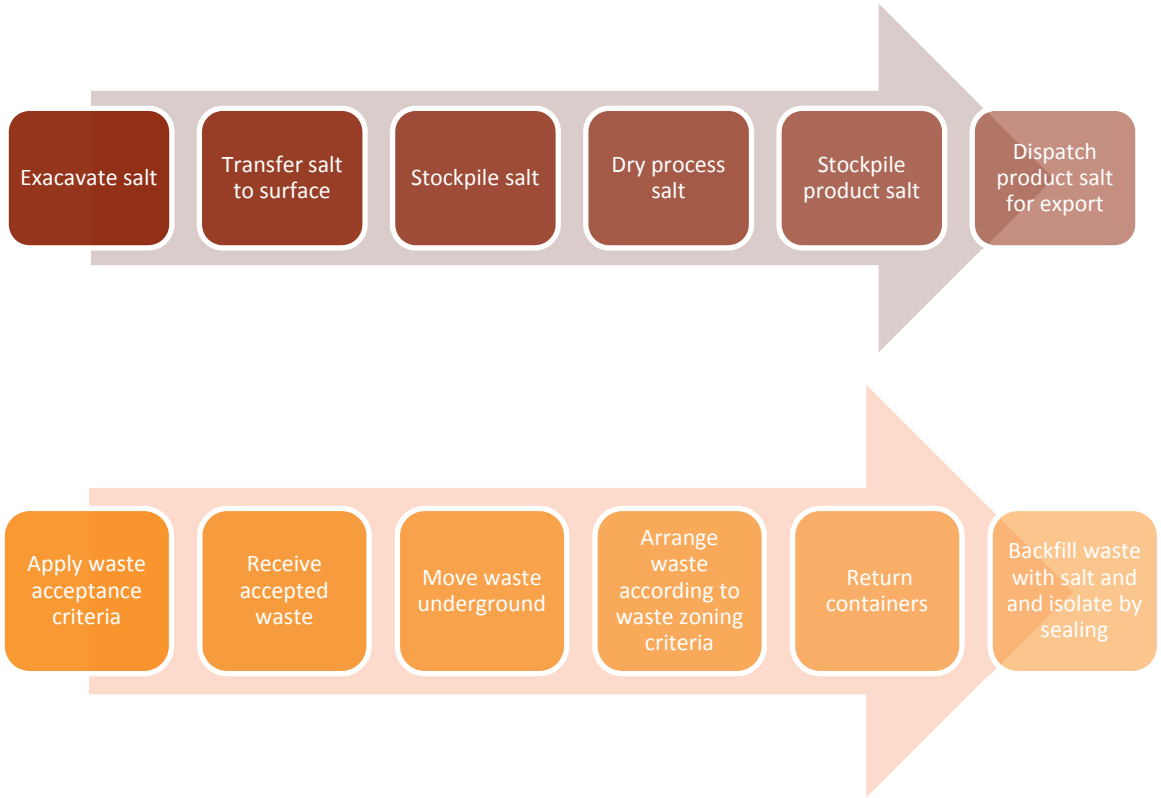


Figure 3-3 Proposal concept

The Proposal represents a major investment and opportunity for long term jobs and business development in a remote and regional part of Australia. If approved, the Chandler Facility would involve a capital investment of around $676 million (nominal, including finance and contingency) and would provide significant long term employment opportunities over its four-year construction and 25-year operation.

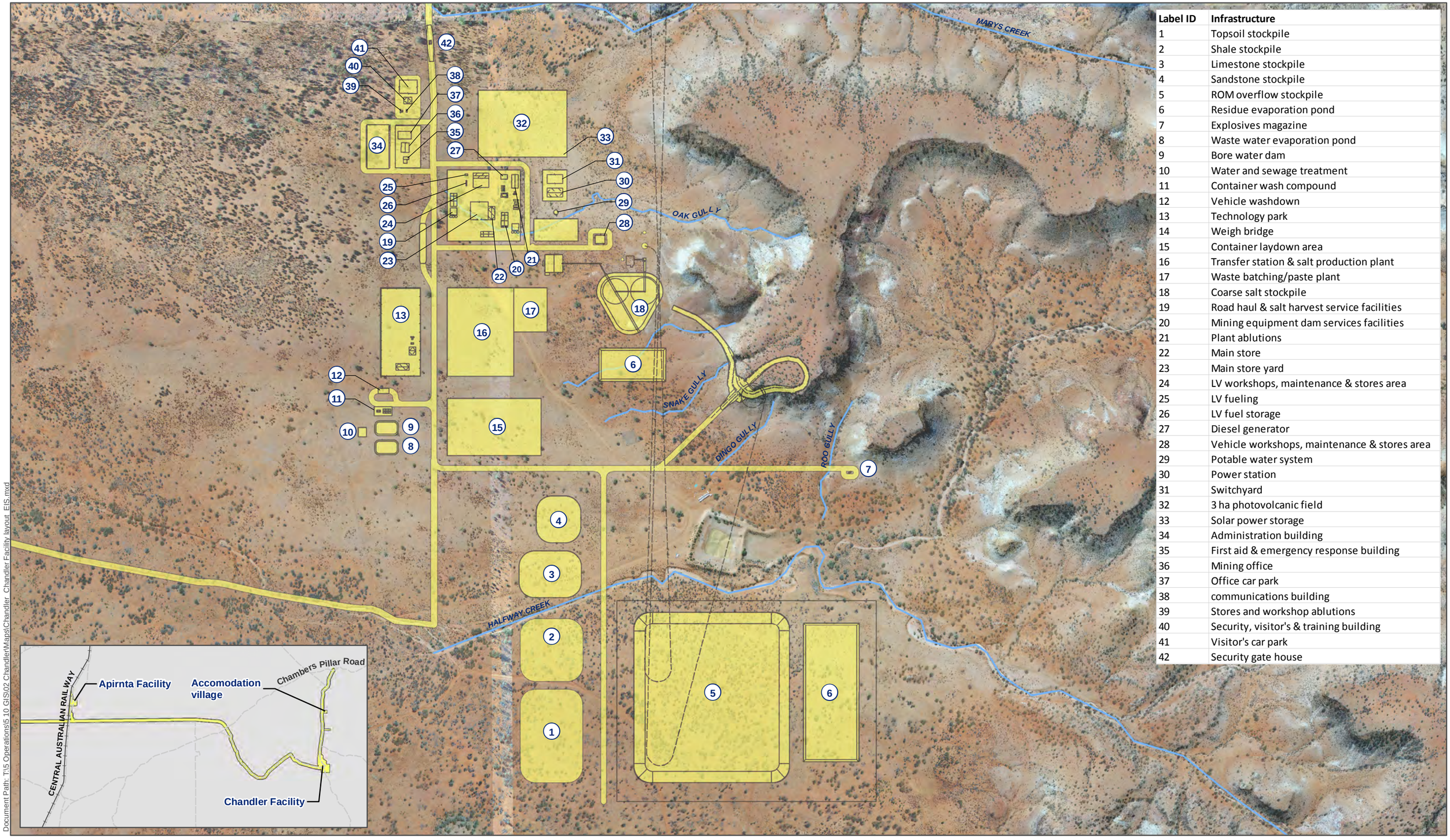
The Proposal would be developed within an isolated and geologically stable site. It would require limited aboveground disturbance to landforms and ecological values. Aquifers with recognised regional value, like the Mereenie Sandstone and the Great Artesian Basin, are not hydro-geologically connected to the Proposal.

Components of the Proposal are listed in Table 3-3 and are illustrated in Figure 3-4 and Figure 3-5.

Table 3-3 Key components of the Proposal

Facility	Primary component	Secondary component
Chandler Facility	*Underground infrastructure*	Underground mine (including room and pillar mining of salt, underground waste rooms, services and workshops)
		Mine access decline (approximately five kilometres long)
		Two vertical shafts (approximately 820 metres and 860 metres long)
Chandler Facility	*Aboveground infrastructure*	Salt processing facilities
		Waste unloading area
		Waste storage warehouse
		Vertical shaft headframe
		Surface hydraulic backfill plant and underground reticulation
		Salt and overburden stockpiles
		Maintenance buildings
		Administration buildings
		Worker accommodation (see below)
		Solar/diesel hybrid power plant
		Clean and raw water dams
		Water and sewage treatment
		Fuel storage facility
		Utility reticulation
		Internal roads
		Compressor building
		Bore field
		Future technology park
Accommodation village	*Above-ground infrastructure*	Accommodation buildings
		Gymnasium
		Leisure centre
		Mess hall/dining room
		Administration buildings
Apirnta Facility	*Aboveground infrastructure*	Rail siding and laydown area
		Open storage yard
		Warehouse
		Liquid storage tank
		Quarantine zone
		Laboratory
		Office
		Maintenance and storage shed
		Internal roads and car parking
		Loading bay, weighbridge and vehicle washdown facility
		Truck driver amenities
		Security gates, fencing, cameras and lighting
		Bunding and stormwater drainage
		Electricity, water and sewerage services

Facility	Primary component	Secondary component
Chandler Haul Road	*Aboveground infrastructure*	Drainage swales
		Check dams
		Light aircraft landing area
		Traffic signs
		Culverts
Henbury Access Road	*Aboveground infrastructure*	Drainage swales
		Check dams
		Traffic signs
		Culverts
		Floodway (Finke River Crossing)
		Controlled intersection at Stuart Highway
Titjikala Access Road	*Aboveground infrastructure*	Drainage swales
		Check dams
		Traffic signs
		Culverts
		Floodway (Hugh River Crossing)



Label ID	Infrastructure
1	Topsoil stockpile
2	Shale stockpile
3	Limestone stockpile
4	Sandstone stockpile
5	ROM overflow stockpile
6	Residue evaporation pond
7	Explosives magazine
8	Waste water evaporation pond
9	Bore water dam
10	Water and sewage treatment
11	Container wash compound
12	Vehicle washdown
13	Technology park
14	Weigh bridge
15	Container laydown area
16	Transfer station & salt production plant
17	Waste batching/paste plant
18	Coarse salt stockpile
19	Road haul & salt harvest service facilities
20	Mining equipment dam services facilities
21	Plant ablutions
22	Main store
23	Main store yard
24	LV workshops, maintenance & stores area
25	LV fueling
26	LV fuel storage
27	Diesel generator
28	Vehicle workshops, maintenance & stores area
29	Potable water system
30	Power station
31	Switchyard
32	3 ha photovolcanic field
33	Solar power storage
34	Administration building
35	First aid & emergency response building
36	Mining office
37	Office car park
38	communications building
39	Stores and workshop ablutions
40	Security, visitor's & training building
41	Visitor's car park
42	Security gate house

N

100 50 0 100 Meters

Coordinate System:
GDA 1994 MGA Zone 53

Legend

Watercourse

Proposed development footprint

Figure 3-4
Chandler Facility layout

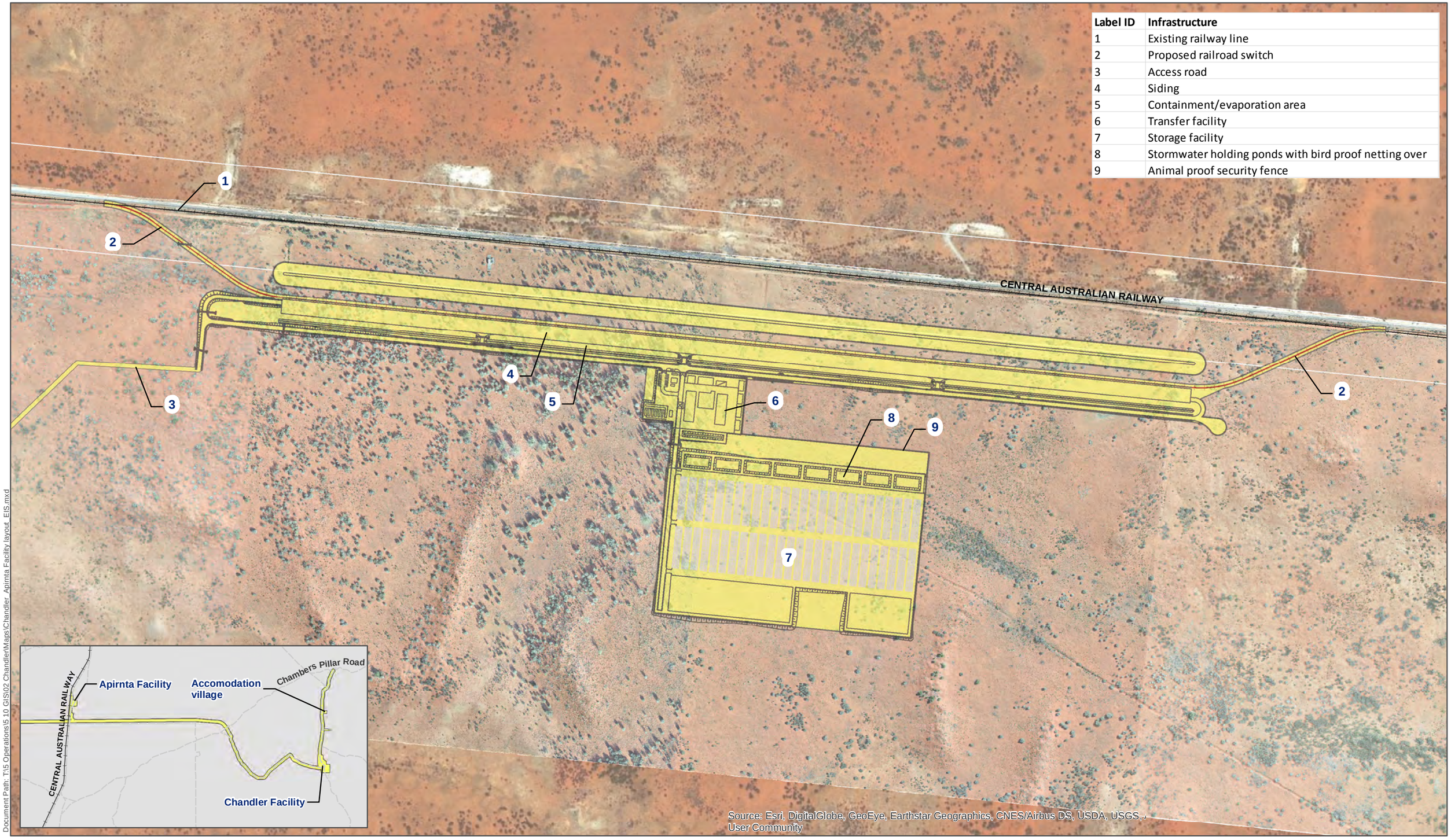
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DLPE NT Government, cadastre, 2016.

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Label ID	Infrastructure
1	Existing railway line
2	Proposed railroad switch
3	Access road
4	Siding
5	Containment/evaporation area
6	Transfer facility
7	Storage facility
8	Stormwater holding ponds with bird proof netting over
9	Animal proof security fence



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100 50 0 100 Meters

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Coordinate System:
GDA 1994 MGA Zone 53

Legend

Proposed development footprint

Figure 3-5
Apirnta Facility layout

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3.2.2 Proposal lifecycle

The proponent is seeking approval and an operating licence for the Proposal for a 25-year period. Following the cessation of mining and waste disposal, rehabilitation and institutional control would follow for a period of time[11]. The lifecycle of the Proposal has several key milestones, as described below in Table 3-4 and presented in Figure 3-6.

Table 3-4 Lifecycle milestones of the Proposal

Year	Activity
1	At the completion of year one, enabling works would have been completed and the accommodation village established. Preparations for the construction of the Apirnta Facility are underway. At this stage, no salt has been mined.
5	Waste would have arrived at the Apirnta Facility by rail and temporarily stored during the construction of the Chandler Facility. Run of mine salt would be brought to the surface and temporarily stockpiled at the Chandler Facility. Waste would be transferred by road from the Apirnta Facility to the Chandler Facility and emplaced underground for permanent isolation into specially designed waste rooms.
10	Waste storage at the Apirnta Facility decreases but continues to be transported to the Chandler Facility for disposal, recovery or permanent isolation. Salt mining continues at an average rate of 750,000 tonnes per annum. Waste emplacement underground takes place over 25 years at an average of 340 kilo tonnes per annum. Waste arrivals at site take place over 29 years at an average rate of 293,000 tonnes.
29	At the completion of year 29, up to 19,800,000 tonnes of salt would have been mined, and up to 8,500,000 tonnes of hazardous waste would have been permanently isolated over 800 metres underground. Unless the proponent wishes to continue operations and an extension of the approval and licence is granted, mining and waste storage would cease. In accordance with the Mine Closure Plan, the shaft and decline would have been backfilled and sealed. Environmental groundwater monitoring continues.
35	Environmental monitoring is completed.
45	Relinquishment of tenements under the *Mining Management Act*. All mining related infrastructure has been decommissioned and surfaces revegetated in accordance with the Mine Closure Plan and Rehabilitation Plan. Transfer of the management of the Chandler Facility to the NT Government along with financial provision for the management of the Chandler Facility during the institutional control period.
45+	NT Government controls the Chandler Facility for the institutional control period.

[11] *The institutional control period for the Proposal is yet to be agreed with the NT Government.*

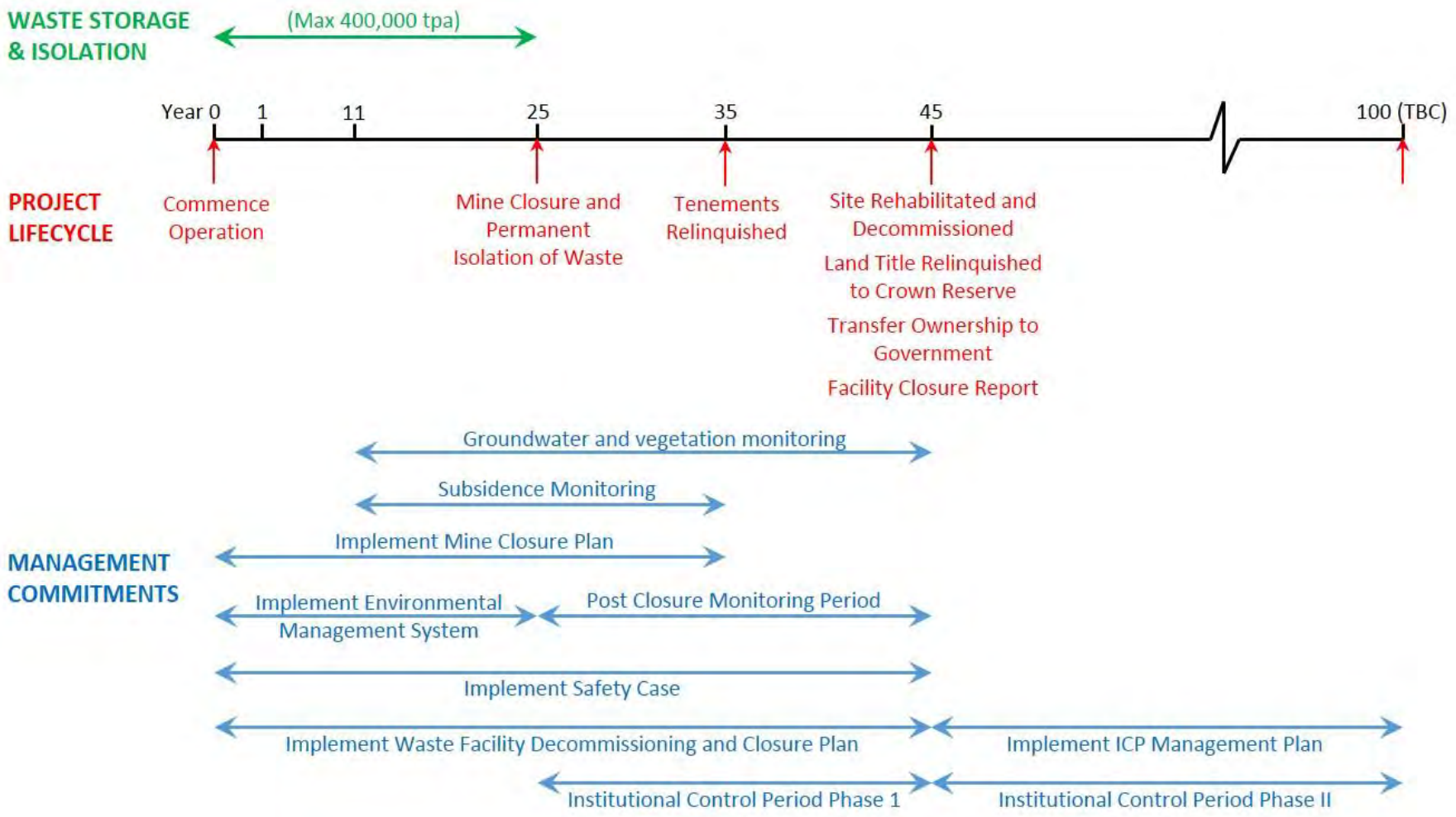


Figure 3-6 Chandler Proposal lifecycle

3.2.1 Regional and local geology

This section describes the regional and local geology at and around the site of the proposed Chandler Facility.

Regional geology

The proponent's exploration leases are located within the Amadeus Basin in the southern region of the NT. The Amadeus Basin is an asymmetrical, east-west trending depression covering approximately 155,000 square kilometres of central Australia (refer to Figure 3-7).

Regional deposition was terminated in the Late Devonian-Early Carboniferous by the Alice Springs Orogeny. Some earlier structures were reactivated during this period of deformation. Substantial uplift of the basement Arunta block along the current northern margin initiated movement of thrust sheets in the Alice Springs and Altunga regions, and resulted in significant structuring of the basin. North over south thrusting and reverse faulting is typical of Alice Springs orogeny deformation.

The Chandler Formation is located within the Amadeus Basin and is a world class salt deposit. The 500 million-year old Chandler Salt Bed at the sit of the Proposal is approximately eight kilometres wide, 800 metres underground, and 200 to 300 metres thick.

Local geology

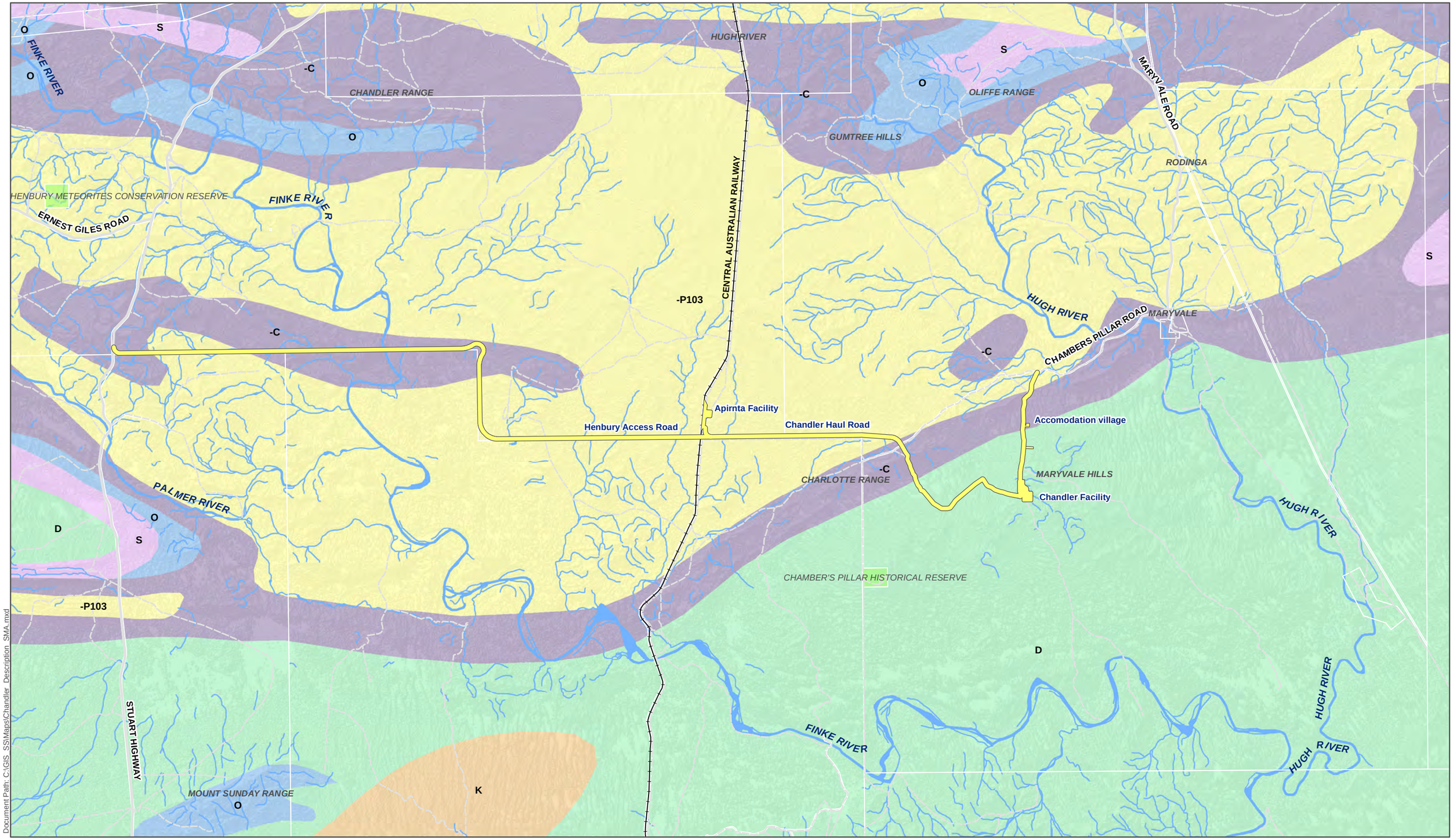
The geology at and around the site of the proposed Chandler Facility is dominated by sandstone and siltstone, before reaching the Chandler Salt Bed at a depth of about 800 metres below ground level. The identified salt resource is a large bed of rock salt (halite) split into an upper 35-metre layer and lower 200-metre layer. The proposed disposal, recovery and permanent isolation horizon would be located in the upper layer.

The Chandler Formation salt has been consistently intersected in all drill holes (historical and recent) within the proponent's tenements as summarised in Table 3-2.

The subsurface geology at and around the site of the proposed Chandler Facility is understood from exploration activities undertaken in the region for resources including metals, potash, uranium and diamonds by entities including CRA Exploration, Toro Energy, Rum Jungle Resources, Exoil, Finke Oil and Pacific Oil and Gas.

The site location lies within surface outcrop of undifferentiated Quaternary rock cover consisting of quartz sands, with some Tertiary silcrete and Devonian Sandstone outcrops (Santo Sandstone). The site of the proposed Chandler Facility lies towards the south edge of the Central Ridge and is not associated with any major local or regional structural elements.

The stratigraphy within the area of the Chandler Facility has been well defined from historical drilling of the petroleum wells Mt Charlotte 1 and Magee 1, which correlate closely with the drilling completed by the proponent.



Document Path: C:\GIS_SS\Maps\Chandler_Description_SMA.mxd

N

4 2 0 4 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Existing road
- Existing track
- Watercourse
- -C: Dolostone, limestone, sandstone, shale, conglomerate
- -P103: Sandstone, dolostone, limestone, diamictite
- D: Sandstone, limestone
- K: Shale, sandstone
- O: Sandstone, shale, dolostone
- S: Sandstone

Figure 3-7
Regional geology

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3.2.2 Soils

Soil categories and land units within the proposed development footprint and vicinity have been investigated and mapped over a three year period (2013 to 2016). A detailed soils report is included in Appendix E.

Soil pH

All soils were found to be slight to moderately alkaline with the pH ranging from 7.78 to 8.12 (refer to Figure 3-8 and Figure 2 in Appendix E). This finding is also supported by the calcium carbonate that was found at S08.

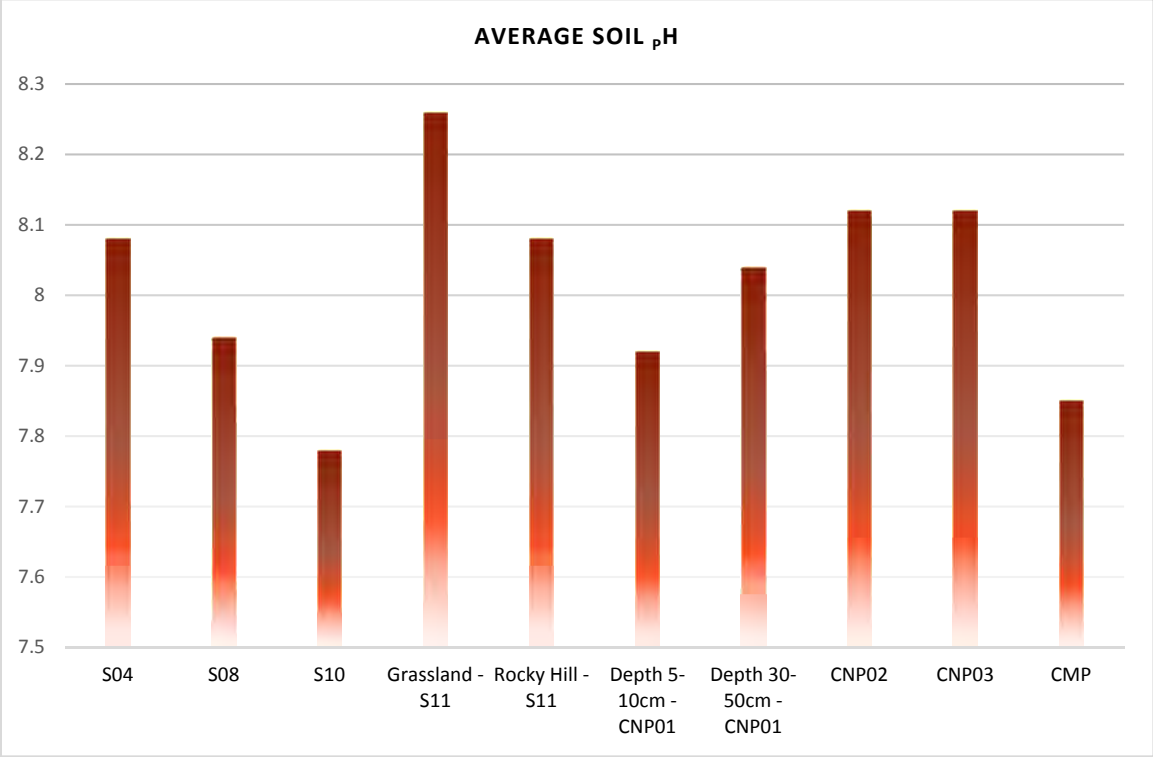


Figure 3-8 Average soil pH by site

Soil salinity

The electrical conductivity of samples ranged from 0.037 to 0.148 ds/m after 15 minutes, from 0.041 to 0.156 ds/m after 3-4 hours and from 0.043 to 0.245 ds/m after 96 hours. While samples from S10, and S04, CNP01-bottom and CNP03 generally remained stable over time. Figure 3-9 illustrates that the salinity increased with time for the remaining samples indicating that, for these samples, increased salt ions were mobilised in solution.

The texture of the soil influences the interpretation of electrical conductivity values. Sandy soils do not hold as much salt as clayey soils and, therefore, tend to give a lower reading. Sandy and loamy soils are considered moderately saline if their $EC_{1:5}$ is greater than 0.3 ds/m while clay soils are considered moderately saline if their $EC_{1:5}$ is greater than 0.6 ds/m (Watling 2007). The rocky ridge slope of S11, CMP01, CNP01-2-top and S08-2 had increased salinity values relative to the other

samples; however, no single $EC_{1:5}$ value exceeds 0.3 ds/m. Therefore, there is little evidence that any of the soils evaluated are saline.

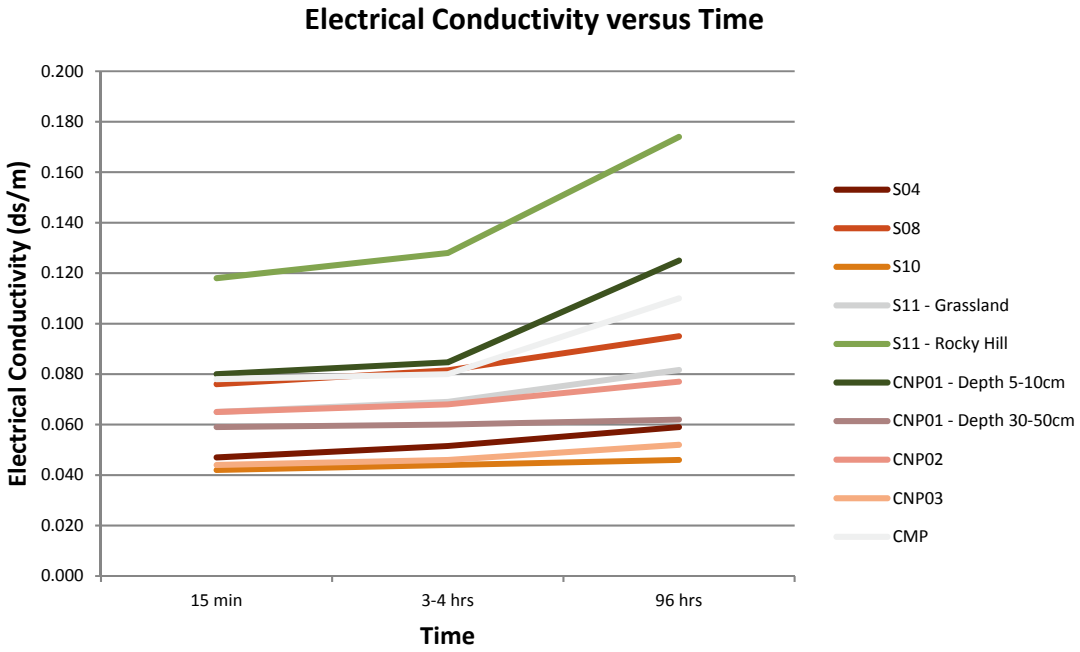


Figure 3-9 Changes in electrical conductivity over time by site

Soil classes, texture and erosion potential

The soil classes across the proposed development footprint and vicinity can be generally categorised as B43 (Rudosols), Nb19 (Sodosols), Nb25 (Sodosols) and LD1 (Calcarosols).

The majority of soils were found to be either loamy sand or sandy loam in texture with very little structure or stability. Erosion modelling was completed in a GIS to rank the sensitivity of soils in terms of low, medium or high risk across the proposed development footprint.

Localised water erosion was evident at sites CNP03, S11-grasslands, S08 indicating a potential for further erosion with disturbance.

Sand dunes and hill slopes are present across the proposed development footprint. Linear structures within the dune will have the potential to cause erosion. Majority of soils have relatively low crust, easily penetrated surfaces and high infiltration rates significantly reducing their erosion potential.

Acidity

There is no potential concern for acid generation. Soils within the proposed development footprint and vicinity are alkaline and do not contain any potential acidic sulfate material such as iron sulfide minerals which when exposed to oxygen, through soil disturbances such as excavation, form acidic soils.

3.2.3 Mineralisation

Historic drilling and local exploration

Historic petroleum exploration over the Amadeus Basin has included numerous seismic surveys and two petroleum wells, namely Mt Charlotte 1 and Magee 1, which were drilled within the area of the proposed Chandler Facility. There is also 145 kilometres of two-dimensional seismic survey information which the proponent has used. Initial exploration in the area targeted diamonds and base metals and this was followed by uranium and most recently potash. No mineral exploration drilling has been recorded in the target mining area of the proposed Chandler Facility.

Resource drilling and surface work

The Amadeus Basin in the NT was short listed as having the best underground salt formation for the dual revenue business and access to markets. The proponent applied for and was granted 1,432 square kilometres in nine EL's, subsequently. It has relinquished two tenements and partially relinquished a further three tenements to the current portfolio size of 816 square kilometres

On 26 March 2012, the proponent announced the completion of a Joint Ore Regional Committee (JORC) compliant exploration target estimate for the Proposal. The initial exploration target estimate covered two potential sites.

- Mt Charlotte site - 4.0 to 4.8 billion tonne exploration target (halite – NaCl).
- Charlotte North site - 0.2 to 0.5 billion tonne exploration target (halite – NaCl) in a substantial halite bed.

The exploration target estimate was prepared by Terra Search Pty Ltd of Townsville, Queensland. Terra Search has extensive experience in resource characterisation and preparation of JORC compliant technical reports. The Chandler Formation salt has been intersected in all drill holes (historical and recent) within the proponent's tenements.

Exploration hole CH003 hit the top of the salt formation at a depth of 772 metres below ground level. Coring and analysis showed two minable layers of high grade salt. The Chandler Formation sits above the deeper (1,800-metre) pre-Cambrian Gillen Salt Formation. Most of Australia's underground salt is from this geological period and is consequently much deeper than the Chandler Formation. A summary of these intersections is presented in Table 3-2.

The study design is based on the mineral resource estimate as at 24th June 2014 (release date 2 July, 2014). The proponent has a JORC compliant measured resource estimate for the Proposal, completed by Ercosplan, Germany (refer to Table 3-5). The measured resource estimate of sodium chloride (NaCl) is 309 million tonnes, indicated resource is 1,128 million tonnes and the inferred resource is 3,103 million tonnes (Ercosplan 2014).

Table 3-5 Mineral resource estimation[12]

Drill hole	Category	Area (km^2)	Thickness (m)	Density (g/cm^3)	NaCl Grade (%)	NaCl Tonnage (Mt)
CH001A	**Measured**	0.64	245.68	2.24	88.56	309.43
CH001A	**Indicated**	1.74	245.68	2.23	88.64	1,128.63
CH003		2.37	60.32			
CH001A	**Inferred**	5.12	245.68	2.23	88.64	3,103.80
CH003		5.12	60.32			

The location of the ore resource in relation to the proposed Chandler Facility is shown in Figure 3-10. More recently, exploration activities have been undertaken by Terra Search on behalf of the proponent. These exploration activities amount to around 30 kilometres of drilling and 145 kilometres of seismic survey lines in and around the site of the Chandler Facility.

The salt resource is estimated at over three billion tonnes in accordance with Australasian JORC *Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves*. The code determines how mineral resources are described in public reports and demands an appropriate level of confidence.

Laboratory testing indicates the salt resource is 80 to 95 % halite with the remainder comprising magnesium rich salts. The salt resource would be selectively mined and selectively processed to produce a product salt exceeding 97 % halite and suitable for a wide range of uses.

[12] *Refer to Mineral Resource compliance statement and Tellus Media Release 02 July 2014*

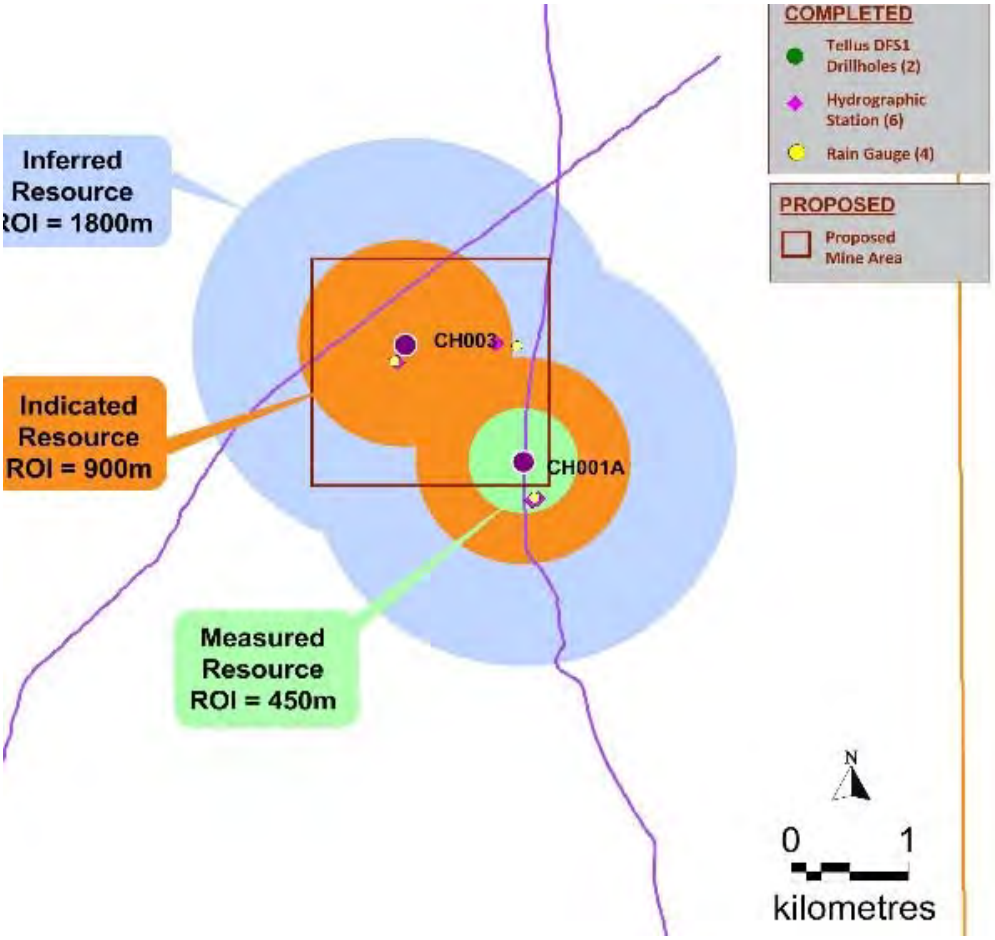


Figure 3-10 Chandler salt resource

Ore characteristics

The rock salt of the Chandler Formation consists mainly of coarse crystalline halite, with minor amounts of anhydrite, calcite, dolomite and quartz.

Laboratory test work

Salt quality analysis has been conducted on drill core samples collected during the exploratory drill campaign (refer to Plate 3-1). Approximately 2,000 metres of core were evaluated across a total of 370 samples. The analysis identified two layers with high quality salt.

Analysis was conducted in two phases: Phase 1 samples were taken from drill hole CH003; and Phase 2 samples were taken from CH001A (refer to Figure 3-9). Quarter core samples were submitted to Nagrom Analytical Laboratory for preparation and analysis. Nagrom was the lead laboratory and coordinated external analysis with Ultratrace Analytical Reference Laboratory and Bureau Veritas. Ercosplan reviewed the proposed analysis methods and confirmed suitability, reviewed assay results and selected samples for independent laboratory cross check analysis; duplicate samples were then sent to Intertek Genalysis.

The objective of the analysis was to provide sufficient information to:

- Meet JORC resource estimation requirements.
- Identify potential product options.
- Consider processing options.
- Identify what further test work was needed to examine process and product options in further detail.



Plate 3-1 Cores from mining horizon

3.2.4 Salt mining

The proposed Chandler Facility would capitalise a large salt resource that has been subject to a number of exploration activities. The salt resource is situated in the south-east of the Amadeus Basin. This basin is a very old and geological stable depression in about 155,000 square kilometres of central Australia.

The Chandler Facility would produce an average of 750,000 tonnes of run of mine salt each year. The salt would be excavated from an underground mine targeting a large salt resource.

Run of mine salt would be hoisted to surface by shaft from the underground mine where it would be stockpiled. Salt would be temporarily stockpiled during construction of the mine decline and then dry processed to become product salt once the Chandler Facility is operationally ready to accept waste materials.

The product salt would be transported via road to the Apirnta Facility where it would be loaded onto trains for dispatch to customers.

The salt would be marketed nationally and internationally for its various beneficial end uses. These could include industrial use and human consumption. It is possible the salt mine could also support the creation of businesses in nearby centres such as Titjikala or Alice Springs.

Further information on the operations involved in salt mining is described in Section 3.6.4.

3.2.5 Materials storage

A range of materials could be safely and securely stored (either temporarily or permanently) inside the void spaces that are left behind from the salt mining operations at the proposed Chandler Facility. Typical materials that may be stored (and retrieved at a later date) include document

archives, film archives, museum artefacts, computer servers, and a host of other valuable documents and equipment.

3.2.6 Waste storage and isolation

Overview

The proposed Chandler Facility would receive waste for storage, recovery and permanent isolation up to a maximum capacity of 10 million tonnes over 25 years. Waste would be sourced from Australia's domestic waste market, and from Australia's Exclusive Economic Zone which extends 200 nautical miles from shore. Approval to import international wastes under the Basel Convention forms part of the Proposal. [13]

Waste accepted (and not accepted) at the proposed Chandler Facility

A range of hazardous wastes could be stored either temporarily (until recovery and treatment is possible) or permanently inside the void spaces left from the salt mining operations at the proposed Chandler Facility. These same waste materials could also be stored temporarily at the Apirnta Facility prior to being transported to the Chandler Facility. A summary of the wastes that would be accepted (and not accepted) at the proposed Chandler Facility is presented in Table 3-7.

An indicative inventory of waste that would be accepted at the proposed Chandler Facility is provided in Appendix F. The waste inventory is indicative, given that the actual quantity of waste would depend on the waste market and agreed waste contracts. This approach ensures planning for the proposed Chandler Facility adequately considers potential risks and impacts on the environment and meets the requirements of the applicable legislation (refer to Chapter 4).

[13] *Australia is a signatory to the Basel Convention which permits. As a signatory, Australia is permitted to accept and manage wastes from developing nations. Furthermore, under the Convention, Australia has an obligation to adequately manage the production of its own intractable wastes. Refer to Chapter 4 of the EIS for further information.*

Table 3-6 Hazardous waste accepted and not accepted at the proposed Chandler and Apirnta Facility

Type of hazardous chemical wastes	Accepted on-site for surface storage[1]	Accepted in underground voids[1]
Chemical wastes listed under the National Environment Protection Measures (NEPM) (refer to Schedule A List 1: Waste Categories) and under Schedule 2 of the NT Waste Management and Pollution Control (Administration) Regulations	✓	✓
Liquid and sludges	✓	✓[1]
Explosive wastes	×	×
Flammable liquids or solids	×	×
Self-combusting wastes or wastes that can generate a gas-air mixture which is toxic or explosive	×	×
Highly corrosive or oxidizing	×	×
Gases	×	×
Clinical waste (infectious hospital waste and body parts)	×	×
Municipal solid waste (putrescible household and commercial waste)	×	×
Putrescible waste (household rubbish that can rot)	×	×
Uncertified waste (which cannot be identified or has not undergone characterisation testing)	×	×
Reacts with the repository geology (such as dissolving it or producing a gas)	×	×
NORM[2]	✓	✓
Low level radioactive waste (e.g. smoke detectors, exit signs, industrial gauges and medical isotopes)	×	×
Intermediate level radioactive waste (e.g. reprocessed spent nuclear fuel and components with high levels of radioactivity)	×	×
High level radioactive waste (e.g. from power generation and defense use)	×	×

Note: ✓ = accepted, × = not accepted, ✓[1]= normally excluded but could be used in hydraulic backfill processing. 1. Exemption activity levels defined as per *The National Directory for Radiation Protection, February 2014 (RPS 6).*

Waste acceptance documentation

The proponent has developed various waste acceptance documents for the Proposal. These include:

- Waste Acceptance Policy.
- Waste Acceptance Criteria.
- Waste Acceptance Procedures.
- Waste Zoning Guidelines.

These documents are discussed below and are provided in Appendix C.

Waste Acceptance Policy

The proponent has developed a Waste Acceptance Policy for the Proposal. The policy stipulates that before waste could be accepted at the proposed Chandler Facility (and Apirnta Facility) that the proponent must be satisfied that the waste meets the requirements of:

- Environmental approvals and licences issued by regulators.
- The Chandler Waste Acceptance Criteria.
- The Chandler Waste Acceptance Procedure.
- The Chandler Waste Zoning Guide.

Together, these steps form the basis of the proponents Waste Acceptance Policy for the Proposal. The Waste Acceptance Policy is provided in Appendix C.

Waste Acceptance Criteria

The proponent has developed strict Waste Acceptance Criteria (WAC) for the Proposal. The WAC defines:

- The criteria that would be applied for the exclusion of certain types of wastes as listed in Table 3-6.
- The criteria that would be applied for the acceptance of certain types of wastes as listed in Table 3-6.
- The requirement for suitable packaging and the criteria that would be applied for packaging acceptance.

The WAC would ensure that waste is only accepted if it can be stored and isolated in a safe and environmentally sound manner that meet the requirements of the under the *Dangerous Goods Act* and the *Work Health and Safety (National Uniform Legislation) Act*. The WAC is provided in Appendix C.

Waste Acceptance Procedure

The proponent has developed a Waste Acceptance Procedure (WAP) for the Proposal. The WAP outlines a three-stage approach that would be undertaken at the proposed Apirnta Facility to determine if wastes meet the WAC. The three-stage approach to waste characterisation would involve:

- **Level 1: Basic characterisation**. This is a thorough determination, according to standardised analysis and behaviour-testing methods, of the characteristic properties of the waste.
- **Level 2: Compliance testing**. This is periodic testing of regularly arising wastes by simpler standardised analysis methods to determine whether a waste complies with licence conditions and whether a waste with known properties has changed significantly.

- **Level 3: On-site verification**. This constitutes rapid check methods to confirm that a waste is the same as that which has been subjected to compliance testing and that which is described in the accompanying documents.

An overview of the WAP is provided in Figure 3-11. The WAP is provided in Appendix C.

Waste Zoning Guide

Waste that passes the WAC would be arranged aboveground (at the proposed Apirnta Facility) and underground (at the proposed Chandler Facility) according to a strict Waste Zoning Guide (WZG). Waste materials would be grouped into compatible waste type groups that can be stored together safely. Dangerous goods segregation protocols would be adopted in accordance with *Australian/New Zealand Standard AS/NZS 3833 The Storage and Handling of Mixed Classes of Dangerous Goods in Packages and Intermediate Bulk Containers.*

Adopting a zoning approach would also increase the opportunity for potential future recovery of certain materials for beneficial use. The WZG is provided in Appendix C.

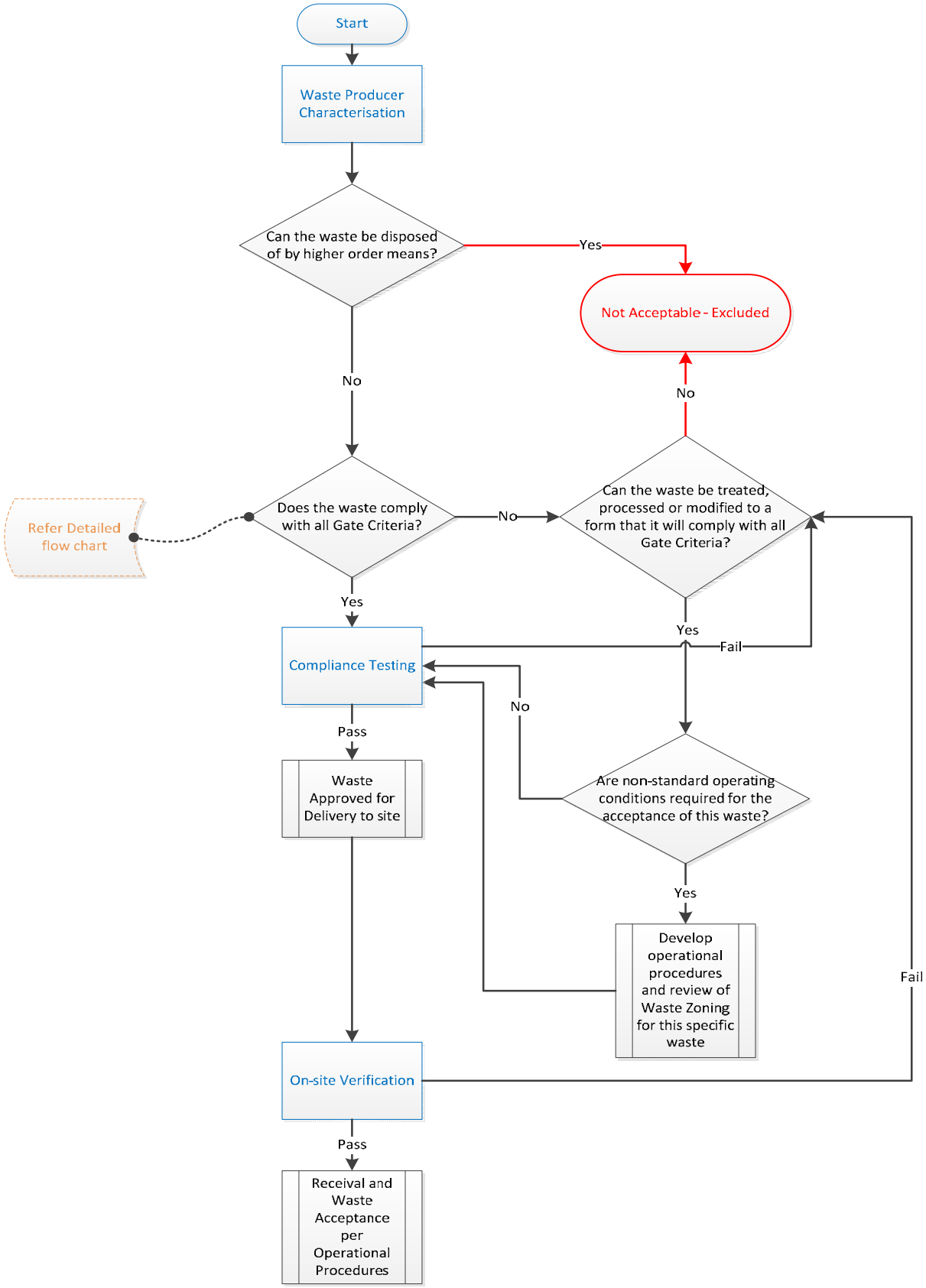


Figure 3-11 Overview of waste acceptance procedure for the Proposal

3.2.7 Multi barrier safety case approach

A multi-barrier safety case approach during transport, storage and disposal operations would be adopted for the Proposal. The multi-barrier approach is summarised below:

- Initially, waste would be placed into specified Dangerous Goods code rated containers, for example a double lined hazardous waste bulk bag, or a heavy duty PVC bag placed into a barrel.
- The smaller containers or waste packages would then be placed into shipping containers during transit operations. The shipping containers are assumed to be mostly transported by train from customers, waste managers or logistic company sites to the proposed Apirnta Facility (although some deliveries may also be made by road).
- The shipping container would be unloaded and taken to the surface storage and transfer station adjacent to the rail sidings at the proposed Apirnta Facility. The waste would undergo waste acceptance verification testing against strict WAC.
- Once the packages have been initially inspected, samples taken and accepted for storage/disposal they would be transferred by road train to the proposed Chandler Facility. Waste would be taken underground via the decline or via the hydraulic backfill system. During the construction phase, the waste packages would be temporarily stored at the Apirnta Facility.
- Waste transferred via the decline would be delivered by truck to designated storage/disposal rooms where it would be unpacked. The empty shipping containers and any pallets would be returned to the surface, cleaned as necessary and returned back into the supply chain.
- Once the waste is in place and confirmation has been received that it cannot be recovered, recycled or reused, any surrounding airspace in the disposal room would be backfilled with fine crushed salt to provide added stability within the room and as a further protective layer.
- Once a room is filled to capacity the entrances would be sealed with an engineered barrier appropriate for the wastes that have been emplaced.
- Ultimately at the end of operations, once the shafts are sealed and backfilled there would be permanent isolation of the material from the biosphere provided by a combination of the engineered barriers and the geological barrier itself (impermeable salt bed and the overburden above the salt bed).

The multi-barrier safety case approach is shown conceptually in Figure 3-12.

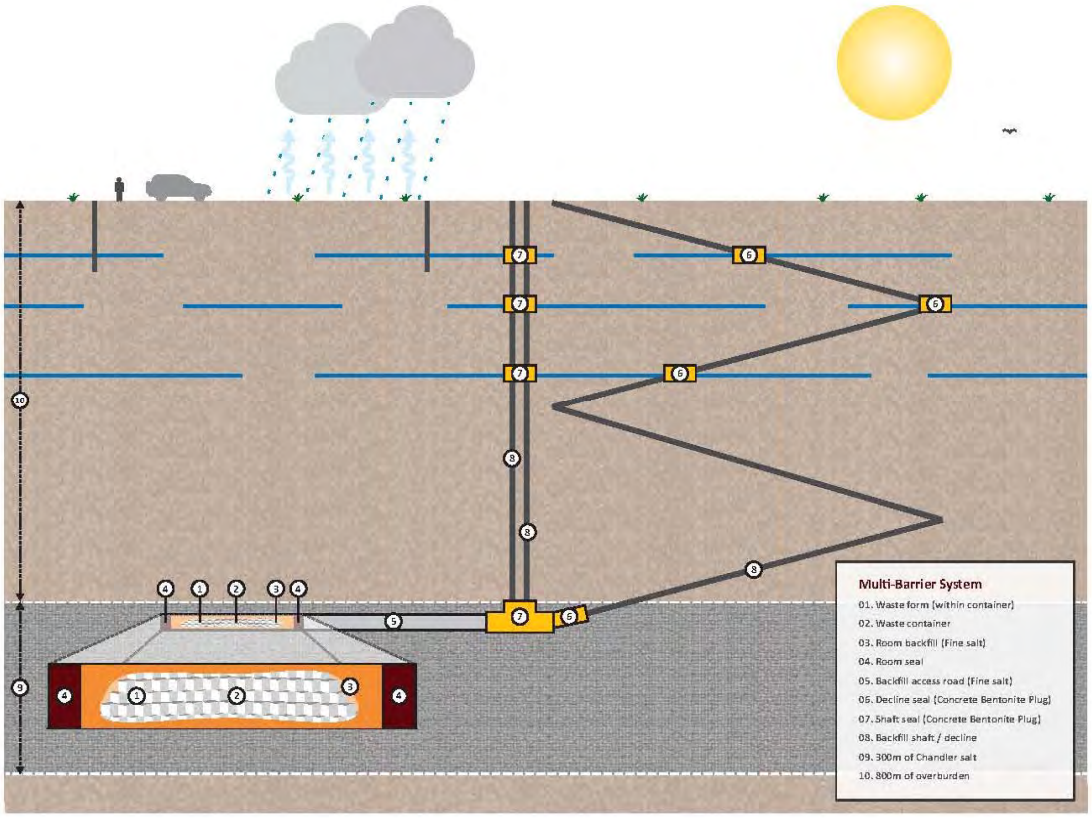


Figure 3-12 Multi-barrier isolation of waste at the Proposed Chandler Facility

3.2.8 Design requirements and criteria of the Chandler Facility

The major requirements that have influenced the design of the Proposal are:

- It shall meet all regulatory requirements.
- It shall be able to safely accept and emplace all forms of intended waste.
- Once closed, including the decline, shaft seals, and the surrounding geosphere, shall passively contain and isolate all waste, so as to protect the environment, and the health and safety of persons.
- The design capacity shall be 400,000 tonnes per annum of assorted wastes.
- It shall be capable of being operated for at least 25 years (including waste emplacement, pre-closure monitoring and decommissioning periods).
- It shall be capable of operating 24 hours per day, seven days per week.
- It shall be located on lands within the Maryvale Station.
- The underground mine design shall balance the needs of stability during the operational phase of the repository and the need to encourage controlled convergence (salt creep) which underpins the post closure safety case.
- If required, the underground waste storage facilities shall maintain a minimum offset of 45 metres from any deep borehole.

Issues that would need to be considered further during planning and detailed design include:

- Site-specific geotechnical issues.
- Salt mining methods.
- Storage material handling techniques.
- Groundwater sealing for the decline and shafts.
- Potential environmental, social and cultural impacts.
- Market conditions and economic criteria.

The principal functional requirements for the proposed Chandler Facility are:

- Provide water tight surface to underground access ways to prevent ingress of water to the underground workings via the access ways.
- Provide efficient personnel access and egress to and from the underground areas of the facility, including during emergency situations which could require evacuation of personnel from below ground.
- Provide for up to 1,200,000 tonnes per annum (maximum) and an average of 750,000 tonnes per annum run of mine salt to be brought to the surface.
- Provide for an average production rate of 120 tonnes per hour mined salt to be brought from underground to the surface.
- Provide for up to 400,000 tonnes per annum of waste storage material input assumed to be transported (predominantly by rail but in some instances by road) in 20 foot ISO freight containers.
- Provide to take equipment from surface to underground including items such as heavy duty continuous miners, supporting equipment for the mining process, storage materials transport and handling equipment.
- Allow for a minimum of 300 cubic metres per second of fresh air to be taken into the underground including the provision for the introduction of cooled air.
- Allow for essential services required underground including process water, high voltage electricity, mine water pumping range and potentially a waste placement reticulation system.

3.2.9 Standards and specifications

The Proposal would be designed, constructed and operated in accordance with relevant industry and regulatory standards and specifications, as summarised in Table 3-8. Sustainability would be a key consideration in the design, construction and operation of the Proposal. This commitment to sustainability would be evidenced by:

- The incorporation of components such as solar power.
- The beneficial reuse of wastewater.
- The use of energy efficient equipment.

Table 3-7 Standards and specifications

Component	Standards and specifications
Sustainability	Infrastructure Sustainability Council of Australia
	Green Building Council of Australia
Building and construction	Construction of all buildings in line with the Australian Building Code.
Flood immunity	1 in 100 year average recurrence interval.
Indoor lighting	*AS 1680.5:2012 Interior and workplace lighting*
Outdoor lighting	*AS 1158.3.1:2005 Lighting for roads and public spaces*
	AS 4282-1997 Control of obtrusive effects of outdoor lighting
Waste handling	*Dangerous Goods Safety Act 2004*
	Radiation Safety Act 1975
	AS 1940-2004 The storage and handling of flammable and combustible liquids
Health, safety and environment	*ISO 9001 Quality management systems*
	ISO 14001 Environmental management systems
	AS 4801 Occupational health and safety management systems
	Australian Drinking Water Guidelines to ensure the health and safety for all construction and operational staff.
	Australian Guidelines for Water Recycling: Managed Aquifer Recharge - For the protection of aquifers and the quality of recovered water during construction and operation of all groundwater bores associated with the Chandler Facility.

3.3 Land requirements

A summary of the land requirements for the Proposal is presented in Table 3-8.

Table 3-8 Summary of land take requirements

Facility	Key dimensions (indicative only)	Land requirement (ha)
Chandler Facility (underground infrastructure)		
Surface conveyors for run of mine salt	300 metre length	1
Underground room and pillar excavation	3.1 kilometres x 1.48 km	360
Vertical shafts	5 metre wide diameter 866 metre depth (max)	2
Reclaimer system	150 metre by 150 metre	2.5
Sub total		***365.5***
Chandler Facility (aboveground infrastructure)		
Mine infrastructure	600 metres by 600 metres	36
Accommodation village	70 metres by 70 metres	0.5
Run of mine salt stockpile[14]	500 metres by 500 metres by 20 metres	25
Power generation (Diesel/gas/solar field)	200 metres by 200 metres	4
Spoil storage piles	500 metres by 100 metres	5
Firebreak	To be confirmed	15[15]
Sub total		***85.5***
Apirnta Facility		
Rail siding	1,800 metres by 50 metres	9
Storage and transfer facility	600 metres by 500 metres	30
Sub total		***39***
Road infrastructure		
Henbury Access Road	60,000 metres by 30 metres	180
Chandler Haul Road	31,000 metres by 30 metres	93
Sub total		***273***
Total land requirement (above and below)		**763**

3.4 Overview of the Chandler Facility

This section presents an overview of the proposed Chandler Facility. Details regarding the construction of the Chandler Facility are presented in Section 3.4 and details regarding operation of the Chandler Facility are presented in Section 3.5.

3.4.1 Site access

During the initial years of construction and operation, the site would be accessed via an existing public road, Maryvale Road. When mining operations begin and revenue is generated, a proposed

[14] *This is based on a worst case scenario of 3,500,000 tonnes of run of mine salt. The footprint would be larger if salt were not stockpiled to this height capacity.*

[15] *This is a nominal amount which will be confirmed during detailed design.*

private access road would be constructed which would be accessed from the Stuart Highway (the proposed Henbury Access Road).

The proposed Henbury Access Road would cross the Central Australian Railway and join a private haul road (the proposed Chandler Haul Road) that would lead to the Chandler Facility. The total distance of the proposed Henbury Access Road and Chandler Haul Road is approximately 90 kilometres. The proposed Henbury Access Road and Chandler Haul Road are located on the Henbury Station and Maryvale Station, respectively.

3.4.2 Underground infrastructure

The key underground infrastructure at the proposed Chandler Facility would include:

- Underground mine.
- Mine access decline.
- Two vertical shafts (one allowing for salt hoisting and personnel riding as well as downcast ventilation, and one for upcast ventilation).

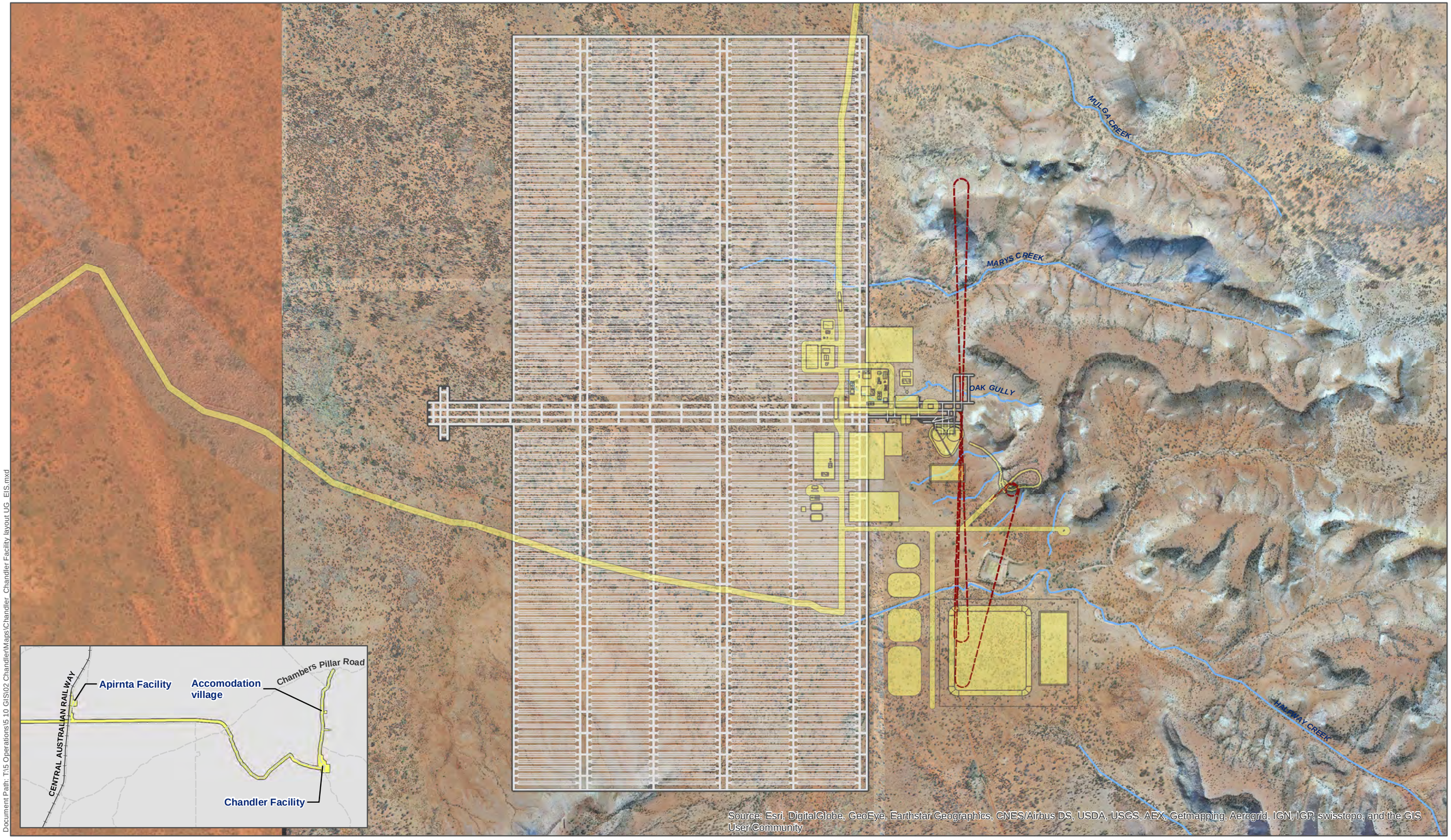
The underground infrastructure is described below and is shown conceptually in Figure 3-13.

Underground mine

The underground mine would be located between about 842 and 848 metres below ground level (this is a current planning assumption based on borehole intersection of the salt bed and may vary over the wider mine infrastructure area). It would be approximately 361 hectares in size.

Salt would be mined using a room and pillar system of mining. The underground mine would, therefore, be composed of multiple lengthy passages (or rooms) running in parallel along a horizontal plane, separated by pillars of unmined material. Each room would be approximately 250 metres long, 15 metres wide and six metres high. Each room would be allocated to a waste type which would allow separation of waste according to the WZG. The indicative layout of these rooms is shown in Figure 3-13.

The underground mine would be fitted with a conveyor system to transfer run of mine salt from the continuous miners to the surface. A dedicated underground workshop and services area would also be established near the bottom of the downcast shaft. The services provided in this area would include personnel amenities, a lunch room, maintenance services and storage areas including a 5.5-kilolitre fuel storage bay.



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200 100 0 200 Meters

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Watercourse
- Proposed development footprint

Underground infrastructure

- Portal and decline
- Indicative layout

Figure 3-13
Underground layout of the proposed Chandler Facility

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Data source: Geoscience Australia, Topographic base data, 2006; AUSURV, Aerial imagery, 2016.

Mine access decline

Construction of the mine access decline would commence by drill and blasting using a box cut into an existing rock outcrop on Maryvale Hills. This technique would create a portal entrance from where the decline would commence.

The mine access decline would comprise a sloped, zig-zag, tunnel approximately five kilometres in length that would connect the surface to the underground mine. The mine access decline would be the main transport route for waste containers entering the underground mine and waste rock leaving the underground mine during construction.

A schematic of the mine access decline in context of the existing environment is provided in Figure 3-14.

Vertical shafts

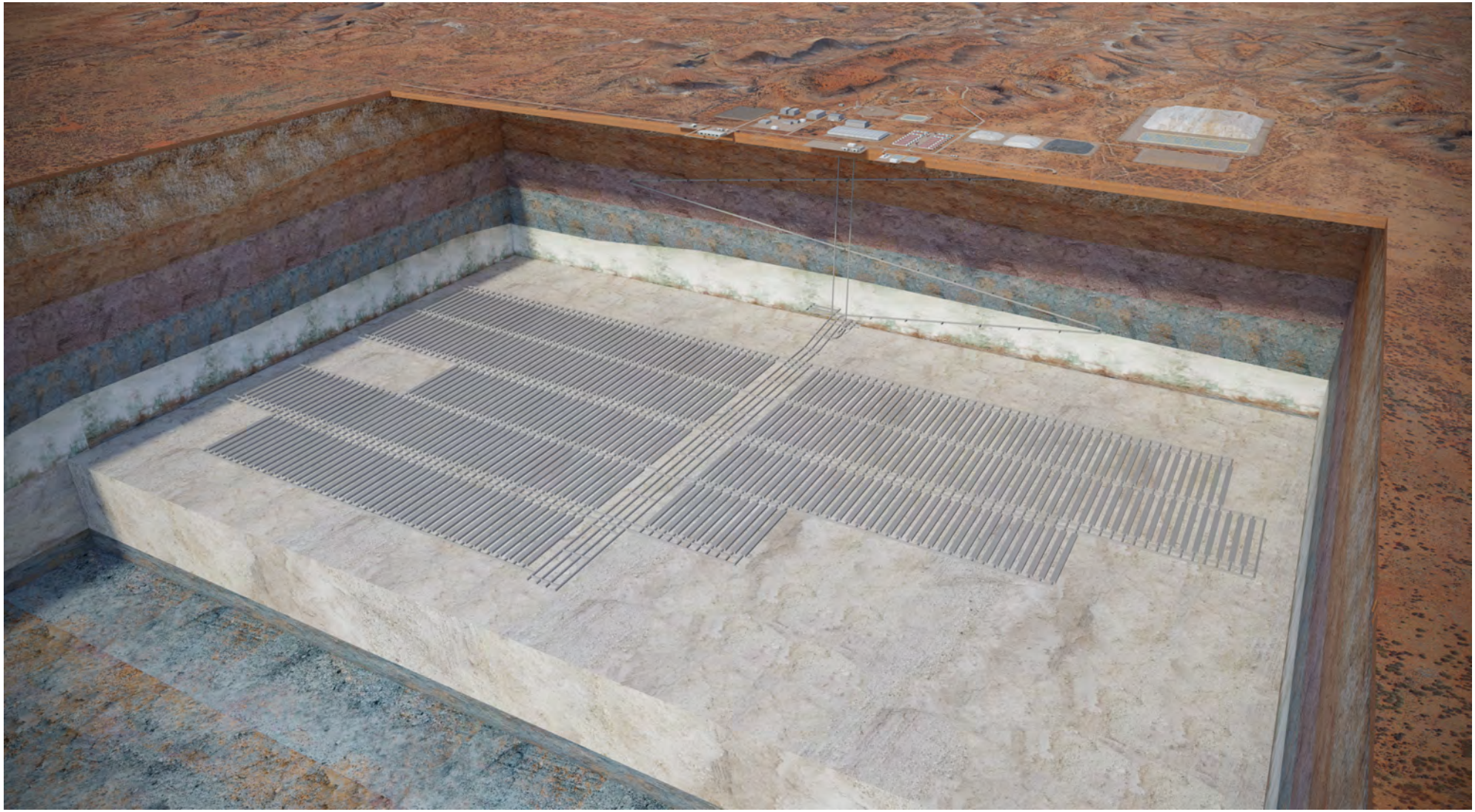
Two vertical shafts would be installed – a main shaft allowing for salt hoisting and personnel riding as well as downcast ventilation, and a secondary shaft for upcast (exhaust) ventilation. The main shaft would be approximately 820 metres long and the secondary ventilation shaft approximately 860 metres long. The shafts would intersect the mine access decline and terminate at the underground mine (refer to Figure 3-14).

The main shaft would be compartmentalised. The main compartment would hold a container or “skip” used to convey run of mine salt, while the counterweight compartment would regulate its movement. An auxiliary compartment would be used to transport workers to the underground mine. The auxiliary compartment would split into two floors that could transport up to six workers per floor.

The main shaft would also reticulate some utilities and services such as raw water, power and communications and would provide fresh air to the underground mine. The main shaft would also be used to run the hydraulic backfill pipeline underground.

The secondary shaft would draw exhaust air from the underground mine to the surface.

Figure 3-14 Proposed mine access decline



3.4.3 Aboveground infrastructure

The key aboveground infrastructure at the proposed Chandler Facility would include:

- Salt processing facilities.
- Waste unloading area.
- Waste storage warehouse.
- Vertical shaft headframe.
- Surface hydraulic backfill plant and underground reticulation.
- Salt and overburden stockpiles.
- Maintenance buildings.
- Administration building.
- Worker accommodation.
- Solar/diesel hybrid power plant.
- Clean and raw water dams.
- Water and sewage treatment.
- Fuel storage facility.
- Utility reticulation.
- Internal roads.
- Compressor building.
- Bore field.
- A future technology recovery park.

The aboveground infrastructure is described below and is shown conceptually in Figure 3-15.

Salt processing facilities

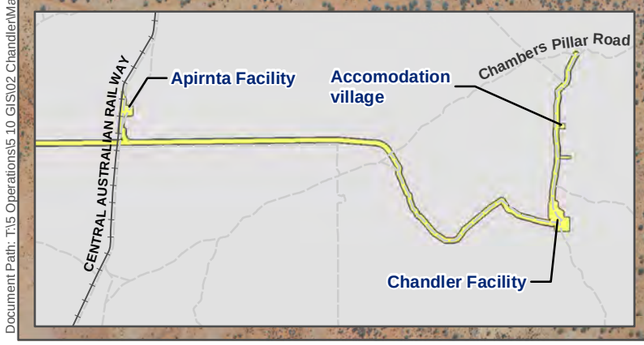
Dry optical sorting facilities are likely to be located within the mine infrastructure area in the vicinity of the run of mine salt stockpile. The final location of these facilities would be determined during detailed design of the Proposal.

Waste unloading area

The waste unloading area would be an engineered hard stand. The area would temporarily hold waste before it is transferred underground. The area would also hold empty containers returned from the underground operations before being transferred back to the proposed Apirnta Facility.

Label ID	Infrastructure
1	Topsoil stockpile
2	Shale stockpile
3	Limestone stockpile
4	Sandstone stockpile
5	ROM overflow stockpile
6	Residue evaporation pond
7	Explosives magazine
8	Waste water evaporation pond
9	Bore water dam
10	Water and sewage treatment
11	Container wash compound
12	Vehicle washdown
13	Technology park
14	Weigh bridge
15	Container laydown area
16	Transfer station & salt production plant
17	Waste batching/paste plant
18	Coarse salt stockpile
19	Road haul & salt harvest service facilities
20	Mining equipment dam services facilities
21	Plant ablutions
22	Main store
23	Main store yard
24	LV workshops, maintenance & stores area
25	LV fueling
26	LV fuel storage
27	Diesel generator
28	Vehicle workshops, maintenance & stores area
29	Potable water system
30	Power station
31	Switchyard
32	3 ha photovolcanic field
33	Solar power storage
34	Administration building
35	First aid & emergency response building
36	Mining office
37	Office car park
38	communications building
39	Stores and workshop ablutions
40	Security, visitor's & training building
41	Visitor's car park
42	Security gate house

MARYS CREEK
OAK GULLY
SNAKE GULLY
DINGO GULLY
ROO GULLY
HALFWAY CREEK



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N

100 50 0 100 Meters

Coordinate System:
GDA 1994 MGA Zone 53

Legend

Watercourse

Proposed development footprint

Figure 3-15
Proposed aboveground layout of the Chandler Facility

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Data source: Geoscience Australia, Topographic base data, 2006;
DLPE NT Government, cadastre, 2016.

Waste storage warehouse

Wastes that are generated during operation would be stored within a designated waste storage warehouse. The warehouse would be located within the vicinity of the stores areas as shown in Figure 3-3.

Vertical shaft headframe

The vertical shaft headframe would be approximately 40 metres high with a plan area of approximately 225 square metres (15 metres by 15 metres). The headframe contains a tower mounted 4.50 metres in diameter. The auxiliary friction hoists, would be approximately 1.4 metres in diameter.

The headframe would contain four metre diameter deflection sheaves for the main hoist head ropes, arresting gear for retarding the conveyances in the event of overwind and overhead crane beams for maintaining and installing the conveyances. Stairs and intermediate floors and platforms would be provided for access and maintenance requirements. An elevator would be installed to service the various floors in the headframe and to provide access to the hoist room.

The main shaft hoist room would be located at the top of the main shaft headframe and has nominal external dimensions of approximately 15 metres by 22 metres with a height of 12.5 metres. The hoist room would have a seven metre overhang to facilitate hoisting of major components for the main hoist from ground surface to the hoist level.

A 50 tonne-rated overhead travelling crane mounted in the hoist room would be used to hoist the equipment and maintenance supplies to the top of the headframe. This hoist room would house all the controls and electrical equipment necessary to operate the hoist along with a local operating station.

The secondary ventilation shaft headframe would be a 40-metre high, insulated and clad steel structure. The headframe would be designed so that the structure would not require major refurbishments during the 100-year design life.

Hydraulic backfill plant and underground reticulation

The hydraulic backfill plant would house equipment for the receiving and processing of solid and liquid wastes. The backfill would be transported underground via a pipeline fitted within the downcast shaft where it would then be reticulated to an excavated room for disposal.

Salt and overburden stockpiles

Salt and overburden (soil and rock) stockpiles would be established within the mine infrastructure area at the proposed Chandler Facility. There would be one stockpile for run of mine salt and product salt generated during operation. There would also be stockpiles for topsoil, sandstone, siltstone and claystone.

The size of the salt stockpile may fluctuate during operation according to supply and demand but would have a volume of approximately 3.5 million cubic metres and a height of about 20 metres. The

soil and rock stockpiles would be smaller ranging in volumes from approximately 58,000 cubic metres to 478,000 cubic metres and a height of approximately 12 metres.

Maintenance buildings

Maintenance buildings and a storage area would be located adjacent to the mine infrastructure area and would be used for minor repairs and preventative maintenance tasks for the shaft components and the equipment used within the mine infrastructure area.

Administration buildings (offices, main control room and amenities building)

The offices, main control room and amenities building would consist of a steel framed, insulated and clad structure. The approximate size of the building would be approximately 25 metres by 25 metres and two-storeys high. The main control room would be equipped with computing, control, and monitoring equipment to marshal all signals and data transmitted from the both aboveground and underground.

The amenities area would be equipped a with change room/locker facilities, lunch room and a training or visitors room. First aid and emergency response would be provided in this area.

Radiological badging for NORM waste and work control would also be managed in the amenities building. A car parking area would be provided to receive staff and visitors. Other facilities that would be provided include a lamp room, mechanical areas and storage.

Worker accommodation

An accommodation village would be established approximately two kilometres north-east of the proposed Chandler Facility. The accommodation village would likely include semi-detached dwellings; ablutions; laundry facilities; car parking; dry mess, wet mess, kitchen and cold room; games room; tennis court and gymnasium; sewage treatment plant; fire water protection; and administration offices.

Worker accommodation would be provided for both the construction and operation workforce. Worker accommodation would be temporarily expanded by utilising modular temporary buildings during relatively short workforce peaks during construction.

Further information on the proposed accommodation village is provided in Section 3.5.10.

Solar/diesel hybrid power plant

A solar/diesel hybrid power plant would be installed to provide baseload power to the proposed Chandler Facility. The hybrid power plant would consist of an array of photovoltaic panels producing approximately two megawatts of power output. The diesel component would supplement the two megawatts of solar power with three megawatts of diesel power plus two megawatt standby.

The hybrid power plant would include fuel storage vessels for consumption during power generation, including an adequate emergency reserve to provide 48 hours power at 35% load. The fuel would be stored within a bunded area within the mine infrastructure area and fuel volumes would not exceed NT WorkSafe Guidelines.

Clean and raw water dams

Dams would be constructed to separate clean and raw water. Water would be drained to these areas where it is expected to evaporate.

Water and sewage treatment

Infrastructure would be constructed to treat raw water for potable supply as well as sewage generated on-site. The location of this infrastructure is shown in Figure 3-3.

Fuel storage facility

A dedicated fuel storage facility would be constructed to manage the acceptance of regular (weekly) fuel deliveries. The storage of fuel in this area would meet the necessary requirements under the NT Dangerous Goods Act. Fuel demand is discussed in Section 3.17.5.

Utility reticulation

The reticulation of process water, particularly for hydraulic backfill, is required during operation of the Proposal. Volumes of reticulated water during operation are discussed in Chapter 8.

Internal roads

A network of internal roads would be constructed within the mine infrastructure area at the proposed Chandler Facility. The roads would be used by personnel and visitors and for the movement of waste materials and salt. The internal roads would be unsealed. The proposed road infrastructure is discussed further in Section 3.10.

Borefield

Up to 54 mega litres of raw water per annum would be required during construction. During operation, 104 mega litres would be required. A borefield would be utilised for water supply and would comprise approximately 15 bores located to the north of the proposed Chandler Facility.

Groundwater research undertaken to date indicates water could be drawn from the Upper Langra Formation which lies at approximately 140 metres below ground level. A water treatment plant would be necessary to treat water for consumption or domestic use by the workforce. Treatment processes may include reverse osmosis, ultraviolet sterilisation, chlorination, or others as required.

Compressor building

A compressor building located close to the main vertical shaft would house two compressors that would provide compressed air for surface and underground maintenance. In the event of an underground emergency, refuge would likely have bottled supply and or rely on large volume of oxygen present in a room.

The steel framed metal clad compressor would have a footprint of approximately nine metres by 10 metres. The building would be designed to act as an acoustic enclosure. Each compressor would be capable of providing compressed air of 30 cubic metres per minute at 830 kilopascals.

Future technology park

The site layout would allow for a technology park for research and development activities throughout the life of the Proposal. The technology park would be designed to enhance the quality of research and development in salt processing and waste recovery as well as other fields such as geophysics and particle physics.

It is expected that the technology park could support members of a research and development community working independently or in joint venture with the proponent.

3.5 Construction of the Chandler Facility

This section provides details regarding the construction of the proposed Chandler Facility. An indicative construction schedule is provided along with the proposed workforce and working hours. Information regarding the typical equipment, machinery and vehicles that would be used during construction is provided along with a description of the different phases of construction (enabling works, construction of aboveground infrastructure, construction of underground infrastructure, and testing and commissioning). Traffic and transportation, utilities, and waste generated during construction are also discussed.

3.5.1 Construction schedule

Subject to obtaining approval, it is anticipated that construction would commence in late 2018. The majority of construction works would occur over a three-year period, ending in late 2021. An additional year would be required for testing and commissioning, ending in late 2022. An indicative construction schedule is provided in Table 3-9.

The proposed Apirnta Facility would likely be commissioned earlier in the construction schedule to provide for early receipt and interim storage of waste in preparation for the commissioning of the proposed Chandler Facility (refer to Section 3.7.1).

Table 3-9 Indicative construction schedule (Chandler Facility)

Activity	Indicative construction period	
	Start	Finish
Planning approval and environmental licences obtained	February 2017	February 2018
Enabling works	March 2018	June 2018
Construction of aboveground infrastructure	October 2018	December 2021
Testing and commissioning	January 2022	December 2022

The construction of the proposed Chandler Facility (including the Henbury Access Road and Chandler Haul Road) would be broken down into five key construction stages, as discussed below and shown in Figure 3-16.



Figure 3-16 Summary of key construction stages (Chandler Facility including Henbury Access Road and Chandler Haul Road)

Stage 1: Site preparation (Month 1 to 6)

- Clearing and grubbing – 100 % complete.
- Construction of accommodation village – 75 % complete.
- Henbury Access Road – 50% complete.
- Chandler Haul Road – 50 % complete.
- Main shaft platform and laydown areas earthworks completed.
- Construct drainage attenuation basins and sediment and erosion control measures.
- Construct groundwater bore field.

Stage 2: Accommodation village and road construction (Month 7 to 19)

- Accommodation village – 100 % complete.
- Commence construction of shaft head frame chambers, intake and exhaust ventilation shaft and decline box cut.
- Henbury Access Road and Chandler Haul Road – 100 % complete.
- Topsoil stockpiled for re-use.

Stage 3: Aboveground infrastructure construction (Month 20 to 32)

- Continuation of decline development.
- Quantity of extractive material retained on-site within stockpiles and re-used in road maintenance, where appropriate.
- Begin construction on vertical shafts.

Stage 4: Underground mine access construction (Month 33 to 45)

- Continuation of decline and vertical shaft development.
- Early commissioning testing commences.

Stage 5: Underground mine development (Month 46 to 48)

- Decline and vertical shafts – 100 % complete.

- Final commissioning testing.

3.5.2 Construction workforce and working hours

At the peak of construction, it is estimated that there would be 270 personnel working on-site. Construction would require workers with a range of skills including labourers, equipment operators, tradesmen (such as plumbers, welders and electricians), surveyors, field engineers (civil, mechanical or process), health and safety staff, administrative staff and cleaners. An indicative profile of the workforce for the duration of construction of the proposed Chandler Facility is provided in Table 3-10.

Hours of construction would be 12 hour shifts, seven days per week (alternating crews working two weeks on and one week off). Night shift work would be necessary for underground development activities and as a contingency to critical aboveground activities. All exceptions to standard working hours would be in compliance with relevant legislation with shift patterns designed accordingly.

The proponent or its contractors would (where suitable) aim to source employees (construction staff) locally either from the community of Titjikala or from Alice Springs or other communities within the NT. Construction workers sourced from further afield than Titjikala would be housed within the accommodation village located to the north of the proposed Chandler Facility.

Table 3-10 Construction workforce profile (Chandler Facility including Henbury Access Road and Chandler Haul Road)

Construction stage	Time (months)	Approximate construction workforce (per month)
Stage 1	1	15
	2	20
	3	40
	4	60
	5	75
	6	80
Stage 2	7 to 12	90
	13 to 19	150
Stage 3	20 to 32	200
Stage 4	33 to 45	270
Stage 5	46	100
	47	75
	48	50

3.5.3 Construction equipment, machinery and vehicles

Enabling and construction works would likely require the following equipment, machinery and vehicles:

- Light vehicles.
- Mini buses to transport employees from the airstrip to site.
- Excavators.
- Dump trucks.
- Fuel truck.
- Front end loaders.
- Vibrating rollers.
- Cranes.
- Water trucks.
- Dozers.
- Graders.
- Prime movers and trailer sets.
- Low loaders.
- Drills.
- Scraper.
- Roller
- Haul trucks.
- Shotcreter.
- Cherry pickers and elevated work platforms.
- Blasting equipment.
- Water trucks.
- Forklifts.
- Underground pumps.
- Temporary construction ventilation fans and ducting.
- Raise boring machine and support equipment
- Temporary services and utilities

3.5.4 Enabling works

Prior to commencement of construction works, the following enabling works would be required:

- Clearing and grubbing.
- Earthworks and grading.
- Utilities and services.
- Temporary fly camp.
- Temporary site offices, crib facilities and buildings.
- Explosives storage.
- Site security.

The enabling works are described below.

Clearing and grubbing

Clearing and grubbing of the site would be necessary to carry out further site preparation activities. Clearing and grubbing would be undertaken progressively over the site in parallel with other site preparation activities to minimise the area of exposed ground and to reduce the potential for erosion.

Where possible, trees above five metres would be retained. This is a decision the proponent has made following consultation with Traditional Owners. Where vegetation is removed, it would be stockpiled, and sometimes chipped, for use in erosion control. Larger woody vegetation that cannot be chipped would be deposited in or around the site as habitat for terrestrial fauna. Subsurface vegetation would be grubbed to a depth suitable to facilitate construction of the proposed Chandler Facility.

Earthworks and grading

Earthworks and grading of the site would be necessary to provide a flat and stable surface for construction and to provide adequate drainage. It is predicted that around one million cubic metres of soil and rock material would be stockpiled and managed at the site of the proposed Chandler Facility.

Topsoil and subsoil would be stripped and stockpiled separately. Topsoil would be stockpiled and maintained for redistribution at the surface. Subsoil would be stockpiled for use as road sub-base or backfill at the site of the Chandler Facility.

Utilities and services

Utilities and services would be established progressively during site preparation and into construction (extending to facility components as they are established). These services would include air, water, power, communications, personal amenities, waste collection, water management, and lighting. Utilities and services are discussed further in Section 3.4.6 and Section 3.16.

Temporary fly camp

A fly camp would be established to allow for enabling works. It would accommodate 50 people. The fly camp would consist of air conditioned rooms, kitchen, laundry units, and an office. Following the completion of the enabling works, a permanent accommodation village would be constructed to provide housing for the construction workforce.

Temporary site offices, crib facilities and buildings

A number of temporary buildings would be required to support the enabling works. These buildings would include site offices and personal amenities. Temporary buildings would typically be transportable and demountable structures and would be removed once no longer needed.

Temporary construction compounds would also be established within construction sites for the storage of equipment and materials during the enabling works. These compounds would be disestablished as construction progresses and permanent facilities are constructed.

Explosives storage

An explosives storage would be established in line with the NT *Dangerous Goods Act* and Dangerous Goods Regulations to store explosives needed for the construction of the mine access decline and box cut. The explosives storage would be situated a safe distance from commonly inhabited parts of

the site and access would be strictly controlled. The explosives storage would remain during construction, but removed during operation of the proposed Chandler Facility.

Site security

Installation of security during enabling works would be necessary to secure the sites and comply with biosecurity regulations. Security controls installed at the proposed Chandler Facility would include:

- Perimeter fencing.
- Lighting and surveillance.
- Security gating at access points.
- Internal fencing at key infrastructure.
- Check points and identification protocols.

Personnel accessing the Chandler Facility would do so via the proposed Henbury Access Road via the Apirnta Facility. Personnel would be subject to security controls at the Apirnta Facility.

3.5.5 Construction of underground infrastructure

Construction of the underground infrastructure would involve:

- Construction of the underground mine.
- Construction of the mine access decline.
- Construction of the vertical shafts.

A description of the activities associated with the construction of the underground infrastructure is provided below.

Underground mine

The underground mine would essentially be constructed through mining during the operation of the proposed Chandler Facility, as described in Section 3.5.4.

The underground mine would be connected to the underground services area. The mine access decline and vertical shafts would be connected to the underground mine by drilling and blasting. Waste rock generated by drilling and blasting would be hoisted to the surface via the main shaft and stockpiled.

Mine access decline

Construction of the mine access decline would involve excavation of a box cut followed by the progressive excavation of the decline. The box cut would be excavated using bulldozers, rock breakers and excavators – along with drill and blast methods if necessary. The mine access decline would be excavated by conventional drill and blast.

Vertical shafts

The vertical shafts would be developed using a conventional raise bore drilling method. This method involves the drilling of a pilot hole to intersect with an underground opening, before attaching a

cutting head and reaming the shaft opening back to the raise bore machine. The shafts would then be appropriately sealed and supported.

The two shafts would be developed in a staged manner from the surface and two underground galleries. The underground galleries would be developed off the mine access decline allowing vertical development to occur in parallel to the decline development.

Once completed, the main shaft would be fitted out for personnel riding and salt hoisting. Services and utilities would also utilise the main shaft including the backfill pipeline. A refrigeration plant would also be fitted at the surface to ensure a suitable air temperature underground.

The secondary shaft would be fitted with exhaust fans mounted on an engineered concrete monolith.

3.5.6 Construction of aboveground infrastructure

Construction of the aboveground infrastructure would involve:

- Construction of surface structures.
- Construction of the vertical shaft headframe and shaft collars.
- Establishment of salt stockpiles.
- Construction of internal roads.
- Construction of the borefield.
- Installation of utilities and services.

A description of the activities associated with the construction of the aboveground infrastructure is provided below. Materials used during construction and the management of construction waste is also discussed.

Surface structures

Surface structures (including the salt processing facilities, waste unloading area, waste storage warehouse, surface hydraulic backfill plant, maintenance buildings, administration buildings, worker accommodation, solar/diesel hybrid power plant, fuel storage facility, and future technology recovery park) would be constructed in accordance with the relevant industry and regulatory standards including the NT *Building Act*, NT Building Regulations and *Building Code of Australia*. In addition, an architect would be engaged to provide services in relation to the design of the buildings.

The permanent accommodation village would be constructed early to provide accommodation for the construction workforce and would also include supplementary accommodation units to manage construction peak manning.

Vertical shaft headframe

Once the collar areas have been prepared and headframe foundations completed, headframe construction would begin at the main shaft. The electrical room and compressor building that adjoin the main shaft headframe would also be constructed.

The main shaft headframe structure would be constructed in its permanent configuration and would look similar to that shown in Figure 3-17. Construction would be completed using conventional steel structure construction practices.

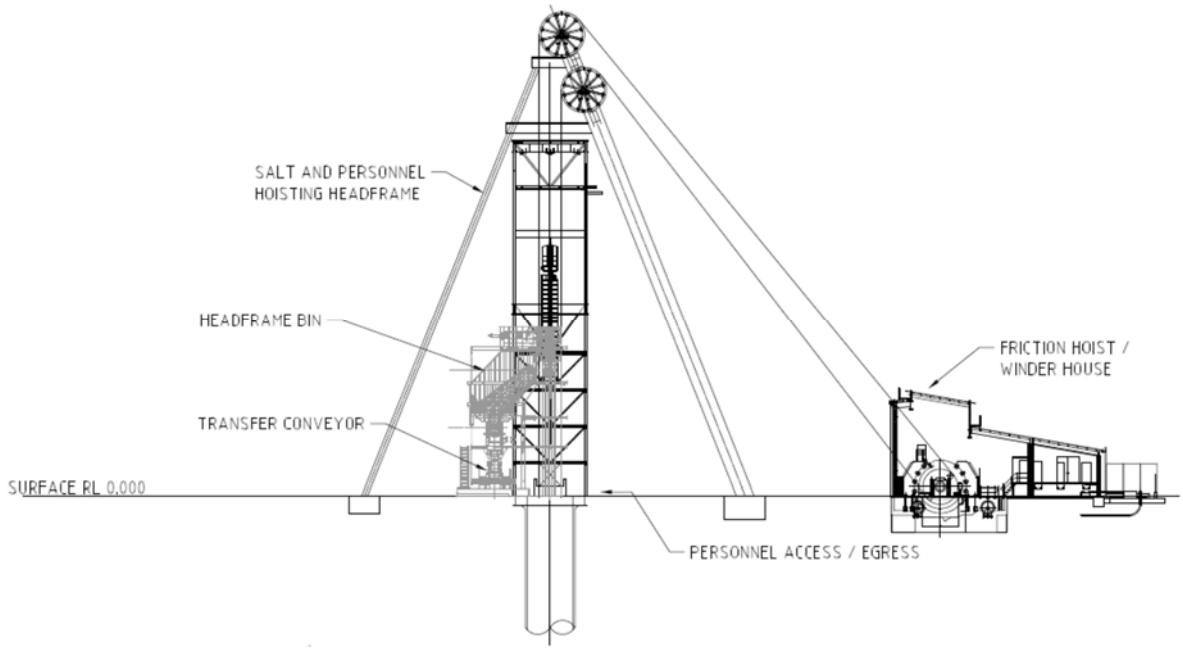


Figure 3-17 Example of main shaft headframe structure (Chandler Facility)

Salt and overburden stockpiles

Salt stockpiles would include run of mine salt and product salt generated during operation. The indicative salt stockpile volumes and dimensions are provided in Table 3-11 and are shown in Figure 3-18. The size of these stockpiles may fluctuate during operation according to supply and demand but, for the purposes of the environmental risk assessment, a worst case run of mine volume scenario has been adopted.

Salt stockpiles would be established on an impervious clay base to block saline leachate from draining into groundwater. Clay would be sourced from excavation of the mine access decline. During rainfall, the surface of the salt stockpiles would naturally form a crust that would protect the surrounding environment from saline runoff. As such, sheltering structures or sheeting are not proposed. Dish drains would be constructed around the perimeter of the run of mine stock piles to control any runoff.

Overburden (soil and rock) would also be stockpiled within the mine infrastructure area at the proposed Chandler Facility. The soil and rock stockpiles would be constructed with 3:1 slopes to ensure stability. In order to prevent ponding of water on the top of the stockpiles, the top of the stockpiles would be graded. Further information regarding the soil and rock stockpiles is provided in Section 3.4.10.

Table 3-11 Indicative salt stockpile volume and height (Chandler Facility)

Salt material	Stockpile volume (m^3)	Stockpile height
Run of mine salt	3,500,000	20 metres

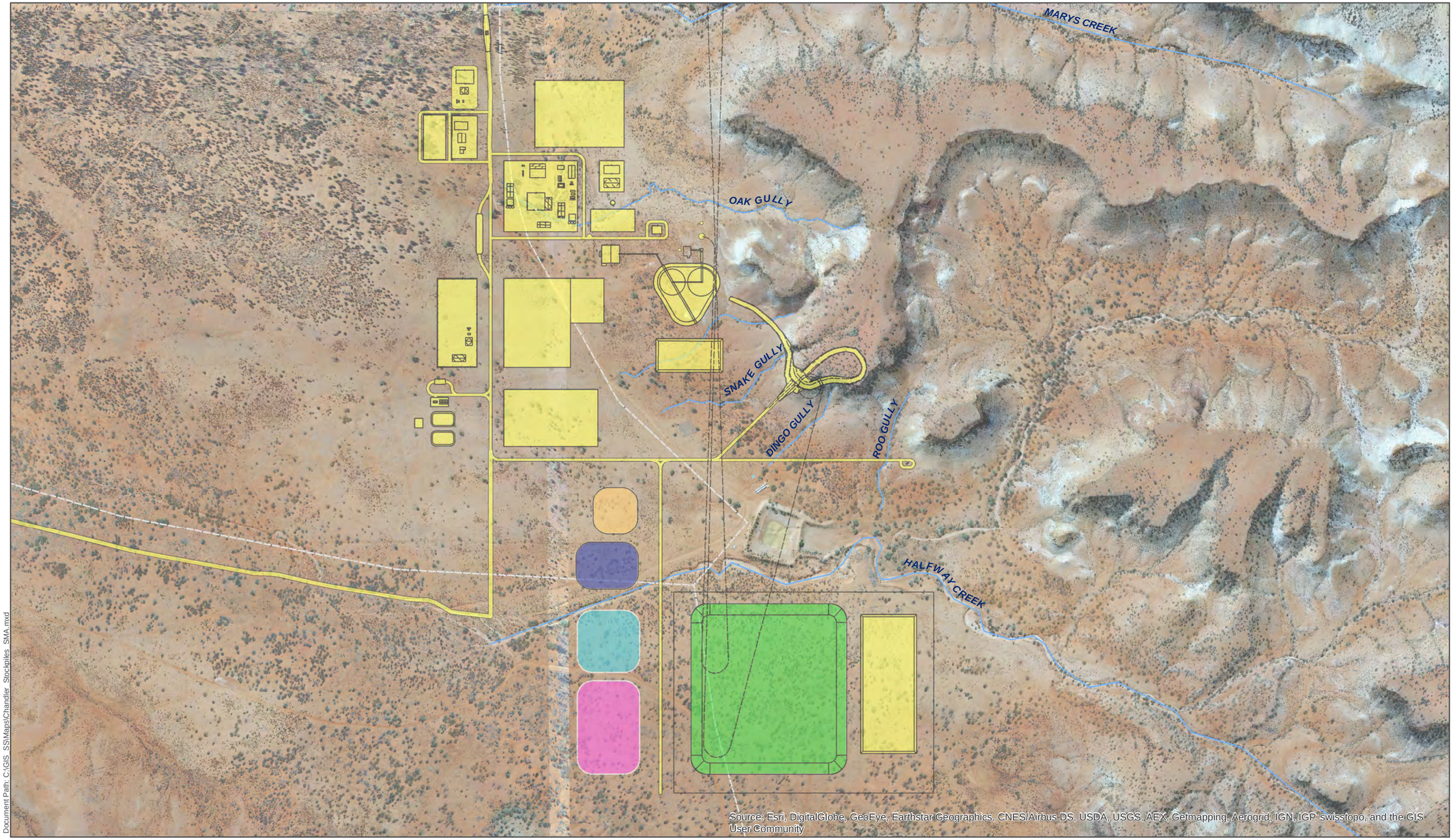
Internal roads

The network of internal roads within the mine infrastructure area would be established toward the end of the construction.

The alignment of the internal roads would be cleared, graded and compacted. The roads would then be constructed on top of the compacted surface with the following layers.

- Road sub-base.
- Road base.
- Road surface.

Construction materials would be sourced from excavations associated with the mine access decline and vertical shafts or from borrow pits located along Maryvale Road.



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N

100 50 0 100 Meters

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Existing track
- Watercourse

Stockpile material

- Limestone
- Salt
- Sandstone
- Shale
- Topsoil

Figure 3-18
Stockpiles including run of mine salt

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Borefield

The borefield and water storage would be constructed early to provide raw water for construction. The reverse osmosis water treatment plant would also be constructed early to provide water for consumption or domestic use by the workforce.

Utilities and services

As discussed above, utilities and services would be established progressively during site preparation and into construction (extending to facility components as they are established). These services would include air, water, power, communications, personal amenities, waste collection, water management, and lighting. Annual demands for water, power and fuel during construction of the proposed Chandler Facility are listed in Table 3-12. Utilities and services are also discussed further in Section 3.16.

Table 3-12 Annual demand for utilities and services during construction of the Chandler Facility

Utilities and services	Annual demand	Primary uses
Raw water	54 ML	Dust suppression and industrial cooling
Potable water	16 ML	Consumption and domestic use
Power	34,000 MWh	Temporary buildings and salt processing
Fuel	8 ML to 10 ML	Equipment and services and underground vehicle transport via mine decline

Construction materials

The most significant material required for construction would be fill comprising soil and rock material. The proponent would aim to source the majority of this material on-site for the construction of the proposed Chandler Facility.

The proponent would also aim to source fill material for construction of the proposed Chandler Haul Road and Henbury Access Road from a series of borrow pits along the alignments of Chandler Haul Road and Henbury Access Road. The location of the borrow pits would be subject to the final alignment of the roads and geotechnical assessment and, thereafter, a site selection protocol to avoid environmental impacts.

A range of other general construction materials such as wood, steel, glass and concrete would be required for the construction of the proposed Chandler Facility. Wood, steel, glass and so on would be ordered and delivered to the site of the proposed Chandler Facility (as needed).

A concrete batch plant would be established at the site and would produce concrete for use during construction. Quantities and providers of these materials would be determined during detailed design and procurement.

Construction waste

Waste generated during enabling and construction works would include construction waste, domestic waste and waste water. Construction waste and domestic waste would be managed by collecting, separating and storing waste according to its potential for reuse, recycling, recovery, treatment and/or disposal. Waste would be stored in appropriate containers such as industrial bins or drums in dedicated waste collection areas for collection by appropriately licensed waste contractors. Waste is discussed further in Section 3.4.10 and Section 3.4.12. The management of waste water is discussed further in Section 3.16.

3.5.7 Testing and commissioning

Testing and commissioning of underground and aboveground infrastructure would be staged progressively during construction and would involve the various facility components as they are established.

Commissioning would include a range of activities including:

- Configuration of systems for operation.
- Mobilisation and assembly of operating equipment.
- Fitout and equipping of buildings including offices and workshops.
- Stocking of storage areas with materials for ongoing maintenance activities.

3.5.8 Traffic and transportation

The movement of the workforce, equipment, materials, waste, utilities and services would generate a number of heavy and light vehicle movements during enabling and construction works at the proposed Chandler Facility. The main routes for these vehicle movements would be Maryvale Road during construction and when operational, along the Stuart Highway and proposed Henbury Access Road and Chandler Haul Road.

Workers who fly-in-fly-out from Alice Springs would utilise commercial services to Alice Springs Airport from the proposed Chandler Facility. It is anticipated that workers would be transported by coach on a weekly basis, staying the proposed accommodation village located to the north of the Chandler Facility.

Equipment required for enabling and construction would be moved to and from the proposed Chandler Facility at the start of the enabling works and at the end of construction. This would generate two short peaks in vehicle movements rather than ongoing vehicle movements.

Materials required for enabling and construction would be delivered, as required, via the Maryvale Road. Vehicle movements would not be significant given that the proponent is aiming to source the majority of fill material from on-site.

Waste generated during enabling and construction would require periodic collection by appropriately licensed waste contractors. Vehicle movements associated with waste collection would not be significant and would likely occur on a weekly basis.

Traffic and transportation impacts and mitigation (including the implementation of a Traffic Management Plan) are discussed further in Chapter 18.

3.5.9 Utilities

Electrical supply and emergency power would be supplied via a stand-alone two megawatt solar/diesel hybrid power plant to the proposed Chandler Facility.

The main vertical shaft hoist, ventilation fans and continuous miners would constitute the major load on electric power during construction of the proposed Chandler Facility. Power would be required for:

- Exhaust fans.
- Refrigeration unit.
- Air compressors.
- Maintenance and storage area, office and amenities building.

Small power distribution transformers would be required for lighting, receptacles, and other facility service loads. The total connected load for the facility is outlined in Table 3-12.

An emergency power system using diesel generators, complete with load bank, would be installed to assure safety in the event of a power failure. An emergency generation capacity of approximately 1,750 kilowatts (that would consist of multiple generators providing the required load with additional capacity) would be required to serve the site loads that are essential for personnel safety.

The emergency power system would be located at the proposed solar/diesel hybrid power plant and would feed equipment through the cables and switchgear used for normal operations. The emergency power system would automatically supply power to critical components within 30 seconds of a power failure. Specialised controls and switchgear would be used to initiate the start-up of the generators and shed non-critical loads following a power outage, as well as allow an uninterrupted switchover when the supply grid is re-energised. Inspection and maintenance programs would be implemented to ensure the reliability of the emergency power system.

3.5.10 Construction waste

Approximately 986,000 cubic metres of overburden (soil and rock) would be excavated during construction of the mine access decline and vertical shafts at the proposed Chandler Facility. The soil and rock would be stockpiled and managed in accordance with a Waste Management Plan (refer to Appendix G). The indicative stockpile volumes and dimensions are provided in Table 3-13 and are shown in Figure 3-18.

It is expected that the waste rock would be used on-site in the construction of roadways and in the build-up of the mine infrastructure area. The soil and waste rock would also be used during closure and rehabilitation of the Proposal. The material has been tested and is not expected to have problematic characteristics such as acid or metalliferous drainage.

Table 3-13 Indicative overburden stockpile volume and height (Chandler Facility)

Soil and rock material	Stockpile volume (m^3)	Stockpile height (m)
Topsoil	120,000	12
Sandstone	478,000	12
Siltstone	330,000	12
Claystone	58,000	12
TOTAL	**986,000**	-

Other waste generated during construction would likely include:

- Cleared vegetation.
- Concrete.
- Scrap metal.
- Wood.
- Paint and resin.
- Used oils and greases.
- General waste.
- Sewage sludge.

Waste would be managed by collecting, separating and storing waste according to its potential for reuse, recycling, recovery, treatment and/or disposal. Waste would be stored in appropriate containers such as industrial bins or drums in dedicated waste collection areas for collection by appropriately licensed waste contractors. Sewage sludge would be removed from site and disposed of at a suitably licensed disposal facility.

3.5.11 Health, safety and environment

Management systems

Construction of the proposed Chandler Facility would be undertaken by one or multiple construction contractors. These contractors would operate their own health, safety and environment management systems.

The proponent would manage risks subject to the control of construction contractors through the contractor selection and negotiation of contract terms. These processes would be formalised in the proponent's health, safety and environment management systems.

Environmental management

The effect of the construction of the Chandler Facility on the environment would be controlled by the implementation of a series of measures collated in a Construction Environmental Management Plan (CEMP). The CEMP would reflect the measures committed to in this EIS and conditions attached to statutory approvals. The CEMP would also contain additional details such as the delegation of responsibility for the implementation of measures and requirements to periodically review the plan for the purpose of adaptive management.

3.6 Operation of the Chandler Facility

This section provides details regarding the operation of the proposed Chandler Facility. An indicative operational schedule is provided along with the proposed workforce and working hours. Information regarding the typical equipment, machinery and vehicles that would be used during operation is provided along with a detailed description of the proposed salt mining and waste storage and

isolation operations. Traffic and transportation, communications, utilities, fuel storage, and worker accommodation are discussed along with the expected waste generated during operation of the proposed Chandler Facility.

3.6.1 Operational schedule

The operational schedule for the proposed Chandler Facility is 25 years. However, waste would be received on the surface beginning in the first year of construction. Therefore, the life of the Proposal would be 29 years. About one tonne of waste would be accepted for every 2.3 tonnes of salt mined at the proposed Chandler Facility (refer to Table 3-14).

Table 3-14 Indicative schedule

Year	Salt mined (approximate tonnes / year)	Waste accepted (approximate tonnes / year)
1		30,000
2		90,000
3		90,000
4	957,645	90,000
5	1,221,090	200,000
6	540,895	200,000
7	509,639	200,000
8	524,479	220,000
9	568,600	240,000
10	612,128	260,000
11	655,063	280,000
12	697,405	300,000
13	713,745	309,000
14	730,438	318,270
15	747,490	327,818
16	853,360	337,653
17	869,152	347,782
18	796,032	358,216
19	814,587	368,962
20	822,926	380,031
21	842,254	391,432
22	838,438	392,000
23	954,476	393,000
24	717,533	394,000
25	750,134	395,000
26	751,924	396,000
27	753,713	397,000
28	751,248	398,000
29	795,114	399,003
AVERAGE	**682,396**	**293,203**

3.6.2 Operational workforce and working hours

Operation of the proposed Chandler Facility would directly employ around 150 to 180 full time equivalent workers. Two environment managers would be employed to manage and monitor environmental performance during construction and operation of the Proposal. The environment managers would (at a minimum) hold a Bachelor of Environmental Science degree (or similar) and would have at least five years' experience in managing large mining operations (or similar large

infrastructure operations). An indicative profile of the workforce for the duration of operation of the proposed Chandler Facility is provided in Table 3-15.

Hours of operation would be 24 hours per day, seven days per week (alternating crews working two weeks on and one week off).

Initially, the majority of workers would fly-in-and fly-out via Alice Springs Airport. The proponent plans to progressively upskill and employ workers in the local region to increase their presence in the workforce. A range of job training initiatives including on-site training and apprenticeships, internal training courses and external training courses (such as TAFE) would be implemented.

Table 3-15 Operational workforce profile (Chandler Facility)

Description	Direct	%	Roster
Management	12	6	9 on 5 off
Mining – Staff	10	5	9 on 5 off
Mining – Crews	48	22	14 on 7 off
Mining - Maintenance	24	11	14 on 7 off
Processing – Staff	2	1	9 on 5 off
Processing – Crews	10	5	14 on 7 off
Processing – Maintenance	7	3	14 on 7 off
Waste staff and crews	52	24	Mix
Site administration staff	3.5	2	9 on 5 off
Contractors on-site	46	21	Mix
Total full time equivalent workers	216	-	-

3.6.3 Operational equipment, machinery, vehicles and other materials

Operation would likely require the following equipment, machinery and vehicles:

- Backhoes.
- Cherry pickers.
- Continuous miners.
- Salt haul trucks.
- Conveyors.
- Drill gophers.
- Forklifts.
- Front end loaders.
- Graders.
- Feeder breaker.
- Haul trucks (waste)
- Haul trucks (salt).
- Jumbos.
- Light vehicles.
- Rock breakers.
- Roll crushers.
- Salt backfill sprayer (snow blower).
- Telehandlers.
- Transformers.
- Ventilation fans.

A range of other materials would also be required during operation, including:

- Mixing agents for use at the hydraulic backfill facility.
- Food and domestic supplies for worker accommodation.
- Maintenance fluids and parts for equipment maintenance.
- Office supplies for control rooms and administration buildings.
- Soil and rock material for maintenance of proposed internal roads and Chandler Haul Road and Henbury Access Road.

The most significant volume of material required for the operation of the Chandler Facility would be mixing agents for use at the hydraulic backfill facility. The primary mixing agent used in hydraulic backfill would be groundwater sourced from the borefield.

Another potential significant material that would be required would be soil and rock for the maintenance of internal roads and the proposed Chandler Haul Road and Henbury Access Road. These materials would be sourced from borrow pits established during construction. The quantities of other materials are not expected to be significant and would be determined along with providers during detailed design and procurement.

3.6.4 Salt mining operations

The proposed salt mining operations would involve:

- Excavating salt.
- Transferring salt to the surface.
- Stockpiling salt.
- Stockpiling product salt.
- Processing salt.
- Clay lining for salt stockpiles.
- Dispatching product salt.

The steps involved in the proposed salt mining operation are described below.

Excavation of salt

The rooms of the underground salt mine would be excavated using continuous miners (refer Plate 3-2). Continuous miners employ a drum shaped head with numerous short picks that cut the salt as the head rotates.



Plate 3-2 Example of continuous miner excavating rooms in a salt mine

On average, approximately 12 rooms in the underground salt mine would be excavated each year (maximum of 15 rooms per year) to meet the operating schedule described in Section 3.6.1. Once an entire room is excavated, the entrance to the room would be barricaded until waste storage and isolation commences, as described in Section 3.5.5.

Transfer of salt to surface

Excavated salt would be transferred by haul truck through the underground mine via conveyor and then hoisted to the surface via the main vertical shaft. The excavated salt may require some initial crushing underground to improve its sizing for the conveyor system.

Salt stockpile

The operational schedule estimates the total run of mine salt (mined salt) at 19.8 million tonnes (over the 25-year life of the Proposal). This tonnage would be driven by the waste emplacement schedule (that is, salt would not be selectively mined). Because of this, salt processing is anticipated to be variable. To manage this, the proponent would defer processing for the first five years of mining resulting in approximately 3.5 million tonnes of salt being stockpiled on the surface. The stockpile would be located to the south of the mine infrastructure area at the proposed Chandler Facility (refer to Figure 3-1). The run of mine salt stockpile could reach a height of approximately 20 metres.

Salt processing would commence in year six of the mining operations and would be undertaken for the remainder of the operational phase (i.e. 20 years of salt processing). The proponent would target a maximum of 750, 000 tonnes per annum of exported salt product giving a total exported volume of approximately 15 million tonnes over the life of the Proposal. The final exported volumes would depend on the quality of the mined salt, feed stock on surface and product specification to be agreed with the customer(s).

Any rejected salt from processing would be returned underground and used to backfill development drives within the salt formation. Fine salt would also be screened prior to processing and used to backfill around the waste packages within the mined rooms. The proponent estimates that approximately 76 % of the salt mined would ultimately be exported leaving approximately 24 % utilised underground as backfill. These volumes would be refined during detailed design of the Proposal.

Product salt stockpile

Run of mine salt that is dry optical sorted and processed to a marketable grade would also be stockpiled as product salt. As noted above, salt processing and export would be deferred until year six (when the first wastes would be emplaced underground).

Dry salt processing

Salt processing would be undertaken, as follows:

- The rock salt extracted by continuous miner would be hauled to a feeder breaker located underground (the position of the feeder breaker would be confirmed subject to geotechnical stability confirmation during detailed design of the Proposal).
- Salt screened out at less than two millimetres would be stockpiled underground and used as room backfill material.

- Salt greater than two millimetres in size and any surplus two-millimetre salt not required for room backfill would be hoisted to the surface and transferred to the run of mine salt stockpile.
- Salt from the run of mine stockpile would be fed by loader to a hopper and reduced in size to less than 10 millimetres and then screened to produce +4 millimetres, +2 millimetres and <2 millimetre fines.
- The +4 millimetre and +2 millimetre fines would be colour sorted via dry process optical sorting machines to remove the high insoluble ore particles. Up to five optical sorting machines would be used to extract industrial grade salt.
- Salt less than specification would be rejected and stockpiled for future use as backfill underground.
- Industrial grade salt or product salt of 98.4 % NaCl quality would be containerised and loaded onto rail for export.

Dry process optical sorting is commonly used for rock salt refining throughout the world. Initial technology selection trials using bulk samples recovered from the proponent's drilling programs at Chandler have been undertaken at TOMRA's facilities in Sydney and Germany.

Clay lining for salt stockpiles

There is estimated to be a suitable quantity of rock available from the mine access decline and vertical shaft excavations to construct rock pads upon which the salt stockpiles could be constructed. The same material could also be used for the construction of water containment structures at the proposed Chandler Facility. The total volume of rock to be excavated during the mine development phase would be approximately 0.9 million cubic meters.

Rock characterisation and design of the pads and water containment structures would be completed during detailed design of the Proposal. However, a three metre high rock pad constructed using the excavated rock would allow the construction of a pad of approximately 29 hectares. In comparison, the 3.5 million tonne run of mine salt stockpile at the proposed 20 metre finished height would take up less than half that area (approximately 12.5 hectares).

The proponent has not yet undertaken any construction-focused surface geotechnical investigations but is confident that in-situ clay materials exist throughout the site. Halfway Dam is a large, existing agricultural dam which the proponent proposes to decommission as part of the Proposal. The dam has been formed using in-situ materials of high clay content suitable for building water retaining structures. This material could be incorporated in layers with the mine development rock to create low permeability structures.

Dispatch of product salt

Product salt would be either filled into bulk bags or bulk filled into lined shipping containers before being transported by road train to the proposed Apirnta Facility via the Chandler Haul Road. The containers would be unloaded and temporarily held at the Apirnta Facility before being loaded onto trains for transport to Adelaide via the Central Australian Railway. Product salt stored in bulk bags prior to being loaded into a shipping container is shown in Plate 3-3



Plate 3-3 Product salt stored in bulk bags

3.6.5 Waste storage and isolation operations

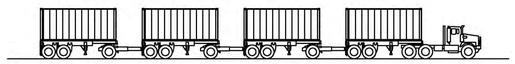
The proposed waste storage and isolation operation would involve:

- Application of the WAC.
- Receiving accepted waste.
- Moving waste underground (dry packaged waste backfill or hydraulic backfill).
- Arranging waste into compatible zones within emplacement rooms.
- Backfilling and room closure.
- Returning containers to surface

The steps involved in waste storage and isolation operation are described below. The waste storage and isolation operation is visually summarised in Figure 3-19. The long term safety case of the proposed operation is visually summarised in Figure 3-20.

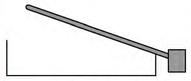
1. TRANSPORT DOCUMENTATION INSPECTED AND EXTERNAL EXAMINATION OF CONTAINERS.
2. STORAGE CERTIFICATED ISSUED.

APRINTA RAIL SIDING TO CHANDLER MINE SITE



MATERIAL TRANSPORTED TO CHANDLER MINE SITE

1



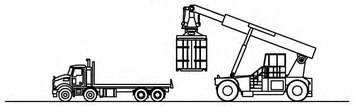
VISUAL INSPECTION

CHANDLER MINE SITE

2



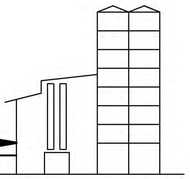
ACCEPTED WASTE TAKEN TO TEMPORARY HOLDING YARD



CONTAINERS LOADED ONTO TRUCKS FOR TRANSPORTATION INSIDE MINE



TRUCK WITH CONTAINERS MOVING TO BELOW GROUND GROUND STORAGE



WASTE BATCHING/PASTE PLANT

MINE SITE GROUND LEVEL

PORTAL EXIT (DECLINE)

OUTGOING EMPTY CONTAINER

INCOMING MATERIAL FOR BELOW GROUND STORAGE

TO STORAGE AREA

TO WASHDOWN AREA

DECLINE 1:7

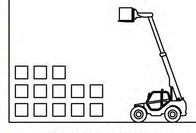
TOP OF SALT BED

TO WASHDOWN AREA

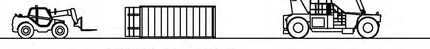
PASTE BACKFILL LINE

DECANTED WATER LINE

4

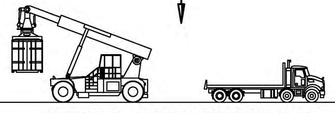


PACKAGED STORAGE

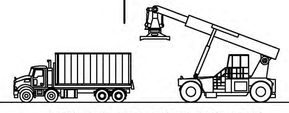


CONTAINER UNPACKING

STORAGE ROOM SEAL



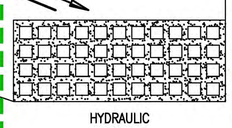
CONTAINER IS UNLOADED FROM TRUCK AT THE UNDERGROUND STORAGE AREA. TRUCK RETURNS TO THE SURFACE WHILE CONTAINER IS BEING UNLOADED



WHEN AVAILABLE, EMPTY CONTAINERS ARE LOADED ONTO OUTGOING TRUCKS FOR REMOVAL FROM MINE

STORAGE ROOM SEAL

4



HYDRAULIC BACKFILL

REFERENCE DRAWING

No	TITLE

REVISIONS

REV	BY	DATE	DESCRIPTION	CKD	DESIGN	ENG APPR	PROJ APPR
A	DSt	29.07.16	ISSUED FOR INFORMATION	JDA			

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APPROVALS	
DRAWN	
CHECKED	
DESIGNED	
ENG APPR.	
PROJ APPR.	
CLIENT APPR.	

CLIENT: TELLUS

Figure 3-19

TITLE: CHANDLER SALT MINE PROJECT
WASTE MATERIALS SCHEMATIC
CHANDLER MINE SITE

A1

SCALE

DRAWING No. 40870-SK-00-P-0004

REV. A

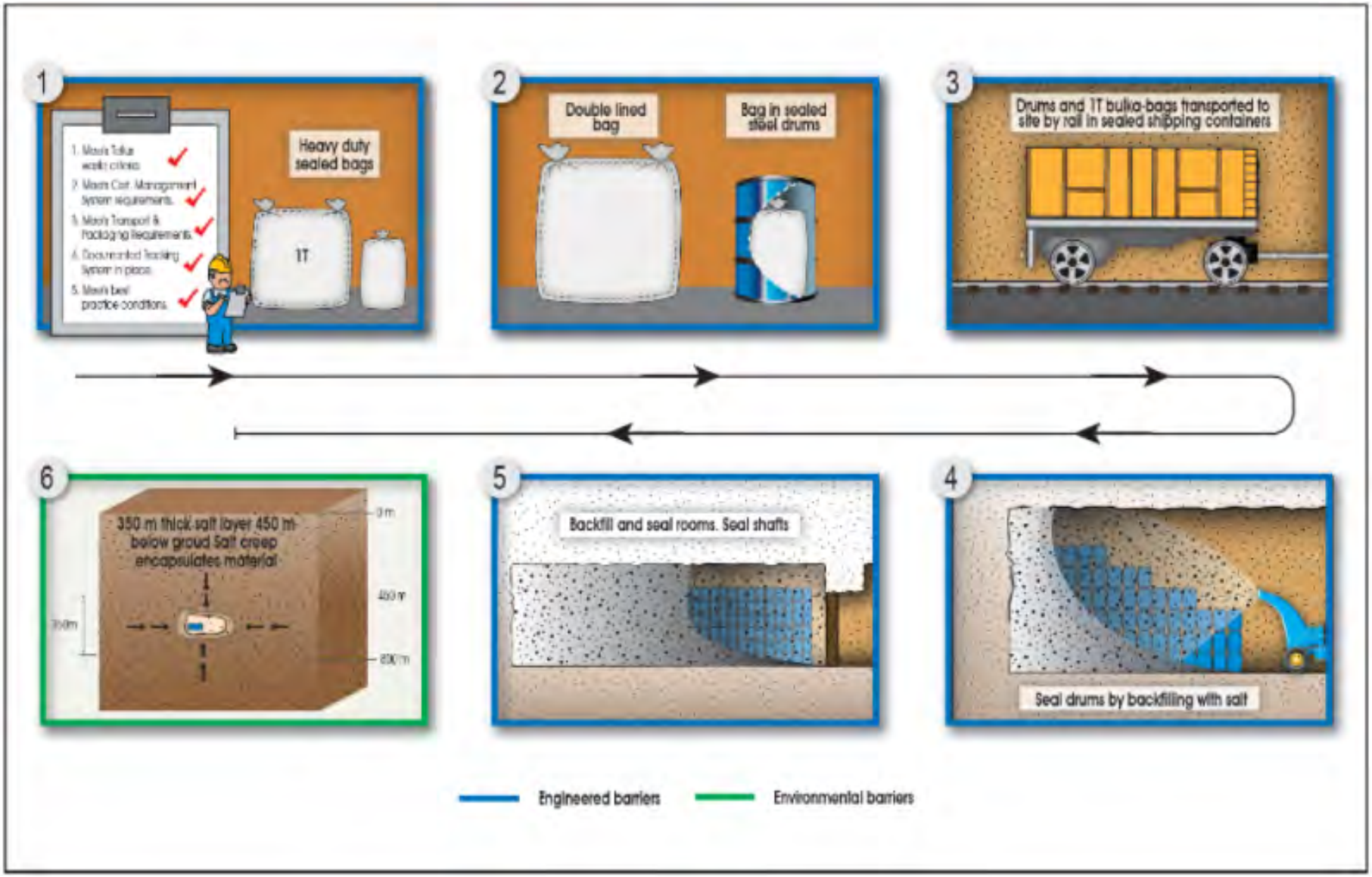


Figure 3-20 Illustration of waste emplacement and long term safety case for packaged waste

Apply waste acceptance criteria

Waste delivered to the proposed Chandler Facility would be subject to strict WAC developed in reference to relevant legislation and guidelines and the specific characteristics of the Chandler site. The WAC would ensure that waste is only accepted if it can be stored in a safe and environmentally sound manner.

In the development of the WAC, the proponent has drawn on the European Union COUNCIL DECISION of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC. Appendix A of that document provides the legislative framework against which underground storage operations in Europe operate. This document has also informed the Operational and Post Closure and Integrated Assessment / Environmental Performance Assessments undertaken for the Proposal (refer to Appendix H).

The WAC is provided in Appendix C, while an indicative waste inventory following the implementation of the WAC is provided in Appendix C.

Receive accepted waste

Accepted waste would usually be transported via the Central Australian Railway to the proposed Apirnta Facility and then via the Chandler Haul Road to the Chandler Facility. The Chandler Facility would receive on average 300,000 tonnes of waste each year while a maximum of 400,000 tonnes would be temporarily stored at Apirnta Facility at any given time. It is anticipated for current planning purposes that approximately 75 % of all wastes would be solid waste and 25 % would be liquid wastes.

Waste would be transported to the Apirnta Facility and the Chandler Facility within primary and secondary containment (refer to Plate 3-4). The primary containers would include appropriately labelled double-barrier containers such as double-lined bulk bags or PVC bags stored within barrels. The containers would be selected to meet Dangerous Goods requirements, as necessary. These primary containers would be stored and transported within ISO 20-foot shipping containers.

The waste would be inspected at the Apirnta Facility to confirm acceptability and compliance with the WAC. Inspection routines would include visual inspection of waste packaging and material safety data sheets, weighing of waste loads, sampling and testing at a laboratory building and measurement of radioactivity. Inspection could occur at the Apirnta Facility and/or the Chandler Facility but would generally occur at the Apirnta Facility.

Received waste that does not meet the WAC, is inappropriately packaged, or is otherwise deemed unacceptable, would be quarantined and returned to the waste generator. If the waste cannot be safely or legally returned, the relevant regulatory authority would be contacted.



Plate 3-4 Container types that would be used for storage, disposal and isolation at the Chandler Facility

Move waste underground

Waste received at the proposed Chandler Facility would be moved underground via the mine access decline or by hydraulic backfill. It is planned that solid waste would be moved underground via the decline in ISO 20-foot shipping containers. The containers would be transported by truck through the underground area to the designated storage or disposal room. Waste would also be transported by hydraulic backfill directly to designated storage or disposal rooms.

Dry packaged waste backfill

Underground storage and disposal rooms would be constructed in accordance with the safety case requirements and to optimize their value for geological storage and disposal, which would involve creating access roads leading to engineered storage/disposal rooms. Each storage room is currently assumed to be approximately 240 metres long, 10 metres wide and six metres high, with disposal rooms of similar design but currently assumed to be 15 metres wide.



Plate 3-5 Pyramid stacking of waste packages

After the ISO 20-foot shopping container has been placed on the floor of the storage room, the individual waste packages would be unpacked from the container and placed in their storage or disposal location. This operation would be undertaken by fork lift trucks or telehandlers. The maximum available height in a storage room would be used with pyramid stacking of packages as illustrated in Plate 3-5. The underground layout would be designed to allow 'like for like' wastes to be stored together to ensure compatibility during the storage and disposal period.

During the surface storage period, after waste acceptance procedures have been carried out, containers would be monitored to ensure no leakage of material from containers. After transfer of waste underground and placement in storage and disposal rooms, active inspection and monitoring systems would be deployed. The monitoring system would involve monitoring the facility atmosphere in the vicinity of the storage operations and in the main ventilation roadways downwind of storage operations to confirm that the stored materials are not emitting any gasses or particulate matter in harmful concentrations.

Once a decision has been taken to permanently dispose of waste, fine salt would be placed around the waste packages using a salt backfill sprayer to fill any voids present (refer to Plate 3-6). This fine salt would re-constitute around the waste packages over time, due to the self-healing nature of rock salt and the surrounding strata, converging back in a controlled manner into the opening created by mining. This process is known as 'salt creep'.



Plate 3-6 Salt backfill sprayer placing fine salt around waste packages

After loose salt backfilling has been completed, an engineered seal or wall would be constructed at the entrance to the disposal room to permanently isolate the wastes. An example of a simple wall structure is shown in Plate 3-7. The appropriate room seal designs for the Chandler Facility would be undertaken during detailed design of the Proposal.



Plate 3-7 Example of simple single-skin wall seal in

Hydraulic backfill

The proponent commissioned a preliminary study during the pre-feasibility stage of the Proposal to examine the feasibility of using hydraulic backfill at the proposed Chandler Facility (refer to Appendix I). The report presents a high-level analysis of the potential wastes that would be received at the proposed Chandler Facility, which were then screened to determine which wastes would, and would not, be suitable for incorporation in hydraulic backfill. The report discusses options for different types of hydraulic backfill systems that could be used at the proposed Chandler Facility. It also presents key safety and operational issues associated with hydraulic backfill at the Chandler Facility.

The application of hydraulic backfilling is a feasible option to dispose of suitable and compatible wastes in excavated rooms of salt mines. These wastes can be liquid or solid but need a grain size small enough to achieve appropriate hydraulic properties. There are fundamentally two types of hydraulic backfill, firstly *flushing backfill* which exhibits low viscosity and is transported by gravity and uses a saturated brine as the transport medium, and secondly *viscous slurry backfill* which exhibits high viscosity and needs a pump to be transported through a pipe system.

There are a number of advantages in adopting hydraulic backfilling where the waste types make this possible. The main advantages include:

- Reduced vehicle movements in the mine access decline and underground reduces some of the health and safety issues associated with running large diesel vehicle fleets.
- Increased void utilisation of the underground space by removing the spaces between packages and when placed in specifically designed rooms there is no void space at roof level.

- The improved use of the void further improves the overall geotechnical control of the underground workings by providing support to the excavation sooner.

Strict recipe development underpinned by waste acceptance procedures would ensure that only compatible wastes are introduced into the hydraulic backfill mixing plant. During the mixing process there could be occasional "gassing off", typically of hydrogen gas, which would be controlled through monitoring before being emitted to the atmosphere.

Hydraulic mixtures would also be designed to ensure that there would be no adverse interaction or dissolution of the host salt rock (saturated brines are generally used in the mixtures). A hydraulic mixing plant which would include safety systems that are used to safeguard correct mixtures are manufactured before being placed in the underground (refer to Plate 3-8).

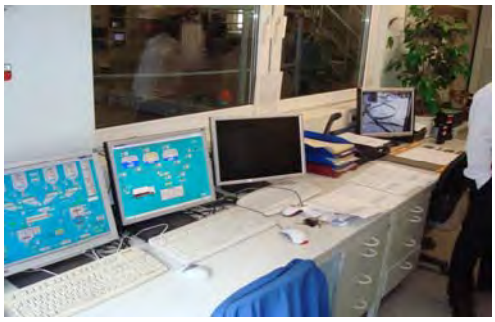


Plate 3-8 Control room of typical hydraulic backfill plant

The underground storage rooms would be specifically designed to accept hydraulic backfill. Currently the planning assumption is that the lower end of the room would be closed with an engineered dam wall following construction. A typical dam wall to contain hydraulically placed waste is shown in Plate 3-9.

Plate 3-9 Typical underground hydraulic backfill



The mixtures would also be designed to set in situ in a matter of days, normally this is achieved by including binding materials within the waste recipe. It is normal to be able to walk on emplaced wastes within a few days of emplacement.

The type, volume and location of all waste accepted and stored underground would be recorded in a database for the purpose of compliance auditing and potential future retrieval.

Details of the hydraulic backfilling method proposed

As discussed above, there are two types of hydraulic backfill , i.e. flushing backfill and viscous backfill, the main difference being the percentage of fluid contained in the backfill mixture transported underground through pipelines. At this stage, a definite choice for one of the two types cannot, and should not, be made as insufficient information on the exact available wastes materials is unavailable. Even with more detailed information on the available waste materials, designating certain wastes to one or both backfill types is only possible based on laboratory testing and subsequent classification. The proponent has assumed the viscous backfill method in their pre-feasibility study and EIS and accepts that this is a reasonable planning assumption subject to further analysis when more information becomes available on the types of wastes to be backfilled.

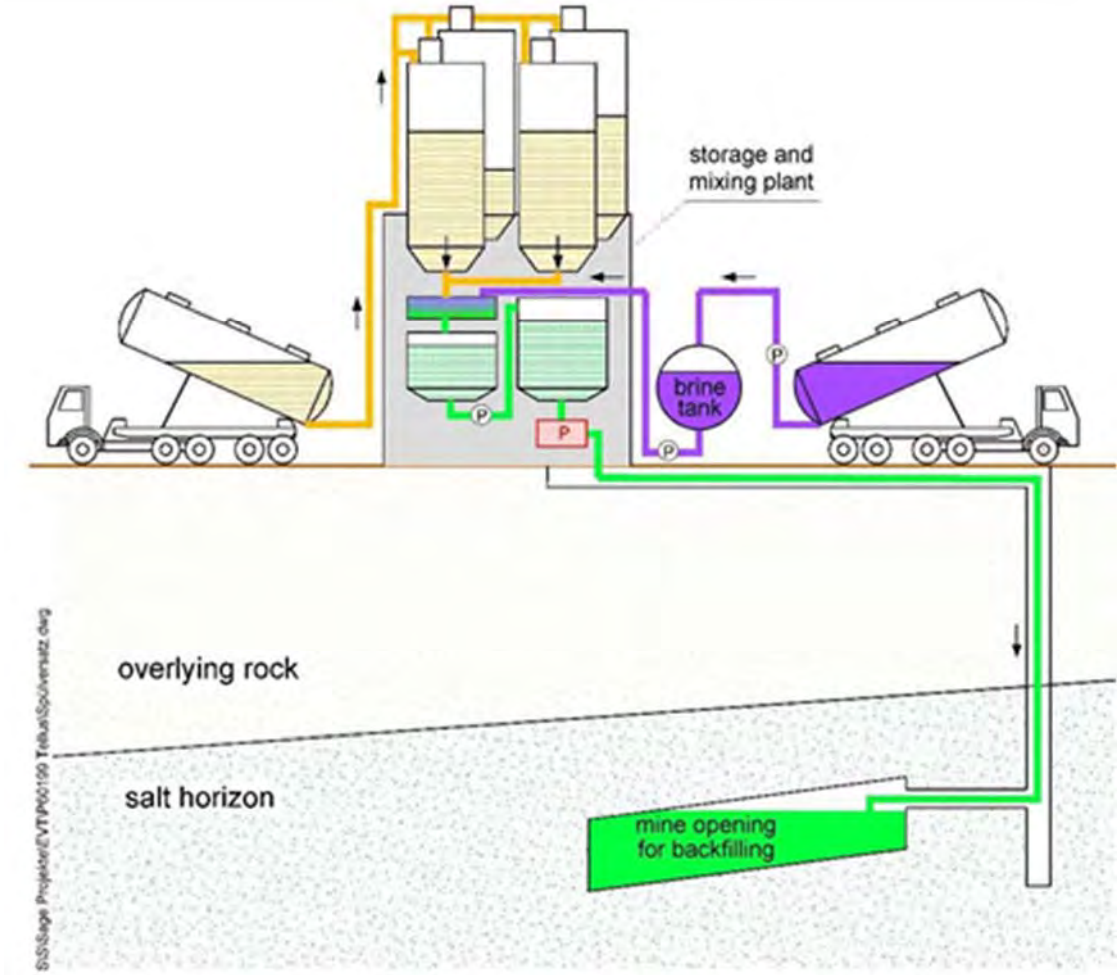
As hydraulic backfill can be emplaced more efficiently than packaged waste backfill due the absence of vehicle transportation and a very high filling rate (utilisation) of the mined rooms, it might be beneficial to maximise the use of hydraulic backfill as a waste emplacement method. An opportunity presents itself to enable the production and emplacement of both flushing and viscous backfill to maximise the range of waste types emplaced hydraulically.

Viscous backfill (current assumption)

Characteristics for the viscous backfill is that the mixture composition contains just enough fluid as to produce a pumpable and flowable backfill suspension. The fluid should be saturated (with salt) for a geological repository in a salt host rock either by itself or through the presence of salts within the waste inventory to avoid any dissolution of the host rock.

It is common for binding agents to be added to viscous backfill in order to bind the major part of the fluid contained in the mixture. When certain waste materials have sufficient binding properties, such as fly ash from waste incineration, no additional binding agents are needed. It is conceivable that such a mixture, without additional binding agents, could be developed for the Chandler Facility due to the expected availability of fly ashes (NEPM code N150, see Table 2 in Appendix I). The experiences in Europe with such combustion residues show good binding properties for viscous backfill recipes and thereby minimise or even eliminate the need for additional binding agents from primary resources, i.e. cement (K-UTECH 2017). An overview of the viscous backfilling process is presented in Figure 3-21.

Although Figure 3-21 shows no fluid being drained from the emplaced backfill mixture, i.e. all fluid is bound within the backfill by the wastes with fluid binding properties, in practice some excess fluid can be expected on top of the backfill. This fluid might appear due to the minor settlement of solids within the backfill mixture after emplacement in the room. The excess fluid can be managed by simply letting it “dry out”, i.e. the fluid evaporates due to the constant mine ventilation air being led through the backfill storage rooms and the expected high temperatures of the Chandler Facility. As only water contained in the fluid evaporates, this process does not spread any contaminants in the mine’s ventilation system nor in the aboveground environment. Further details on the backfill preparation process, plant and related infrastructure is given in paragraph 2.1.3 in Appendix I.



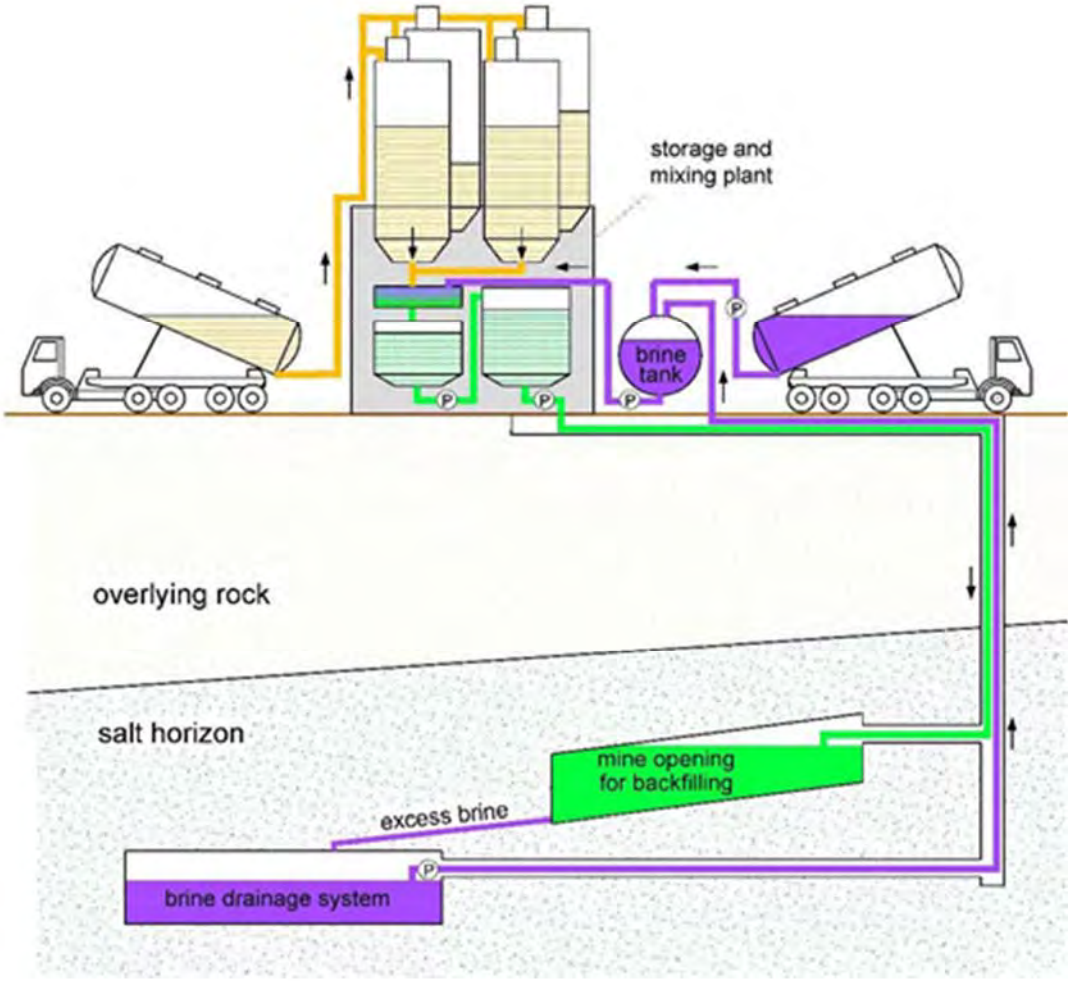
Note: "P" denotes a pump.

Figure 3-21 Process overview for viscous backfill

Flushing backfill

The flushing backfill contains more fluid than the viscous backfill and the fluid needs to be saturated for a geological repository in salt to avoid dissolution of the mine's host rock. The fluid is basically only used as a transport medium for the waste and drains from the emplaced backfill to be re-used again for the production of more flushing backfill mixture. Contrary to viscous backfill, the recipe for flushing backfill is less critical as setting/hardening of the mixture is not necessarily required.

Similar to viscous backfill, the actual mixture recipe(s) would constantly change reflecting the waste supply to the Chandler Facility over its lifetime. For the emplacement of flushing backfill, the particle size distribution is critical because the solid parts of the backfill mixture must settle in an appropriate timeframe so that the excess fluid can be drained. This drained fluid is collected and pumped back to the ground surface where it is used again to produce more flushing backfill mixture. A significant portion of the transport fluid is thus circulated and only the fluid volume remaining in the backfill body, i.e. which cannot be drained in a relevant timeframe, has to be added or "topped up" into the backfill mixture production process. The process overview for flushing backfill is presented in Figure 3-22.



Note: "P" denotes a pump.

Figure 3-22 Process overview for flushing backfill

Description of process, plant and infrastructure for hydraulic backfill

The process, plant and infrastructure required for viscous and flushing backfill are similar but not the same, i.e. an installation built for flushing backfill is unlikely to be suitable for the production of a viscous backfill without some modifications and additional equipment. The following information describes the process for the production of hydraulic backfill, commencing at the delivery of suitable waste materials at the proposed Chandler Facility.

Waste delivery and storage

Dry waste materials would be delivered in pneumatic tanker trucks, big-bags, or other modes of bulk transportation to the proposed Chandler Facility. They would be transferred to silos and/or bunkers by, for instance, pneumatic transport. In order to minimise the number of silos required, the waste materials would be grouped (through laboratory investigations prior to delivery of wastes to the Chandler Facility) and stored in silos combining certain waste types. From experiences in Germany it could be expected that between four and eight different materials groups, and corresponding silos/bunkers would be necessary to allow most backfill

mixtures to be produced. Apart from dry waste materials, one or more fluids, such as brines, could be used in the backfill mixture.

Hydraulic backfill production

Both viscous and flushing backfill would require a mixing unit, which would be fed via dosing units from the silos/bunkers to blend the backfill. A mixing unit could comprise a screw mixer feeding a mixing vessel with a high intensity agitator. Apart from mixing the dry components of a backfill mixture, the mixing unit would allow fluid to be added, thus forming a suspension. Due to the expected gas-formation potential of the waste materials once mixed with brine, e.g. due to the reaction of aluminium containing wastes with brine, a gas extraction infrastructure would be installed over the mixing unit. To aid further gas extraction and allow other chemical reactions to occur, a second agitated vessel would be fed from the mixing unit, the so-called homogenising vessel. Retention time in this vessel could be up to eight hours to sufficiently allow chemical reactions and/or de-gassing to occur which would be checked by a combination of sensors and laboratory proofing of samples taken from the mixture.

Pipeline transport of hydraulic backfill

After the backfill mixture has been homogenised and/or degassed it would be ready for transport to the storage and disposal rooms. The suspension would be pumped into a pipeline through the main vertical shaft in which gravity would be used for transport. The depth of the Chandler Facility (> 800 metres below ground level) would create a hydraulic head: backfill mixture gradient (approx. 0,16 bar/metre) times depth (approx. 850 metres) equals 136 bar static head.

Although some dynamic pressure loss would occur in the vertical shaft pipeline, the pipeline infrastructure would be laid out with a sufficient factor of safety and the corresponding pipeline pressure rating would be over 160 bars. This pressure rating largely determines the type and quality of the pipeline system to be used. In addition to the pressure requirements, the pipeline system would be resistant against abrasion and corrosion. In Europe, two-layer steel pipeline systems are often used in which the inner layer provides resistance against abrasion and thickness against corrosion while the outer layer ensures the pressure can be held regardless of the state of the inner layer.

The hydraulic head build up in the shaft pipeline would be used to “pump”, through its own pressure, the suspension through the mine’s (horizontal) roadways towards its final destination. Pressure reduction of the built-up hydraulic head would be performed by the dynamic friction loss within the horizontal pipelines in the mine. Careful design of the horizontal pipeline infrastructure would, therefore, be critical to tune the pipeline diameter to the friction properties of the backfill mixture. Apart from pressure reduction by dynamic friction losses in the pipeline, some form of additional pressure reduction may be necessary which could be a choke station and/or a choke valve. Once most of the hydraulic head is reduced the backfill mixture would be expelled from the pipeline into the mine storage or disposal room to be backfilled. Typical expel pressures would generally not surpass a few bars to minimise sonic emissions from the outflow.

Backfill emplacement and drainage

The process layouts for viscous compared to flushing backfill would differ significantly from this point onwards as the viscous backfill would remain completely in the mined rooms whilst the flushing backfill would need to be drained of the excess carrying fluid. The rooms designated for flushing backfill would, therefore, be equipped with a filter at its lowest point comprising, for example, sand and gravel combined with geotextiles or porous bricks. The filter would prevent waste materials from entering the drainage system and would allow a solid free drainage fluid to be collected within a roadway below the lowest point of the rooms to be backfilled.

The drained fluid would be centrally collected underground and pumped back to the ground surface to be re-used in the production of more flushing backfill. This would require a high-pressure pump to be installed underground to overcome the hydraulic head of the drainage fluid: Pressure gradient (approx. 0,12 bar/metre) times depth (approximately 850 metres) plus dynamic friction loss in vertical shaft pipeline equals > 120 bar required pump head. For this pressure, some type of piston pump would be best suited.

Auxiliary equipment and safety

The production of hydraulic backfill would be a batch process but the transport of the backfill mixture to the mine could be a semi-continuous operation when multiple homogenisation vessels are used in the surface plant. Regardless of continuous transport of backfill mixture to the mine, the need for a flushing and cleaning system of the overall plant and pipeline infrastructure exists and would be accounted for in the detailed design of the Proposal. This is of particular importance for viscous backfill as binding agents and/or wastes with binding properties might cause blockage/scaling of the vessels and pipelines when flushing is not performed regularly.

The flushing system could also comprise so-called “pigging” stations from which a pig (a foam ball or rubber plug) is send through the pipeline system from the surface plant to the storage or disposal room. Pigs could either be caught in a receiver station down in the mine or simply be expelled in the mine room to be backfilled and left there. Considering the average lifetime of a foam or rubber pig, the latter method would likely be most efficient.

Other auxiliary equipment required for hydraulic backfill would comprise the overall monitoring and control of the process. Pressure sensors, flow sensors, gas monitoring in the plant and in the storage or disposal rooms to be backfilled would be required to operate an efficient and safe hydraulic backfill process. Concerning gas monitoring in the mine rooms, it could not be ruled out that some gas formation would continue within the emplaced backfill. It would be important to allow for this in the design of the mine’s ventilation system and to limit the access to rooms being backfilled as gasses could potentially be flammable (hydrogen) and/or toxic (ammonia). In Europe, this is not considered a real challenge as ample experience with, gas monitoring, restricted access, etc. has been gained.

Mine room layout

The general layout of the mine rooms designated to be hydraulically backfilled is shown in Figure 3-23 and Figure 3-24. Rooms should be designed, planned and constructed in a way that a gradient is included to ease the filling of the rooms and maximise the emplaced quantity of hydraulic backfill.

The rooms designed for viscous backfill are best constructed using a single entrance from the highest level to avoid the need for a dam at the lower end of the room to hold the backfill in place during emplacement. For flushing backfill the rooms are also best constructed from a single entrance however they should be connected, e.g. through one or more borehole, with a fluid collection system in a second roadway below the lowest level of the rooms. As stated earlier these room are also equipped with a filter to avoid waste materials to enter the drainage system.

Types of wastes suitable for hydraulic backfill

Independently of the type of backfill used, i.e. flushing or viscous backfill, only detailed laboratory work, prior to and during the operation of the Chandler Facility, could determine the suitability of any waste type for hydraulic backfill and the specific backfill mixture recipe. Over time, the backfill mixture recipe would also likely change following changes in the supply of waste types for storage at the proposed Chandler Facility. In addition, it is very likely that multiple recipes would be used in parallel to maximise the quantities of wastes being backfilled hydraulically at the Chandler Facility.

Both viscous and flushing backfill would have similar requirements for the waste materials regarding their particle size, but in a viscous backfill smaller particles could be processed as settlement of the mixture in the mined rooms is not envisaged. Very fine particle sizes could not be processed in a flushing backfill because the settlement requirements set a limit, i.e. particle sizes must be large enough to allow settlement of particles within a timeframe relevant for the operation of the proposed Chandler Facility. The maximum waste particle size for both viscous and flushing backfill types would be limited due to blockage risks and flow properties in mixing/reaction vessels and pipelines. Furthermore, abrasion would be taken into account during selection of waste types for hydraulic backfill as the backfill mixture transport would take place in pipelines in a turbulent hydraulic regime.

In general, most waste materials which could be collected (at their source), transported, unloaded and stored as a bulk material and fulfil the particle size distribution criteria could be emplaced using the hydraulic backfilling method. Restrictions on the type of waste materials suitable for hydraulic backfill would most likely be chemical, i.e. their reaction behaviour in combination with other waste materials and/or brine. In addition, physical phenomena might exclude a waste from being suitable, e.g. hydrophobic behaviour, which would lead to separation of particles in the mixing and transport infrastructure as well as in the room to be backfilled.

Waste materials which do not fulfil the particle size distribution criteria could be made suitable by particle size reduction. This would, however, necessitate an additional process step prior to intermediate storage in silos/bunkers. Since particle size reduction would be an energy intensive process, a case-by-case weighing of advantages, cost and disadvantages (e.g. dust hazard) would be undertaken for each waste type supplied to the proposed Chandler Facility.

Based on the preliminary inventory of wastes available for long-term storage at the proposed Chandler Facility, a preliminary assessment of their suitability for hydraulic backfill was undertaken (refer to Appendix I). The results of this assessment are presented in Table 3-16.

Table 3-16 Waste types and examples potentially suitable for hydraulic backfill

NEPM code	Waste description	Waste examples
N205	Residues from industrial waste treatment/ disposal operations	Spent activated carbon
		Ion-exchange column residues
		Industrial waste treatment sludges and residues
		Residues from pollution control operations
		Includes sewerage sludge & residues (including biosolids, where contaminated with substances contained in this list above guideline levels
N120	Soils contaminated with a controlled waste	Soils contaminated with residues of substances contained in this list
		Dredging spoil similarly contaminated
N150	Fly ash	Fly ash from coal combustion
		Fly ash from incineration or EfW processes
D220	Lead, lead compound	Leaded glass (CRT glass, small particles & glass dust)
		Grit blast waste
		Lead and zinc refining slags
		Mine tailings
		Baghouse dust
C100	Basic solutions or bases in solid form	Wastes with pH > 10
		Wastes from cleaning fuels with bases
		Ammonium hydroxide
		Calcium hydroxide
		Sodium hydroxide, potassium hydroxide
		Pickling bases
		Red mud from alumina refining
D110	Inorganic fluorine compounds excluding calcium fluoride	Spent Pot Liner (SPL) waste from aluminium smelting
		Simple fluoride salts such as sodium fluoride and potassium fluoride
D230	Zinc compounds	Zinc ash/dust

NEPM code	Waste description	Waste examples
		Galvaniser's ash
		Smelting slag
		Spent filter cartridges (from electroplating/ galvanising)
D300	Non-toxic salts	**Coal seam gas industry brine and salt wastes**
		Aluminium dross
		Aluminium industry salt slag
		Simple inorganic chlorides
B100	Acidic solutions or acids in solid form	**Waste acids**
		Pickle liquors (acids)

Note: Colour coding is as follows:

Principally suited for hydraulic backfill without pre-treatment.

Possibly suited for hydraulic backfill after pre-treatment (e.g. particle size reduction).

Transport and emplacement of waste materials using hydraulic backfill

For both types of hydraulic backfill, the advantages over dry/containerised wastes would be very similar and mainly connected to the ease of handling, transport and emplacement in the underground mined rooms.

Following the path of the waste from the source to the final deposition in the storage or disposal rooms, the advantages of hydraulic backfill would be as follows:

- Waste materials could be collected at the source as bulk material – packing and/or containerising would not be necessary and even undesirable (e.g. unpacking of waste materials at the disposal site could be labour intensive, could impose the need for additional process steps and would thereby be costly and introduce potential additional worker exposure during chemical waste handling).
- The transport of waste materials as a bulk material could be performed in a clean and contained manner when using the right loading, hauling and unloading equipment. For powder waste materials (ashes, salts, etc.) the loading, hauling and unloading could be done by pneumatic systems whereby interaction with humans and the environment would be principally absent. Liquid waste materials could be pumped into tankers and unloaded at the disposal site into tanks, i.e. also fully contained. Coarser materials such as slags and filter cakes could be loaded and hauled in (covered) dump trucks/trains, however, would require, after unloading and possibly intermediate storage, a size reduction step before application in a hydraulic backfill is possible.

- The different waste materials to be used in a hydraulic backfill mixture could be temporarily stored at the disposal site in tanks, silos/bunkers or (covered) areas until they are mixed into a hydraulic backfill. The size of this temporary storage would differ between a viscous and flushing backfill operation as the viscous backfill is based on a specific and stringent recipe whilst the flushing backfill has a more flexible recipe. This means that the different waste materials could be mixed into a flushing backfill more quickly decreasing the size of intermediate storage at the disposal site. Since the recipe of the viscous backfill is usually rather stringent, more intermediate storage would be needed to allow for the supply of waste materials to meet the recipe(s). Most wastes could be stored fully contained in silos or tanks thereby eliminating impact on humans and the environment.
- Once the waste materials are required in a hydraulic backfill mixture they could be taken from their respective silos/bunkers and/or tanks and transported to the backfill production facility by pneumatic or pipeline transport, again fully contained, thus clean, efficient and safe.
- After production of the backfill mixture, it could be transported through pipelines to the storage or disposal rooms in the mine:
    - For a flushing backfill the shaft pipeline itself would act as a "pump" as the gravitational force on the mixture builds pressure in the vertical shaft pipeline eliminating the need for significant pump effort to transport the mixture from the shaft to the underground rooms. Drainage fluid being re-circulated in this case would need to be pumped to the ground surface requiring energy.
    - The consistency of viscous backfill would be such that gravity alone most likely would not suffice for transport to the storage and disposal rooms and a pump would be needed. On the other hand, no drainage fluid would need to be pumped to the surface making the total pump effort comparable with the flushing backfill.
    - Transport of dry/containerised waste would require heavy plant to drive down and then back up the mine access decline or use the vertical shaft. The energetic efficiency of transport by heavy equipment/vehicles is generally considered to be significantly lower than pipeline transport, compare long distance transport of oil and gas.

Emissions from hydraulic backfill

As described above, the transport of the wastes used in a hydraulic backfill mixture could be performed in a relatively contained manner and, thereby, would be efficient and clean. Using the proper techniques and equipment, a safe, emission-free and energy efficient transport, storage and production process could be designed. However, considering emissions, the following should be noted for the storage and transport of wastes within the overall process of production, transport and emplacement of hydraulic backfill:

- Storage and transport of dry wastes would require fit for purpose design of (pneumatic) equipment such as compressors, silos and pipelines. Important themes during the design of

this equipment would be material choice (abrasion), moisture control (compressed air must be dry to avoid clumping) and filters (waste powders should not enter the atmosphere through inadequate solids/air separation). Furthermore, all equipment would require regular maintenance to ensure a sustained emission-free storage and transport process.

- Storage and transport of liquid wastes and/or brines would require fit for purpose design of equipment such as pumps, tanks and pipelines. Important themes for the design of this equipment would be material choice (abrasion and corrosion) and pressure class (blockage could lead to high pressures in e.g. pipeline and tanks). Again, a rigorous maintenance schedule would eliminate unplanned and desired emissions.
- Handling of coarse wastes such as slags and filter cakes would require size reduction, i.e. crushing and/or milling, as an additional process step before they can be used in hydraulic backfill. This size reduction step could be a source for emissions: in the case of wet crushing/milling (using brine) gas emissions could occur if the wastes contain aluminium and in the case of dry crushing/milling dust control would be necessary. Proper design of the crushing/milling equipment would mitigate emissions and eliminate environmental impact.

Apart from transport, hydraulic backfill would be produced in a mixing plant where dry and liquid wastes are mixed (with brine) to a specific recipe and to a predetermined density. Considering emissions during the mixing phase of the process, the following should be noted:

- Hydrogen could be formed during mixing of wastes containing aluminium resulting from the reaction of aluminium with water (brine). Hydrogen is not per se a toxic or harmful gas for the environment but is flammable and explosive under the right conditions. The air above the mixing tank would need to be extracted and the corresponding electric equipment would need to be ATEX certified.
- During mixing of viscous hydraulic backfill where the pH could not be kept near 7 (generally recipes for viscous backfills create a pH of around 10 to 11) ammonia gas could form as a result from the reaction of flue-gas-cleansing-salts (cleansing flue gas from in particular NO_x). Ammonia is a harmful gas and the concentration of ammonia in the air expelled to the atmosphere would need to be controlled by either a scrubber (removing the ammonia) or by dilution with large quantities of clean air. Similar reactions could take place when wastes contain, for instance, phosphorus (phosphine) or arsenic (arsine).
- In order to avoid large quantities of gas being formed underground after the hydraulic backfill has been deposited in the storage and disposal rooms, the backfill mixture would need to be conditioned in a homogenisation tank for up to eight hours. During this time, most of the gas forming reactions would have completed and gas formation diminishes.
- It is likely that some gas formation would continue after deposition in the storage and disposal rooms. The layout of the rooms and the mine ventilation system would need to be designed to accommodate the proper extraction and dilution of any gases formed underground. Rooms in which hydraulic backfill is deposited would also need to be classified for some time as ATEX zones and continuous multi-gas monitoring would need to take place.



- Some gas formation from the emplaced hydraulic wastes in the storage and disposal rooms would be normal and could be managed safely by:
    - Monitoring of gas formation during backfill preparation.
    - Adjusting retaining time in the homogenisation tank accordingly.
    - Ample ventilation of the waste emplacement rooms in the mine.
- Underground waste storage facilities in Germany have shown that gas formation can be managed safely on a routine basis without forming a hazard to workers, the environment, the mine's stability or jeopardising the long-term isolation of wastes from the biosphere.

Risks associated with backfill composition

The composition of hydraulic backfill would be crucially important for viscous backfill but far less critical for flushing backfill. The reasons for this are as follows:

- For flushing backfill, the brine with which the wastes are mixed, would merely be used as a transport medium and the actual mixture could constantly change reflecting the actual waste supply. Thus, for flushing backfill the emplacement of the waste materials in the rooms and concurrent drainage of the brine would constitute a semi-solid backfill body in the rooms being backfilled. This means that the strength of the backfill, after emplacement, would not rely on chemical (binding) reactions to occur per-se. Strength would mainly be developed by the deposition and subsequent consolidation of particles in the flushing backfill within the storage and disposal rooms. Some strength could develop from chemical binding and crystallisation as well, similar to viscous backfill (see next item in this list). Therefore, real risks associated with the backfill mixture not reaching the required composition would not be expected. Care should, however, be taken that the particle size distribution of the backfill mixture is such that sedimentation of the solids in the backfill mixture within the rooms in the mine could take place within a relevant time scale. To illustrate, when all the solid particles in a flushing backfill mixture are fine silt or clay sized, the sedimentation may take years (decades) and the drainage would thus take a very long time. As a result, large quantities of free liquid (brine) could remain in the mine post-closure which is undesirable from a long-term safety point-of- view.
- For viscous backfill, the risks associated with the backfill mixture not reaching the required composition would be more significant because the fluid, i.e. brine added to the dry waste materials would not merely be a transport medium but also a chemical reactant enabling the backfill mixture to set (harden) similar to the setting of a cement mixture. As with the setting of a cement mixture, when the mixture does not have the correct composition, the viscous backfill may either set too quickly, resulting in e.g. clogged pipelines, or not set at all resulting in the mine openings to be filled with a liquid mass instead of a solid mass. This risk could be considerable when thinking of the possible variations of wastes' compositions. Thorough analysis of incoming wastes would be necessary to sufficiently and effectively reduce this risk.

- Despite the risks described in the previous two bullet-points the risks associated with the hydraulic backfill mixture not reaching the required composition (e.g. excess fluid in viscous backfill) could be fully mitigated by the overall design and construction of the storage and disposal rooms within the proposed Chandler Facility. This risk could be avoided by certifying the following:
    - The rooms of the mine would be designed such that their stability is not dependent on the hydraulic backfill properties after deposition in the rooms. In other words, no load carrying capacity could be assigned to the backfill for at least the operational period of the facility.
    - The mine layout and ventilation design would be such that it allows any gas formed in the mine to be properly diluted, extracted and expelled into the atmosphere taking into account gas concentrations and absolute gas quantities. When the latter are considered too great, the residence period in the homogenisation tank should be lengthened.
    - The rooms could be closed-off after being filled with the backfill mixture in such a manner that no fluids could escape from the rooms during or after the operation of the facility. The room seals could be designed and constructed in such a way that the convergence of the salt would neither be hampered by the seal nor the seal integrity deteriorates due to the convergence. In Germany, significant experience with seals. As examples, the extensive research and practical implementation of drift seals in the salt mines of Sondershausen and Teutschenthal are relevant.
    - The (vertical) position of the mine within the strata (horizons) could be chosen such that any fluids contained in the rooms post-closure could not enter the biosphere. Good practice would be to allow for sufficient salt roof thickness to contain any fluids being pressed out of the room as a result of creep, i.e. room convergence.

Considerations associated with groundwater contamination due to backfilling and possible preventative steps

The contamination of groundwater, irrespectively in which stratum, would be primarily prevented by the design of the proposed Chandler Facility, i.e. the position of the mining horizon within the geology. It is stated in German Law that the saline host rock functions as the only barrier rock and the long-term safety documentation in principle has to be provided for the saline rock as a barrier rock. Additional geological barriers may provide extra safety; however, they are not mandatory. The aim of the facility should be to completely and permanently seal the wastes from the biosphere and all requirements on wastes, mined voids, geotechnical barriers and all other technical devices and/or operational measures are geared towards that objective.

For the use of hydraulic backfill as a transport and emplacement method for the long-term storage of waste materials this means that the facility's design should fulfil this premise regardless of the composition of the backfill itself while considering the following requirements:

- Hydraulic backfill must not impair the barrier function of the host rock by e.g. dissolution.



- Gas formation or other chemical reactions should not diminish the long-term safety of the facility.

When the composition of hydraulic backfill fulfils these requirements and, in combination with a proper design of the facility that can pass the long-term safety evaluation for dry wastes, this evaluation will also be valid for hydraulically backfilled wastes achieving complete and permanent isolation from the biosphere, i.e. no contamination to any groundwater.

How does hydraulic backfill ensure a low permeability seal to prevent leakage of liquid waste material from the salt cavern?

The hydraulic transport and emplacement of waste materials itself does not in itself ensure a low permeability seal preventing leakage of liquid waste material. The complete and permanent isolation of waste materials, regardless if they are solid or liquid, must be ensured by the design and construction of the proposed Chandler Facility.

The hydraulic emplacement of wastes, and in particular, the setting of hydraulically emplaced waste would not necessarily have a negative effect on the facility's seals. On the contrary, it could even be beneficial to the complete and permanent isolation of waste materials from the biosphere because:

- Through nearly complete filling of the rooms (better void utilisation than packaged waste backfilling), convergence and consequent strain in the host rock mass would be reduced. The potential for development of cracks or connected porosity that could form a pathway for fluids, would thereby be minimised.
- The majority of fluid contained in the hydraulic backfill would either largely be drained or chemically bound.
- The permeability of the backfill mass after emplacement in the mined rooms would usually be very low thereby physically containing any fluids.
- The backfill mass could potentially have significant geotechnical strength whereby it could resist the salt's convergence and thus avoid pressing out of fluids containing contaminations such as heavy metals.
- Since fluids contained in the backfill should be saturated for a geological repository in a salt host rock, they would be unable to dissolve the host rock and therefore the development of hydraulic pathways through the saline host rock, by dissolution, would be avoided.

In order for any wastes and/or fluids which have been hydraulically emplaced in the storage and disposal rooms to permanently stay in these rooms, the rooms would need to be closed off from the rest of the facility by dams (seals). The construction and material choice for these dams would be instrumental in the isolation of the hydraulically emplaced wastes.

Dam design and construction should, therefore, be well thought through and performed by specialists. After the operational period of the facility the accesses, i.e. vertical shafts and mine access decline, should be properly sealed to further ensure the complete and permanent isolation of wastes from the biosphere.

Lessons learnt from other jurisdictions (e.g. Europe and the United States)

Lessons learnt regarding long-term waste storage in the United Stated of America have been primarily gained during the development and operation of the Waste Isolation Pilot Plant (WIPP) in New Mexico. The WIPP however has been developed for the storage of mainly radioactive wastes, and whilst the lessons learnt during the development of this facility can be useful for the Proposal, they will not surpass lessons learnt in the European underground waste storage and disposal industry.

Some general lessons taken from the operation of European underground waste storage facilities are:

- If possible try to designate a single regulator to oversee and coordinate all other regulators to ensure efficiency, avoid duplication and create a clear and transparent authority and responsibility framework. The most eligible regulator in Europe is usually the mining authority as they will have significant in-house expertise with regards to the critical aspects of underground storage such as geology, geotechnical stability and risk assessment methodologies suitable for assessing and proving long-term safety.
- Gain sufficient real-life experience within the planned facility, through the (initial) development of gateways, drifts and rooms, before actual waste emplacement takes place. Proper exploration followed by analytical calculations and numerical simulations can yield tremendous insights in the mechanisms responsible for impairing the barrier function of the salt rock. Subsequent actual physical development of the facility, combined with in-situ testing, can confirm the assumptions used in the project's earlier development phases to further improve an already well supported safety case.
- Separate responsibilities such as the facility's operation, its regulatory oversight and the (scientific) review of safety supporting documentation to sustain a transparent decision-making structure before, during and after operation of the facility.
- Cooperate internationally and exchange information with specialists, operators and regulators in other countries operating underground waste storage facilities such as the United Kingdom, Germany and France.
- Involve the general public in the early stages of a project in order to "educate" and enable incorporation of public feedback in the overall safety case.

The lessons learnt regarding long-term waste storage in underground storage facilities in Europe, has been largely incorporated into European Directives and respective Member State Law. German law contains a very detailed description of all aspects concerning the safe and efficient long-term storage of wastes. A summary is presented of the relevant themes from German experiences.

Site specific safety assessment

The acceptance criteria for underground storage can only be derived by referring to local conditions, i.e. by assessing the risks related to containment accounting for the overall system of wastes



emplaced, engineered structures, mined voids and the host rock for the actual planned site. The risk assessment should identify the following, pertaining to the actual site of the planned facility:

- The hazard, i.e. the emplaced wastes including e.g. their potential behaviour over time, interaction with the host rock and interaction with each other.
- The impact of wastes or their derivatives when they may reach the biosphere.
- The receptors within the biosphere that may be influenced by the wastes or their derivatives.
- The pathways through which the wastes or their derivatives can reach the biosphere.

Baseline information

The assessment process should be initiated by collecting the baseline information required in all subsequent phases. In order to properly build the supporting baseline information database, baseline data collection should be based on the actual site, including the foreseen mine layout. Baseline information to be gathered includes the following:

- **Geological conditions**: barriers, exploration data, resource estimations, host rock structure, tectonic history and strain, historic and present seismic data etc.
- **Mine layout details**: dimensions, depth, gateway cross-sections, ramps, slopes, (blind-) shafts, levels and sub-levels, cause, origin and composition of expected influxes, presence of hydrocarbons, safety pillars, existing drillings, etc.
- **Hydrological conditions**: stratigraphy, petrography, storage potential of host rock, neighbouring rocks and overburden, aquifers, aquitards, aquicludes, permeabilities, pore fluid composition, salinity, utilisation of groundwater, surface water, etc.
- **Waste emplacement**: waste types, emplacement methods, geotechnical behaviour of emplaced wastes, solubility behaviour, gas generation, host rock interaction, etc.

Overall safety concept

Using all the information collected during the baseline information gathering, an overall safety concept should be developed before a final risk assessment is prepared. This concept should yield a first opinion on whether complete and permanent isolation of wastes can be achieved and sustained over the long-term while considering the site-specific conditions. The development of an overall safety concept will show the necessity for additional and/or complementary research into baseline information.

Safety assessment components

Based on the baseline information and the overall safety concept, the final risk assessment would include the following components:

- Geological assessment (local, regional) (refer to Section 3.2.1).
- Geo-technical/geo-mechanical assessments (testing/analytical/numerical/validation) (refer to Appendix K).
- Hydrological assessment (numerical/validation/monitoring for groundwater and pore fluids) (refer to Chapter 8 and Appendix R).
- Geochemical assessment (groundwater quality, waste – host rock interaction) (refer to Chapter 8 and Appendix P).
- Biosphere impact assessment (identification and evaluation of receptors) (refer to baseline assessment in Chapters 7 to 17).
- Assessment of risks related to or present during the operational phase (refer to Chapter 6 and Chapters 7 to 18).
- Assessment of long-term risks (refer to Chapters 7 to 18).
- Assessment of risks related to the surface facilities at the planned site (refer to Chapter 6 and Chapters 7 to 18).
- Assessment of other risks (mining/waste emplacement and their strict separation) (refer to Appendix C).

The geo-mechanical/geo-technical assessment forms the basis for any successful safety concept (refer to Appendix K for more information on the geo-technical properties of the salt horizon to be used for permanent waste isolation).

German law on underground waste disposal/storage states that if the mechanical stability of the host rock is sufficiently proven, by testing and modelling, under any current or future circumstances, thereby proving complete and permanent isolation of the wastes from the biosphere, further assessments of the eventual dispersing of contaminants through the overburden is not mandatory.

Geo-mechanical/geo-technical (stability) assessment

The requirements with regards to the facility's stability which should ensure complete and permanent isolation of wastes from the biosphere are:

1. No deformations of the rooms and ground surface are to be expected, during and after operation of the mine, which could impair the mine's functional capacity, i.e. the ability to:
    a. extract salt and;
    b. seal the wastes from the biosphere.
2. The bearing capacity of the host rock (salt) should sufficiently prevent collapse of the mined rooms that could have a negative effect on the long-term safety of the waste storage facility.

3. The stored wastes should contribute to the mine's stability in the long-term.

4. After closure of the mine the host rock's ability to creep, which is a particular property of salt, has to provide full enclosure of the wastes.

During the (continuous) assessment, the following subjects should be sufficiently elaborated over the course of several phases before and during operation of the facility:

- Relevance of geological/tectonic and hydrological information to the expected mechanical situation in the underground facility.
- Dimensioning of the mine voids preferably supported by experiences from initial mine development and/or in-situ testing.
- Comprehensive analysis of expected mechanical behaviour of the rock mass (host rock, overburden) and emplaced waste materials based on laboratory experiments and numerical prognoses. The numerical models to be developed and maintained/improved during the operation of the facility should focus on the stability and convergence of the mined voids, consequent surface subsidence and the long-term effectiveness of the geological barriers, i.e. through a coupled hydro-mechanical assessment.
- Explanation of potential hazards to geo-mechanical stability arising from numerical prognoses and design of mitigating measures to minimise or eliminate their impact on long-term safety.
- Design of a permanent monitoring system to prove mechanical stability and assess long-term safety and integrity of the host rock. Data yielded by the system can be used for the continuous improvement of the arithmetical proof of long-term safety of the facility.
- In-situ measurements of the stress state during the facility's development and when considered relevant in-situ measurement of permeabilities.
- Development of stability and integrity enhancing measures to be applied during and after operation of the facility.

Proof of long-term safety

Using the baseline information collected, the safety concept and the several different assessments performed, in particular the geo-mechanical/geo-technical assessment, proof of long-term safety can be established. This comprehensive and all-embracing long-term safety analysis of the complete waste/underground construction/host rock system should comprise the following individual systems and evaluate them on the basis of the multiple barrier system:

- Assessment of natural barriers (halite and aquatards).
- Assessment of impacts on natural barriers caused by human intervention (e.g. shafts).
- Assessment of technical barriers.



- Assessment of events that might impair the complete and permanent isolation of the wastes and cause mobilisation of contaminants (natural events and human induced events) (refer to Appendix H to understand what levels of assessment have already been undertaken).
- Comprehensive evaluation of the complete system accounting for all safety-relevant aspects.

Arrange waste into compatible zones

Once waste is accepted and moved underground, waste would be organised according to a strict zoning scheme (refer to the WZG in Appendix C). The zoning scheme would ensure:

- Separation of waste with incompatible hazardous characteristics.
- Separation of acidic and alkaline wastes.
- Separation of waste with other potentially reactive properties.

Waste in containers would be unloaded and arranged in double-barrier containers such as double-lined bulk bags or PVC bags stored within barrels. Bulk bags placed in an excavated room are depicted in Figure 3-25. Hydraulic backfill would be pumped directly as depicted in Plate 3-5.

Waste storage, disposal and permanent isolation rooms

The emplacement room dimensions have been determined based on the geotechnical requirements with consideration of waste package emplacement requirements. An optimal emplacement room length of 250 metres was selected by considering the following factors:

- Health and safety considerations, i.e., egress time from rooms,
- Geotechnical considerations.
- Capital cost.
- Operating cost.

Backfilling and room closure

As discussed above, once a decision has been taken to permanently isolate waste, fine salt would be placed around the waste packages using a salt backfill sprayer (snow blower-type machine) to fill any voids present (refer to Plate 3-6). After loose salt backfilling has been completed an engineered seal or wall would be constructed at the entrance to the disposal room to permanently isolate the waste. The salt would deform over time and fill remaining gaps between the waste containers in a process known as salt creep (refer to Figure 3-23). A schematic showing the proposed sealing strategy is shown in Figure 3-24.

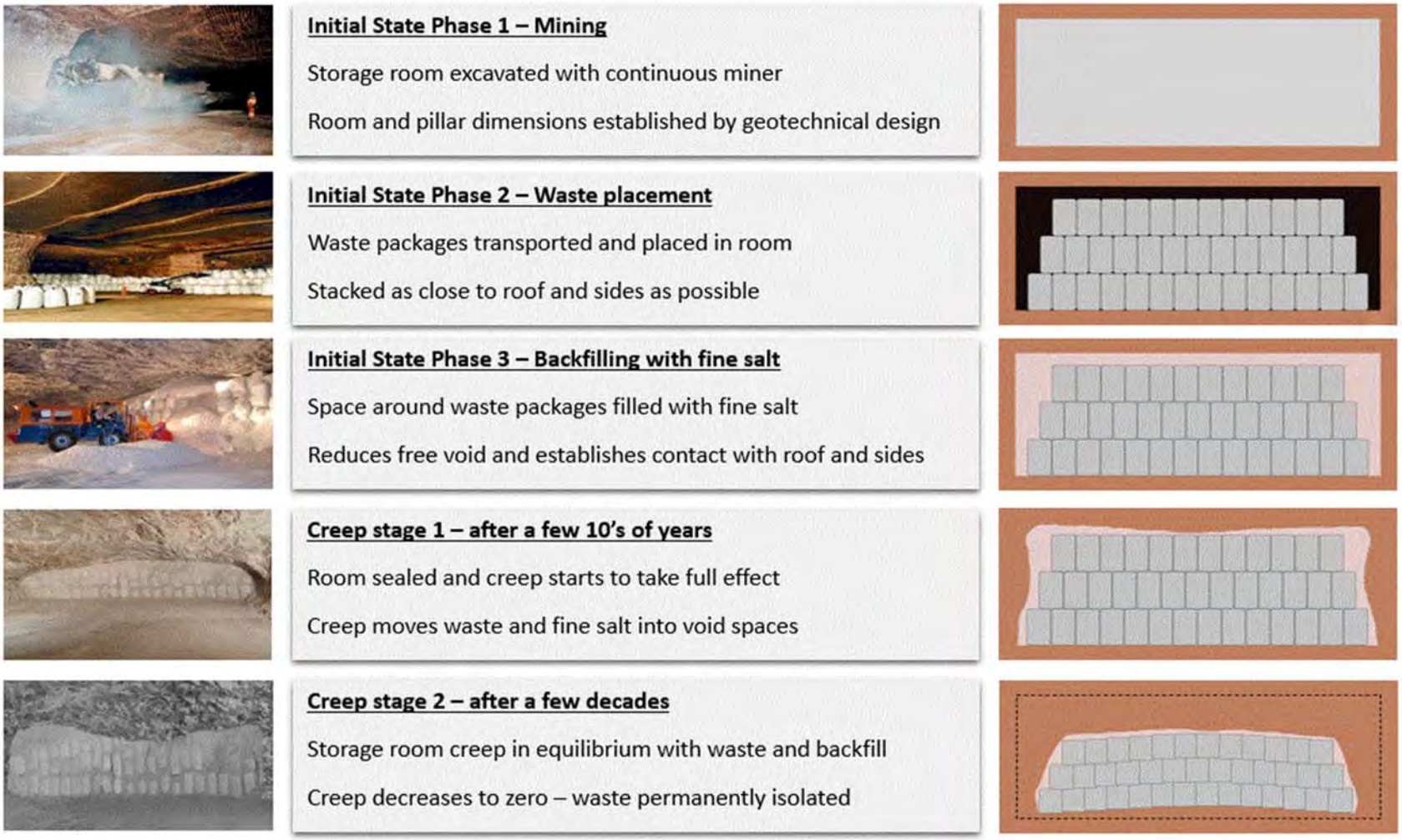


Figure 3-23 Salt creep in excavated room

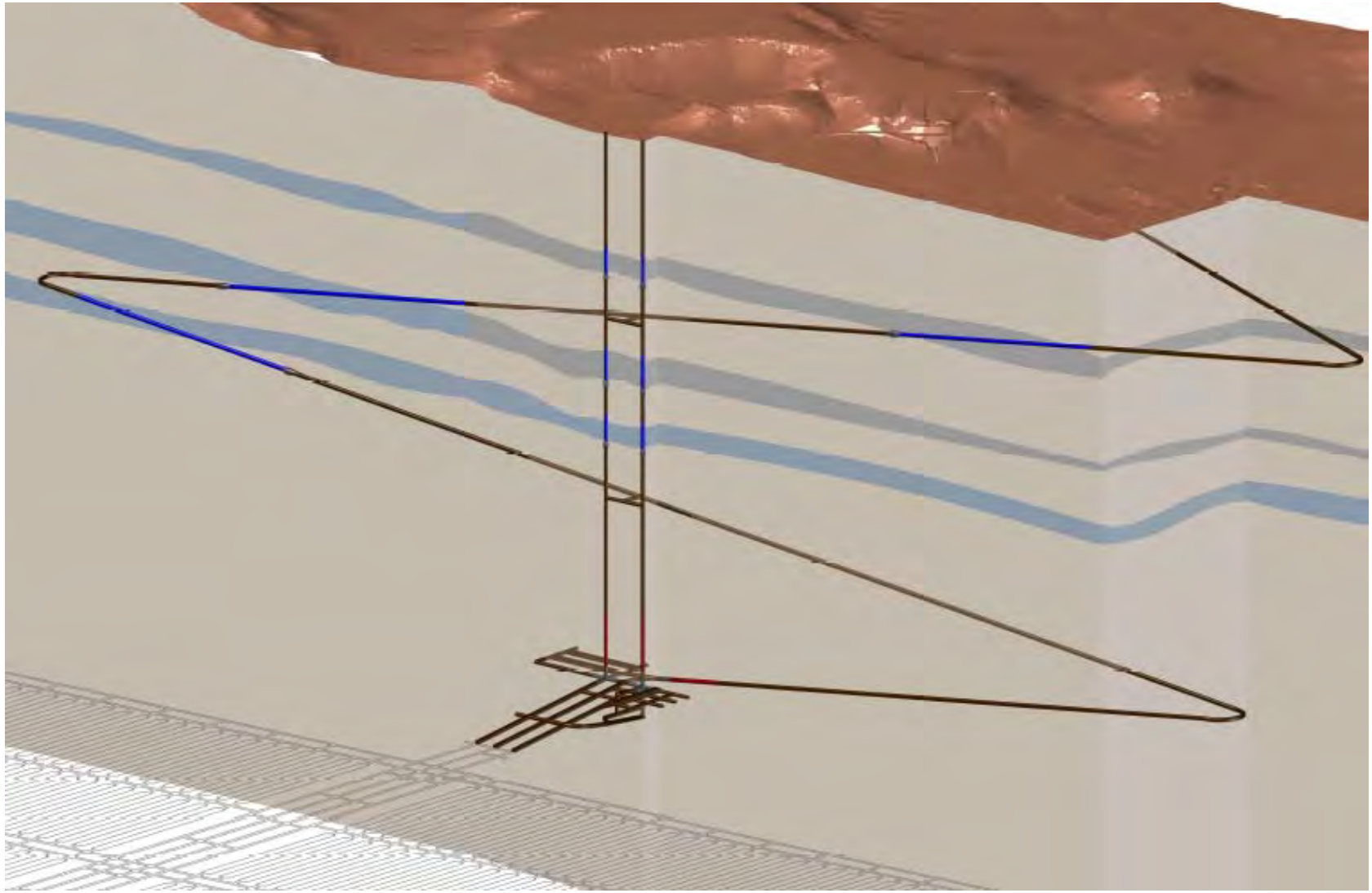


Figure 3-24 Schematic of proposed sealing strategy

Return of containers to surface

Unloaded ISO 20-foot shipping containers would be returned to the surface via the mine access decline. These containers would be stored at the surface to dispatch product salt, as required (refer to Section 3.5.4).

Containers would be visually inspected for damage and signs of contamination. Where contamination is identified the container would be cleaned using an appropriate technique. This would likely be carried out by simple sweeping out to collect any dry materials identified followed by washing or steam cleaning. Workers undertaking this operation would be equipped with appropriate personal protective equipment.

Any wash out would be carried out on a suitable pad with collecting sump to avoid any loss of contaminated water to the environment. The collecting sump would be monitored and excess water removed for appropriate disposal. Depending on the destination and use of the salt to be dispatched, the container may be fitted with an inner disposable lining for bulk transport as bagged salt would already be suitably protected from contact with the container inner surface.

3.6.6 Traffic and transportation

Heavy and light vehicle movements would be generated by salt and waste operations at the proposed Chandler Facility. These operations would not generate large volumes of traffic on the external road network. Salt exports and inbound waste would be transported primarily via the Central Australian Railway (although waste would be able to be received via road at the proposed Apirnta Facility). Between the Apirnta Facility and the Chandler Facility, salt and waste would be transported via the proposed Chandler Haul Road.

The movement of the workforce, equipment, materials, waste, utilities and services would also generate a number of heavy and light vehicle movements during operation of the proposed Chandler Facility. The main routes for these vehicle movements would be the Stuart Highway and Maryvale Road.

Workers who fly-in-fly-out from Alice Springs would utilise commercial services to Alice Springs Airport from the proposed Chandler Facility. It is anticipated that workers would be transported by coach on a weekly basis, staying the proposed accommodation village located to the north of the Chandler Facility.

Materials required for operation would be delivered as required via the Maryvale Road in the initial years of operation. During operation, materials would be delivered to site via the Henbury Access Road. Vehicle movements would not be significant given that the more voluminous materials required would be sourced on-site, for example, water from the proposed borefield, and fill from the mine access decline and vertical shafts or from borrow pits located along Maryvale Road and along the proposed alignments of the proposed Chandler Haul Road and Henbury Access Road.

Waste generated during operation would require periodic collection by appropriately licensed waste contractors. Vehicle movements associated with waste collection would not be significant and would likely occur on a weekly basis. Traffic and transportation impacts and mitigation (including the implementation of a Traffic Management Plan) are discussed further in Chapter 18.

3.6.7 Communications

Communications systems

The communications system includes infrastructure required for both aboveground and underground components including:

- Telephones.
- Wireless radios.
- Business network.
- Process control network.

The communications infrastructure would likely be a fibre optic network with cable supplied in the main shaft. This equipment would be used for local switching and as an overall link to the main network.

Ethernet-based telephone (i.e. Voice over Internet Protocol (VoIP)) technology would be used for both aboveground and underground telephone service. It would be connected via fibre optic link, for access to external lines and the mine infrastructure area internal phone network. Hard-wired emergency phones would be installed at the aboveground main control room, at the main shaft and secondary ventilation shaft stations, and at each underground refuge station.

The emergency phone system would be connected by twisted pair cable which would be installed in a ring between each phone. These phones would be for emergency communications in the event of failure of the other voice communications systems (VoIP phones and radio) and because the system would use separate and isolated infrastructure, it would provide additional redundancy to emergency communications and would not be affected by loss of electrical power.

Wireless voice coverage would be provided for the underground repository, main and secondary ventilation shafts, and the aboveground main control room using “leaky feeder” technology. Leaky feeder is a simple and robust analogue system that, for example, utilises a coaxial antenna cable. This cable would be hung throughout the underground tunnels using hangers and can easily be removed from emplacement rooms as they are filled with waste.

A separate channel would be provided for in-shaft work, as this would be required to ensure uninterrupted communications between shaft workers and the hoist control operator, particularly during maintenance and shaft inspections.

Although alerts of fire or other emergency conditions would be made via the radio system, the primary system of notification to the underground would be via another system, for example a stench gas system.

The leaky feeder radio system would also be used to carry monitoring signals from remotely installed instrumentation. The leaky feeder would carry cable modem terminal services connectivity to support ethernet data communications requirements in remote areas of the underground installation.

The business network would provide access for business computers to e-mail, internet and other network services at all appropriate locations both aboveground and underground. The process control network would carry all signals for monitoring and controlling systems at the mine infrastructure area both aboveground and underground. This network would be provided in key locations where connectivity between instrument and equipment is required. Main process network switches would be installed in the main control room.

Control and monitoring systems

Mine infrastructure area operators would be able to view custom-configured control screens that display equipment and system status and allow inputs to be executed through a mouse/keyboard interface. The operator could also monitor key areas through the use of closed circuit video monitors.

In the off-shift hours, selected main control room functions would be transferred to the underground control room, which would be continually staffed, allowing an operator to monitor underground operations and respond to any alarms.

Shaft hoisting operations would be controlled from the respective control terminals. Hoisting operations could be automated or controlled manually. A certified hoist operator would be on-site at all times that the hoist is in operation.

The following underground equipment would be monitored and controlled from the main control room:

- Sump and dewatering pumps.
- Power distribution facilities including motor starters and some switchgear.
- Ventilation fans and refrigeration units.

The following equipment would only be monitored in the main control room because this equipment either would not require control or would be controlled locally:

- Fire detection and suppression systems.
- Uninterruptible power supplies (status monitoring).
- Water quality monitoring, as required.

- Air quality monitoring, as required.
- Ground support monitoring, as required.
- Hoist system monitoring.

The fire detection and suppression system would report into the main control room but would be monitored and controlled by a separate and isolated infrastructure.

The control and monitoring system would allow for connection and activation of alarm devices to notify personnel of abnormal or unsafe conditions. Alarm notification devices would be used within the main control room and, as necessary, underground.

Video monitoring systems would be installed throughout the aboveground facilities. Closed circuit cameras would be used and the video data carried over the business network to the main control room where the operator would monitor these areas through the use of multiple screens. There would also be closed circuit cameras specific to the hoisting system that would feed to the respective hoist control for monitoring.

3.6.8 Worker accommodation

As discussed above, an accommodation village would be established approximately two kilometres north-east of the proposed Chandler Facility. The accommodation village would likely include:

- Semi-detached dwellings (180 rooms).
- Ablutions.
- Laundry facilities.
- Car parking.
- Dry mess, wet mess, kitchen and cold room.
- Games room including an internet connection.
- Tennis court and gymnasium.
- Sewage treatment plant.
- Fire water protection.
- Administration offices.

A concept layout of the proposed accommodation village is presented in Figure 3-25.

The location of the accommodation village was selected to facilitate ease of access to the operation and crew rotations to and from the Chandler Facility and Apirnta Facility. The proposed accommodation village is considered to be at a reasonable distance to minimise potential exposure to noise or dust emissions during both construction and operation of the Proposal.

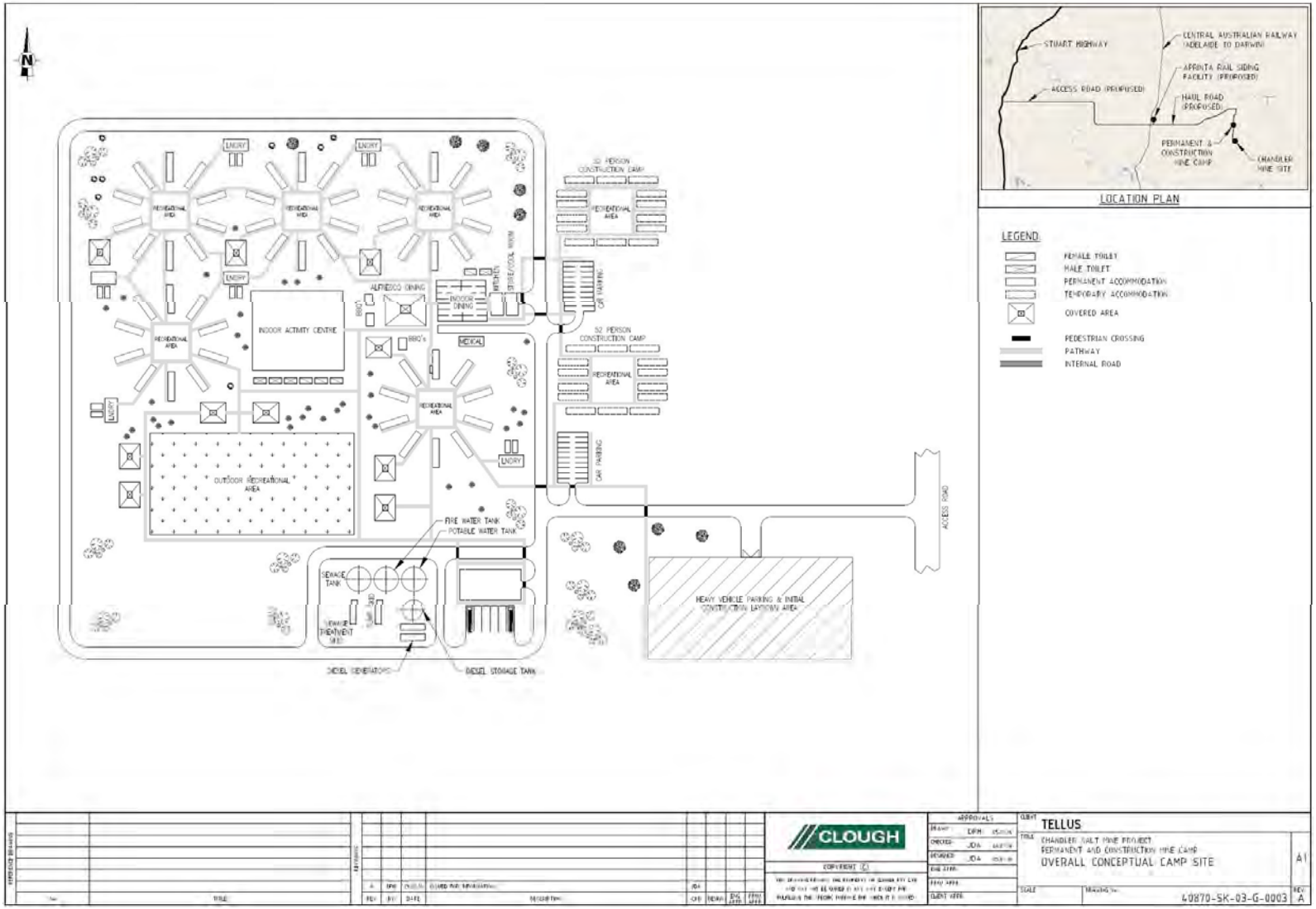


Figure 3-25 Concept layout of the accommodation village

3.6.9 Operational waste

This section discusses waste generated during operation of the proposed Chandler Facility. Also discussed are hazardous materials storage and waste management strategies during operation of the Chandler Facility.

Operational waste generated

Waste generated during operation would include maintenance waste, domestic waste, wastewater and reject salt. Non-mining waste that would be produced during operation would typically include:

- Tyres, oil, grease, detergent, solvents, paint.
- Scrap metal, wood, paper, cardboard, plastic and glass.
- General waste such as food waste, food containers and packaging.

Maintenance waste and domestic waste would be collected, separated and stored in appropriate containers according to their potential for reuse, recycling, recovery, treatment and/or disposal. Waste would be kept in dedicated areas for collection by appropriately licensed waste contractors. There is also potential for some of this waste to be stored underground within the storage and disposal rooms of the Chandler Facility.

Wastewater generated during operation would include:

- Raw water recaptured as process water after industrial use.
- Treated water recaptured as grey water after domestic use.
- Potable water recaptured as sewage after human consumption.

Wastewater would be beneficially reused or otherwise reinjected or released off-site. Opportunities for beneficial reuse include dust suppression, industrial use or domestic use. Irrigation of treated sewage may occur providing potential for permaculture at the accommodation village.

Reinjection or release of wastewater would be carried out in accordance with an environmental protection license under the NT *Waste Management and Pollution Control* Act and would be subject to meeting environmental water quality objectives.

The volume of water to be reused, treated, reinjected or released would be subject to the demand for reuse, the quality of the wastewater and the state of the receiving environment.

Some run of mine salt fed through the salt processing plant would be rejected due to the presence of other materials such as quartz, sandstone, siltstones and to a lesser extent anhydrite and gypsum. This reject material would be stockpiled separately to the run of mine salt and product salt and would be preferentially managed through reuse as backfill in the underground mine.

Potential release of treated water is explained further in Chapter 8, while general management of waste generated at the Chandler Facility is explained further in Appendix G.

Hazardous materials storage

Waste hydrocarbons would be stored in a tank within a bunded area. All hazardous and chemical wastes would be located to ensure they are:

- Clearly marked.
- Have secondary containment that is of sufficient capacity to contain 110 % of the maximum contents of the waste source volume.
- Located away from sensitive receptors (i.e. watercourses).
- Not at risk of theft of vandalism.
- Not damaged through exposure to the elements.
- Easily accessible.
- Unlikely to be damaged.

The quantity of chemicals and hazardous substances would be determined during detailed design of the Proposal. The management of hazardous wastes is discussed further in Chapter 11.

Waste management strategies

During operation, waste management would follow the principles of the waste hierarchy, as illustrated in Figure 3-26. A draft Waste Management Plan has been prepared for the Proposal (refer to Appendix G). The Waste Management Plan would be finalised following completion of the detailed design of the Proposal.

Waste management would begin with resource efficiency with a focus on:

- Ordering the correct amount of materials to be delivered when needed.
- Ensuring materials are not delivered to site damaged and unusable.
- Reducing the amount of packaging used by suppliers.
- Ensuring wastes are handled and stored correctly.
- Segregation of difficult types of waste.
- Maintaining a monthly record of waste types and volumes that are generated.

Waste types with the potential for reuse or to be recycled on site include:

- Concrete.
- Excavation spoil.
- Topsoil.
- Timber.
- Metals.
- Clay, concrete pipes, blocks and bricks.
- Packaging and plastics.

Hazardous waste generated during construction and operation would be temporarily stored at the Apirnta Facility until it could be permanently isolated at the Chandler Facility. All other non-hazardous waste would be taken off-site to landfill in Alice Springs.

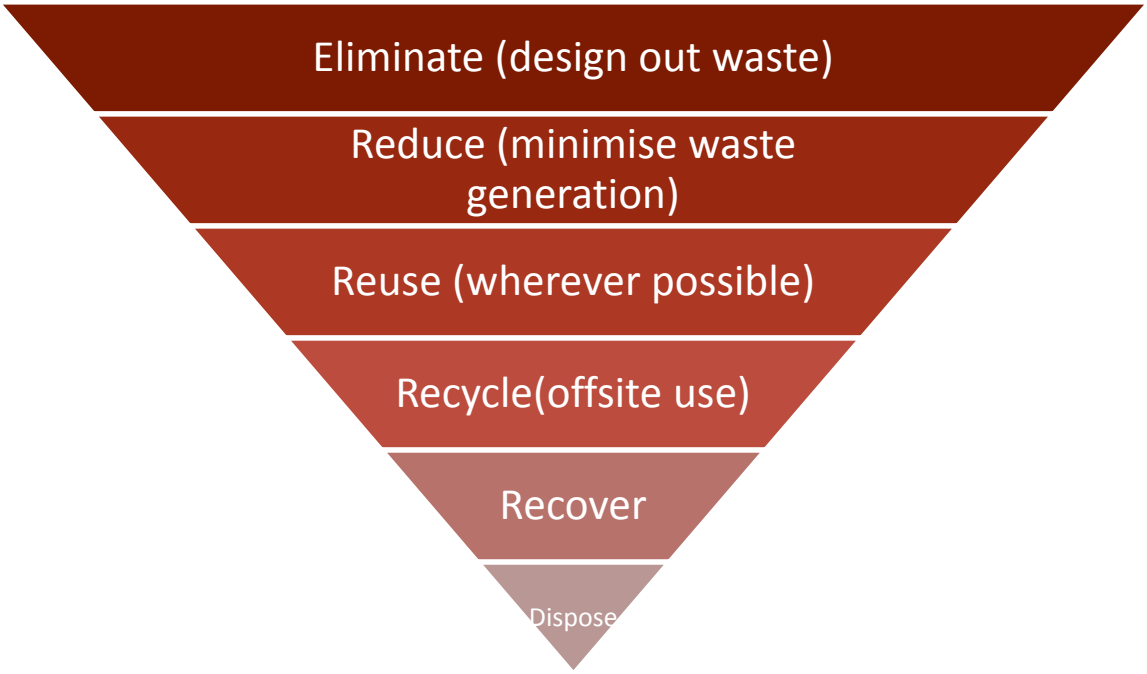


Figure 3-26 The waste hierarchy

3.6.10 Health, safety and environment

Management systems

The proponent operates integrated management systems in line with industry standards including:

- AS 4801 Occupational health and safety management systems.
- ISO 14001 Environmental management systems.
- ISO 9001 Quality management systems.

The management systems include a range of policies with associated objectives in areas of:

- Health and safety.
- Environmental management.
- Community relations.
- Fitness for work.
- Fire prevention.
- Workplace rehabilitation.
- Sustainable development.

These policies and objectives would be implemented through a range of issue-specific management plans (including the safety case) that would be developed for the Proposal.

The management systems and subordinate policies and plans would be periodically reviewed and improved as the proponent transitions into future stages of development of the Proposal.

Health and safety plans

The health and safety of workers would be managed in accordance with a Health and Safety Management Plan. The management plan would include a risk assessment including controls to reduce risk.

The proposed Chandler Facility qualifies as a major hazard facility under the Work Health and Safety (National Uniform Legislation) Regulations. As such, the facility requires the preparation of a Safety Case to demonstrate that it can be operated safely and within the requirements of the Work Health and Safety (National Uniform Legislation) Regulations. The Safety Case would include a risk assessment of major incidents involving hazardous materials and would include controls to reduce risk at the proposed Chandler Facility.

A draft Emergency Response Management Plan has been prepared and is included in Appendix T. The plan would guide the response of workers in the event of an emergency such as a fire, explosion, collapse or gas leak. The Emergency Response Management Plan would be finalised prior to construction of the Proposal.

Health, safety, environment and quality monitoring

A number of systems would be installed to monitor the Chandler Facility and the surrounding environment. These systems would include:

- Leak detection.
- Fire detection.
- Radiation monitoring.
- Structural monitoring.
- Air quality monitoring.
- Groundwater monitoring.
- Surface water monitoring.
- Waste sampling and testing.
- Salt product sampling and testing.

3.7 Overview of the Apirnta Facility

This section presents an overview of the proposed Apirnta Facility. Details regarding the construction of the Apirnta Facility are presented in Section 3.7 and details regarding the operation of the Apirnta Facility are presented in Section 3.8.

3.7.1 Description of the Apirnta Facility

The proposed Apirnta Facility would occupy an area of approximately 30 hectares and provide for the temporary storage of up to 400,000 tonnes of waste material prior to its permanent storage, recovery and isolation at the Chandler Facility.

The key infrastructure at the proposed Apirnta Facility would include:

- Rail siding.
- Loading bays.
- Waste inspection bays.
- Vehicle weighbridge.
- Storage warehouse.
- Open storage yard.
- Liquid waste tank.
- Quarantine zone.
- Laboratory.
- Office buildings.
- Maintenance shed.
- Access road.

The Apirnta Facility would be appropriately secured with security fences, gates and cameras. Only authorised persons would be granted access. Identification protocols would be developed to ensure security.

The Apirnta Facility would also be appropriately designed with stormwater drainage and would be connected to essential services including electricity, water and sewerage.

The Apirnta Facility would be designed in accordance with the NT Planning Scheme and the *Land Development Corporation Development Guidelines Version 2 – June 2012* (LDC 2012). A number of sustainability measures would also be incorporated into the design of the Apirnta Facility, as discussed below.

3.7.2 Storage areas for dry and solid waste materials

Two storage areas (a warehouse and an open storage yard) would be constructed to store dry and solid waste materials.

Warehouse

A warehouse would be constructed to temporarily store waste materials before being transported for permanent isolation and storage at the proposed Chandler Facility. The warehouse would be approximately 6,600 square metres in area. It would be a single storey, steel-framed building (refer to Figure 3-27)

Waste materials to be stored in the warehouse would be sealed in appropriate waste packages on wooden pallets then stacked in high-bays, similar to what is shown in Plate 3-10. The waste would be segregated as necessary in designated areas in accordance with appropriate Australian standards, codes and guidelines, particularly the Dangerous Goods Code as detailed in the WZG



Figure 3-27 Conceptual design of the Apirnta Facility looking east

(refer to Appendix C). The warehouse would be fitted out with safety equipment such as emergency showers, an eye wash station and spill kits (refer to Plate 3-11 and Plate 3-12). Attached to the warehouse would be a laboratory and an office building (refer to Section 3.7.6). Rainwater tanks would be installed adjacent to the warehouse for various purposes such as for vehicle wash down and dust suppression during construction (refer to Section 3.7.7).

Installation of solar panels on the warehouse roof will be assessed as part of the detailed power study and engineering phase of the Proposal.



Source: Sperrin Metal Storage Solution
Plate 3-10 Example high-bay stacking of wood pallets



Source: GibbGroup
Plate 3-11 Example of emergency shower and eye wash station



Source: GibbGroup
Plate 3-12 Example of spill kit

Storage yard

An open storage yard would be constructed to store 20-foot shipping containers that would be stacked four high. This activity would involve preparing a suitable sub-base and appropriately engineered surface. The yard would be used for the temporary storage of waste that would be sealed in the shipping containers.

At capacity, the storage yard would be approximately 198,000 square metres in size and would occupy the majority of the site. The storage yard would be capable of housing about 20,600 shipping containers (up to 400,000 tonnes of waste, for which approval is being sort).

The shipping containers would be segregated into 'like for like' waste categories and in accordance with the appropriate Australian standards, codes and guidelines including Dangerous Goods Code as detailed in the WZG (refer to Appendix C).

An internal road network would be constructed within the storage yard. The road network would be strictly one-way and would be used by authorised personnel operating forklifts. The road network is discussed further in Section 3.7.7.

3.7.3 Liquid waste storage tank

One liquid storage tank with a capacity of 40,000 litres would be installed at the proposed Apirnta Facility. The liquid storage tank would be used to store a variety of liquid wastes as listed in Appendix F. The perimeter of the liquid storage tank area would be completely bunded to contain any potential spillages and leaks.

3.7.4 Road and rail interchange areas and rail spur

Two interchange areas would be constructed where waste would be transferred from trucks and trains to the site for temporary storage (either in the warehouse or in the storage yard). A rail spur would also be constructed off the Central Australian Railway.

Road interchange

The road interchange area would be approximately 3,575 square metres in area and located in the southern portion of the site. The road interchange area would have designated truck grids (parking bays). Truck driver amenities would also be located in this area (refer to Section 3.7.7).

Rail siding and interchange

A rail siding at the Apirnta Facility, approximately two kilometres in length, would connect to the Central Australian Railway. A sealed interchange area would be established beside the rail siding to allow for the transfer of product salt and waste material to and from the railway, respectively. The siding would act as a transhipment point for outgoing salt and incoming waste.

Incoming materials would be transported in sealed shipping containers and off loaded from rail wagons at the rail siding and transferred to the proposed Apirnta Facility for temporary storage. From there, materials would be transported by road train vehicles for onward transport to the proposed Chandler Facility.

Outgoing salt which would have been brought from the mine site by road train would be loaded onto the empty rail wagons for onward transport to customers via Adelaide Port.

3.7.5 Quarantine zone

A quarantine zone would be constructed where waste materials that is transferred from trains would be stored prior to inspection and testing at the laboratory. Once tested, the waste would be moved and appropriately stored within the site (either in the warehouse or in the storage yard).

Similar to the storage yard, an internal road network would be constructed within the pre-inspection area. It would be strictly one-way and used by authorised personnel operating forklifts. A fence would also be installed around the boundary of the pre-inspection area. The internal fence line would be approximately 1.8 metres in height, increasing to 2.6 metres at the boundary of the site.

3.7.6 Laboratory, office and maintenance and storage shed

Laboratory and office

A laboratory and office would be provided within the warehouse. The laboratory would be used to test and verify received waste materials. The laboratory would house laboratory equipment including a fume hood to vent any potential gases that may be emitted during the waste inspection and testing. All chemicals and reagents would be stored in appropriate and suitable chemical storage cabinets, compliant with the relevant NT WorkSafe standards. The Apirnta Facility would be accredited for a range of chemical test methods by the National Association of Testing Authorities.

The office building would be used by staff and for security administration purposes. It would house office space, first aid rooms, store rooms and amenities (including a locker area, lunch room, toilets and showers). The office would be strategically located to oversee internal warehouse operations.

Maintenance and storage shed

A maintenance and storage shed would be constructed. The maintenance and storage shed would be approximately 405 square meters in area, and the yard would be approximately 4,518 square metres in area. Similar to the warehouse, it would be a single storey, steel-framed building used for both the maintenance and storage of plant and equipment.

3.7.7 Infrastructure

The following infrastructure would also be installed at the site.

Internal roads

A road network would be constructed within the site. The road network would be predominantly one-way with traffic management controls, as appropriate. As discussed above, an internal road network would be constructed within the storage yard and pre-inspection area and would be used by authorised personnel operating forklifts.

The road network in the operational area would be used by employees, contractors, visitors and by truck drivers delivering waste to the site.

Car parking

Two car parks would be constructed on-site. The main car park would be located to the south of the warehouse. It would occupy an area of approximately 1,450 square meters and would accommodate up to 25 car parking spaces.

The car park would cater for employees, contractors and visitors. The number of car parking spaces would be sufficient for all employees at the site during operation. The car parks would be designed to comply with NT Planning Scheme requirements and the Australian Standard (AS) *AS 2890.1-1993 Parking facilities – Off-street car parking*.

Loading bay

One loading bay would be installed adjacent to the laboratory, the dimensions of which would be approximately 7.5 metres by 3.5 metres.

Weighbridge and vehicle wash down facility

A weighbridge would be installed to weigh trucks and their contents as they enter the site (loaded). A wash down facility would also be installed adjacent to the road interchange area.

Truck driver amenities

Truck driver amenities would be provided adjacent to the road interchange area. The amenities would include bathroom facilities and an undercover waiting area.

Security gates, fencing and cameras

Four security gates would be installed at the site. One security gate (and accompanying gatehouse) would be installed at the entrance to the site. Another security gate would be installed at the exit. Two additional security gates would be installed to the west of the rail interchange area to allow forklift movement between this area and the storage areas.

A perimeter fence would be erected around the site. It would be approximately 2.6 metres high to preclude intruders as well as animals. As discussed above, internal fencing would be installed around the perimeter of the pre-inspection area to preclude pedestrians and other vehicles from entering this area. The internal fencing would be similar to the perimeter fencing but would be approximately 1.8 metres in height.

Twenty-four hour surveillance via closed circuit television cameras would also be installed at various locations within the site and along the perimeter fence.

Lighting

Lights would be installed at the site for safety and security purposes. Perimeter light poles would be approximately 10 metres high with luminaires pointing inwards, towards the site. Light poles within the site would be approximately 15 metres high with up to 10 luminaires per light pole.

Energy efficient lighting would be used at the site. Lighting would be at the minimum level of illumination necessary and would comply with Australian/New Zealand Standard (AS/NZS) *AS/NZS 1680.5:2012 Interior and workplace lighting, AS/NZS 1158.3.1:2005 Lighting for roads and public spaces – Pedestrian area* and *AS 4282-1997 Control of obtrusive effects of outdoor lighting*.

Bunding and stormwater drainage

Stormwater drainage would be installed at the site. All surface water would be contained on-site via a bunded drainage system that would include one or multiple water/oil separators. An underground gravity fed pipe system would direct stormwater towards the warehouse, laboratory, office and maintenance and storage shed.

After on-site treatment has taken place, the water would be used for ablutions, at the wash down facility and in the rainwater tanks (refer to Plate 3-13 and Plate 3-14). The capacity of the stormwater drainage system would accommodate a 1-in-100 year rainfall event over a 24-hour period. No stormwater would be discharged off-site.

Electricity, telecommunications, water and sewerage services

Connections to existing electricity, telecommunications and water would be required. Solar energy, located on the warehouse roof, would also be investigated as an alternative means to power the site. A septic tank system would be installed to manage sewerage at the site.



Source: Northline
Plate 3-13 Example of rainwater tank



Source: Northline
Plate 3-14 Example of vehicle wash down facility

3.8 Construction of the Apirnta Facility

This section provides details regarding the construction of the proposed Apirnta Facility. An indicative construction schedule is provided along with the proposed workforce and working hours. Information regarding the typical equipment, machinery and vehicles that would be used during

construction is provided along with a description of the different phases of construction (enabling works, construction of aboveground infrastructure, and testing and commissioning).

3.8.1 Construction schedule

Subject to obtaining approval, it is anticipated that construction would commence in the middle of 2018. Construction would occur over a six month period, ending in late 2018. About three months would be required for testing and commissioning, ending in early to mid 2019. An indicative construction schedule is provided in Table 3-17.

Table 3-17 Indicative construction schedule (Apirnta Facility)

Activity	Indicative construction period	
	Start	Finish
Planning approval and environmental licences obtained	February 2017	February 2018
Enabling works	March 2018	June 2018
Construction of aboveground infrastructure	July 2018	December 2018
Testing and commissioning	January 2019	March 2019

3.8.2 Construction workforce and working hours

Construction of the proposed Apirnta Facility is expected to require approximately 50 full-time equivalent jobs.

Hours of construction would be 12 hours a day, seven days per week. It is not anticipated that night shift work would be required for the construction of the proposed Apirnta Facility, however, the proponent has identified this as a contingency option for specific and appropriate work tasks during the construction phase.

The proponent or its contractors would (where suitable) aim to source employees (construction staff) locally either from the community of Titjikala or from Alice Springs or other communities within the NT. Construction workers sourced from further afield than Titjikala would be housed within the accommodation village located to the north of the proposed Chandler Facility.

3.8.3 Construction equipment, machinery and vehicles

Enabling and construction works would likely require the following equipment and machinery:

- Light vehicles
- Bulldozer.
- Excavator.
- Grader.
- Backhoe.
- Earth removal trucks.
- Concrete trucks.
- Cranes.
- Tip trucks and trailers.
- Hand held tools.

3.8.4 Enabling works

Prior to commencement of construction works, the following enabling works would be required:

- Detailed site survey including services searches.
- Geotechnical investigations.
- Installation of temporary erosion and sediment controls.
- Installation of traffic management measures.
- Installation of fencing and signage to delineate work boundaries.
- Installation of any necessary drainage diversions.
- Installation of temporary construction facilities including a perimeter security fence and temporary site office and construction compound (described further below).
- Delineation of parking areas for construction vehicles.
- Vegetation removal.
- Earthworks (including topsoil stripping and stockpiling and earthworks).
- Installation of drainage.
- Rehabilitation of disturbed areas designated for landscaping (via topsoiling, seeding and planting).

Access would be restricted by the early installation of a perimeter fence around the site. A temporary, demountable site office would be erected. The office would be approximately 100 square metres and would be removed on completion of the construction works.

A construction compound would be established. It would be used for crew parking, deliveries, site sheds and for the storage of equipment and materials. A temporary amenities building would also be set up in the construction compound to ensure compliance with worker health and safety requirements.

Fences would be placed around construction areas and construction compounds to ensure safety during construction works.

3.8.5 Construction of the Apirnta Facility

Construction of the proposed Apirnta Facility would involve:

- Installation of suitably engineered hardstand areas.
- Construction of the warehouse (including laboratory and office) and maintenance and storage shed.

A description of the activities associated with the construction of the Apirnta Facility is provided below.

Installation of impervious hardstand areas and associated infrastructure

Following construction of footings, construction of the building and pit slabs would occur. Typical works required as part of the slab installation would include:

- Installation of formwork.
- Installation of conduits.
- Installation of services.
- Installation of a water barrier.
- Installation of steel reinforcement.
- Installation of sealed surface.
- Striping of formwork once sealed surface is complete.

Additional infrastructure that would be installed would include:

- Liquid storage tank.
- Weighbridges and vehicle wash down facility.
- Truck driver amenities.
- Security gates, fencing, cameras and lighting.
- Stormwater drainage.
- Electricity, water and sewerage services.
- Ablutions.

Construction of warehouse and maintenance and storage shed

Construction of the warehouse (including the laboratory and office) would involve erecting the structural frame of the warehouse including the installation of steel columns, wall bracing, roof sections and roof bracing. Following completion of the structural frame, the building cladding would be installed, including the following installations:

- Communications.
- Electrical wiring.
- Air conditioning.
- Insulation.
- Wall sheeting.
- Roof sheeting.
- Roof vents.
- Rollers doors, doors and windows.

Upon completing the structural works, fit out of the warehouse would commence. This would include the installation of lighting, plumbing, internal communications, fire services, laboratory equipment and furniture. No painting would likely be required.

The maintenance and storage shed would be constructed in much the same way as described above for the warehouse. All buildings would be constructed in accordance with the relevant provisions of the NT *Building Act*, NT Building Regulations and *Building Code of Australia*. An architect would be engaged to provide services in relation to the design of buildings.

3.8.6 Testing and commissioning

Once construction is complete, testing and commissioning of the proposed Apirnta Facility would commence. The purpose of this is to ensure that all systems and components are tested to verify if they function according to their design objectives or specifications.

3.8.7 Construction environmental management

A CEMP would be prepared to include specific work details and safeguards to be implemented during construction of the proposed Apirnta Facility to reduce identified risks to the environment.

3.9 Operation of the Apirnta Facility

This section describes the operation of the proposed Apirnta Facility. The volume and type of waste that would be delivered and stored at the site is provided. Traffic and access to the site, workforce and hours of operation are also provided.

3.9.1 Workforce and hours of operation

At a peak storage capacity event, it is estimated that approximately 25 people would be required on-site at any one time. The number of staff required during the initial years of operation is likely to be approximately 10-15 full-time employees and contractors.

The hours of operation would be the same as those for construction, namely 12 hours a day, seven days per week, day shift only for the Apirnta Facility in the initial years of operation. Transfer of containers from the Apirnta Facility to the Chandler Facility may also occur over a night shift depending on operational requirements.

3.9.2 Site operational process

The site would receive waste materials transported via road and rail utilising companies licenced to transport dangerous goods. The overall process is summarised below and is illustrated in Figure 3-28.

The waste would arrive to the site in sealed and labelled storage containers, including:

- Flexible intermediate sealed and labelled storage containers or bulka bags.
- Rigid intermediate sealed and labelled storage container or sealed and labelled drums, typically containing waste liquids.

The above would typically be received on wrapped pallets, or transported within sealed ISO 20-foot shipping containers (refer to Figure 3-30). Waste arriving via trucks would enter the site at the site gatehouse located off of the access road which would be connected to the Chandler Haul Road. Waste arriving via rail would do so via the rail siding off the Central Australian Railway. The site operational details for both road and rail are discussed below.



Figure 3-28 Waste storage container (ISO 20-foot shipping container)

The proponent would adopt a rigid Quality Assurance, Traceability, Notification and Certification System. This process is summarised in Figure 3-29 and is designed to complement tracking systems required by other legislation such as the *Australian Code for the Transport of Dangerous Goods by Road and Rail* and the *National Environmental Protection (Movement of Controlled Wastes between States and Territories) Measure.*

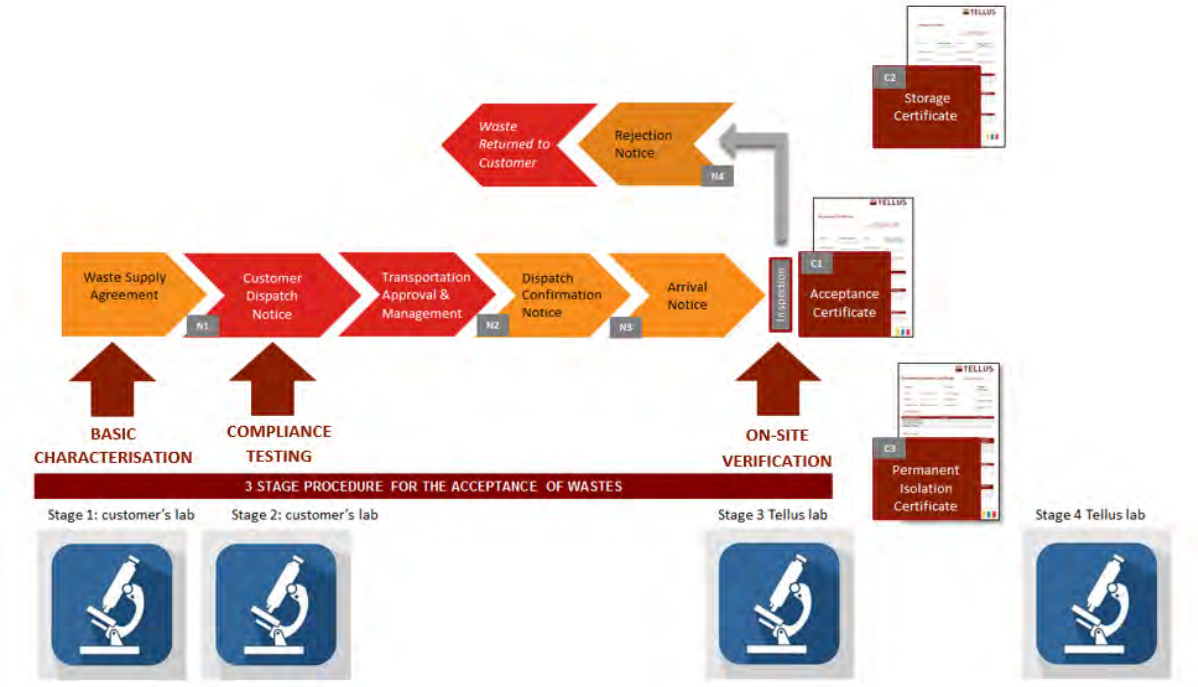


Figure 3-29 The proponent's traceability process

The proponent would implement a notification service for management of the waste that is delivered to the proposed Apirnta Facility. This would include:

- **N1 - Dispatch notice issued by customer**. Prior to dispatching waste to the Apirnta Facility, the customer must issue a Dispatch Notice to the proponent. The Dispatch Notice must be issued so that deliveries are in accordance with the Waste Delivery Plan. The Dispatch Notice will include information on the waste code, description, weight, volume, material safety data sheets, proposed date of delivery and Transport Plan.

  It is anticipated that following the issue of a Dispatch Notice the customer will secure all required approvals for transportation (e.g. NEPM approvals for movement of controlled substances and Dangerous Goods), arranging packing and accredited transporters.

- N2 - **Dispatch confirmation notice issued by the proponent**. The proponent will issue a Dispatch Confirmation Notice to the customer, either confirming that the dispatch may proceed; or may not proceed, including reasons (example: resources or space temporarily not available). This will normally be issued within five business days of the proponent receiving evidence from the customer of all required approvals for transportation. The proponent is not required to accept waste at the facility unless the proponent has issued a Dispatch Confirmation Notice.

- **N3 - Arrival notice issued by the proponent.** All deliveries of waste must be booked in at least 48 hours prior to the arrival of the delivery. This is to ensure that sufficient segregated storage is available for any particular waste stream. Un-booked deliveries may be subject to delays in unloading and/or may incur additional charges. The proponent will issue an Arrival Notice to the customer confirming arrival of the delivery at the Apirnta Facility (provided

that the proponent has issued a Dispatch Confirmation Notice in relation to that delivery). The Arrival Notice will be generated at the weighbridge (in real time).

- **Inspection point.** Following the issue of an Arrival Notice, at the Apirnta Facility Delivery Point, the waste will be subjected to weighing, visual inspection of containers, and sampling. On-site laboratory testing (Level 3, on-site verification checks) will be performed by qualified persons to analyse the waste streams to determine if the WAC are satisfied and to ensure compliance with any site licence Conditions of Acceptance.

  If the waste is accepted, this is the point of risk transfer and an Acceptance Certificate is issued. If the waste is rejected, there is no transfer of risk, and a Rejection Notice is issued. A representative sample will be taken from each delivery batch and waste type. Details of third party analysis and a material safety data sheet will assist in the correct identification.

  The Conditions of Acceptance for the Nominated Facility will specify that the Customer must provide:

  - Prior to unloading, documentation supporting that waste was transported in accordance with all required approvals.
  - The weight card, which provides evidence of the gross weight of the delivery to be used as the basis for billing.
  - Documentation of waste volume, and waste codes.
  - Acceptable packaging.

  The waste must not comprise any unlawful material. The delivery must be consistent with the Dispatch Notice from the customer.

- **N4 - Rejection notice issued by proponent (if necessary).** If an Acceptance Certificate is not issued, the customer will be issued a Rejection Notice and will remain responsible for the delivery; and the rejected delivery will be managed in accordance with the Rejection Procedure. The Procedure will provide that, amongst other things, the proponent may procure the return of the delivery to the address in the Dispatch Notice (at the cost and risk of the customer).

  The proponent may (in its sole discretion) elect, by notice in writing, to accept the delivery in which case the proponent may treat and or repackage the waste at the cost of the customer. If the proponent makes this election, the waste will be deemed to be Acceptable Waste and an Acceptance Certificate will be issued.

3.9.3 Traffic and access

Trucks would enter the site at the site gatehouse located off the access road. The site would operate with a one-way traffic system with one entry and one exit point for safety reasons. Traffic on-site would be limited to a speed of 15 kilometres per hour. A fleet of 32-tonne container handling forklifts would operate within the site transferring waste materials from trucks and trains into the storage areas.

At a peak storage capacity event, the frequency of one-way truck movements would be approximately five per hour over a 10 hour working day. Train movements would be approximately one per day, which is based on storing 400,000 tonnes of waste.

Traffic and transportation impacts and mitigation (including the implementation of a Traffic Management Plan) are discussed further in Chapter 18.

3.9.4 Volume and type of waste delivered to site

The site would be designed and constructed to store a maximum of 400,000 tonnes of waste at any given time. The site would be capable of accepting a wide range of waste materials. Typical waste types accepted (and not accepted) at the site are listed in Table 3-7. A likely waste inventory is provided in Appendix F.

3.10 Road infrastructure

This section describes the proposed road infrastructure required for the Proposal. A summary of the roads proposed is presented in Table 3-18.

Table 3-18 Haulage and access road summary

Road name	Function	Length	Area (30 m wide zone)
Henbury Access Road	• Personnel • Construction materials • Waste materials for storage	60 km	180 ha
Chandler Haulage Road	• Personnel • Construction materials • Waste materials for storage • Salt	30 km	93 ha
Internal mine infrastructure roads	• Personnel • Visitors • Waste materials for storage • Salt	16 km	48 ha
TOTAL			**321 ha**

3.10.1 Henbury Access Road

The proposed Henbury Access Road would be approximately 60 kilometres long and would connect the Apirnta Facility to the Stuart Highway. It would provide for the movement of workers and delivery vehicles to and from the Stuart Highway to the Apirnta Facility and through to the Chandler Facility.

The key features of the proposed Henbury Access Road would include:

- An unsealed surface.
- An approximately 30 metre wide road with a single lane in each direction

- Longitudinal drainage system for the management of surface water runoff including water quality basins and appropriate cross-drainage structures such as culverts at waterway crossings.
- Cross culverts and/or weirs at water course crossings, including the Finke River. Where significant drainage/creek crossings are required, culverts would be constructed.
- No road lighting apart from intersections with major roads (i.e. Stuart Highway) where appropriate safety measures would be incorporated.
- A light aircraft strip approximately 250 metres long. The light aircraft strip would provide for day and night emergency access to the Chandler Facility. The light aircraft strip would predominantly be used in unusual circumstances, such as evacuation for medical emergencies. When the road is used as an emergency landing strip road traffic would be restricted by traffic lights to prevent collision.
- An upgraded road crossing to provide adequate durability and safety for road users at the Central Australian Railway. The design of the upgraded crossing would be subject to consultation and agreement with the NT Department of Transport.
- Borrow pits for road construction and ongoing road maintenance activities.
- A road design in accordance with the NT Department of Transport and Department of Infrastructure requirements.

The following activities would be undertaken to prepare the surface of the Henbury Access Road:

- Vegetation clearing and topsoil stripping (topsoil would be stockpiled for use in future rehabilitation works).
- Surface rolling to identify soft spots.
- Removal of soft spots and backfilling with consolidated material to develop a stable sub-base.
- Surface preparation works including laying road material for the access road in three stages:
    - Road sub-base.
    - Road base.
    - Road surface.

Construction materials would be sourced from borrow pits discussed in Section 3.5.6. The construction methodology would be agreed with the proponent's contractors during detailed design but would be conventional and in line with industry best practice.

3.10.2 Chandler Haul Road

The proposed Chandler Haul Road would be approximately 30 kilometres long and would connect the Chandler Facility to the Apirnta Facility. It would provide for the movement of salt from the Chandler Facility to the rail siding at the Apirnta Facility. It would also provide for the movement of waste temporarily stored at the Apirnta Facility to the Chandler Facility.

The key features of the proposed Chandler Haul Road would include:

- An unsealed surface.
- Approximately 30 metre wide road with a single lane in each direction
- Longitudinal drainage system for the management of surface water runoff including water quality basins.
- Cross culverts and/or weirs at watercourse crossings.
- No road lighting apart from intersections with major roads (i.e. Chamber Pillars Road) where appropriate safety measures would be incorporated.
- An upgraded road crossing to pride adequate durability and safety for road users at Chambers Pillar Road. The design of the upgraded crossing would be subject to consultation and agreement with the NT Department of Transport.
- Borrow pits for road construction and ongoing road maintenance activities.
- A road design in accordance with the NT Department of Transport and Department of Infrastructure requirements.

The following activities would be undertaken to prepare the surface of the haul road:

- Vegetation clearing and topsoil stripping (topsoil would be stockpiled for use in future rehabilitation works).
- Surface rolling to identify soft spots.
- Removal of soft spots and backfilling with consolidated material to develop a stable sub-base.
- Surface preparation works including laying road material for the haul road in three stages:
    - Road sub-base.
    - Road base.
    - Road surface.

Construction materials would be sourced from borrow pits discussed in Section 3.5.6. The construction methodology would be agreed with the proponent's contractors during detailed design but would be conventional and in line with industry best practice.

3.10.3 Other roads

In addition to the Henbury Access Road and Chandler Haul Road there would be a network of smaller internal access roads within the bounds of the proposed Chandler Facility. The access roads would be unsurfaced, unsealed and about 10 metres wide and would include longitudinal drainage

and stormwater basins. The specification and geometry of all roads would be finalised following comprehensive geotechnical investigations, test work and detailed design of the Proposal.

3.11 Closure

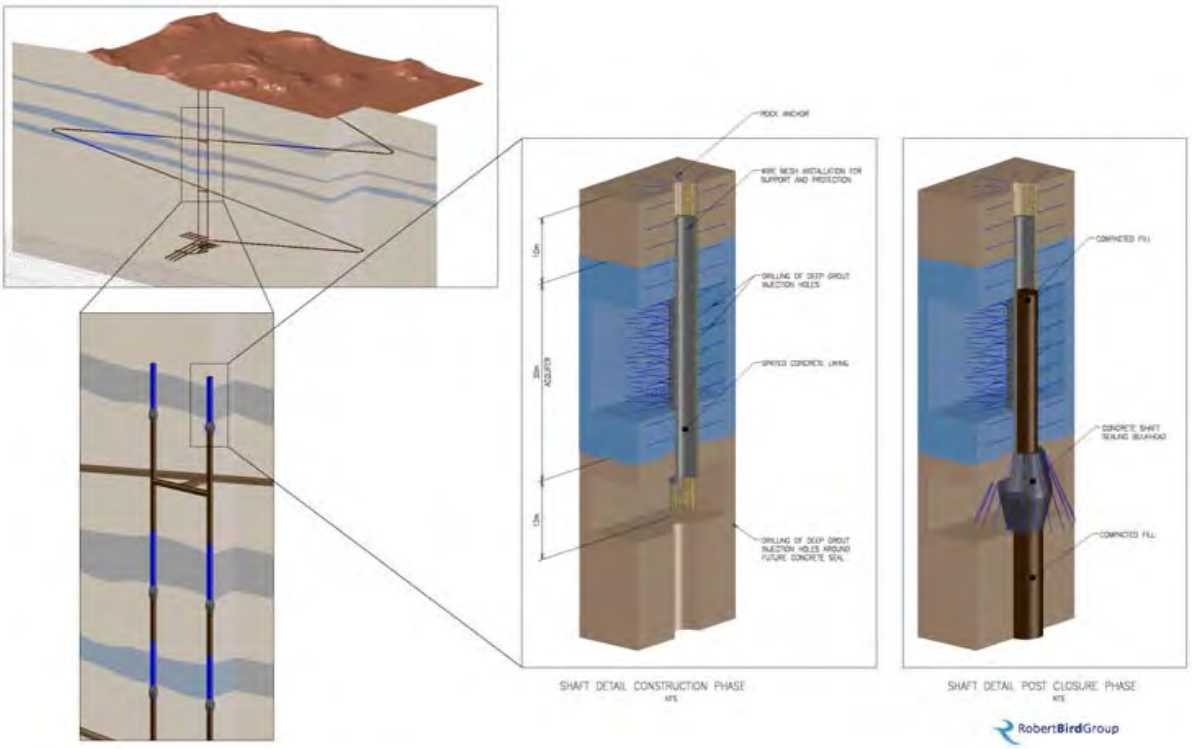
Closure would occur at the end of year 25 of operations (year 29 of the Proposal) and would involve:

- Finalisation of underground operations.
- Demobilisation of underground equipment.
- Backfilling of underground mine, access decline and vertical shafts.

Finalisation of underground would include backfilling of the remaining excavated rooms with waste material, finely crushed salt and engineered barriers as described in Section 3.5.5. Demobilisation of underground equipment would include the transfer of the equipment to the surface via the mine access decline or vertical shafts. Mine closure would also be funded through a financial security established under the *Mining Management Act 2001*.

Chapter 13 provides further discussion on closure and rehabilitation requirements, potential impacts and necessary mitigation and management measures. A draft Rehabilitation Closure Plan (RCP) has been prepared for the Proposal (refer to Appendix J).

Figure 3-30 Establishment of engineered barriers to underground mine



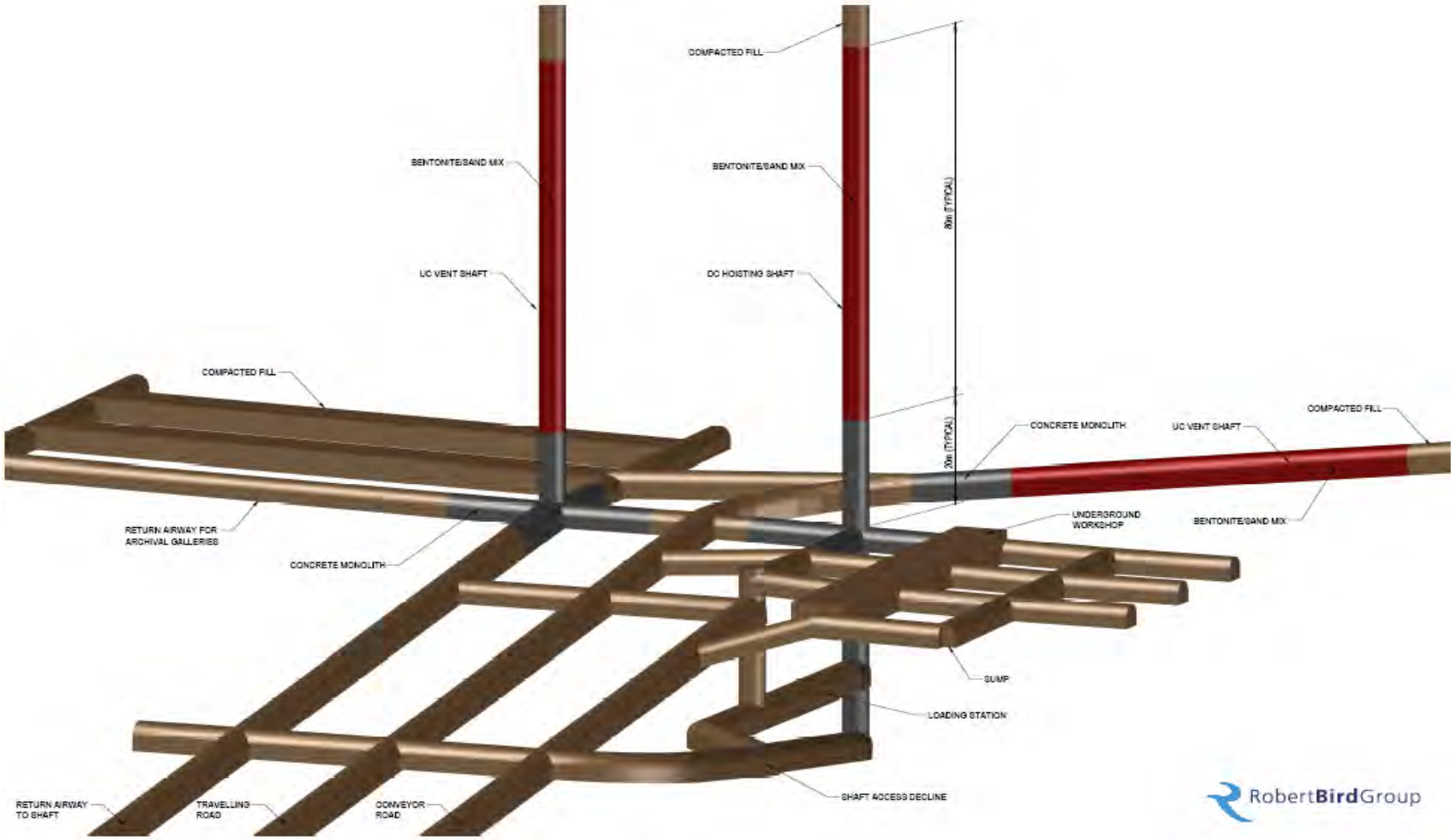


Figure 3-31 Backfilling of underground mine

3.12 Decommissioning

Decommissioning would occur at the end of the life of the Proposal. Decommissioning would include:

- Demobilisation of equipment.
- Demolition of buildings.
- Decommissioning and removal of utilities.
- Backfilling and sealing of underground mine.
- General site clean-up.

Demobilisation of equipment would include the transport of salt mining and waste storage equipment that is not required for closure or rehabilitation activities. The equipment would be demobilised to regional locations for reuse or scrapping and recycling or disposal.

Demolition of buildings would include the removal of surface infrastructure and underground infrastructure. Disconnection and removal of utilities would involve initial disconnection then progressive dismantling, cleaning and removal of infrastructure.

Decommissioning of utilities would firstly entail electrical isolation then disconnection of all connections to power, water, compressed air, etc. This would be followed by complete clean-down and drainage of all lubricating fluids and mechanical disassembly for recovery/reclamation/recycling, where possible.

Backfilling of the underground mine would include backfilling of remaining excavated rooms and development drives with bulk salt followed by the reinstatement of soil and rock material from overburden stockpiles to the mine access decline and vertical shafts.

General site clean-up would include removal of stockpiled waste, other waste such as litter and remediation of any identified contaminated areas such as areas where leaks or spills have occurred. Waste would be stockpiled separately according to reuse, recycling and recovery potential. Concrete footings would be crushed and stockpiled for recycling, for example.

There is potential for contamination of land, particularly within the mine infrastructure area as a result of operational activities associated with the proposed Chandler Facility. Possible contamination sources include fuel or oil leakage and concentrated sodium chloride discharges from the run of mine salt stockpile. Any contaminated sites would be registered and remediated using suitable methods throughout the mine life or during the decommissioning phase of the Proposal.

The site would generally be returned to its original condition as far as possible, and all topsoil returned to the landscape, where possible.

Decommissioning would be guided by a detailed RCP. The RCP would include measures to control potential impacts on the environment. Decommissioning would also be supported through a financial security established under the *Mining Management Act 2001*.

3.13 Rehabilitation

To ensure that the objectives of rehabilitation are achieved, a draft RCP has been developed for the Proposal (refer to Appendix J). .

Following decommissioning the site of the Chandler Facility and Apirnta Facility would be rehabilitated with the following objectives:

- Achievement of the same or similar land use capabilities as existed prior to the disturbance, unless other beneficial land uses are pre-determined and agreed.
- Creation of a stable landform – waste stockpiling areas and other disturbed land would be rehabilitated to a condition that is self-sustaining or to a condition where maintenance requirements are consistent with an agreed post-mining land use.
- Surface and groundwater that leave the lease should not be significantly degraded. Current and future water quality would be maintained in accordance with relevant water quality standards.

The creation of a stable landform would involve ripping, grading and redistribution of topsoil from topsoil stockpiles to mimic the natural landform around the site of the proposed Chandler Facility and Apirnta Facility.

The creation of a stable landform would also restore pre-existing land use capability but this would also require revegetation with native species and reinstatement of pre-existing drainage lines.

Maintenance of pre-existing surface water and groundwater quality would be achieved through the creation of a stable landform and restoration of pre-existing land use capabilities and would be subject to ongoing surface water and groundwater monitoring against water quality objectives.

Surface monuments would be installed after decommissioning and remediation of the Chandler Facility to identify the isolation/disposal area.

3.14 Post closure

3.14.1 Overview

The safety philosophy for underground storage of hazardous waste requires the permanent isolation of the waste from the biosphere by a geological barrier. To ensure this, a site-specific risk assessment was undertaken and included the following elements:

- Post closure risk assessment (refer to Appendix H)
- Geological and geo-technical assessment (refer to Appendix K).
- Geo-mechanical assessment (refer to Appendix K).
- Hydrogeological assessment (refer to Appendix P)
- Assessment of the operational phase (refer to Appendix H).
- Environmental impact assessment (this EIS)

The long term assessment has determined that no credible pathways to the biosphere would be generated during the long-term post-operation of the underground storage. The barriers of the underground storage site (e.g. the waste quality, engineered structures, back filling and sealing of shafts and drillings), the performance of the host rock, the surrounding strata and the overburden would be quantitatively assessed over the long-term and evaluated on the basis of site-specific data or sufficiently conservative assumptions where site data does not exist.

The geochemical and geo-hydrological conditions such as groundwater flow, barrier efficiency, natural attenuation as well as potential leaching of the deposited wastes has to be taken into consideration.

The long-term safety of the underground storage has been demonstrated by a safety assessment comprising a description of the initial status at the time of closure followed by a scenario outlining important changes that are expected over geological time. The consequences of a release of substances from the underground storage has been assessed for different scenarios reflecting the possible long-term evolution of the biosphere, geosphere and the underground storage (refer to Appendix H).

The demonstration of long-term safety of underground disposal in a salt rock would principally be undertaken by designating the salt rock as the barrier rock. Salt rock fulfils the requirement of being impermeable to gases and liquids, of being able to encase the waste because of its convergent behaviour (creep) and of confining it entirely at the end of the transformation process.

The convergent behaviour of the salt rock does not contradict the requirement to have stable cavities in the operation phase. The stability is important, in order to guarantee the operational safety and in order to maintain the integrity of the geological barrier over unlimited time, so that there is continued protection of the biosphere.

3.14.2 Post closure monitoring

The principal focus of monitoring in the post closure phase would be on groundwater monitoring. In addition, the performance of revegetation programs would also be monitored.

Post closure monitoring objectives for the Proposal are contained within the Draft Water Management Plan contained in Appendix Q. Monitoring of groundwater and surface across the Proposal site has been in place since 2013 to determine baseline environmental conditions at and around the proposed Apirnta Facility and Chandler Facility.

Although the proposed Chandler Facility has been assessed to not result in any changes to existing groundwater conditions (refer to Chapter 8), the proponent would monitor groundwater during mine operations and after mine closure and report on the post-closure performance of the Proposal.

Monitoring results would be interpreted and analysed to identify either long-term trends or significant changes between sampling events. This is facilitated by a plot of analyte levels over time. If analytes change significantly between sampling events, a further sampling event would be conducted immediately to verify the result. If either a long-term trend is identified or a significant change between sampling events is verified, the NT EPA would be advised and the reason for the change investigated as a matter of priority.

For any perceived long-term trends to be true trends rather than normal fluctuations in environmental quality, they need to be based on a number of years of data.

The results of the monitoring program would be reported to NT EPA annually. Any anomalies would be reported within seven days of being identified

3.15 Water resources

This section provides an overview of the water resource requirements during construction and operation of the Proposal.

3.15.1 General water supply

Based on groundwater drilling research undertaken during 2014 and 2015, sufficient water could be supplied to meet calculated water demand from the Upper Langra Formation. Further information regarding water supply is provided in Chapter 8.

3.15.2 Accommodation village

During enabling works, potable water would be supplied to the accommodation village via truck that would travel to site using Maryvale Road. Following the completion of a borefield, potable water would be supplied to the accommodation village via reverse osmosis plant and pipeline.

During the peak construction period, potable water demand for a 270-person accommodation village would require a demand of approximately 16 mega litres of water. This volume is expected to fall during operation to a volume of approximately 12 mega litres for a 180-person accommodation village.

3.15.3 Construction and operation requirements

Raw water demand during construction and operation has been calculated at 54 mega litres per annum. The bulk of raw water demand would be for dust suppression and the remainder would be used in day to day operations within mine infrastructure area at the proposed Chandler Facility.

Underground hand washing stations would be similar to those used in typical underground mining operations, where the washing stand is integrated with a small reservoir, pump, and water heater.

Service water would primarily be required for the construction phase of the Proposal to supply water for drilling, dust suppression and equipment wash down. During operations, use of service water would be limited as it would be important to limit moisture at the repository to minimise the potential for condensation within the secondary ventilation shaft.

Service water would be supplied underground using a heavy-wall steel pipeline in the downcast shaft. The water main would be appropriately designed and include automatic shut-off valves in the event that the water column fails. At the base of the shaft, a pressure reducing valve would be used to reduce the static pressure to a safe working pressure. Steel pipes would distribute the water throughout the mine with down-pipes provided at regular intervals to provide access for hose connections.

3.15.4 Total water demand

Total water demand during construction has been estimated at 54 mega litres per annum. During operation, total water demand increases to 104 mega litres per annum.

3.15.5 Potable and service water

Potable water would be transferred underground in portable containers and provided to all personnel in the underground areas for both drinking and hand washing. Bottled water would be available at various locations including the underground lunch room.

3.15.6 Underground dewatering

Any seepage water from the mine access decline or vertical shafts would be collected in sumps at each of these locations and pumped to a dewatering sump.

If required, underground sump water could be used in hydraulic backfill processing. Water would be pumped to the surface via a positive displacement pump via the downcast shaft or via staged sumps up the decline.

To minimise potential contamination, the underground maintenance shop and the underground diesel fuel bay would be equipped with an isolated containment sump and bunded. These sumps would be suitable for containing any accidental fluid spills, such as fuel, oil, or engine coolant and any captured fluids would be pumped into a drum on the repository level and transferred in the main shaft cage to surface for appropriate treatment or use in hydraulic backfill processing.

The dewatering system would consist of a series of sumps. The combined storage capacity of the shaft bottom could be used for emergency and temporary water storage in the remote event of an unlikely major water in-rush.

3.15.7 Sewage

For sewage in the underground areas, toilets would be provided at the sanitary facilities. These 'mine toilets' are typical to underground mining applications and use compressed air to function as simple, small-scale sewage treatment plants. This allows the self-contained toilet/reservoir units to function for approximately 18 months before a fluid clean-out is required. These would be placed by forklift and taken to aboveground for clean-out work to be completed.

3.15.8 Stormwater management systems

All stormwater would be managed in accordance with the measures outlined in the draft Water Management Plan (refer to Appendix Q). In summary, all stormwater run-off from the mine infrastructure area, as well as any groundwater pumped to surface from underground sumps, would be directed via ditches to the stormwater management pond for treatment to remove suspended solids. The pond water could be used for dust suppression.

To control stormwater within this area, a stormwater management system would be designed to include a perimeter drainage ditch, oil/water separators and an intermediate settling pond.

Overland flow would be designed to drain directly to the perimeter drainage ditch. Sub-drains and catch basins would be used around the building areas to facilitate effective drainage, discharging to the perimeter ditch. Pumped water from the main shaft and the secondary ventilation shaft would be directed to an oil/water separator and then released into the perimeter ditch.

All of the stormwater collected by the surrounding drainage ditch would be released from a single outlet into the intermediate settling pond. The drainage water in the settling pond would be directed to a second oil/water separator and then released to the perimeter ditch which ultimately would discharge into the stormwater management pond.

Stormwater run-off from the waste rock/spoil mound area would be collected in a network of trapezoidal drainage ditches around the perimeter of this area. It would then be directed to a stormwater management pond.

Rainfall run-off volumes from the two aforementioned areas are summarised for the six hour, 25 millimetre and the 1:100 year events. The assumed run-off coefficients are also tabulated. As the surface facilities area is assumed to be predominantly paved, the run-off coefficient is correspondingly higher than for unpaved areas.

The primary function of any on-site stormwater management pond would be to control total suspended solids prior to discharge and, to contain any contaminated surface water and preventing any off-site discharge. A pond would consist of:

- A retention area for settling of particles (to a size of approximately 0.02 millimetres).
- An extended storage area for larger storm events (spill over basin).
- A low permeability base (e.g., composite or natural) with a protective cover (granular material).

The stormwater management system would be designed with capacity to:

- Retain the six hour, 25 millimetre storm for a period of 24 hours.
- Safely pass the 1 in 100 year storm event without overtopping of the embankments and erosion of the outlet system.

To prevent discharge from ponds in the unexpected event that contaminants in the discharge water exceed acceptable limits, or general discharge needs to be halted due to downstream issues, a gate would be installed on all outlets. Gates would be controlled manually and would normally remain in the open position. They would be closed in advance of storm fronts. Information on storm fronts would be obtained from the Automatic Weather Station located at the proposed Chandler Facility.

3.15.9 Erosion and sediment control

A draft Sedimentation and Erosion Management Plan has been prepared for the Proposal (refer to Appendix L). The purpose of the plan is to (a) identify risks and (b) inform the detailed design of the Proposal.

The draft Sedimentation and Erosion Management Plan outlines drainage control measures for areas within and surrounding the mine infrastructure area and spoil heaps, including the run of mine salt

stockpile at the proposed Chandler Facility. The Sedimentation and Erosion Management Plan would be finalised following further topographic survey during the detailed design of the Proposal.

3.16 Utilities and services

Utilities and services would be needed throughout aboveground infrastructure and underground infrastructure at the proposed Chandler Facility and also at the proposed Apirnta Facility. Utilities and services would include:

- Air circulation.
- Water and reticulation.
- Power and reticulation.
- Gas and reticulation.
- Fuel delivery and storage.
- Communications infrastructure.
- Personal amenities.
- Waste management.
- Surface water controls.
- Groundwater controls.
- Lighting installation.
- Emergency services.

3.16.1 Air circulation

Air circulation would be provided to the underground mine through a system of fans and ducting installed throughout the mine. Fresh air fans would be installed in the mine access decline and the main shaft, booster fans would be installed throughout the mine, and exhaust fans would be installed in the secondary shaft.

3.16.2 Water and reticulation

A borefield, water storage and water treatment would be utilised for water supply during construction and operation of the Chandler Facility as described in Section 3.2.3.

Raw water would be reticulated to aboveground and underground areas through a network of balance tanks, booster pumps and piping (including down the vertical shaft). Potable water would likewise be reticulated aboveground but would be provided to underground workers in bottles.

The Apirnta Facility would also require its own raw water supply. The facility would also utilise rainwater and recaptured stormwater runoff, as appropriate.

3.16.3 Power and reticulation

Power for the proposed Chandler Facility would be generated at the hybrid solar/diesel power plant and reticulated across the site, including the aboveground and underground domains. The accommodation village and Aprinta Facility would require separate, standalone power supplies.

3.16.4 Gas and reticulation

Gas would be delivered to the Chandler Facility in tanks for use in construction and operation activities such as welding and some mining activities.

3.16.5 Fuel delivery and storage

Fuel would be delivered by appropriately licensed contractors who are able to demonstrate compliance with the *Australian Code for the Transport of Dangerous Goods by Road & Rail*.

Fuel would be trucked to the hybrid solar/diesel power plant, as required. Fuel would also be stored at an emergency fuel storage facility at the power plant and the underground fuel storage bay.

Diesel fuel and lubrication oils would be provided by supply truck from Alice Springs to the Chandler Facility, as needed. Drums would be filled at the fuelling station and brought to the mine infrastructure area for transfer underground to the diesel fuel bay and for use by underground equipment.

The diesel fuel storage tank for the emergency diesel generators allows for 48 hours of operation of the diesel generators at 35 % loading. The storage tank would consist of an aboveground double-walled tank and would be connected directly to the generators.

Both aboveground and underground fuel storage areas would be provided with sufficient sump capacity to collect accidental spillage that could occur during fuel transfer or leakage from tanks or pipes. Berms would be constructed as needed to ensure that any spillage of fuel or lubricant is retained within the storage and refuelling areas. Space for only a single piece of mobile equipment would be provided in the underground diesel fuel bay to reduce the risk of a fire incident.

The following fuel demand is required during operation for the Proposal:

- The mobile fleet usage is as per the 1.4 million litres per annum the EPA has questioned.
- The larger component is power. A five megawatt and two megawatt solar power plant could use upwards of 8.8 million litres per annum.

3.16.6 Communications infrastructure

Communications at the Chandler Facility would be provided through a combination of fibre optics, Ethernet and wireless infrastructure established at the site – providing services such as email and VOIP technology.

3.16.7 Personal amenities

Personnel amenities would be provided at key locations around the Chandler Facility site including administration buildings, worker accommodation and a dedicated underground services area.

Sewage would be treated through modular sewage treatment plants while sludge residue would be routinely collected by appropriately licensed waste contractors for off-site management.

3.16.8 Waste management

Waste would be stored in appropriate containers such as industrial bins or drums in dedicated waste collection areas. Waste would be routinely collected by appropriately licensed waste contractors.

3.16.9 Surface water controls

Surface water controls at the Chandler Facility and Apirnta Facility would function to divert clean water away from surface infrastructure areas.

Stormwater at the Chandler Facility would include perimeter ditching along with a simple network of channels leading to stormwater ponds where runoff would collect and allow entrained sediment to settle at the bottom. Oil and water separators would be installed, where necessary.

The stormwater controls would be designed to withstand the 1 in 100 year average recurrence interval (ARI) event without releasing stormwater. Gates would be installed at stormwater ponds to enable controlled release of stormwater when water quality and downstream conditions are appropriate.

3.16.10 Groundwater controls

Groundwater in the underground area would be collected in a system of sumps and pumped to the surface for treatment and reuse, reinjection or off-site disposal. Water treatment facilities would be situated near the mine access decline and vertical shafts. The facilities would include storage and settlement tanks with appropriate treatment or amendment.

3.16.11 Lighting installation

Lighting would be installed where necessary to ensure a safe working environment. Areas to be lit include outdoor working areas, buildings and surface infrastructure and areas of the underground salt mine.

3.16.12 Emergency services

The closest emergency services that may be required for assistance in the event of an emergency situation are those located in Alice Springs. Emergency response facilities would, however, be established on-site to enable an appropriate, fast response in the event of an emergency such as a fire or hazardous spill.

These facilities would include emergency communication devices, firefighting equipment and spill clean-up equipment. An emergency phone system would also be established. The system would be independent of power and communications systems in order to remain functional in the unlikely event of a breakdown. The emergency response facilities would be situated at both at the proposed Chandler Facility and Apirnta Facility.

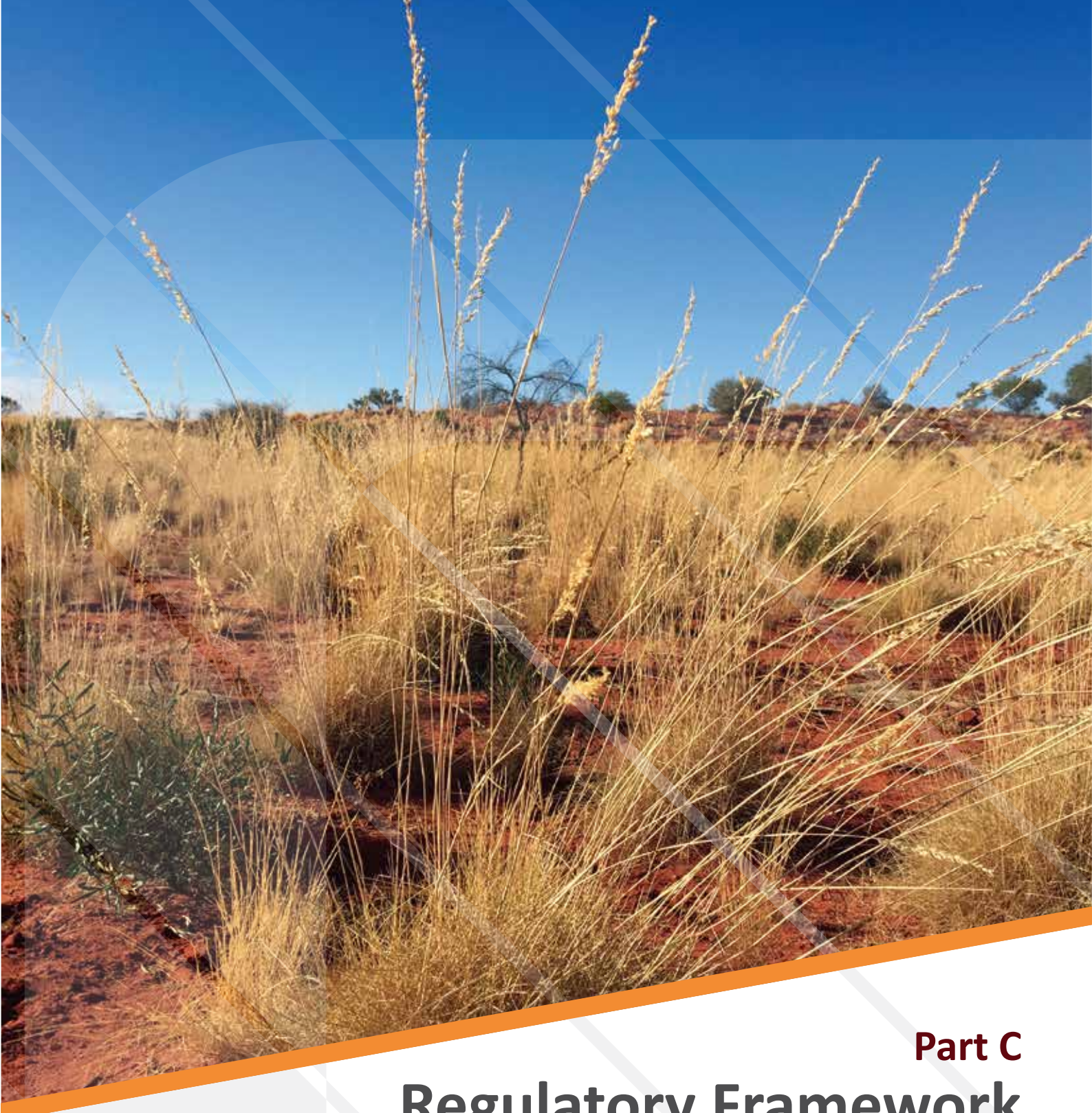
The Chandler Haul Road would also be appropriately designed to allow for light aircraft (operated by the Royal Flying Doctors Service) to land on-site in the event of a medical emergency. The section of road would be designed to relevant standards for remote airstrips, including those specified by the Royal Flying Doctors Service.



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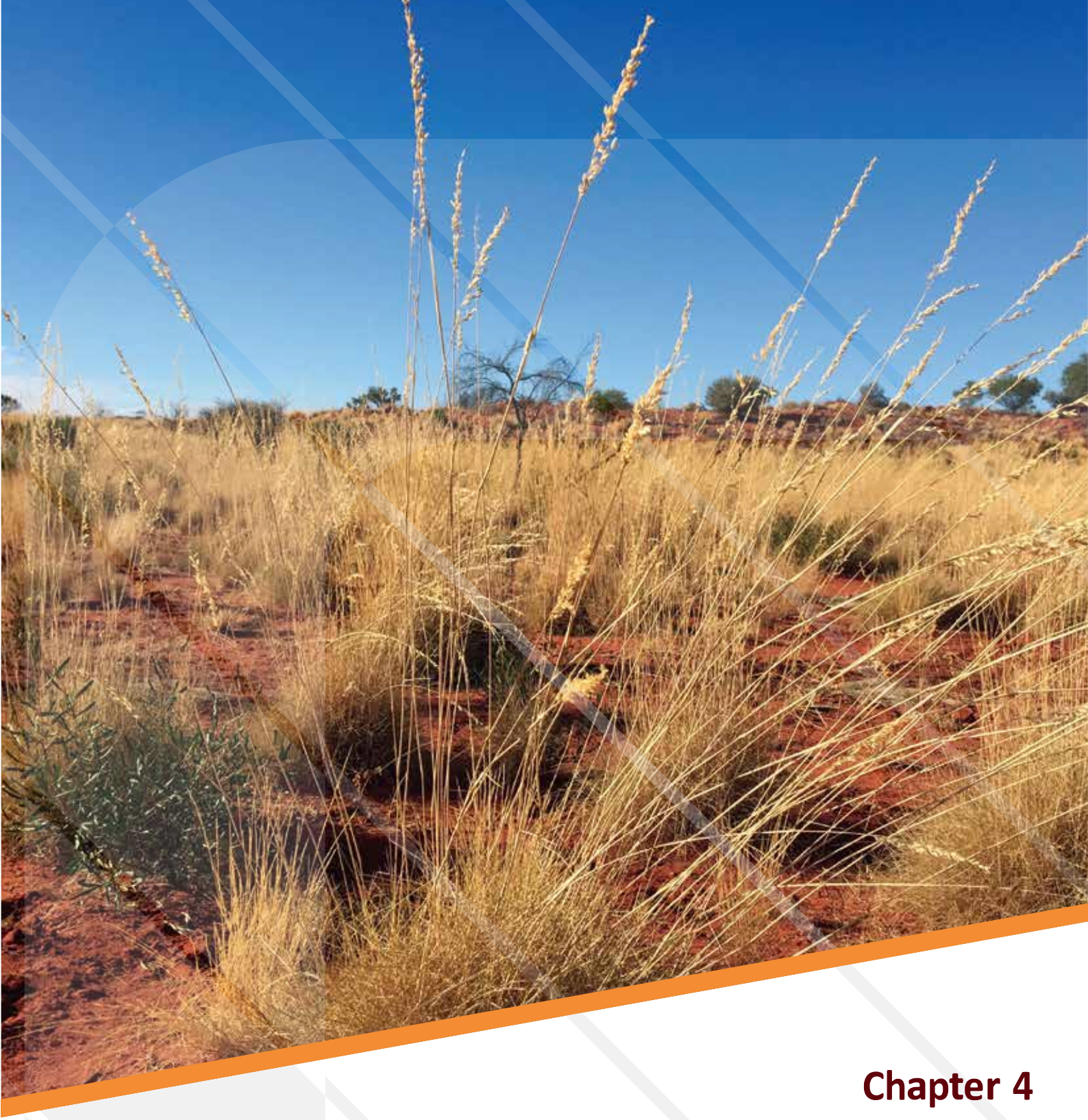
Approvals and Stakeholder Engagement

TELLUS



Part C

Regulatory Framework and Engagement



Chapter 4

Approvals Pathway

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4 APPROVAL PATHWAY

4.1 Proposal components

The Proposal comprises an underground rock salt mine and a storage and permanent isolation facility (the Chandler Facility), as well as a supporting rail siding and surface storage and transfer facility (the Apirnta Facility) and haul and access roads (the Chandler Haul Road and the Henbury Access Road). Construction, operation closure and rehabilitation require approval, regulation and licencing and encompass components detailed below.

4.1.1 Mining operation

- **Chandler Facility (Mine site)** – an area for the conduct of actual mining and all the infrastructure required to facilitate such mining, including processing facilities, power generation facilities, product storage facilities, workshops, offices, consumable storage facilities, accommodation and messing facilities, sediment detention basins and water bores.
- **Access to the Chandler Facility** – during construction from Maryvale Road including upgrade of existing pastoral access tracks to allow access of people and supplies to the mine. During operation from a private access road named the Henbury Access Road.
- **Apirnta Facility including a rail siding (minerals transit)** – an area adjacent to the Central Australian Railway line for the export of product salt.
- **Access to the Apirnta Facility (minerals transit)** – a road allowing the transport of mine product from the Chandler Facility to the Apirnta Facility. This road is named the Chandler Haul Road.

4.1.2 Waste storage operation

- **Waste storage site –** a surface area for the above ground temporary storage of waste and voids below ground the long term storage of waste and storage and retrieval of other material**.**
- **Access to Chandler Facility from Henbury Access Road –** a road to allow access of people and supplies to the Facility.
- **Apirnta Facility including a rail siding (waste transit) –** an area adjacent to the Central Australian Railway line for the receipt and temporary storage of waste materials.
- **Access to the Apirnta Facility (waste transit) –** a road allowing the transport of waste materials from the Apirnta Facility to the Chandler Facility. This road is named the Chandler Haul Road.

Additionally, the mine operation and the waste storage operation require consideration of:

- **Water requirements –** groundwater bore field.
- **Port operations –** salt transit and waste transit on the Adelaide to Darwin railway to or from licensed transfer station and storage areas**.**

4.1.3 Tenure requirements

The underground salt mining and mineral transport operations proposed by the proponent require mineral titles and access authorities granted under the *Minerals Titles Act (NT)* (MTA). The mining and mineral transport operations on the mineral titles and access authorities will also be regulated by authorisations under the *Mining Management Act (NT)* (MMA).

There are no other mineral titles in the MTA that provide rights to waste other than waste generated by a title holder from mining activities on their mineral titles. The right to store waste and other material does not extend to commercial storage operations. Similarly, the MMA cannot authorise activities where unrelated waste is brought from off-site onto the title holder's mineral titles. The right to conduct mining activities pursuant to the terms of a relevant mineral title therefore, does not include all rights necessary for the storage any type of unrelated waste.

The proponent's mining and mineral transport operation is separate at law from the waste storage operation – even if the mining operations and waste operations are co-located. Consequently, the proponent must procure tenure of the land necessary to conduct the waste storage operations. Tenure of the land through land titles is required to provide the proponent with the legal authority to access and use the land for the waste operations.

Without tenure of the land, the proponent has no right to access and use the land for the purpose of the waste operations. However, the proponent will have rights to access and use the land for mining activities under mineral titles.

Third party agreements are required, particularly from pastoralists and native title holders. These are being sought by the proponent through separate and confidential commercial negotiations.

A summary of tenure approvals required for both mining operations and waste storage and isolation operations is provided in Table 4-1 and in Table 4-2 respectively.

Table 4-1 Mining operation approval process

Facility	Tenure	Third parties	Process
Chandler Facility (mine site)	Mineral Lease Application 30612	Native Title Party Pastoralist	Native Title Act right to negotiate Minerals Title Act
Apirnta Facility (mineral transit)	Ancillary Mineral Lease (Section 40(1)(b)(ii) of MTA	Native Title Party Pastoralist	Native Title Act right to negotiate Minerals Title Act
Chandler Haul Road (mineral transit)	Access Authority	Native Title Party Pastoralist	Native Title Act right to negotiate Minerals Title Act
Access to Chandler Facility from Maryvale Road	Access Authority	Native Title Party Pastoralist	Native Title Act right to negotiate Minerals Title Act

Table 4-2 Waste storage and isolation approval process

Facility	Tenure	Third parties	Process
Chandler Facility (mine site)	Crown lease term convertible to either freehold or a Crown Lease in Perpetuity	Native Title Party Pastoralist	• Indigenous Land Use Agreement (ILUA) • Surrender
Apirnta Facility (mineral transit)	Crown lease term convertible to either freehold or a Crown Lease in Perpetuity	Native Title Party Pastoralist	• Indigenous Land Use Agreement (ILUA) • Surrender
Chandler Haul Road (mineral transit)	Crown lease term convertible to either freehold or a Crown Lease in Perpetuity	Native Title Party Pastoralist	• Indigenous Land Use Agreement (ILUA) • Surrender
Access to Chandler Facility from Maryvale Road	Crown lease term convertible to either freehold or a Crown Lease in Perpetuity	Native Title Party Pastoralist	• Indigenous Land Use Agreement (ILUA) • Surrender

4.1.4 Existing interests and stakeholders

The proponents existing interests relating to the Proposal include the Maryvale and Henbury estates as well as all Native Title Parties. Key government and non-government organisations are also important stakeholders during pre-development, construction, operation, closure and rehabilitation of the Proposal.

- **Maryvale pastoral lease** (NT Portion 810 PPL 1063) – Maryvale underlays the proposed Chandler Facility. It also underlays the Chandler Haul Road and access from Maryvale Road. The pastoral lease includes water bodies within the boundaries of the pastoral lease, though the *Water Act (NT)* regulates watercourses.
- **Henbury pastoral lease** (NT Portion 657, PPL 1094) – Henbury underlays the proposed rail siding and Apirnta Facility, part of the Chandler Haul Road, and all of the Henbury Access Road. The

pastoral lease includes water bodies within the boundaries of the pastoral lease, though the *Water Act (NT)* regulates watercourses.

- **Native Title Parties** – the Native Title Party are the Registered Native Title Claimants or the Registered Native Title Body Corporate. There is currently one registered Native Title Claim on the Maryvale pastoral lease and the Henbury pastoral lease. This has triggered the formal processes of the Commonwealth *Native Title Act 1993*. The Central Land Council (CLC) will lodge native titles claims in response to notifications of the proposed grant of mining leases. In addition, the CLC may also lodge native title claims in relation to all areas affected by the Proposal's operations.
- **Department of Lands Planning and Environment** (DPIR, NT Government) – the department charged with administration of the *Crown Lands Act (NT)* from which the proponent seeks the grant of tenure.
- **Department of Primary Industry and Resources** – (DPIR, NT Government) – the department administering the MTA and MMA which will govern the mine operations.
- **Environment Protection Authority** – (NT EPA, NT Government) - the department administering the *Environmental Assessment Act (NT)* (EA Act) and the *Waste Management Pollution Control Act (NT)* (WMPC Act).
- **Genesee and Wyoming Australia** – operators of the Adelaide to Darwin Railway line and holders of sub-leases for the rail line and easement of land immediately adjacent to the rail infrastructure.

4.2 Approval process summary

Environmental desktop studies, field investigations and detailed analysis of environmental data for the EIS have occurred between 2013 and 2016. These studies have been necessary in order to address various sections of environmental legislation and regulations which are used to approve and/or licence the Proposal.

The Proposal will involve the proponent seeking approvals, licenses and permits from both the Commonwealth and NT Government. In summary, the key approval and licensing requirements for the Proposal fall under the administration of:

- The Australian Minister for the Environment under the provisions of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and Environment Protection and Biodiversity Conservation Regulations 2000.
- The NT Minister for Mines and Energy under the provisions of MMA, specifically Section 82 of the MMA. The Mining Management Regulations (MN Regulations) are also relevant to the Proposal.
- The NT Minister for the Environment under the following legislation:
    - EA Act and Environmental Assessment Regulations (EA Regulations) and the Environmental Assessment Administrative Procedures.

- WMPC Act and Waste Management Pollution Control Regulations. The WMPC Act deals with the granting of any licences and/or permits for storage, transportation or discharge of material.

The Minister agreed that a single draft EIS and Supplementary EIS be prepared for the purposes of the above stated approvals processes. Figures 4-1 and 4-2 summarise the approvals process.

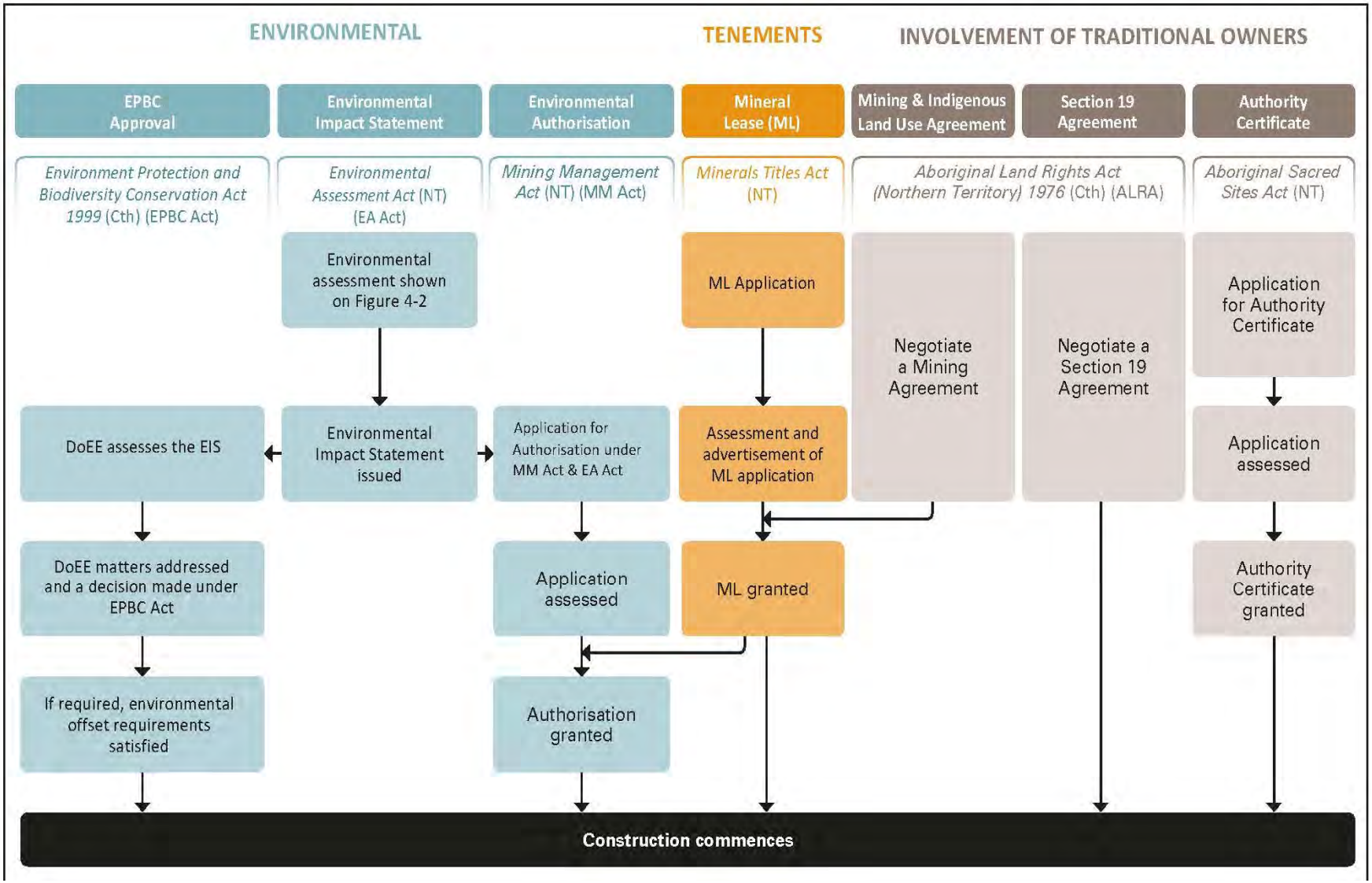


Figure 4-1 Approval process (environmental, tenements and Traditional Owners)

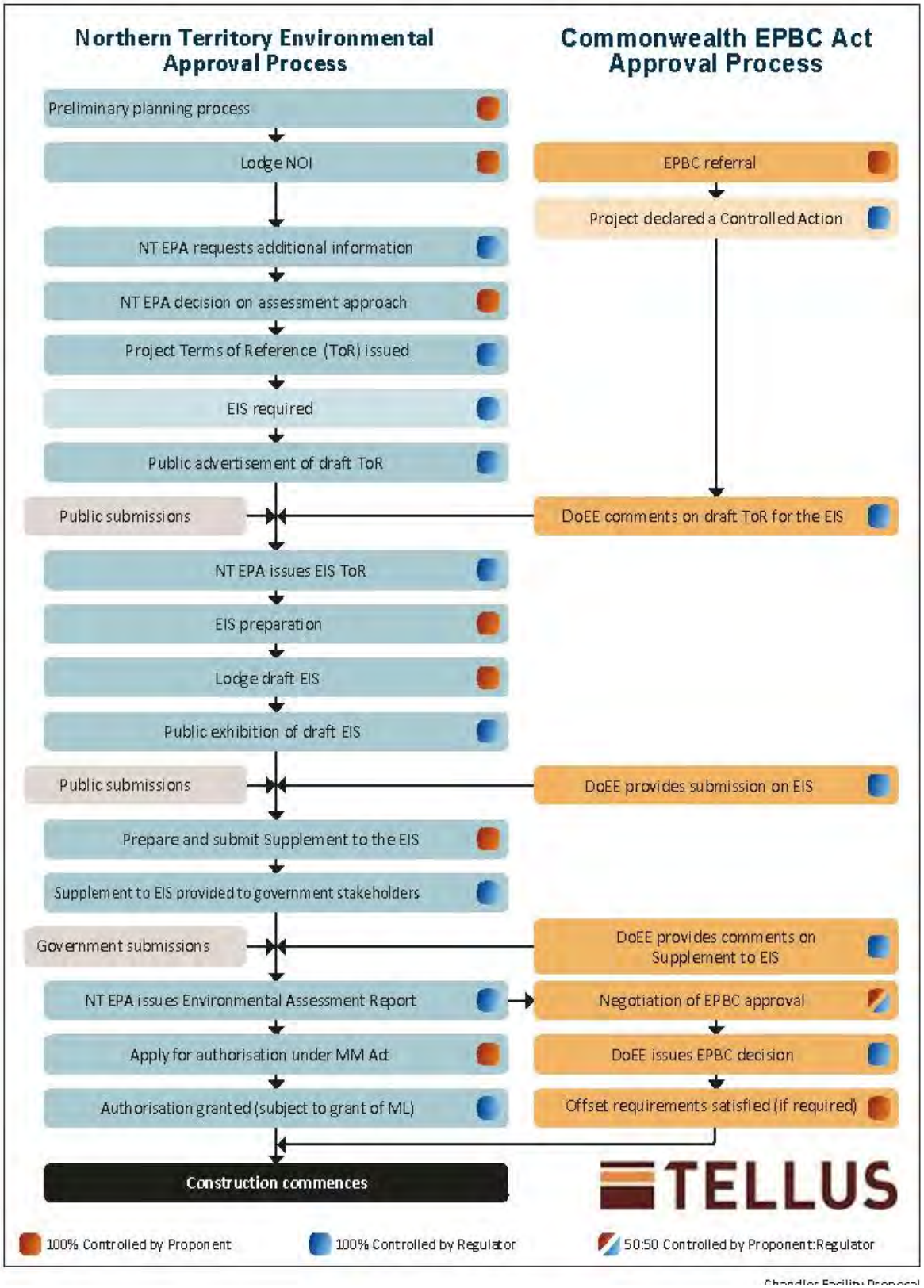


Figure 4-2 Approval process (EIS)

4.3 Commonwealth approvals

4.3.1 Approvals legislation

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection Biodiversity Conservation Act* (EPBC Act) facilitates national environmental assessment and approvals, protects biodiversity and integrates the management of important natural and cultural places. Under the provisions of the EPBC Act, actions that are likely to have a significant impact on a Matter of National Environmental Significance (MNES), are subject to a detailed assessment and approvals process.

The Proposal was referred to the DoEE in December 2012 due to the potential for the proposed action (the Proposal) to have a significant impact on Matters of National Environmental Significance (MNES). In February 2013, the DoEE determined that the proposed action was a controlled action and required assessment under the EPBC Act. In April 2016, the Proposal was varied and the DoEE was notified. Following review of the variation, the Federal Minister for the Environment determined the Proposal to be a 'controlled action' under the EPBC Act.

Of the seven MNES identified under the EPBC Act, one was identified as controlling provision for the Proposal. This was listed threatened species and communities (sections 18 and 18A). The potential impacts on this controlling provision is discussed in Chapter 7.

The bilateral agreement between the Australian Government and the NT allows a single EIS to be undertaken under the EA Act and the *Environmental Assessment and Administrative Procedures* and for each jurisdiction (the NT and Commonwealth) to consider the results from such assessment and suggest conditions (in the case of the NT) or impose conditions (in the case of the Commonwealth).

The matters to be addressed by an EIS under the EPBC Act are listed under Schedule 4 of the *Commonwealth Environment Protection and Biodiversity Conservation Regulations 2000* (EPBC Regulations).

Native Title Act 1993

The *Native Title Act 1993* provides for the recognition and protection of native title and contains processes for effecting native title claims. The *Native Title Act* also sets out processes by which native title rights are established, protected and compensation determined, in addition to facilitating Indigenous Land Use Agreements (ILUA's) between native title parties and other interest holders.

The proponent's MLA including its associated infrastructure is subject to the outcomes of a current application in this matter.

Aboriginal Land Rights (Northern Territory) Act 1976

The *Aboriginal Land Rights Act* (ALR Act) provides for the granting of Traditional Aboriginal Land in the NT for the benefit of Aboriginal people, and for other purposes.

Section 46 of ALR Act requires a proponent to enter into an agreement with the Central Land Council (CLC) (representing the Traditional Aboriginal Owners) before the mineral lease can be granted.

The agreement, under section 46, stipulates the parties must adhere to the terms and conditions to which the grant of the mineral lease will be subject and the minister has consented, in writing, to the grant of the mining interest. Such an agreement has been entered into with the CLC and negotiations in good faith continue.

Hazardous Waste (Regulation of Exports and Imports) Act 1989

The Commonwealth Government implements its Basel Convention responsibilities through the *Hazardous Waste (Regulation of Exports and Imports) Act 1989*[16] (the "Hazardous Waste Act"), which regulates (via a permitting system) movement of hazardous wastes in and out of Australia.

The object of the Hazardous Waste Act is to:

"… regulate the export, import and transit of hazardous waste to ensure that exported, imported or transited waste is managed in an environmentally sound manner so that human beings and the environment, both within and outside Australia, are protected from the harmful effects of the waste."

Key aspects to be considered are:

- The definition of 'waste' (Section 4, p.9 of *Hazardous Waste Act*).
- The definition of 'disposal' (Section 4, p.5 of *Hazardous Waste Act*).
- The definition of 'hazardous waste' (Section 4, p.5 of *Hazardous Waste Act*).
- The definition of environmentally sound management (ESM) (Section 4E, p.14 *Hazardous Waste Act*).
- Facilities within Australia that may provide management alternatives for the hazardous waste.

With regard to the last point, Section 17(5) (p.32) of the Hazardous Waste Act allows for a permit to be refused on the basis of the existence of a facility in Australia, if a waste's management in such a facility is consistent with ESM and can be done "safely and efficiently". Section 17(5) of the Hazardous Waste Act says, specifically:

> *"(5) The Minister may decide not to grant the permit if the permit sought is a Basel export permit and the Minister thinks that:*

[16] https://www.environment.gov.au/protection/hazardous-waste/about

(a) the hazardous waste could be disposed of safely and efficiently by using a facility in Australia; and

(aa) such a disposal would be consistent with the environmentally sound management of the waste; and

(b) having regard to the desirability of using facilities in Australia for the disposal of hazardous waste, the waste should be disposed of by using that facility rather than in accordance with the export proposals."

ESM is defined in the Act as:

"A reference in this Act to the environmentally sound management of hazardous waste is a reference to taking all practicable steps to ensure that the waste is managed in a manner that will protect human health, and the environment, against the adverse effects that may result from the waste."

Both sections 17(5) and 4E are important in any export permit deliberations by the Australian Government once the Chandler facility is operational, as a strong case exists to argue that salt repository is both "safe and efficient" and consistent with "environmentally sound management".

4.3.1 Other relevant legislation

Hazardous waste in Australia is regulated at the state/ territory level, addressing risks arising from generation, workplace health and safety, transport, treatment and disposal. Increasingly, the Commonwealth Government has taken an overarching role in coordination, consistency and prioritising areas of policy intervention at a national level, in concert with states and territories.

Prior to the commencement of construction and operation, a number of other approvals would be required for the Proposal. These approvals are listed in alphabetical order in Table 4-3. This list of approvals and legislative requirements is indicative of the types of approvals that may be required for the Proposal. It is a summary and not an exhaustive list.

4.3.2 Policies and codes of practice

National policies and codes of practice have been considered in assessing the Proposal. A summary, rather than an exhaustive list of these polices and codes of practice, is presented in Table 4-4.

Table 4-3 Commonwealth legislation, regulation and policies

Legislation	Purpose / objective	Relevance	Legislation requirements and approvals	Administering agency
Australian Jobs Act 2013	The main objective of this Act is to support the creation and retention of Australian jobs by (a) requiring Australian Industry Participation plans for major projects.	The Proposal must prepare an Industry Participation Plan that meets the requirements under the Act.	Australian Industry Participation Plan and Agreement under section 18, 19 or 20.	Commonwealth Government
National Greenhouse and Energy Reporting Act 2007	To establish a national framework for corporations to report greenhouse gas emissions, reduction, removals and offsets, and energy consumption and production.	The Proposal will report greenhouse gases emissions and offsets it may achieve over life of operations.	Requirement to report greenhouse gas emissions and energy production and consumption.	Department of Environment and Energy (DoEE)
National Environment Protection Council Act 1994	To ensure that people enjoy the benefit of equivalent protection from air, water or soil pollution and from noise wherever they live; and that business decisions are not distorted and markets are not fragmented by variations in major environment protection initiatives between member governments.	Air Quality National Environment Protection Measures (NEPMs) and Movement of Controlled Waste NEPM have been adopted for the Proposal.	Requirement to comply with compulsory reporting.	National Environmental Protection Council
Biosecurity Act 2016	An import permit is required to import goods, containers and vessels into Australia that pose a biosecurity risk. All vessels are required to arrive at a First Point of Entry location unless an exemption is approved before arrival. Certain goods must be unloaded on these sites.	The Department of Agriculture and Water Resources regulates imported goods, containers and vessels under the *Biosecurity Act 2015*. The Act replaced the *Quarantine Act 1908* on 16 June 2016.	*Biosecurity Act 2016*	Department of Agriculture and Water Resources
Customs Act 1901	The Australian Government controls the import and export of certain goods. Restricted goods require written permission (a permit) from	Import of goods	All imported goods with a value greater than AUD $1,000 are liable for duties, taxes and charges unless an exemption or	Australian Government

Legislation	Purpose / objective	Relevance	Legislation requirements and approvals	Administering agency
	relevant authorities in order to import or export those goods		concession applies. Certain goods (like tobacco, tobacco products or alcoholic beverages) are liable for duties, taxes and charges regardless of their value	
Australian Radiation Protection and Nuclear Safety Act 1998.	To accept NORM waste at exempt levels.	The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) regulates radioactive activities with direct Commonwealth involvement under the Australian Radiation Protection and Nuclear Safety Act 1998.	To accept NORM waste at exempt levels.	ARPANSA

Table 4-4 National policies and codes of practice

Policy/code of practice	Purpose/objective	Relevance
Inter-governmental Agreement on the Environment 1990	To unify federal and state and territory governments' regulations and processes relating to environmental matters, through the development of complementary legislation, regulations and guidelines.	The Proposal requires joint assessment and approval from the Australian and NT Government.
National Environment Protection Measures (NEPMs) – Ambient Air Quality, National Pollutant Inventory, Movement of Controlled Waste, Used Packaging Materials, Assessment of Site Contamination, Diesel Vehicle Emissions and Air Toxics	NEPMs are broad framework setting statutory instruments which outline agreed national objectives for protecting or managing particular aspects of the environment.	Air Quality National Environment Protection Measures (NEPMs) and Movement of Controlled Waste NEPM have been adopted for the Proposal.
National Strategy for Ecologically Sustainable Development 1992	To develop and maintain ecological processes on which life depends. Specific objectives related to mining include ensuring mine sites are rehabilitated and managed in accordance with appropriate standards.	The principles of ecologically sustainable development are relevant to the Proposal Specific requirements of the ecologically sustainable development guiding principles are discussed in Chapter 20
National Greenhouse and Energy Reporting System (NGERS)	To establish national mandatory reporting requirements (under the Greenhouse and Energy Reporting Act 2007) for greenhouse gas emissions, reductions, removals and offsets, and energy consumed and produced. The NGERS framework is also the basis of the Australian Emissions Trending Schedule (now called the Carbon Pollution Reduction Scheme).	Operation of the Proposal would result in greenhouse gas emissions. Measures to reduce emissions and balance net outcomes are discussed in Chapter 18.
National Waste Policy	Provides for a coherent, efficient and environmentally responsible approach to waste management in Australia. Places emphasis on waste reduction, recycling and reuse.	The Proposal has been developed with consideration of the National Waste Policy. If implemented, the Proposal would support the following key areas of the policy: - 'Improving the market — efficient and effective Australian markets operate for waste and recovered resources, with local technology and innovation being sought after internationally'. - 'Reducing hazard and risk — Reduction of potentially hazardous content of wastes with

Policy/code of practice	Purpose/objective	Relevance
		consistent, safe and accountable waste recovery, handling and disposal'. - 'Tailoring solutions — Increased capacity in regional, remote and Indigenous communities to manage waste and recover and re-use resources'.
Australian Groundwater Modelling Guidelines	The *Australian Groundwater Modelling Guidelines* (NWC 2012) were developed to provide a consistent and sound approach for the development of numerical groundwater flow modelling in Australia.	As per the Terms of Reference, a site conceptual model has instead been developed and is presented in Section 8. The site conceptual model has been developed in accordance with the Australian Modelling Guidelines (NWC 2012).
National Water Quality Management Strategy and National Water Initiative	To achieve sustainable use of water resources by protecting and enhancing their quality and to improve water management while maintaining economic and social development.	Relevant to water supply options for the Proposal.
National Strategy for the Conservation of Australia's Biological Diversity	To protect biological diversity and maintain ecological processes and systems.	Native vegetation would be cleared during construction of the Proposal. Mitigation and management measures would be implemented to reduce impacts on biological diversity and maintain ecological processes (refer to Chapter 7).
National Framework for the Management and Monitoring of Australia's Native Vegetation	To reverse the long term decline in native vegetation, conserve and restore native vegetation, and retain, enhance and improve the condition of existing native vegetation.	Native vegetation would be cleared during construction of the Proposal. Mitigation and management measures would be implemented to reduce impacts on native vegetation including ensuring that vegetation clearing is kept to a minimum (refer to Chapter 7).

4.4 Northern Territory approvals

4.4.1 Approvals legislation

Environmental Assessment Act

The environmental assessment process is administered under the EA Act and through the *Environmental Assessment Administrative Procedures*.

In November 2012, a Notice of Intent for the Proposal was submitted to the NT EPA. In March 2013, the NT EPA determined that the Proposal required assessment under the EA Act at the level of an EIS. *Final Guidelines for the Preparation of an Environmental Impact Statement* (referred to as the "EIS Guidelines") were issued by the NT EPA on 19 July, 2013. A period of three years was set to submit the EIS.

In April 2016, both the NT EPA and DoEE were notified that changes had been made to the Proposal. The changes involved the removal of some previously proposed infrastructure (mine site surface processing plant; airstrip; specialty salt processing and packing plant with training school and visitor centre; crystallisation and evaporative ponds; wet processing of salt; and storage and transfer facilities in Darwin and Alice Springs) thereby reducing the footprint of the Proposal. The changes also involved a change to, or addition of, the following infrastructure:

- Change of access from the Stuart Highway to the proposed rail siding (and proposed Apirnta Storage and Transfer Facility). Rather than using Maryvale Road, an existing access road located on the Henbury Station would be upgraded and used as the primary access road to the Apirnta Storage and Transfer Facility from the Stuart Highway (the Henbury Access Road). This change in access was made due to significant health and safety concerns regarding the use of Maryvale Road.
- Change to storage processing (in addition to the emplacement of solid wastes, it is proposed to permanently isolate some waste types by hydraulic backfill).
- Addition of a helicopter pad (a helicopter pad would be constructed in lieu of the previously proposed airstrip).
- Addition of a storage and transfer facility located adjacent to the proposed rail siding (the Apirnta Storage and Transfer Facility capable of storing approximately 400,000 tonnes of waste).

In addition to the above changes in infrastructure, the capital investment increased from $200 million to $644 million. The number of jobs created during construction also increased from 267 to 350 and the number of jobs created during operation increased from 66 to 160.

In May 2016, the NT EPA determined that the changes to the Proposal were broadly allowed for by the EIS Guidelines issued in July 2013. Several additional matters pertaining to the proposed hydraulic backfilling method, the rail siding and the Apirnta Facility were, however, required to be addressed. This decision was supported by the DoEE in June 2016.

In June 2016, a six month extension was requested on the timeframe for submitting the EIS. This extension was granted with the proviso that new guidelines would be issued and subject to public exhibition. In September 2016, the new Terms of Reference were issued by the NT EPA (refer to Appendix A).

This draft EIS has been prepared to address the requirements set out in the Final Terms of Reference issued by the NT EPA under the EA Act in September 2016. The EIS will be submitted to the NT EPA and the DoEE for assessment in accordance with relevant legislation and the requirements of the EA Act and the associated *Environmental Assessment Administrative Procedures*.

Mining Management Act

The *Mining Management Act* (MMA) and associated Regulations, regulate mining activities and the management of mining sites. The objectives of the MMA and regulations are to ensure the development of mineral resources in the NT is in accordance with the best practice health, safety and environmental standards and to protect the environment and health and safety of all persons on mining sites. The legislation is administered by the DPIR.

An operator of a mining site that proposes to undertake works that would cause "substantial disturbance" (as defined in the MMA) requires an authorisation under the MMA (Section 35).

The Proposal lies within EL29018 and MLA30612. An application for an authorisation must be accompanied by an operational Mine Management Plan (MMP) (section 36). The MMP must describe the mining activities proposed and management systems to protect the environment, health and safety, details of ownership, plans for the mine workings and infrastructure, and a plan and costing of closure activities (section 40).

The proponent will submit a MMP compliant with the MMA. It will describe:

- Proposed mining activities.
- Company structure.
- Management systems to be implemented for environmental, health and safety aspects.
- Closure plans.

The proponent for the Proposal would comply with the MMP in force for the site. Pursuant to section 37 of the MMA, the proponent would make an Environmental Mining Report available to the public at intervals not exceeding 12 months.

In addition, under section 43 of the MMA, the proponent for the Proposal would provide a financial security bond to the Minister for the purposes of securing costs and expenses in the event the Minister requires action to be taken to prevent, minimise or rectify environmental harm.

Minerals Title Act

The MTA and associated Regulations establish a framework for granting and regulating mineral titles that authorise exploration for, and extraction and processing of, minerals and extractive minerals; to facilitate the commercialisation of activities conducted under mineral titles by authorising the creation and transfer of interests in the titles; and to authorise other activities relating to minerals or extractive minerals to be conducted without mineral titles.

The proponent requires a mineral lease for the Proposal under the MTA. A mineral lease can only be granted if the Minister for Primary Industry and Resources is satisfied the proponent has obtained the permission, consent or agreement required under the ALR Act section 74(1).

The proponent for the Proposal has lodged a MLA under section 41 and 66 of the MTA including but not limited to:

- A description of the land comprising the proposed title area of the mining lease.
- Evidence of an ore body of likely economic value in the proposed title area.
- A summary of the work proposed to be carried out for conducting authorised activities under the mining lease.

Where appropriate, the proponent will report activities conducted under the mineral lease and, will require written consent if it wishes to disturb improvements on land in the title area, or damage, or otherwise disturb a Territory or Council road.

Waste Management Pollution Control Act

The *WMPC Act* and associated Regulations is to provide for the protection of the environment through encouragement of effective waste management and pollution prevention and control practices. It facilitates the implementation of national environment protection measures under the *National Environmental Protection Council (Northern Territory) Act.*

An approval is required if a proposal involves “storing, recycling, treating or disposing of listed wastes on a commercial basis.” A license is required if a proposal involves any activities listed under Schedule 2 of the Act including “collecting, transporting, storing, recycling, treating or disposing of listed wastes on a commercial basis.”

Separate environmental protection approval and environmental protection licence would be required for storing/disposing of waste.

Work Health and Safety (National Uniform Legislation) Act

The objective of the *Work Health and Safety (National Uniform Legislation) Act* is to provide a balanced and nationally consistent framework for the health and safety of workers and workplaces. This Act applies to all facets of the proposal at the proposed Apirnta and Chandler Facilities.

The Act and its associated Regulations, provide the proponent with guidance as to how works and other persons should be given the highest level of protection against harm to their health, safety and welfare from hazards and risk arising from work or from specified types of substances and/or plant.

Work Health and Safety (National Uniform Legislation) Regulations (WHS Regulations) 536, 537 and 547 require those Operators and proposed Operators to notify, or re-notify, the Regulator depending on the circumstance when they exceed or propose to exceed, or are likely to exceed 10% of the threshold quantities of hazardous chemicals listed within Schedule 15 of the WHS Regulations.

The WHS Regulations require that notification be made in accordance with Part 9.2 of the Regulations, in particular Regulation 538 dealing with the content of the notification.

Regulation 548 requires the new operator of the determined major hazard facility to give the Regulator a notification that contains information specified in Regulation 538(2) in relation to the proposed new operator.

Water Act

The *Water Act* provides for the investigation, allocation, use, control, protection, management and administration of surface and groundwater resources, as well as the administrative process for licensing these activities and related purposes.

Pursuant to section 7 of the *Water Act*, mining activities (as defined by the MM Act) or another activity for a purpose ancillary to that mining activity, including the use of water as drinking water, are exempt from a number of provisions of the Act, including Parts 5 and 6 regarding surface water and groundwater, respectively. However, the proponent proposes to take and use water outside the boundaries of NT a water control district but will still apply for a licence to take or use water under section 45.

The *Water Act* also control the issue of waste discharge licences. Where required, the proponent would apply for a licence under the *Water Act* for the discharge of any potentially contaminated mine waters from its tenements.

Heritage Act

The *Heritage Act* provides a system for the identification, assessment, protection and conservation of the Territory's natural and cultural heritage. Such heritage includes fossils, buildings, gardens, ruins, archaeological sites, landscapes, ecosystems, coastlines, plant and animal communities.

The *Heritage Act* provides protection for any heritage places or objects (European or Aboriginal). Under the Act, if any archaeological places or objects are to be disturbed, permission must be sought from for an approval (a work approval) to carry out work on a heritage place or object. An application can only be made with the consent of the owner of the place or object (the relevant Land Trust).

The proponent has conducted a thorough search of the public register (section 139) to identify archaeological sensitivity in the area of its proposed mining operations. In addition, the

development envelope was surveyed for the presence of Aboriginal and non-Aboriginal archaeological sites with the assistance of Traditional Owners. The archaeological heritage assessment was undertaken by Ninti One, specialist Heritage consultants (refer to Chapter 10).

4.4.2 Summary of Northern Territory approvals for mining operations

As described in Chapter 3, the Proposal has a number of Facilities which have different tenure and require ongoing consultation with third parties. Table 4-5.

Table 4-5 Summary of Facility tenure and agreements to be reached for mining operations

MINING OPERATION			
Facility	**Tenure**	**Third Parties**	**Process**
Mine Site	Mineral Lease Application 30612	1. Native Title Party 2. Pastoralist	1. NTA – right to negotiate 2. MTA – may object, consent not required
Rail Siding (Mineral Transit)	Ancillary Mineral Lease (section 40(1)(b)(ii) of MTA)	1. Native Title Party 2. Pastoralist	1. NTA – if section 24MD(6B) applies, right to notice and object 2. MTA – may object, consent not required
Access to the Rail Siding (Mineral Transit)	Access Authority	1. Native Title Party 2. Pastoralists	1. NTA – s24MD(6A) must not unreasonably refuse consent 2. MTA – notice required
Access to the Mine Site from Maryvale Road	Access Authority	1. Native Title Party 2. Pastoralist	1. NTA – s24MD(6A) must not unreasonably refuse consent 2. MTA – notice required

4.4.3 Summary of Northern Territory approvals for waste storage, recovery and waste isolation operations

Similarly, to proposed mining operations, the waste storage, recovery, isolation business would require tenure, consultation with third parties. Table 4-6 summaries these aspects and lists the necessary process and what course of action may be applicable to the tenement should, in the unlikely event, third party agreements cannot be reached.

Table 4-6 Summary of Facility tenure and agreements to be reached for waste management operations

WASTE STORAGE OPERATION				
Facility	**Tenure**	**Third Parties**	**Process**	**NTG Acquisition Process (if NO agreement with Third Parties)**
Waste Storage Site	Crown Lease Term ("CLT") convertible to either freehold or a Crown Lease in Perpetuity ("CLP")	1. Native Title Party 2. Pastoralist	1. ILUA 2. Surrender	1. NTA – right to negotiate, grant arbitrated at NNTT 2. LAA – possible Tribunal or Court compensation case
Rail Siding (Waste Transit)	CLT convertible to either freehold or CLP	1. Native Title Party 2. Pastoralist	1. ILUA 2. Surrender	1. NTA – right to negotiate, grant arbitrated at NNTT 2. LAA – possible Tribunal or Court compensation case
Access to the Rail Siding (Waste Transit)	CLT convertible to either freehold or CLP	1. Native Title Party 2. Pastoralists	1. ILUA 2. Surrender	1. NTA – right to negotiate, grant arbitrated at NNTT 2. LAA – possible Tribunal or Court compensation case
Access to the Waste Storage Site from Maryvale Road	CLT convertible to a CLP	1. Native Title Party 2. Pastoralist	1. ILUA 2. Surrender	1. NTA – right to negotiate, grant arbitrated at NNTT 2. LAA – possible Tribunal or Court compensation case

4.4.4 Documents and interested parties

Table 4-7 summarises what documentation would be required against various Acts and Regulations for different activities of the Proposal. Interested parties and relevant key stakeholders are also listed. Where appropriate, commentary is provided for further information.

4.4.5 Other relevant legislation

Prior to the commencement of construction and operation, a number of other approvals would be required for the Proposal. These approvals are listed in alphabetical order in Table 4-5. This list of approvals and legislative requirements is indicative of the types of approvals that may be required for the Proposal. It is a summary and not an exhaustive list.

4.4.6 Policies and codes of practice

NT policies and codes of practice have also been considered in assessing the Proposal. A summary of these polices and codes of practice, is presented in Table 4-6.

Table 4-7 Required documents and parties involved

Document	Parties	Comments
Title under the *Mineral Title Act* including: • Mineral lease. • Ancillary mineral lease (for accommodation facilities). • Ancillary mineral lease (for the rail-siding and other infrastructure such as the solar plant); • Access authority (access to the site from Maryvale road). • Access Authority for haul road from mine to rail siding. • Possible Extractive Mineral Permits for construction materials for access/haul roads.	• DPIR. • The proponent.	-
Land tenure including: • Surrender of pastoral lease over site. • Possible Crown lease or freehold granted under the *Crown Lands Act* for the site (surface and volumetric sub-surface). • Easement/Crown lease/freehold title for haulage road to the railway.	• DPIR. • The proponent. • registered owners of Maryvale and Henbury Stations.	The proponent would seek an Access Authority which is an easement under the Mineral Titles Act. This could later be converted to a Crown Lease or Freehold.
Licences under the *Mining Management Act* including: • An authorisation and approved mining management plan.	• DPIR • The proponent.	-
Licences under the *Waste Management and Pollution Control Act* including: • Environmental protection approvals. • Environmental protection licences.	• NT EPA • The proponent.	-
Licences under the *Water Act* including: • Underground waste disposal licence. • Licence to take ground water.	• Territory (through the Controller of Waters in DENR). • The proponent.	DPIR can issue approval for water extraction but not a discharge licence.
Environmental Assessment from the NT EPA including:	• The proponent.	-

Document	Parties	Comments
• This EIS	• NT EPA	
Approvals under the *Planning Act* and the *Building Act* (if necessary) including: • Development consent (subdivision). • Possible exceptional development permit. • Occupancy permits.	• DPIR. • The proponent.	-
Approvals under the *Dangerous Goods Act* and the *Work Health and Safety (National Uniform Legislation) Act* including: • Major hazard facility licence (supported by a Safety Case). • Dangerous goods licence.	• Territory (through NT WorkSafe) • The proponent	-
Compliance with the: • *Environmental Protection Biodiversity and Conservation Act 1999* (Cth). • National Greenhouse and Energy Reporting Act 2007 (Cth) and reporting requirements. • The NT *Environmental Assessment Act*. • The Heritage Act (in undertaking clearances etcetera). • The NT *Sacred Sites Act* (and the grant of an authority certificate).	• The proponent.	-
Miscellaneous approvals including: • Registration as a food business under the NT *Food Act* (and other licences). • Registration under the NT *Public and Environmental Health Act* such as licences or approvals for waste disposal (both landfill, wastewater and sewerage) and accommodation facilities. • Liquor licence under the NT *Liquor Act*. • Agreement with Department of Infrastructure Planning and Logistics for use of Maryvale Road and intersection of mine access road with Maryvale Road.	• NT Government (through the Liquor Commission, the Chief Health Officer, Department of Health, DIPL and DENR). • The proponent.	-

Document	Parties	Comments
Compliance with requirements of the Project Facilitation Agreement: • Industry Participation Plan • Social Impact Management Plan • Community Benefits Plan	• NT Government (Department of Chief Minister, Department of Business, DPIR). • The proponent	-
Agreement with registered native title claimants (if any) including: • Co-operation and mining deed (includes royalty payments). • Section 31 agreement/tripartite deed under the *Native Title Act 1993* (Cth) to provide for the grant of mining tenure. • Section 31 agreement/tripartite deed under the N*ative Title Act 1993* (Cth) to provide for the grant of freehold or crown lease on surface lands and waters. • Indigenous land use agreement for the grant of the land tenure.	• Central Land Council. • The proponent • NT Government (through Department of Justice).	-
Construction contracts including: • construction of the mine. • construction of the accommodation facilities. • construction of the haulage road, rail siding, landing strip etcetera.	• Third parties. • The proponent	-
Operational contracts including: • Road haulage, road transport and train loading agreement; • Rail freight/rail wagons rental agreement; • Mine operations/crushing/refining contract; • Bulk handling agreements. • Assaying contract. • Rail-siding agreement; • Shipping/stevedoring contracts.	• Third parties. • The proponent. • Adelaide Port Corporation.	-

Document	Parties	Comments
Accommodation/workforce contractions including: • Accommodation/messing agreements. • Agreements with the Territory to use prison workforce ('sentenced to a job').	• Third parties • The proponent	-
Customer contracts including: • Long-term sale contracts for the sale of the salt; • Long-term storage contracts.	• Third parties • The proponent	-
Due diligence report prepared for the financiers of the transaction in the approved form including: • Review of all the documents listed above. • Review of the corporate documents of Tellus including the constitution, board minutes and ensuring the relevant documents were executed in accordance with the law/constitution. • Review of the existing financing arrangement and securities granted. • Review of the joint venture agreements (if any). • Obtaining responses from Territory departments and Commonwealth departments in relation to the search requests. • Undertaking searches of the land register, mineral titles register and litigation searches etcetera. • Representation letters from the relevant law firms.		-

Table 4-8 Other relevant Northern Territory legislation

Legislation	Purpose/objective	Relevance	Legislation requirements and approvals	Administering agency
Bushfires Act	Provides the framework for managing bushfire in areas outside major towns in the NT.	Construction and operation of the Proposal may result in an increased incidence of bushfire.	No approvals or licenses required. Mitigation and management measures would be implemented to prevent bushfires. A bushfire management plan has been prepared for the Proposal (refer to Chapter 7).	Department of Environment and Natural Resources
Control of Roads Act	Provides process by which roads can be opened and closed.	Any public or gazetted roads that are required to be opened or closed during construction or operation of the Proposal. If so, this act applies.	No approvals or licenses required. Any public or gazetted roads that are required to be opened or closed during construction or operation of the Proposal would need to follow the provisions of the Act.	Department of Transport
Crown Lands Act	This *Crown Lands Act* relates to all Crown lands.	For proposed waste storage activities, this Act is applicable because the proposal would require land upon which that activity would be carried out to be converted to either a Crown Lease Term convertible to either freehold or a Crown Lease in Perpetuity.	ILUA and/or surrender of pastoral land.	Department of Lands, Planning and the Environment
Dangerous Goods Act, Dangerous Goods Regulations, Dangerous Goods (Road and Rail Transport) Act **and** ***Dangerous Goods (Road and Rail Transport) Regulations***	To provide for the safe storage, handling and transport of certain dangerous goods.	Dangerous goods would be handled, stored and used during construction and operation of the Proposal.	Construction would require the use of explosives and, therefore, a license for the storage of explosives would be required. A license to keep or convey certain dangerous goods in excess of the relevant prescribed amounts would be required. In addition, a licence to transport dangerous	Department of Business (NT WorkSafe)

Legislation	Purpose/objective	Relevance	Legislation requirements and approvals	Administering agency
			goods by road or rail would be required.	
Disasters Act, Fire and Emergency Act and Fire and Emergency Regulations	To provide for the protection of life, property and the environment from the effects of disasters and emergencies, including fire.	Appropriate emergency response would be required during both construction and operation of the Proposal.	No approvals o licenses required. Construction and operation of the Proposal would be in accordance with the provisions of the Acts and Regulations, where applicable. An emergency response management plan would be prepared for the Proposal.	NT Counter Disaster Council and NT Fire and Rescue Service
Pastoral Land Act	To make provision for the conversion and granting of title to pastoral land and the administration, management and conservation of pastoral land, and for related purposes.	Under Division 3 of the Act, surrender of pastoral land to over which the Proposal applies. In this case on the Maryvale pastoral lease and Henbury pastoral lease.	Application to the Minister under section 62(1) to surrender the lease in exchange for a perpetual pastoral lease of the whole or specified part of the land the subject of the existing lease.	DLPE
Soil Conservation and Land Utilisation Act	For landholders/developers to make provision for the prevention of soil erosion and for the conservation and reclamation of soil.	Soil disturbance would occur during site preparation for the construction of the Proposal.	No approvals required. Mitigation and management measures would be implemented to prevent soil erosion (refer to Chapter 21).	Department of Environment and Natural Resources (DENR)
Territory Parks and Wildlife Conservation Act **and** ***Territory Parks and Wildlife Conservation Regulations***	To make provision for the study, protection, conservation and sustainable utilisation of wildlife. This includes declaration and control of feral animals.	Construction and operation of the Proposal may result in the introduction of pest or feral species.	No approvals required. Mitigation and management measures would be implemented to prevent the introduction of pest or feral species (refer to Chapter21).	Parks and Wildlife Commission of the NT
Traffic Act **and** ***Traffic Regulations***	To regulate traffic and include provisions in relation to the erection and operation of traffic control devices.	Construction and operation of the Proposal may require the erection and operation of traffic control devices.	Consent would be required prior to the erection and operation of traffic control devices if required during construction and operation of the Proposal.	Department of Transport

Legislation	Purpose/objective	Relevance	Legislation requirements and approvals	Administering agency
Weeds Management Act* and *Weeds Management Regulations	To protect the economy, community, industry and environment from the adverse impact of weeds.	Construction and operation of the Proposal may result in the introduction of weed species.	No approvals required. Mitigation and management measures would be implemented to prevent the introduction of weed species including the preparation of a weed management plan (refer to Chapter 21).	DENR
Work Health and Safety (National Uniform Legislation) Act* and *Work Health and Safety (National Uniform Legislation) Regulations	To promote occupational health and safety.	Construction and operation of the Proposal would present health and safety risks.	A licence may need to be obtained to perform certain work. There may also be notification requirements for certain work and a need to register certain items of plant. Mitigation and management measures would be implemented to prevent occupational health and safety risks, including the implementation of a Safety Case.	Department of Business (NT WorkSafe)

Table 4-9 Territory policies, guidelines, standards and codes of practice

Policy/code of practice	Purpose/objective	Relevance
NT EPA Waste Management Strategy for the Northern Territory 2015-2022	Provides a basis for understanding and improving the management of waste to reduce the generation of waste, increase rates of resource recovery and to minimise the environmental impacts caused by waste.	The Proposal would help to fulfil a number of the objectives for improving the management of waste and minimising the environmental impacts caused by waste. The Proposal would provide a best practice facility that would provide for the long-term storage and permanent isolation of hard to manage waste. In addition, the Proposal would be designed and managed to allow for future waste recovery opportunities.
NT Department of the Chief Minister Framing the Future	Sets a strategic plan for the future of the NT. It focuses on four strategic goals: a prosperous economy, strong society, balanced environment and confident future. It plans for an economy that creates wealth and jobs; is open, competitive and innovative; is built on exports and the needs of trading partners; lands new local, national and international investment; and captures the ideas, energy and opportunities across the NT.	The Proposal would help to fulfil a number of the objectives for building a prosperous economy in the NT. The Proposal would see the export of salt mined within the NT to customers both domestically and within Asia. The Proposal would also serve other growing sectors including the onshore and offshore oil and gas section and the mining, agricultural and manufacturing sectors in northern Australia. It would do so by providing a licensed facility capable of permanently storing waste materials generated by these industries.
Guidelines for the Preparation of an Economic and Social Impact Assessment	These Guidelines provide advice to proponents on the NT EPA expectations for the assessment and management of economic and social impacts of development projects assessed under the EA Act. Adherence to these Guidelines will assist in achieving the following objectives: • To document the economic and social impacts of a proposed development on the locality and region. • To mitigate negative economic and social impacts on the locality and region.	The Terms of Reference required the proponent to assess potential socio-economic impacts. These guidelines were used in the preparation of the EIS Chapter.

Policy/code of practice	Purpose/objective	Relevance
	• To encourage development of new and/or expansion of existing businesses in the locality. • To foster sustainable development and community wellbeing.	
Guidelines for assessment of impacts on Terrestrial Biodiversity	These guidelines are provided so that proponents of development: Have a clear understanding of what is required when they undertake an assessment of a project's impacts on biodiversity as required for a Public Environmental Report or an Environmental Impact Statement. Are able to focus their biodiversity assessments on significant impacts potentially caused by their projects, rather than an unfocused broad scale biodiversity survey of an area. Develop information sufficient to allow planning for mitigation of potential impacts and future rehabilitation of the development site.	The Terms of Reference required the proponent to assess potential impacts on biodiversity. These guidelines were used in the preparation of the EIS Chapter and specialist reports.
Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory	Provides guidance to landfill operators, developers, planning authorities and regulatory bodies on the site selection, development, design, construction, operation, closure and post-closure management of municipal solid waste, and commercial and industrial (C&I) general waste landfill facilities	This document was used by the proponent for the planning of environmental approvals and licensing of the Proposal.

Policy/code of practice	Purpose/objective	Relevance
	so that they can comply with the *Waste Management and Pollution Control Act.*	
Water Management Plan Guideline	The Water Management Plan is required to outline how environmental issues associated with surface and groundwater at a mine site will be managed through all aspects of the Proposal's approval period.	The Terms of Reference requires the proponent to draft a Water Management Plan.
Water Sampling Procedure	Details on sampling procedures for trace metals and chemical analysis.	The EIA for the Proposal involved water quality sampling involving third parties from remote locations. This document was used to guide those resources undertaking water sampling on behalf of the proponent.
AS/NZ 1SO 31000:2009	Risk management – Principles and guidelines	Risk assessment prepared (see Chapter 6).

4.5 Local government requirements

4.5.1 MacDonnell Regional Council

The Proposal would be located within the MacDonnell Regional Council Local Government Area.

The Proposal would fall within Council's *Regional Management Plan – Central Australia Region*. The Regional Management Plan addresses key issues relating to local government in the region and includes resource sharing between local councils and regional development.

MacDonnell Regional Council also has a set of by-laws. The Proposal would operate under the by-laws which would apply.

4.6 Relevant international legislation or agreements

A multilateral environmental agreement (MEA) is a legally binding agreement between three or more countries relating to the environment. MEAs usually have their underpinnings in the United Nations, via the United National Environment Programme (UNEP). The agreements of primary interest to this Strategy are described below.

4.6.1 Basel Convention and its implementation in Australia

The *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*[17] (the 'Basel Convention') regulates the movement of hazardous wastes across international boundaries. Australia was a foundation signatory to it in 1992, when it came into force.

The Convention puts an onus on exporting countries to ensure that hazardous wastes are managed in an environmentally sound manner in the country of import. These obligations are placed on countries that are party to the Convention. One hundred and fifty-one countries have ratified the Basel Convention as at December 2002. The obligations are to:

- Minimise generation of hazardous waste.
- Ensure adequate disposal facilities are available.
- Control and reduce international movements of hazardous waste.
- Ensure environmentally sound management of wastes.
- Prevent and punish illegal traffic.

The Commonwealth Government implements its Basel Convention responsibilities through the *Hazardous Waste (Regulation of Exports and Imports) Act 1989* (the 'Hazardous Waste Act'), which regulates (via a permitting system) movement of hazardous wastes in and out of Australia.

[17] http://www.basel.int/Portals/4/Basel%20Convention/docs/text/BaselConventionText-e.pdf

4.6.2 The Waigani Convention

Parties to the Basel Convention must not trade in hazardous wastes with non-Parties, but an exception to this is provided for in Article 11 of the Convention, whereby Parties may enter into specific agreements either with other Parties or with non-Parties.

The Waigani Convention (*Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region*) is one such agreement which entered into force in 2001.

The main effect of this Convention is to ban the import of all hazardous and radioactive wastes into Pacific Island Countries. Importantly, it also enables Australia to receive hazardous wastes exported from these countries, even in the event that they are not Parties to the Basel Convention. Lastly, it differs from the Basel Convention in that it also covers radioactive waste.

The convention has been ratified by Australia, Cook Islands, Fiji, Kiribati, Federated States of Micronesia, New Zealand, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.

Waigani Convention approval processes would be necessary for import of wastes destined for Tellus facilities from non-Basel Pacific Island nations.

4.6.3 The Stockholm Convention

The Stockholm Convention on Persistent Organic Pollutants (POPs) ("the Stockholm Convention"), came into force on 17 May 2004. POPs are hazardous and environmentally persistent substances which can be transported between countries by the earth's oceans and atmosphere. POPs accumulate in living organisms and have been traced in the fatty tissues of humans and other animals.

The Stockholm Convention is an MEA that aims to protect human health and the environment from the effects of POPs. The Convention has a range of control measures to reduce and, where feasible, eliminate the release of POPs, including emissions of unintentionally produced POPs such as dioxins. The Convention also aims to ensure the sound management of stockpiles and wastes that contain POPs.

The Convention originally covered a list of 12 chemicals. This was expanded by a further 10 in 2009, followed by the listing of hexabromocyclododecane (HBCD) in 2013.

Chemicals covered by the Convention are listed either for elimination, restriction of use or preventing their unintentional manufacture. The Convention applies to chemicals, but Article 6, which deals with waste, specifically covers both stockpiles and items containing or contaminated with listed chemicals. No recycling, recovery or reuse options are allowed for these wastes, except where there is a specific exemption, such as for recycling of articles (like e-waste) containing bromodiphenyl ethers.

Disposal of these wastes generally needs to be in a manner which either destroys the chemical or irreversibly transforms it. However, the Convention allows some flexibility. Since Article 6 is about reducing or eliminating "releases from" wastes, rather than necessarily the wastes themselves, Article 6 1. (d) (ii) allows wastes to be

"… otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferable option…"

For POP wastes (such as potentially POP-contaminated biosolids) destruction (high temperature thermal processes) or irreversible transformation (chemical processes not well established for POPs at all, never mind in Australia) would be unlikely to be an 'environmentally preferable option' in Australia. Once Chandler is operational however, it is likely to meet the Convention's definition of environmentally sound management, which is the same as the Hazardous Waste Act definition (see this report's section 2.2.1).

There is no single piece of legislation implementing the Convention in Australia but various aspects are addressed in the Industrial Chemicals (Notification and Assessment) Act 1989, Customs (Prohibited Exports) Regulations 1958, Customs (Prohibited Imports) Regulations 1956, Agricultural and Veterinary Chemicals (Administration) Regulations 1956, the National Strategy for the Management of Scheduled Waste and various state and territory legislation.

4.6.4 The Minamata Convention on Mercury

The Minamata Convention on Mercury (the "Minamata Convention") is a global treaty to protect human health and the environment from the adverse effects of mercury. It was agreed in January 2013.

The Convention draws attention to a global and ubiquitous metal that, while naturally occurring, has broad uses in everyday objects and is released to the atmosphere, soil and water from a variety of sources. Controlling the anthropogenic releases of mercury throughout its lifecycle has been a key factor in shaping the obligations under the convention.

The major aspects of the Minamata Convention include a ban on new mercury mines, the phase-out of existing ones, control measures on air emissions, and the international regulation of the informal sector for artisanal and small-scale gold mining.

4.6.5 New Zealand legislation

New Zealand is a signatory to a number of multilateral environmental agreements (MEAs). Of these, three MEAs place obligations on New Zealand's management of waste: The Stockholm Convention, the Basel Convention and the Waigani Convention.

The international requirements for these three MEAs are implemented domestically through the *Imports and Exports (Restrictions) Prohibition Order (No 2) 2004* (the Order). The Order was amended in August 2011 to reflect changes under the Stockholm Convention, including the addition of new listings such as pentaBDE and octaBDE. Further amendments have very recently

been made, clarifying some of the definitions of waste and the movement of wastes between OECD countries.

To export hazardous wastes, the exporter must obtain a permit from the NT EPA which can only be issued if the waste material will be processed in an environmentally sound manner at the destination facility. Under the Order, waste material that is likely to contain Stockholm-listed chemicals cannot be exported for reuse or recycling.

4.7 Approval timeframes

An overview of the environmental impact assessment process is shown in Figure 4-3. It shows where the proponent's approval application currently lies within the NT EPA impact assessment process.

The anticipated approval timeframes for the Proposal are those outlines in the *Environmental Assessment Act*, the EIS Guidelines and the information response times estimated by the proponent.

The submission of this EIS will be followed by its release for review from the public and relevant NT government agencies. During the review period, the draft will be publicly available through the NT EPA website, hardcopies of the draft for all stakeholders and neighbours of the property and public exhibition at the designated NT government agencies. It will also be made available on the proponent's website with NT EPA contact details made available should a member of the public wish to comment.

The proponent will compile responses to the submissions through the EIS supplement. Following the submission of this report and the supplement report, the NT EPA will prepare an Environmental Assessment report.

That report will be submitted to the Minister for Environment and Natural Resources who will then forward it onto the minister or minsters responsible for consent for inclusion in permit, lease or licence conditions

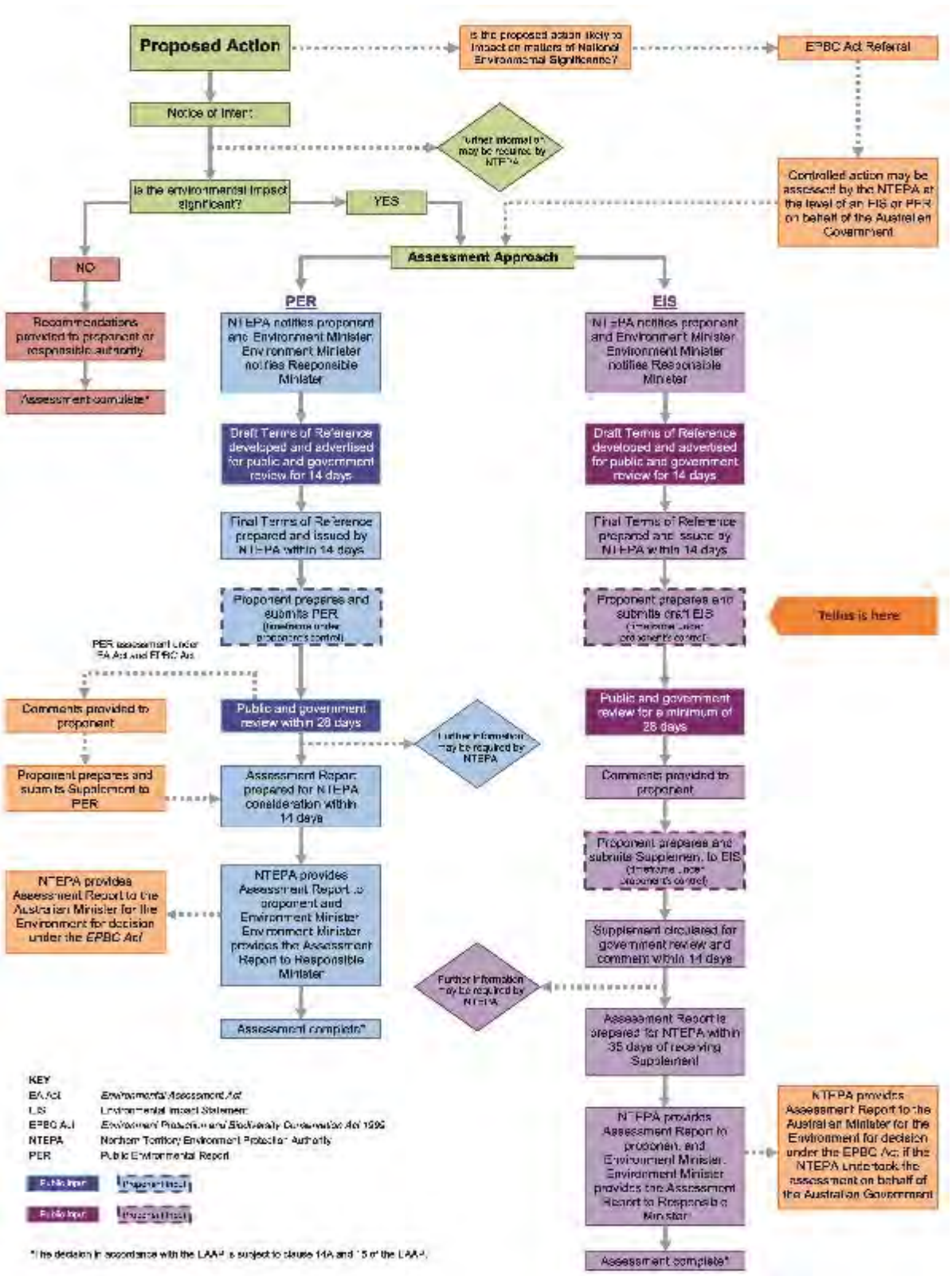


Figure 4-3 Environmental impact assessment process (NT EPA)



Chapter 5

Stakeholder Engagement and Consultation

TELLUS

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5 STAKEHOLDER ENGAGEMENT AND CONSULTATION

5.1 Introduction

This chapter provides an overview of stakeholder consultation activities undertaken during the development of the Proposal and the EIS. This includes a description of the consultation objectives, methodology, identification of key stakeholders and how they were consulted, a summary of any issues raised and how they have been addressed in the EIS.

The consultation process began in March 2012 and, if the Proposal is approved, it will continue during construction and operation.

5.2 Regulatory requirements

In September 2016, the *Terms of Reference for the Preparation of an Environmental Impact Statement – Chandler Facility* (the "Terms of Reference)" were issued by the NT EPA. The terms of reference for a proposal define the required scope of matters relating to the environment that a proponent must address in an EIS. They are released for public and government comment and input prior to finalising and issuing to a proponent and are requirement stipulated under the EA Act.

The matters raised in the Terms of Reference, along with the chapter and/or section of the EIS that addressees each matter, are provided in Appendix A.

5.3 Consultation objectives

The following objectives were established for stakeholder consultation:

- Identify key stakeholders and stakeholder groups and/or organisations relevant to the Proposal.
- Disseminate relevant information about the Proposal.
- Increase community and stakeholder awareness of the Proposal.
- Ensure stakeholders were provided with opportunities through the consultation process to identify issues, impacts and possible mitigation so that they could be included in the Proposal.
- Build community understanding and support for the Proposal.

These objectives were supported by:

- Establishing an open, honest, two-way communication process.
- Providing relevant, factual and timely information about the Proposal.

- Demonstrating a willingness to answer questions and respond to concerns directly with stakeholders.
- Considering and integrating the outcome of stakeholder consultation (ideas, suggestions, etc.), as appropriate, into the Proposal.

5.4 Consultation methodology

The methodology for stakeholder consultation was developed in accordance with the Terms of Reference and with the principles and core values of the International Association for Public Participation (IAP2). Stakeholder consultation was also undertaken with reference to:

- *Guidelines for the Preparation of an Economic and Social Impact Assessment* (NT EPA 2013).
- *Social Impact Assessment: Guidance for Assessment and Managing the Social Impacts of Projects* (International Association of Impact Assessment 2015).

The steps involved in the consultation process included the identification of key stakeholders and the development and implementation of a consultation and engagement strategy and review and response to issues raised

5.4.1 Identification of key stakeholders

Preliminary list of stakeholders was identified through:

- Background research on the local and regional area.
- The proponents contact with various individuals and organisations.
- Results of consultation conducted.

Stakeholders were identified as individuals or organisations that may be interested in or affected by the Proposal. These included:

- Australian, state and local government agencies.
- Non-government organisations.
- Industry and business.
- Landholders (pastoral lease holders and managers).
- Residents of the surrounding communities.

Once the initial stakeholder list had been compiled, the proponent developed and implemented a project consultation and engagement strategy.

5.4.2 Consultation and engagement strategy

A consultation and engagement strategy was developed to ensure effective and timely consultation activities during the development of the proposal and the EIS. The consultation and engagement strategy outlined the:

- Types of consultation activities to be undertaken.
- Timing of consultation activities.
- Responsibilities for consultation activities.
- Communication protocols.
- Reporting and feedback arrangements.

Stakeholders were engaged using a range of consultation and communication techniques, including face-to-face meetings, workshops, interviews, community information sessions, telephone and email communications, as well as media releases and website updates. These were supported by stakeholder feedback mechanisms, including a company-specific email address. The stakeholder list was refined throughout the consultation process.

5.5 Consultation activities undertaken

5.5.1 Consultation and communication tools and techniques

Stakeholders were engaged using a range of consultation and communication tools and techniques including face-to-face meetings, workshops, interviews, community information sessions, telephone and email communications, as well as news releases and website updates.

These were supported by stakeholder feedback mechanisms, including a company-specific email address and newsletters. Table 5-1 provides a summary of the proponent's activities (i.e. face to face meetings) and the purpose of each activity.

Table 5-1 Summary of stakeholder consultation and engagement activities

Activity	Purpose and activity to date
Face-to-face meetings	Face-to-face meetings were held to present information and obtain feedback on the Proposal. Face-to-face meetings were held with numerous stakeholders including representatives of government departments and non-government organisations and with pastoral lease holders and members of the local community. Several on-country meetings were also held with traditional owners.
Workshop / presentations	Workshops were held to present information and obtain specific feedback such as the identification of potential impacts and suggested mitigation for the Proposal. Since the Proposal was granted Major Project Status, two presentations were given to representatives on the NT Major Project Working Group.
Interviews	Interviews were held to obtain feedback on the Proposal. A total of 37 interviews were conducted with various stakeholders including representatives of government departments and non-government organisations, business groups and with pastoral lease holders and members of the local community. The majority of the interviews were conducted in Titjikala and Alice Springs.
Community information sessions	Community information sessions were held to present information and obtain feedback from the local community on the Proposal. Community information sessions were held within the community of Titjikala (2013, 2014 and 2015) and more are scheduled in 2016 and early 2017. An example of the communication tools used during the community information sessions is presented in Plate 5-1.
Site visits	Site visits were undertaken to obtain local information regarding the site of the proposed infrastructure and to obtain feedback on the Proposal. Site visits were undertaken with members of the community, including traditional owners (refer to Plate 5-1). In addition, site visits were undertaken with representatives of government departments and non-government organisations.
Telephone and email communications	Telephone and email communications with government agencies and other stakeholders was undertaken regularly to obtain baseline information and to provide updates on the Proposal.
Media releases	Media releases were produced at major milestones during the development of the Proposal and draft EIS. A total of 26 articles appeared in newspapers and online in publications such as Alice Springs News Online, Centralian Advocate/Local News Alice, NT News, ABC News, The Australian Mining Review, Alice Springs News and Imparja News, among others. Seven radio and one television interview have also been undertaken.
Website updates	The company website was updated regularly with the latest information regarding the Proposal. There have been thousands of visits to the website from March 2012 up to public review of the draft EIS (November 2016).

During preparation of the EIS, the proponent has engaged with and supported local businesses and communities (refer to Plate 5-1). It has created opportunities for local and regional skilled workers and education grant programs (refer to Plate 5-1).



Supporting local businesses



Create local jobs for TO's



Support local communities (Titjikala Tidy Town)



Support education programs - CDU



Support local indigenous girls programs



Site visits for Traditional Owners

Plate 5-1 Site visit with traditional owners

5.5.2 Stakeholders consulted and level of consultation undertaken

The stakeholder consultation and engagement activities undertaken from March, 2012 up to exhibition of the draft EIS are listed in Table 5-2. The table also identifies the type of consultation undertaken with each stakeholder group. In addition, Tellus have also presented at annual forums such as the Annual Geoscience Exploration Seminar and the Central Australia Regional Mining Seminar, held in Alice Springs.

Table 5-2 Stakeholders consulted and type of consultation undertaken

Stakeholder category	Stakeholder	Type of consultation	Date
Australian Government	Major Projects Approval Agency	• Face to face meeting	February 2017
	Department of the Environment and Energy	• Face-to-face meetings • Telephone and email communications	2015 and 2016
	Department of the Prime Minister and Cabinet	Interview	2015
Other stakeholders (Commonwealth)	Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)	Face-to-face meeting	2016
	Army Aboriginal Community Assistance Programme	Face-to-face meeting	2015
NT Government	NT EPA	• Face-to-face meetings • Telephone and email communications • Presentations	2012 to 2016
	Major Projects Working Group	Presentations	2015 to 2016
	Department of Lands, Planning and the Environment	• Face-to-face meetings • Presentation	2015
	Department of Primary Industry and Resources	• Face-to-face meetings • Presentation	2013 to 2016

Stakeholder category	Stakeholder	Type of consultation	Date
		• Telephone and email	
	Department of the Chief Minister	• Interview • Face-to-face meeting • Presentation • Telephone and email communications	2013 to 2016
	Department of Transport	• Face-to-face meetings • Telephone and email communications • Presentations	2015
	Department of Environment and Natural Resources	• Face-to-face meetings • Presentation • Telephone and email communications	2015 and 2016
	Department of Infrastructure	Presentation	2015
	Parks and Wildlife Commission of the Northern Territory	Letter correspondence	2016
	Department of Business	Letter correspondence	2016
	Department of Correctional Services	Interview	2016
	Chamber of Commerce	• Letter correspondence • Presentation / conference	2016
	Tourism NT	Letter correspondence	2016

Stakeholder category	Stakeholder	Type of consultation	Date
	Power and Water Corporation	Face-to-face meetings Presentation	2015
Other stakeholders (NT)	Central Land Council	• Face-to-face meetings • Presentation	2013 to 2016
	Aboriginal Areas Protection Authority	Letter correspondence	2013
Northern Territory Government – Departmental Ministers	Chief Minister	• Interview • Face-to-face meetings	2014
	Minister for Mines	• Interview • Face-to-face meetings	2014
Local Government	MacDonnell Regional Council	• Face-to-face meetings • Interview	2016
	Mayor of Alice Springs	Interview	2014
Non-Government Organisations	Minerals Council of Australia	• Letter correspondence • Face-to-face meeting	2014
	Desert Knowledge Australia	Face-to-face meeting	2015
	NT Shelter	Interview	2014
	Waltja Tjutangku Palyapayi Aboriginal Corporation	Interview	2014
	Multicultural Community Services of Central Australia	Interview	2015

Stakeholder category	Stakeholder	Type of consultation	Date
	Arid Lands Environment Centre	• Interview • Face-to-face meeting • Telephone and email correspondence Workshop	2015 and 2016
	MAX Employment (Alice Springs)	Interview	2014
	Catholic Care	• Interview • Telephone and email correspondence	2015 and 2016
	NT Industry Capability Network	Interview	2014
	NT Cattlemen's Association	Interview	2014
Traditional owners	The Kenny Family	Face-to-face meetings	2014 - 2016
Pastoral lease holders	Maryvale Station	• Face-to-face meetings • Letter • Telephone and email correspondence	2013 to 2016
	Henbury Station	• Face-to-face meeting • Letter • Telephone and email correspondence	2016
	Palmer Valley Station	Letter correspondence	2014
	Deep Well Station	Face-to-face meeting	2016

Stakeholder category	Stakeholder	Type of consultation	Date
Local community	Residents and businesses within the community of Titjikala	Presentations	2015
	Businesses and community of Alice Springs	• Presentations • Community award ceremonies • Sporting events	2015 and 2016
Industry and business representatives	Genesee & Wyoming	• Face-to-face meetings • Presentation • Email and telephone correspondence	2015 and 2016

5.5.3 Major Project Working Group presentations

Presentations were held to brief the NT Major Projects Working Group on the following matters in relation to Proposal:

- Overview of the proposed project.
- Design and technical aspects of operations.
- Status of environmental and other studies.

The presentations were followed by a question and answer session and further discussion on any aspects of the Proposal including but not limited to groundwater, logistics, likely waste inventory and safety case.

The proponent's Environment and Approvals Manager and Technical Services Manager presented to the Major Projects Working Group using a PowerPoint slide presentation [TCO-530-20-40-001] which had also been prepared as a handout and a case study presentation [TCO-530-20-40-002].

5.6 Key issues raised during stakeholder consultation

During the consultation process, stakeholders identified a range of issues, concerns and interests in relation to the project at the time of consultation. The key themes identified during consultation were:

- General environmental.
- Waste storage and transport.
- The salt mine and associated facilities.
- Transport and road safety.
- Impact on services.
- Employment and education.
- Economic development and business opportunities.
- Culture and heritage.
- Other social impacts.
- Corporate social responsibility.
- Government priorities.
- Tourism.

The issue main issues that resulted from five years of consultation are listed in Table 5-3.

Table 5-3 Issues raised by stakeholders and interested parties since 2012

Issues	Events	Stakeholders	
		Distinct	Total
Economic and social	145	184	277
Transport and logistics	54	99	121
Cultural heritage	41	37	62
Waste	32	81	102
Surface water	16	52	52
Groundwater	12	42	43
Human health	7	25	25
Landscape and visual amenity	5	30	30
Biodiversity	5	22	22
No issues	97	75	118

Figure 5-1 shows are breakdown of the most common issues raised during fives of consultation whilst developing the EIS. Figure 5-1 shows that stakeholders were most interested in the potential economic and social benefits associated with the Proposal. Stakeholders were also interested with issues relating transport and cultural heritage. A more even spread of issues were raised for surface water, groundwater and waste.

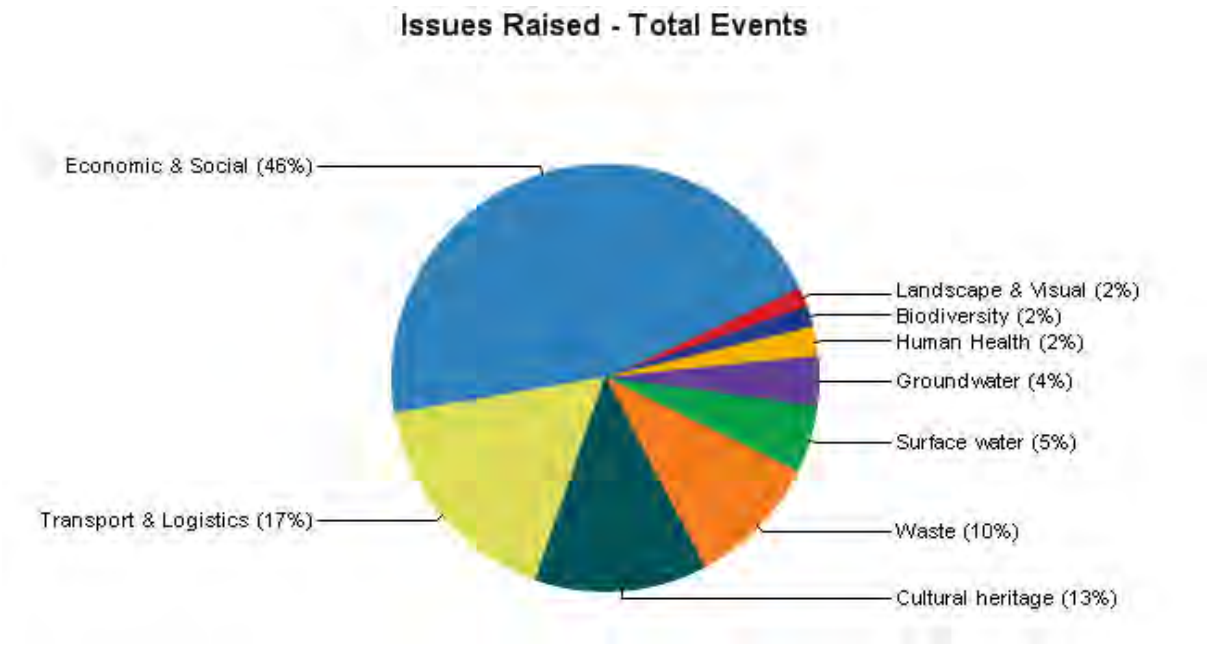


Figure 5-1 A breakdown of the top ten issues raised during the preparation of the Chandler EIS

A summary of the key issues, concerns and interests raised during stakeholder consultation and engagement are listed by theme (together with a response and the relevant chapter of the EIS which addresses that issue) is provided in Table 5-4. Early stakeholder consultation helped shape the technical studies for the EIS. Community feedback also influenced the design of the Proposal. For example, the use of Maryvale Road as the primary access road to and from the Chandler Facility was abandoned due to safety concerns from the community. In addition, some of the aboveground infrastructure at the Chandler Facility was relocated in response to

feedback from traditional owners to avoid culturally sensitive sites and mature Desert Oak tree specimens.

Table 5-4 Key issues concerns and interests raised during stakeholder engagement and consultation

key issues, concerns and interests	Raised by	Response	Location in EIS
Environmental			
Impact on availability and quality of drinking water for the community of Titjikala	Traditional owners, residents of Titjikala	A large amount of water would not be used during construction or operation of the Proposal. Some brackish water would be used for activities such as dust suppression during construction. Dry processing would be used during operation. Water would be recycled, where possible. Potable water would be drawn from different aquifers to the community's drinking water.	Chapter 9
Clearance of land changing the landscape, with impacts on visual amenity	Traditional owners, residents of Titjikala	The proposed infrastructure would change the landscape to a certain extent, however, much of the salt mine's footprint would be underground. The salt mine and surface infrastructure would not be visible from any roads, such as Maryvale Road or Chambers Pillar Road or from recreational areas such as Chambers Pillar.	Chapter 17
Pollution of surface water (spills from waste or chemicals used during processing)	Non-government organisations (environmental groups), traditional owners, residents of Titjikala	Processing of salt is relatively straight forward, unlike other mining. This includes a dry process of crushing and bagging the salt. There would be strict controls to bund and contain processing areas to prevent the run-off of water and pollutants either during processing or during heavy rainfall events.	Chapter 9
Ecological issues were raised in the context of contributing to ecological studies and ongoing land management opportunities and ranger programs	Australian Government and NT Government (various departments), traditional owners	Traditional owners have assisted with the ecological and cultural heritage studies. Opportunities for ongoing land management opportunities and ranger programs would be investigated.	Chapter 7
Proposed use of solar energy and contribution to solar research (seen by stakeholders as a strong positive)	NT Government (various departments), residents of Titjikala	A solar farm and hybrid power station would be constructed to power the proposed Chandler Facility. The use of solar energy provides an opportunity to offset all or a portion of the Chandler Facility's electricity consumption during operation. There may be potential for connections to local or regional power grids – providing renewable energy to	Chapter 18

key issues, concerns and interests	Raised by	Response	Location in EIS
		surrounding communities and Alice Springs. This would be investigated in consultation with the Power and Water Corporation.	
Waste storage and transport			
Waste storage (nature of waste to be stored, the implications for people and the environment and safety both now and after the mine has closed)	Non-government organisations (environmental groups), traditional owners, residents of Titjikala	Waste stored at the Chandler Facility and Apirnta Facility would be subject to strict waste acceptance criteria. The waste acceptance criteria would ensure that waste is only accepted if it can be stored in a safe and environmentally sound manner.	WAC Appendix C
Storage of uranium or nuclear waste	Non-government organisations (environmental groups), traditional owners	Uranium, nuclear waste, biological waste or any waste from unknown origins would not be stored at either the Chandler Facility or the Apirnta Facility.	Chapter 3
Contributing to the fossil fuel cycle (storage of drilling muds and oil and gas waste contributing to the use of fossil fuels)	Arid Lands Environment Centre	Comment noted. The Proposal would, however, contribute to the broader environmental good by removing hazardous and intractable waste (including drilling muds, oil and gas waste) that is currently stored inappropriately in various locations across the country and storing it in a safe and secure facility with the possibility for retrieval and recycling at a later date.	Chapter 3
The salt mine and associated facilities			
Proposal footprint (above and below ground)	Traditional owners, residents of Titjikala	Details of the above and below footprint are detailed in the EIS' Proposal Description (Chapter 3). The above ground footprint would be considerably smaller than the underground footprint.	Chapter 3
Chemicals and storage (concerns about what chemicals or waste would be used and stored on-site, including tailings and waste rock and the potential for spills, pollution, toxicity and health impacts above and below ground)	Non-government organisations (environmental groups), traditional owners, residents of Titjikala	Because of the nature of the Proposal, there would be no for requirement for tailings management. Strict licensing provisions covering storage at the Proposal site would minimise any health risks to workers or the community.	Chapters 3
Transport and road safety			

key issues, concerns and interests	Raised by	Response	Location in EIS
Road safety risks due to increased traffic on Maryvale Road and Titjikala Road (particularly because of the poor condition of the road and because of the heavy use of these roads by the local community, including children)	NT Government (various departments), MacDonnell Regional Council, pastoral lease holders, residents of Titjikala	In response to the issue of road safety, particularly on Maryvale Road, an alternate haul and access road (the Maryvale Haul Road and Henbury Access Road) would be constructed and utilised during construction and operation of the Proposal. Maryvale Road would be used during the early stages of construction until the Maryvale Haul Road and Henbury Access Road are built. Upgrades to Maryvale Road would be undertaken to accommodate construction traffic, as appropriate, and in consultation with MacDonnell Regional Council and the NT Government.	Chapter 18
Road safety risks due to traffic crossing Chambers Pillar Road (the proposed haul road would cross Chambers Pillar Road which is a four-wheel drive track used by tourists heading to Chambers Pillar Conservation Reserve)	NT Government (various departments), MacDonnell Regional Council, residents of Titjikala	The risk of collisions between mine and tourism traffic would be addressed through the implementation of a construction and operational traffic management plan. The plan would include measures such as erecting prominent signage at the start of Chambers Pillar Road and on approaches to the crossing.	Chapter 11
Impact on services			
Impact on government services (pressure on housing, demand for increased police services and emergency response capability)	NT Government (various departments), MacDonnell Regional Council, non-government organisations	Jobs for people living in nearby communities, including Alice Springs would be prioritised over recruiting from other parts of the NT and Australia. It is unlikely, however, that a sufficient labour force would be available locally, particularly during peak construction periods and in specialised positions. Fly-in-fly-out employees would then be utilised to fill these positions. Fly-in-fly-out employees would have limited impact on government services both locally and in Alice Springs.	Chapter 13
Employment and education			
Employment of local people, in particular Aboriginal people	NT Government (various departments), Central Land Council, Catholic Care, Minerals Council of Australia, traditional owners, residents of Titjikala	Jobs for Aboriginal and non-Aboriginal people living in nearby communities, including Alice Springs would be prioritised over recruiting from other parts of the NT and Australia. It is unlikely that construction or operational staff would need to be recruited from overseas.	Chapter 12

key issues, concerns and interests	Raised by	Response	Location in EIS
Use of fly-in-fly-out workers (few benefits to the local community)	Business community	Jobs for people living in nearby communities, including Alice Springs would be prioritised over recruiting from other parts of the NT and Australia. It is unlikely, however, that a sufficient labour force would be available locally, particularly during peak construction periods and in specialised positions. Fly-in-fly-out employees would then be utilised to fill these positions.	Chapter 12 and 13
Poaching staff from other employers (higher wages at the mine leading to lower paid workers leaving existing employers, making it hard for tourism, hospitality, pastoral, trades, retail and other sectors of the economy to compete)	NT Government (various departments), MacDonnell Regional Council	Issue noted. There is little that the proponent can do to stop people leaving jobs, however, a regional workforce strategy that takes accounts of the skills of all regional employers would be developed. Training would also provide professional development and skills development that would deliver long-term benefits to the region's capacity and individual employers as staff move between jobs.	Chapter 12
Working with school children (creating a link with schools to provide career paths via site visits, work experience, school-based apprenticeships, scholarships to boarding school and university)	NT Department of Education, residents of Titjikala	Issue noted. Creating a link with schools to provide career paths would be implemented in the company's ongoing community and stakeholder consultation and engagement strategy.	Chapter 12
Economic development and business opportunities			
Local procurement	NT Government (all departments), Chief Minister, Alice Springs Regional Economic Development Committee, MacDonnell Regional Council, Industry Capability Network, pastoral lease holders	The proponent has a strong commitment to prioritising local businesses who can meet the company's safety, quality and reliability standards. The proponent would work with the NT Government, Chamber of Commerce and NT Industry Capability Network to provide timely and relevant communication on likely opportunities, how to win work and the standards that would be expected of all services and supplies. The proponent has prioritised working with local pastoralists to offer contracts such as civil works, and purchasing petrol and water from Maryvale. Ooraminna is likely to be too far to safely commute to work	Chapter 12 and 13

key issues, concerns and interests	Raised by	Response	Location in EIS
		at the mine site but may be considered for management or training functions.	
Impact on business capacity	NT Chamber of Commerce	Issue noted. Some of these impacts would be subject to commercial arrangements and market forces. Consultation would be undertaken with the NT Industry Capability Network to package available work and to look for joint venture opportunities.	Chapter 12 and 13
Aboriginal enterprises (support for the development of Aboriginal enterprises either as cottage industries based on use of the salt or enterprises providing goods and services to the mine e.g. mechanics, rangers, cooking, cleaning and catering businesses)	NT Department of Business, Central Land Council, traditional owners	Comment noted. Consultation would be undertaken to find ways to maximise opportunities for local enterprises to feed into the supply chain of the Proposal.	Chapter 12
Economic development (contributing to regional economic development and jobs)	NT Department of the Chief Minister, NT Department of Primary Industry and Resources, NT Government Departmental Ministers (Chief Minister, Minister for Mines)	An annual sustainability report would be prepared and would include reporting on commitments such as local jobs, procurement, development of new economic sectors and general contributions to the sustainable development of the Central Australian economy. In 2014 the Proposal was awarded Major Project Status by the NT Government.	Chapter 13
Pastoral properties (land tenure and access arrangements on Maryvale Station and Henbury Station)	NT Cattlemen's Association, Pastoral lease holders	Land tenure and access arrangements would be negotiated with the pastoral properties affected by the Proposal.	Separate and confidential land use agreements
Culture and heritage			
Respect for connections to country	Central Land Council, Aboriginal Areas Protection Authority, traditional owners, residents of Titjikala	A cultural awareness program would be developed for all staff and would employ traditional owners as cultural advisers and mentors. The program would include codes of conduct to ensure respect for Aboriginal connections to country. Confirm with cultural report.	Chapter 10

key issues, concerns and interests	Raised by	Response	Location in EIS
Impacts to heritage sites (Aboriginal and European)	Aboriginal Areas Protection Authority, NT Heritage Advisory Council, traditional owners	No impact is envisaged on any heritage sites (Aboriginal or European). The proposed infrastructure has been located to avoid culturally significant sites. A cultural awareness program would be developed for all staff and would employ traditional owners as cultural advisers and mentors. In addition, traditional owners would be consulted to discuss potential signage or other protection of key sites of significance in the vicinity of the Proposal.	Chapter 10
Maintaining access for traditional uses such as hunting and food gathering	Central Land Council, residents of Titjikala	Though the Facility would have restricted access to areas approved under the *Mining Management Act*, the Proposal would agree access for traditional owners and uses outside of areas approved for mining activities under an Indigenous Land Use Agreement.	Separate and confidential documentation
Other social impacts			
Housing (availability and affordability of housing at a local and regional level)	NT Government (various departments), MacDonnell Regional Council, non-government organisations (NT Shelter, Waltja Tjutangku Palyapayi Aboriginal Corporation)	Comment noted. Worker accommodation would be provided for around 160 workers for the Chandler Facility.	Chapter 12
Cost of living (influx of people creating heavy demand or scarcity of goods and services, especially if mining wages and incentives create inequity; high wages may compound the disadvantage of low income families)	Non-government organisations	Comment noted. This impact would be monitored during construction and operation of the Proposal through implementing the recommendations of a Social Impact Management Plan (SIMP).	Chapter 12
Cash royalties (likely to have a negative social impact because it creates a new form of welfare dependency and because cash payments may be spent on	NT Government (various departments), Central Land Council	Comment noted. Royalties would be invested in community projects in consultation with the Central Land Council.	Chapter 12

key issues, concerns and interests	Raised by	Response	Location in EIS
alcohol, drugs, gambling and expensive consumer goods)			
Distribution of benefits and higher wages (if people are earning higher wages, there may be pressures from family to share the benefits or spend money on alcohol, drugs and consumer goods)	NT Government (various departments), non-government organisations	Comment noted. A SIMP would address the comments raised.	Chapter 12
Mobility of people for work (changing the character, cohesion and resilience of the community, causing existing community members to move and bringing in new people with weaker links to the community)	Non-government organisations, residents of Titjikala	Comment noted. The impact of mobility would be monitored during construction and operation of the Proposal through implementing the recommendations of a SIMP.	-
Need for increased childcare services	MacDonnell Regional Council	Comment noted. The need for childcare services would be monitored during construction and operation of the Proposal.	-
Corporate social responsibility			
Earning a social licence to operate (perceptions of bad practice and legacy issues by mining has eroded community trust in the NT)	NT Government (various departments), Arid Lands Environment Centre	Comment noted.	-
Sponsorship (community events and scholarships)	NT Government (various departments), traditional owners, residents of Titjikala	The proponent will continue its sponsorship program of local sporting clubs.	Community engagement strategy
Community consultation (the importance of continued communication and consultation	NT Government (various departments), MacDonnell Regional Council	If approved, consultation would continue through site preparation and construction and during operation of the Proposal.	Community engagement strategy

key issues, concerns and interests	Raised by	Response	Location in EIS
throughout development of the Proposal)			
Government priorities			
Government's agenda (supporting key government objectives of regional economic development, reducing the disadvantage of Aboriginal people, providing jobs, building trade with Asia and attracting investors to the NT)	Australian Government and NT Government (various departments)	The Proposal would support the achievement of these objectives.	SIMP
Has the change in the share market (mining investment) impacted on your ability to raise capital	Department of Business	Due to the Proposal being a *dual business model*, the slow-down in the mining sector has not affected the proposed business thus far. Proposal justification and benefits explained in the EIS address this question.	Chapter 2
What is the length of the access and access road now since the submission of the Notice of Intent?	Department of Transport	The proposed private access road would be 60 kilometres. It would begin at a section along the Stuart Highway, approximately 140 kilometres south of Alice Springs and follow an existing pastoral track/road until it reaches the Central Australian Railway crossing. From there it joins up to the original haul road. Further detail is provided in the EIS Proposal Description.	Chapter 3
Are the access and haul roads, Gazetted roads?	Department of Infrastructure	No. It is and will be a private road.	Chapter 3
Has Tellus considered risks for the railway corridor?	Department of Infrastructure	Yes – the proponent has assessed risks of transport along the railway corridor. Where appropriate, quantitative air quality and human health modelling has been undertaken to assess risk scenarios.	Chapter 16
What is planned for the connection with the Stuart Highway and what specifications will the new haul road and access road be built to?	Department of Infrastructure	The decision to use a private access road via the Stuart Highway came about as a result of an internal risk assessment and consultations. Specifications for the new haul and access road will be contained within the EIS.	Chapter 2 and 3
Will you be connected to the grid?	Power and Water	No – details of power and energy supply will be detailed in the EIS.	Chapter 3

key issues, concerns and interests	Raised by	Response	Location in EIS
How much diesel? Will it come by road or rail?	Power and Water	Details of diesel volumes and the method of transport will be detailed in the EIS.	Chapter 3
When will the Facility be operational?	Department of Business	Based on the current schedule and approval timeframe, the Chandler Facility would be operational in late 2021.	Chapter 3
5/2 ratio for diesel/solar?	Department of Transport	Details of the ratio for diesel and solar for the planned hybrid solar plant will be provided in the EIS.	Chapter 3
Will the Facility be a FIFO or a DIDO operation?	Department of Primary Industry and Resources	The proponent expects some of the workforce to fly into Alice Springs. On-site worker accommodation would be the preferred method of accommodation allowing people to drive in and drive out from Alice Springs and other local communities.	Chapter 3 and Chapter 12
How far is the site from the Great Artesian Basin?	Department of Environment and Natural Resources	The edge of Great Artesian Basin is approximately 100 kilometres south-east of the Proposal site.	Chapter 8
What is the quality of groundwater?	Power and Water	Moderately to hyper-saline and slightly alkaline water. Other trace metals have been tested and information is contained within the baseline environment of the Groundwater chapter.	Chapter 8
Would organic waste and sewerage be excluded?	NT EPA	Yes – the Proposal would not accept any biological wastes including organic and sewerage wastes.	Chapter 3
What will be the maximum time of surface storage before taking material underground? What about at the mine site? Will you be storing containers at the mine before taking them underground?	NT EPA	Surface storage would be managed by a purpose built, off-site storage and transfer facility. The maximum time it would be stored would be approximately 3 to 4 years as the Chandler underground mine is being constructed and salt is being extracted.	Chapter 3
If waste is rejected, how long will it remain on-site?	NT EPA	Firstly, waste would be stored off-site and not on-site. The proponent is progressing its Western Australia Sandy Ridge Proposal which will be able to accept Class IV and Class V hazardous and intractable waste by the end of 2017. The proponent also is in a JV to manage Australia's only Class V facility located 7 kilometres east of the proposed Sandy Ridge Proposal. Therefore, waste need not remain at the off-site facility.	Chapter 3

key issues, concerns and interests	Raised by	Response	Location in EIS
Some of the material is coming from offshore, is there an issue with returning it to the originating point?	NT EPA	The management of offshore waste would be undertaken in line with international conventions that are outlined in the Approvals Chapter of the EIS. The proponent has also developed a detailed and stringent Waste Acceptance Policy which has provisions for unacceptable wastes being received and returning it to the original point.	Chapter 4 and Appendix C
Does ownership of the waste transfer to Tellus?	NT EPA	Yes – the details of transfer and ownership are contained in the proponents Waste Acceptance Criteria and Policy.	Appendix C
Is this sort of waste accepted in Europe?	Department of Primary Industry and Resources	Yes – there are similar operations in the UK and Germany. These would be detailed in the EIS.	Chapter 3
Has (NORMS) be spelt out in the ILUA?	Department of Lands Planning and Environment	The ILUA process began in September 2016. The details of NORMS have always been on the proponent's website and will be spelt out in the ILUA and Environmental Protection Approval and Licence applications.	Chapter 3
Will there be a visual impact? Are traditional owners concerned?	Department of Environment and Natural Resources	Yes – any development results in visual impacts. Traditional owners have been consulted from an early stage of the Proposal and continue to be consulted. The EIS provides an assessment of visual impacts through construction, operation and decommissioning. Management measures to avoid to minimise visual impacts are also provided.	Chapter 18
The new road is likely to traverse drainage lines. What are the likely impacts?	Power and Water	Yes – upgrading existing access tracks and roads will require crossing existing drainage lines. Some very small and some large. The impacts of this are addressed in the surface water chapter of the EIS.	Chapter 9
With two storage facilities, you will need individual hazardous waste licences and for the transport of hazardous materials. It will be covered by the *Transport of Dangerous Goods Act.* It will be subject to higher than normal safety conditions, because of the large volumes of hazardous materials which has an elevated	NT WorkSafe	Noted – volumes and risks of transporting large volumes of waste will be addressed in the air quality and human health chapter of the EIS. The proponent will also prepare a Safety Case report in line with NT legislation.	Chapter 15

key issues, concerns and interests	Raised by	Response	Location in EIS
risk, i.e. higher than normal oversight of MHFs			
You have a Mine Management Plan for exploration. Will need another one for mining	Department of Primary Industry and Resources	Yes – an operational Mine Management Plan is being prepared in parallel with the Proposal's Indigenous Land Use Agreement.	To be completed
Discussion about (exothermic) heat from the hydraulic storage processes, in the mine, ventilation	Department of Primary Industry and Resource	Noted and will be addressed in the human health and air quality chapter of the EIS.	Chapter 11 and Chapter 15
What about radon?	NT EPA	Baseline assessment of the lithology and geology, including an independent report indicates there is no evidence of radon.	Chapter 3
Risk assessments within EIS' are not generally well understand. Ensure the EIS follows the EIS guidelines for the risk assessment	NT EPA	Noted – The EIS has prepared a comprehensive risk assessment. It is the intention of the proponent to prepare a *risk based EIS*.	Chapter 6
How many jobs are expected to be created during construction and operation? What is Tellus' target indigenous employment rate?	Department of Business	About 270 full time equivalent construction jobs and 180 full time equivalent jobs in operation. The trigger effects of the Proposal for local business and employment would be detailed in the economic impact assessment of the EIS. The proponent is targeting an initial 6% indigenous employment rate with a view to increase to 10 %.	Chapter 3 and Chapter 12
Tourism			
Displacement of tourism (poaching hospitality and tourism workers and taking low-cost airline seats and hotel accommodation)	Tourism NT	Comment noted. These concerns would be monitored during construction and operation of the Proposal through implementation of a SIMP.	SIMP

5.7 Ongoing consultation (next steps)

Stakeholder consultation will be ongoing throughout the environmental impact assessment process. If approved, consultation would continue through site preparation and construction and during operation of the Proposal.

5.7.1 Public exhibition of the draft EIS

The draft EIS will be made available online and in hard copy at the following locations:

- NT EPA, Level 1, Arnhemica House, 16 Parap Road, Parap, Darwin.
- Mines and Energy Information Centre, Department of Primary Industry and Resources, 3rd Floor, Paspalis Centrepoint, 48 Smith Street Mall, Darwin.
- The Environment Centre NT, Unit 3, 98 Woods Street, Darwin.
- NT Library, Parliament House, Bennett Street and Mitchell Street, Darwin.
- Central Land Council, 27 Stuart Hwy, Alice Springs.
- Arid Land Environment Centre, 90 Gap Road, The Gap.
- Alice Springs Public Library, Lot 5134 Gregory Terrace and Leichhardt Terrace, Alice Springs.

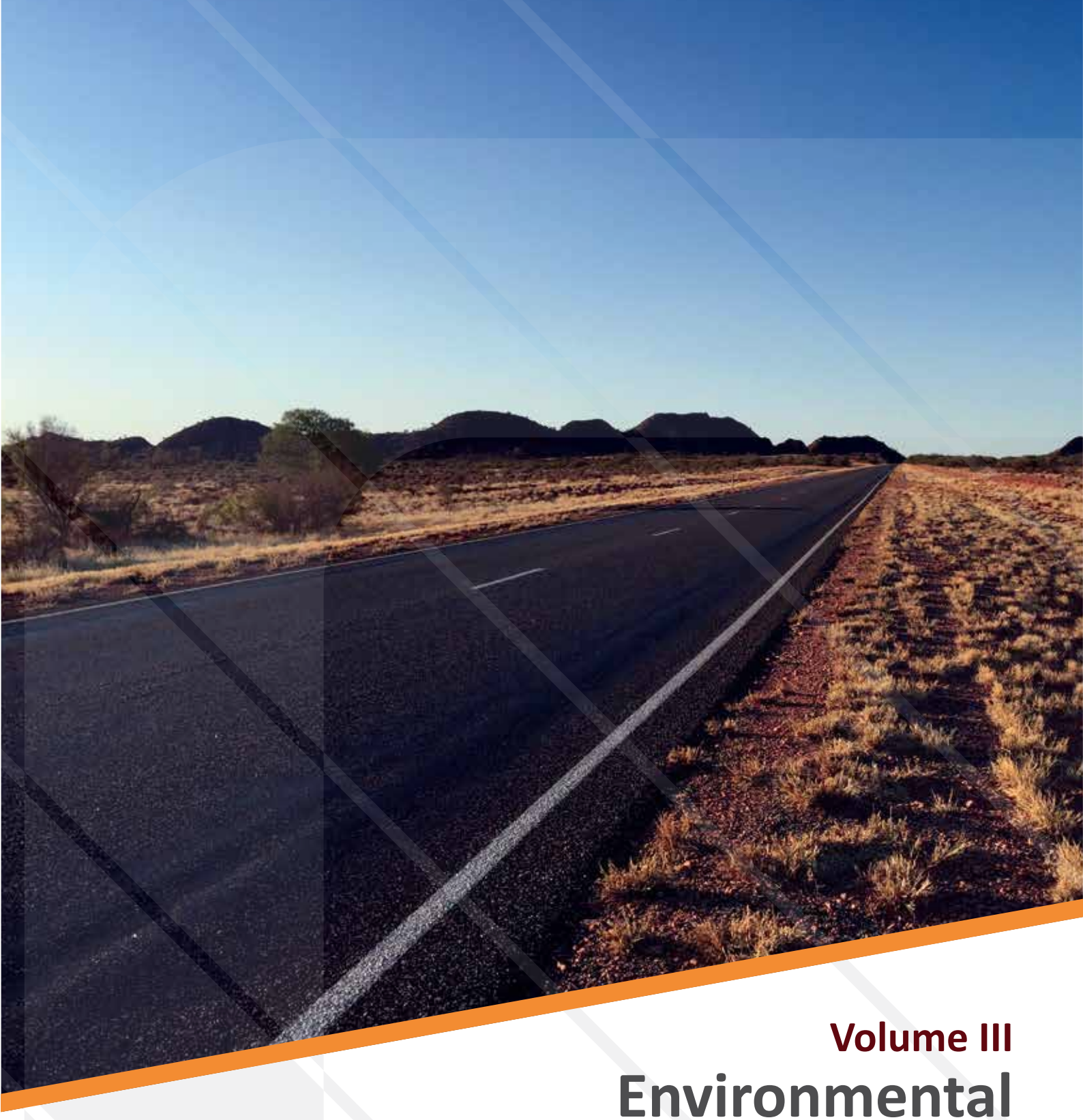
Information regarding how to make a submission is provided at the commencement of this draft EIS.

5.7.2 Post public exhibition of the draft EIS

Following completion of the public exhibition period, all stakeholder feedback will be reviewed and addressed in a Supplement to the EIS.

5.7.3 Future consultation activities

Information will be disseminated to stakeholders on a regular basis, particularly once site preparation and construction of the Proposal commences.



Volume III

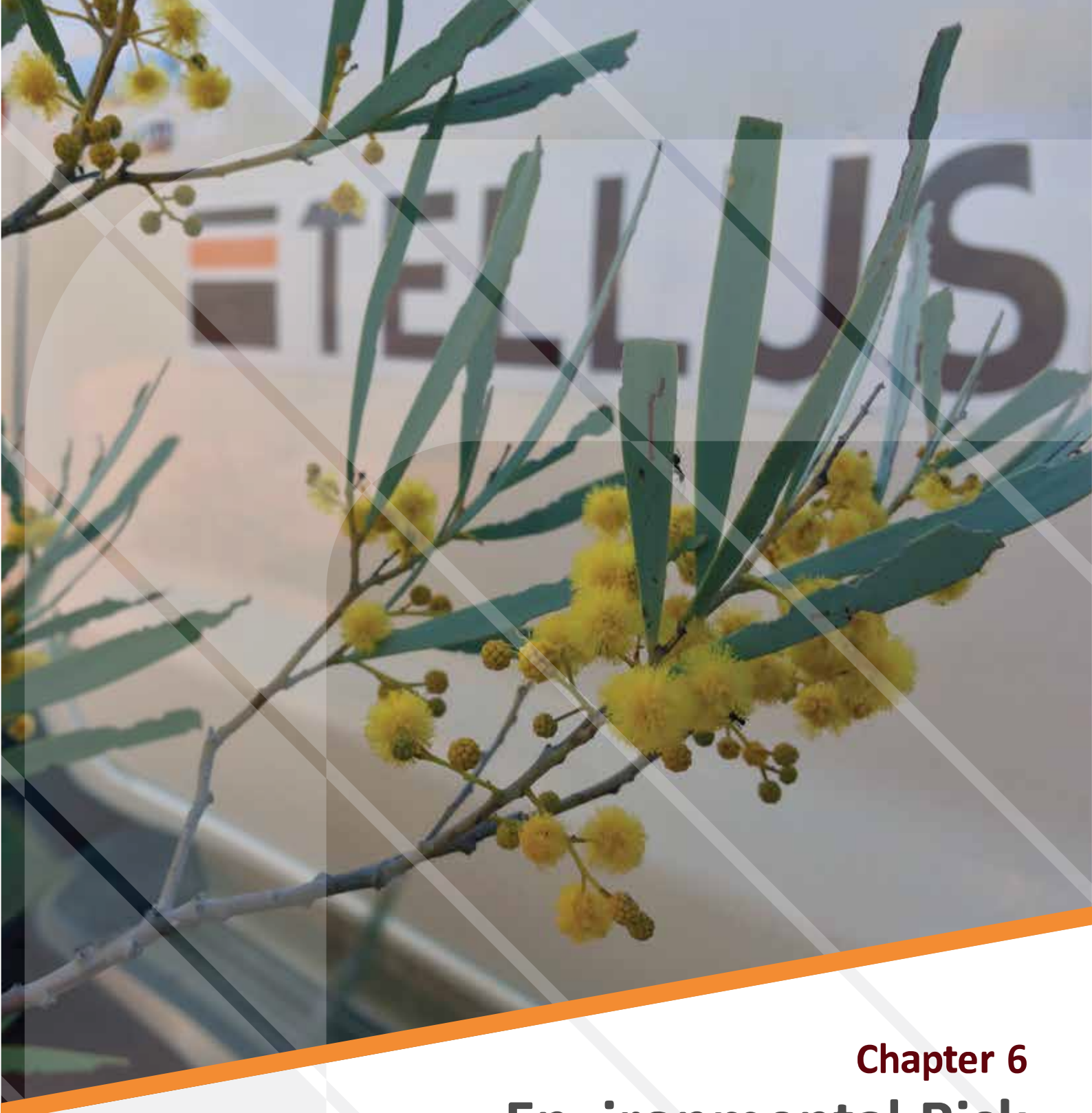
Environmental Impact Assessment

TELLUS



Part D

Approach to Impact Assessment



Chapter 6

Environmental Risk Assessment

TELLUS



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6 RISK ASSESSMENT

6.1 Introduction

Environmental risk assessment is the process undertaken to identify, evaluate and apply mitigation and control measures to the potential environmental risks of a proposed development. As the environmental impact assessment for the Proposal included input from a wide range of technical disciplines, a 'whole of Proposal' risk assessment was undertaken to promote a consistent benchmarking of the identified environmental risks.

A range of hazards were identified by the NT EPA through a preliminary assessment of the Proposal. The Proposal's risk assessment has assessed these hazards, as well as others identified by the proponent during a series of risk workshops.

Risk workshops were undertaken by the proponent at key milestones in the preparation of the EIS and Proposal design. The results of the workshops were collated into a detailed risk matrix which is presented in Appendix N.

The objectives and methodologies adopted for the assessment of direct and/or indirect risks during key phases of the Proposal, namely construction, operation, closure and rehabilitation, are summarised below.

6.2 Objectives

The Proposal's environmental risk assessment is undertaken to:

- Identify and discuss potential hazards generated or affected by the Proposal.
- Identify relevant potential direct and indirect consequences of the identified hazards, and determine their associated likelihood.
- Quantify and qualify risks to identify the key environmental issues that require detailed assessment, and to provide a mechanism to focus a range of management responses to adequately manage those risks.
- Identify levels of uncertainty about estimates of risks and the effectiveness of risk controls in mitigating risk.
- Identify stakeholders who may be subject to residual risks.
- Provide transparent and auditable guidance in decision making for mitigation prioritisation and escalation.
- Demonstrate that the Proposal represents best practicable technology, implementing Best Practicable Measures and industry standards, where applicable.

6.3 Risk assessment methodology

The risk assessment methodology has been devised by Tellus based upon the broad definitions and methodology and principles outlined in AS/NZS ISO 31000:2009. The standardised risk assessment for the Proposal involved the following steps:

- **Assessment criteria**
    - Develop a series of validated risk matrices.
    - Develop look-up tables for likelihood and consequence.
- **Establishing the context**
    - Describe the boundaries of the Proposal, functions and spatial scale for each area.
- **Identify the hazard(s)**
    - The identification of potential environmental hazards associated with various components ('aspects') of the Proposal.
    - Identifying the nature of the identified hazards ("beneficial", "neutral" or "adverse").
- **Analyse the risk (pre-mitigation)**
    - Assessing the 'likelihood' of an identified hazard occurring.
    - Defining the 'consequence' of the hazard occurring, as described by impacts of health & safety, environmental, financial, project delivery or social impacts.
    - As a product of the likelihood and consequence, determining the pre-mitigation composite risk index (i.e. 'risk'CRI = likelihood x consequence).
- **Identifying required mitigation**
    - Identify the mitigation required to control the 'likelihood' of that risk.
    - Identifying the mitigation required to control the 'consequence' of that risk.
    - Documenting the owner of those mitigation actions, the time and cost implications and detailing a review date.
- **Identify appropriate mitigation and/or management measures**
    - Discuss appropriate measures within risk workshops.
- **Analyse the risk (post mitigation)**
    - Reassessing the 'likelihood' of an identified hazard occurring in light of the implemented mitigation.
    - Reassessing the 'consequence' of the hazard occurring in light of the implemented mitigation.
    - As a product of the mitigated likelihood and consequence, determining the post-mitigation composite risk index (i.e. 'risk' CRI = likelihood x consequence).

The risks derived through the above methodology are presented on a dimensionless scale of 'extreme', 'high', medium' and 'low', which may be used within a multi-discipline analysis to provide a context for the evaluation of impacts which are essentially incomparable. For example, comparing the changes (both adverse and beneficial) to air quality with changes to other environmental considerations (e.g. water quality, heritage or noise) or socio economic impacts. The relative risk is provided as a dimensionless product of the defined values attributed to 'likelihood' and 'consequence'.

The determined risk may be used to highlight the relative environmental risk and to highlight the general requirement for the application of appropriate controls and mitigation. It is noted that the above approach is designed to provide an overall impact risk, and is not intended to represent the defining determination for the requirement for mitigation and control.

A standardised approach to evaluating risk does not replace the methodologies used by technical disciplines to identify or assess impacts, nor does it replace methods of impact assessment prescribed by existing guidance. Rather, it adds to the impact assessment by providing clear, more readily comparable conclusions regarding the significance of impacts.

The environmental and social systems, resources and receptors potentially affected by the Proposal were defined through desktop based research, field surveys and preliminary consultation with key agencies within the NT Government, regional stakeholders and local communities. A summary of the issues raised during consultation and how they were incorporated into the environmental assessment is provided in Chapter 5.

6.3.1 The nature of an identified hazard

By definition, a 'hazard' is described as a source of potential harm, but as the risk assessment methodology may be used to identify beneficial impacts in this context a 'hazard' is identified as impact of the Proposal (of "beneficial", "neutral" or "adverse" nature).

For the purposes of this assessment the descriptors presented in Table 6-1 are used to describe the nature of an identified hazard:

Table 6-1 Nature of a hazard

Nature	Descriptor
Beneficial	the hazard has a potential beneficial impact upon the environment
Neutral	the hazard has neither a beneficial or adverse impact on the environment. Occasionally, the term 'benign' is used. Typically, a hazard will be categorised as having a neutral nature post-mitigation.
Adverse	the hazard has a potentially adverse impact on the environment

6.3.2 Evaluating likelihood

The 'likelihood' of a hazard and an impact occurring can be described in terms of probability. Overlaying this is the need to recognise that uncertainty may be associated with potential risks occurring, particularly during the initial risk assessment process. Where scientific uncertainty exists, a precautionary approach was taken which identified a higher level of risk. Each identifiable impact can be assigned a likelihood of occurring, ranging from 'Remote' to 'Almost certain'.

In simplifying the 'likelihood' of potential hazards for the purpose of a risk assessment an element of subjectivity is introduced. The purpose of the risk assessment is not necessarily to agree on the probability of any particular impact, but to facilitate an understanding of the relative probability of different impacts.

The pre-mitigation assessment of likelihood needs to account for the probability of an identified hazard occurring, assuming the incorporation of 'designed-in' mitigation, that is, measures that would be required to comply with legislation, relevant guidance, or otherwise which is intrinsic to the design specification upon which the development proposal has been based.

Columns two to four in Table 6-2 give descriptions that elaborate on the possible likelihood categories. These are presented to help view the impact from different perspectives.

Table 6-2 Likelihood of a hazard

Likelihood	Description	Probability	Mid interval	Community outlook
Eliminated	Would not occur as a result of being designed out of the Proposal	P 0	0.00	Not affected
Remote	May occur only in exceptional circumstances	0.01<P<0.10	0.05	Few or no people affected or interested
Unlikely	Could occur at some time	0.11<P<0.40	0.25	Some people affected
Possible	Might occur at some time	0.41<P<0.60	0.50	Many people affected
Likely	Will probably occur in most circumstances	0.61<P<0.90	0.75	Most people affected
Almost certain	Is expected to occur in most circumstances	0.91<P<1.00	0.95	Almost everyone affected

6.3.3 Evaluating consequence

To determine the 'consequence' of an identified hazard, clearly described thresholds were developed which included the scale of potential impact, its geographic extent, duration, ecological and social sensitivity, reversibility, and potential cumulative effects.

In simplifying the potential 'consequence' of potential hazards for the purpose of a risk assessment an element of subjectivity is introduced. The purpose of the risk assessment is not necessarily to agree on the defined consequence of any particular hazard, but to facilitate an understanding of the relative impacts.

Consistent with the assumptions for 'likelihood', the pre-mitigation assessment of consequence needs to address the severity of an identified hazard occurring, assuming the incorporation of 'designed-in' mitigation, that is, measures would be required to comply with legislation, relevant guidance, or otherwise which is intrinsic to the design specification upon which the development proposal has been based.

Table 6-3 provides descriptions that elaborate on the possible consequence categories. These are presented to help view the impact from different perspectives.

Table 6-3 Consequence of a hazard

Consequence descriptor	Description (examples)				
	Health	Environmental	Financial Loss	Project Delivery	Social
Insignificant	No injuries.	None	Low financial loss.	Trivial.	Insignificant.
Minor	First aid treatment.	On-site release immediately contained.	Medium financial loss.	Project can be completed with changes.	Additional local engagement.
Moderate	Medical treatment required.	On-site release contained with outside assistance.	High financial loss.	Project can be completed with moderate changes.	Additional meetings.
Major	Extensive injuries.	Off-site release with no detrimental effects.	Loss of production capability Major financial loss.	Project can only be completed with major changes (redesign).	Reactive media plan, recovery plan, working committees.
Catastrophic	Death.	Toxic release off-site with detrimental effect.	Cessation of production capability / Huge financial loss.	Project incapable of completion / Unviable.	No social licence to operate.

6.3.4 Evaluating risk

The risk of an identified hazard (sometimes also called the 'significance') was determined as a product of the likelihood of the hazard and its consequence on the environment, resource, social value or receptor that it would potentially impact, or as a consequence to the delivery of the Proposal, assuming that the mitigation required to comply with legislation, relevant guidance and the design specifications for the Proposal have been implemented.

In order to standardise the significance rating assigned to potential environmental impacts, a matrix was developed and two multi-disciplinary workshops were held by key members of the EIA team in May 2015 and again in March 2016. A generic set of risk definitions is provided in Table 6-4 and this approach enables a consistent description of risks (of either 'adverse' or 'beneficial' nature). In each chapter, the significance criteria are made relevant to the topic being considered.

Table 6-4 Risk significance criteria

Significance	Criteria
Eliminated	As a consequence of mitigation, the likelihood and/or the consequence has been removed.
Low	These impacts are recognisable, but acceptable within the decision-making process. They are still important in the determination of environmental management requirements. These impacts tend to be short term, or temporary and at the local scale.
Medium	These impacts are relevant to decision making, particularly for determination of environmental management requirements. These impacts tend to range from long to short term, and occur over medium scale areas or focused within a localised area. Environmental receptors are moderately sensitive, and/or the impacts are of regional or local significance.
High	These impacts are likely to be of importance in the decision-making process. They tend to be permanent, or otherwise long to medium term, and can occur over large or medium scale areas. Environmental receptors are high to moderately sensitive, and/or the impacts are of state significance.
Extreme	These impacts are considered critical to the decision-making process. They tend to be permanent, or irreversible, or otherwise long term, and can occur over large scale areas. These effects are generally but not exclusively associated with sites and features of and/or the impacts of national importance. Typically, mitigation measures are unlikely to remove such effects.

6.3.5 Risk assessment matrix

Based on the assessment of likelihood and consequence, any foreseeable impact can be assigned a significance of risk, as defined in Table 6-4. The EIS is at this point intended to focus on potentially significant environmental risks and impacts.

Table 6-5 is to be read as a matrix, with consequence as a scale across the top row and likelihood as a scale on the left column. Any potential risks that fall in the top right of the matrix are therefore addressed as *key environmental issues requiring detailed environmental assessment* in the EIS. Risks that fall into the bottom right of the matrix are addressed as *other issues* in the EIS

Table 6-5 Risk significance matrix

Consequence / Likelihood	Eliminated	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Eliminated	High	High	High	Extreme	Extreme
Likely	Eliminated	Medium	Medium	High	High	Extreme
Possible	Eliminated	Low	Medium	Medium	High	High
Unlikely	Eliminated	Low	Low	Medium	Medium	High
Remote	Eliminated	Low	Low	Low	Medium	Medium
Eliminated	Eliminated	Eliminated	Eliminated	Eliminated	Eliminated	Eliminated

For example, a pre-mitigated hazard may be determined to be “possible” in likelihood and “minor” in terms of consequence. Using the matrix presented in Table 6-5, the pre-mitigated risk would be evaluated as being a “medium” risk.

6.3.6 Duration

This assessment also requires consideration of the duration of the impact. The definitions used to describe the duration of an identified hazard are provided in Table 6-6.

Table 6-6 Risk duration

Duration of environmental effects	Period
Temporary	Days to months
Short-term	Up to 1 year
Medium-term	From 1 to 5 years
Long-term	From 5 to 30 years (approval period)
Permanent/irreversible	Over multiple generations (post Facility closure)

The assessment is further required to assess potential risks in accordance with the EPBC Act Significant Impact Guidelines for Matters of National Environmental Significance (MNES), and as such mitigation measures may be proposed where the determined risk is less significant and/or where the duration of effects might be short-term or temporary.

6.3.7 Potential impacts

The preliminary assessment of the Proposal undertaken by the NT EPA identified a range of key environmental risks. These included:

- Biodiversity.
- Groundwater.
- Surface water and flooding.
- Cultural Heritage.
- Human health.
- Socio-economic values.
- Closure and rehabilitation.

Other risks, such as, fire, air quality, noise and vibration and visual amenity were also identified by the NT EPA.

The proponent took the above identified risks and developed a comprehensive assessment of each component. The results of that assessment are presented in the risk matrix in Appendix N. The assessment took into consideration outline management and mitigation measures including design changes within the development of the Proposal.

The residual risk assessment undertaken took into consideration additional mitigation measures to control and manage the 'likelihood' and/or 'consequence' and thereby reduce the significance of residual risks.

6.4 Pre-mitigation risk assessment

Each technical discipline considered both direct and indirect impacts of the Proposal by undertaking the following steps:

- Clearly identifying the cause / effect relationships between each action and impact.
- Taking a conservative approach by assuming the most significant likely magnitude of the relevant impact.
- Clearly stating factors affecting the worst case and likely case outcomes.

Indirect impacts were considered within the EIA for the Proposal. For example, vibration effects from the blasting of geological strata during mine shaft construction may potentially permanently dislodge rocks on surrounding hills which may result in indirect adverse effects on items of cultural heritage and/or visual amenity.

Refer to Table 6-10 for pre-mitigated risk assessment.

6.5 Mitigation and management measures

6.5.1 Introduction

After pre-mitigation risks were quantified, the proponent discussed and proposed relevant mitigation and management measures during the risk workshops. The mitigation and environmental management measures are explained within the following chapters of this EIS:

- Chapter 7 – Biodiversity.
- Chapter 8 – Groundwater.
- Chapter 9 – Surface water.
- Chapter 10 – Historic and Cultural Heritage.
- Chapter 11 – Human Health.
- Chapter 12 – Economic and Social.
- Chapter 13 – Closure and Rehabilitation.
- Chapter 14 – Bushfire.
- Chapter 15 – Air quality.
- Chapter 16 – Noise and vibration.
- Chapter 17 – Visual amenity.
- Chapter 18 – Other impacts.
- Chapter 18 – Cumulative impacts.
- Chapter 20 – Environmental management.

6.5.2 Key considerations

Key considerations for preferred mitigation measures were to:

- Respond to the appropriate level in the 'mitigation hierarchy' i.e. avoid; minimise; rehabilitate; manage; offset or compensate.
- Discuss if mitigation measures were reasonable and appropriate in terms of effort and expense to the significance and nature of the identified potential impact.

The level of mitigation measures proposed should respond to the significance of the relevant risks identified. For example, an impact considered to be of extreme significance would need to be met with a high level of mitigation that avoids, eliminates or makes provisions for offsetting (if required). Conversely, an impact that was considered to be of low significance may either not require mitigation or only require management by control of impacts through day to day management with occasional monitoring required as validation, for example. It is worth noting that a low significance

risk does not exclude the provision of mitigation, and the risk assessment demonstrates that a range of mitigation options would be provided to manage low significance risks.

6.5.3 Mitigation approach

Table 6-7 provides a summary of the approach that was implemented when developing mitigation and management measures. This approach ensured that the level of mitigation proposed for each impact was appropriate and in proportion to the level of impact significance.

Table 6-7 Management and mitigation measures

Initial impact significance rating	Mitigation response
Eliminated	No mitigation or management is typically required because the risk has been removed by either removing the risk through design changes and/or consultation with key stakeholders.
Low	Management of impacts should be addressed in day to day management. Monitoring may be required to validate that impacts are low.
Medium	Management of impact will be required and closely monitored to check that impacts are not more severe than predicted. Replacement may be required where consequence of the action on resources of low or moderate value is extreme (i.e. complete loss of the resource). Rehabilitate disturbed areas is likely and monitoring required to check effectiveness of mitigation measures.
High	High impacts must be avoided where ever possible and otherwise offset or fully compensated. An environmental bond must be in place. Ongoing monitoring is recommended to confirm effectiveness of mitigation and management measures.
Extreme	Risks must be designed out, eliminated or fully offset or compensated with offset and / or compensation measures in place before the project proceeds. International and national standards will need to be complied with and specialists with internationally or nationally recognised expertise should be involved in development and implementation of mitigation and offsetting. High level of ongoing monitoring is required to confirm effectiveness of mitigation measures and whether additional mitigation or other corrective actions are required.

As previously stated, the pre-mitigation risk assessment assumes the incorporation of 'designed-in' mitigation that is required to comply with legislation, relevant guidance, or otherwise which is intrinsic to the design specification upon which the Proposal has been based.

Once mitigation and management measures were identified, post-mitigation risks (sometimes called 'residual risks') were assessed. By managing the likelihood and consequence of a risk occurring through mitigation and/or management measures, the residual consequence of the same risk

occurring after mitigation would mean it would be managed (minimised or eliminated). The assessment of, and compliance with, international and national standards was undertaken in development and implementation of Proposal's mitigation and management techniques.

6.5.4 List of control and/or management measures

Future controls and mitigation measures that were identified during the risk workshops and factored into the assignment of the risk levels are listed in Table 6-8. Please note that the table is indicative only and the measures included in Table 6-8 are further detailed in Chapter 20 and would be further developed through detailed design and associated management plans.

Table 6-8 List of controls and mitigation measures

Category	Environmental control and/or mitigation measure
Occupational health and safety requirement	Personal protection equipment including equipment used in hazardous locations
	Occupational health screening and monitoring i.e. periodic blood testing, lung function etc.
	Testing for particulates and gases
	Provisions of full time emergency services
	Enforcement of safe working practices
	Provision of adequate safety measures for electrical equipment, working at height, confined spaces and other hazardous work conditions
Construction and operation	Monitoring of groundwater conditions
	Monitoring of surface water conditions
	Monitoring of air quality conditions
	Enforcement of policies and procedures for management of hazardous materials including chemical, fuels and explosives
	Effective contractor management
	Material Safety Data Sheets
	Surface water run-off management
	Bushfire buffer zones and hazard reduction measures
	Effective communication with key stakeholders
	Provisions of adequate ventilation, dust extraction and standard duct control and operating procedures for enclosed spaces
	Implementation of appropriate stock / land use management system
	Recycling materials where appropriate
	Requirement to undertake further modelling (groundwater)
	Above ground designs of surface infrastructure including aspect, wind directions, lighting
Standards	Compliance with Australian Dangerous Goods for transport of all hazardous goods
	Compliance with all applicable Australian (and other) Standards
Design of plant and equipment	Design in accordance with standards and conditions of consent
	Design for correct capacity
	Design to include environment and climate considerations.
Certification	ISO 9001
	ISO 14001
Other Tellus plans and polices	Enforce all environmental management plans
	Enforce all operational policies, such as employment policies, which will be required to be adopted as a minimum by all contractors and sub-contractors

Following the identification and recording of appropriate mitigation and management measures, a post mitigation risk assessment was undertaken to determine the magnitude and consequence of residual risks (see Table 6-10).

6.5.5 Confidence

The confidence of mitigation is assigned according to the descriptors in Table 6-9.

Table 6-9 Confidence descriptors for mitigation options

Confidence descriptor	Examples
High	• Proven Best Practice Measures (BPM). • Best Available Technology (BAT). • Environmentally Sound Management (ESM). • Policy and guidance.
Moderate	• Effective mitigation strategy and considered standard practice. • Is not documented as Best Practice Measures, Best Available Technology, Environmentally Sound Management, or satisfying all requirements of policy and guidance.
Low	• Technology has not been demonstrated in industry. • Not yet tried and/or tested.

6.6 Post mitigation risk assessment

Following the adoption of mitigation and environmental management measures, a second iteration of the risk assessment was undertaken to account for the potential effect of the adopted measures to control the likelihood and consequence of each risk. This is the post mitigation risk assessment.

Table 6-10 summarises the results of the pre-mitigation and post-mitigation risk assessment undertaken against the Proposal's identified risks. To promote transparency, each identified hazard is assessed as a pre-mitigation' risk, the proposed mitigation measures to be adopted, and then sequentially as the post-mitigation risk.

For the pre-mitigation and post-mitigation summary, Table 6-10 summarises:

- Likelihood, as defined in Table 6-2.
- Consequence, as defined in Table 6-3.
- Risk significance, as defined in Table 6-4 and determined from Table 6-5.
- Nature, as defined in Table 6-1.
- Duration, as defined Table 6-6.



Table 6-10 also summarises the environmental management and/or mitigation measures the proponent would adopt to avoid, reduce or minimise environmental risks. A confidence level (see Table 6-9) rating is assigned to each mitigation measure.

Table 6-10 Risk assessment

Risk identified by NT EPA during preliminary assessment	Hazard identified by the Proponent in the EIS	Pre-mitigated risks					Mitigation			Post-mitigated risks					Risk outcome
		Likelihood	Consequence	Risk ranking	Nature	Duration	Mitigation to reduce likelihood	Mitigation to reduce consequence	Confidence	Likelihood	Consequence	Risk ranking	Category	Duration	
Biodiversity (Chapter 7)	Loss of habitat and/or mortality of threatened fauna species	Possible	Major	High	Adverse	Long term	Biodiversity Management Plan (BMP)	BMP	Moderate	Unlikely	Major	Medium	Adverse	Long term	Risk reduced
	Removal of vegetation	Almost certain	Moderate	High	Adverse	Long term	BMP	BMP	Moderate	Almost certain	Minor	High	Adverse	Long term	Risk reduced
	Loss of fauna habitat from removal of vegetation	Almost certain	Moderate	High	Adverse	Long term	BMP	BMP	Moderate	Almost certain	Minor	High	Adverse	Long term	Risk reduced
	Habitat fragmentation from removal of vegetation	Almost certain	Moderate	High	Adverse	Temporary	BMP	BMP	Moderate	Possible	Moderate	Medium	Adverse	Long term	Risk reduced
	Fauna displacement injury or mortality from removal of vegetation	Possible	Moderate	Medium	Adverse	Temporary	BMP	BMP	Moderate	Unlikely	Minor	Low	Adverse	Short term	Risk reduced
	Fauna strike (vehicle)	Possible	Catastrophic	High	Adverse	Temporary	Traffic Management Plan	Speed restrictions	Moderate	Unlikely	Catastrophic	High	Adverse	Temporary	Risk reduced
	Removal of vegetation resulting in edge effects	Almost certain	Minor	High	Adverse	Temporary	BMP	BMP	Moderate	Possible	Minor	Medium	Adverse	Short term	Risk reduced
	Altered hydrology leading to flora mortality and loss of habitat	Possible	Minor	Medium	Adverse	Long term	Water Management Plan	Detailed engineering design	Moderate	Unlikely	Minor	Low	Adverse	Long term	Risk reduced
	Groundwater abstraction (at 50 m below ground level) impacting vegetation	Remote	Minor	Low	Neutral	Long term	Water Management Plan	Bore design	Moderate	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Risk reduced
	Contamination of soil and water	Possible	Minor	Medium	Adverse	Temporary	Sediment and Erosion Management Plan (SEMP)	Bunding and detailed engineering	Moderate	Eliminated	Minor	Eliminated	Neutral	Not applicable	Risk reduced
	Erosion and sedimentation of soils	Likely	Major	High	Adverse	Temporary	SEMP	Bunding and detailed engineering	Moderate	Unlikely	Major	Medium	Adverse	Temporary	Risk reduced
	Dust deposition from vehicle traffic and earthworks	Almost certain	Minor	High	Adverse	Short term	Air Quality Management Plan (AQMP)	AQMP	Moderate	Possible	Minor	Medium	Adverse	Temporary	Risk reduced
	Construction light, noise and vibration	Almost certain	Minor	High	Adverse	Temporary	Noise Management Plan (NMP)	NMP	Moderate	Likely	Minor	Medium	Adverse	Temporary	Risk reduced
	Operational light, noise and vibration	Almost certain	Minor	High	Adverse	Long term	NMP	NMP	Moderate	Likely	Minor	Medium	Adverse	Long term	Risk reduced
	Introduction and spread of weeds and invasive species	Likely	Minor	Medium	Adverse	Short term	Weed Management Plan	Weed Management Plan	Moderate	Unlikely	Minor	Low	Adverse	Short term	Risk reduced
	Increased predator species	Likely	Minor	Medium	Adverse	Short term	Pest Management Plan (PMP)	PMP	Moderate	Unlikely	Minor	Low	Adverse	Short term	Risk reduced
	Increased introduced fauna	Likely	Minor	Medium	Adverse	Short term	PMP	PMP	Moderate	Unlikely	Minor	Low	Adverse	Short term	Risk reduced

Risk identified by NT EPA during preliminary assessment	Hazard identified by the Proponent in the EIS	Pre-mitigated risks					Mitigation			Post-mitigated risks					Risk outcome
		Likelihood	Consequence	Risk ranking	Nature	Duration	Mitigation to reduce likelihood	Mitigation to reduce consequence	Confidence	Likelihood	Consequence	Risk ranking	Category	Duration	
	Bushfire	Possible	Catastrophic	High	Adverse	Short term	Bushfire Management Plan (BFMP)	BFMP	Moderate	Possible	Minor	Medium	Adverse	Short term	Risk reduced
	Salt erosion and spoil erosion	Likely	Catastrophic	Extreme	Adverse	Temporary	SEMP	SEMP	Moderate	Remote	Major	Medium	Adverse	Temporary	Risk reduced
	Soil compaction and topsoil loss	Possible	Minor	Medium	Adverse	Short term	SEMP	SEMP	Moderate	Unlikely	Minor	Low	Adverse	Short term	Risk reduced
Groundwater (Chapter 8)	Changes to groundwater levels	Almost certain	Minor	High	Adverse	Long term	Water Management Plan (WMP)	Do not over abstract	Moderate	Possible	Minor	Medium	Adverse	Short term	Risk reduced
	Changes to groundwater chemistry	Possible	Minor	Medium	Adverse	Short term	WMP	WMP	Moderate	Remote	Minor	Low	Adverse	Short term	Risk reduced
	Changes to groundwater flow (direction)	Possible	Moderate	Medium	Adverse	Long term	WMP	WMP	Moderate	Remote	Minor	Low	Adverse	Long term	Risk reduced
	Contamination of Horseshoe Bend Shale aquatards from drilling activities	Remote	Major	Medium	Adverse	Temporary	Design of decline and shafts in line with best practice techniques	Design of decline and shafts in line with best practice techniques	High	Eliminated	Major	Eliminated	Neutral	Not applicable	Risk reduced
	Contamination of Langra aquifer from drilling activities	Remote	Major	Medium	Adverse	Temporary	Design of decline and shafts in line with best practice techniques	Design of decline and shafts in line with best practice techniques	High	Eliminated	Major	Eliminated	Neutral	Not applicable	Risk reduced
	Contamination of Hermannsberg Formation groundwater from drilling activities	Remote	Major	Medium	Adverse	Temporary	Design of decline and shafts in line with best practice techniques	Design of decline and shafts in line with best practice techniques	High	Eliminated	Major	Eliminated	Neutral	Not applicable	Risk reduced
	Contamination of Stairway Sandstone groundwater from drilling activities	Remote	Minor	Low	Adverse	Temporary	Design of decline and shafts in line with best practice techniques	Design of decline and shafts in line with best practice techniques	High	Eliminated	Minor	Eliminated	Adverse	Not applicable	Risk reduced
	Contamination of Jay Creek Limestone groundwater from drilling activities	Remote	Minor	Low	Adverse	Temporary	Design of decline and shafts in line with best practice techniques	Design of decline and shafts in line with best practice techniques	Moderate	Eliminated	Minor	Eliminated	Adverse	Not applicable	Risk reduced
	Contamination of Titjikala water supply through loss of containment	Eliminated	Catastrophic	Eliminated	Neutral	Not applicable	No pathway	No pathway	Moderate	Eliminated	Catastrophic	Eliminated	Neutral	Not applicable	Risk same
	Contamination of Alice Springs aquifer through loss of containment	Eliminated	Catastrophic	Eliminated	Neutral	Not applicable	No pathway	No pathway	Moderate	Eliminated	Catastrophic	Eliminated	Neutral	Not applicable	Risk same

Risk identified by NT EPA during preliminary assessment	Hazard identified by the Proponent in the EIS	Pre-mitigated risks					Mitigation			Post-mitigated risks					Risk outcome
		Likelihood	Consequence	Risk ranking	Nature	Duration	Mitigation to reduce likelihood	Mitigation to reduce consequence	Confidence	Likelihood	Consequence	Risk ranking	Category	Duration	
	Contamination of Great Artesian Basin through loss of containment	Eliminated	Major	Eliminated	Neutral	Not applicable	No pathway	No pathway	Moderate	Eliminated	Major	Eliminated	Neutral	Not applicable	Risk same
	Contamination of livestock through loss of containment	Eliminated	Major	Eliminated	Neutral	Not applicable	Water Management Plan	Water Management Plan	Moderate	Eliminated	Major	Eliminated	Neutral	Same level of risk	Risk same
	Uncontrolled inflow of groundwater during construction	Unlikely	Minor	Low	Adverse	Temporary	Surface water design / bunding	Surface water design / bunding	Moderate	Remote	Minor	Low	Adverse	Temporary	Risk reduced
	Uncontrolled inflow of groundwater during operations	Remote	Catastrophic	Medium	Adverse	Temporary	Surface water design / bunding	Surface water design / bunding	Moderate	Remote	Major	Medium	Adverse	Temporary	Risk reduced
	Engineered uses of naturally occurring corrosive groundwater	Almost certain	Major	Extreme	Adverse	Long term	Management of saline waters / desalination	Management of saline waters / desalination	Moderate	Almost certain	Minor	High	Adverse	Long term	Risk reduced
	Over abstraction of groundwater leading to local or regional drawdown	Remote	Minor	Low	Adverse	Long term	Do not over abstract demand requirement and undertake groundwater monitoring	Do not over abstract demand requirement and undertake groundwater monitoring	Moderate	Eliminated	Minor	Eliminated	Neutral	Short term	Risk reduced
	Lack of groundwater for supply	Remote	Major	Medium	Adverse	Long term	Water Management Plan	Water Management Plan	Eliminated	Eliminated	Minor	Eliminated	neutral	Not applicable	Risk reduced
Surface water (Chapter 9)	Surface water ingress into decline area and general mining infrastructure	Likely	Moderate	High	Adverse	Temporary	SEMP	SEMP	Moderate	Remote	Moderate	Low	Adverse	Temporary	Risk reduced
	Contaminated surface water runoff off-site	Unlikely	Minor	Low	Adverse	Temporary	Water Management Plan and bunding	Water Management Plan and bunding	Moderate	Remote	Minor	Low	Adverse	Temporary	Risk reduced
	Salt dissolution and transport off-site	Likely	Major	High	Adverse	Long term	Water Management Plan and bunding	Water Management Plan and bunding	Moderate	Remote	Minor	Low	Adverse	Temporary	Risk reduced
	Flash flooding into mine infrastructure area	Possible	Major	High	Adverse	Temporary	Storm water drains / flood relief	Storm water drains / flood relief	Moderate	Remote	Moderate	Low	Adverse	Temporary	Risk reduced
	Flooding of access/haul roads	Likely	Moderate	High	Adverse	Temporary	SEMP	SEMP	Moderate	Possible	Minor	Medium	Adverse	Temporary	Risk reduced
	Soil erosion leading to excess sedimentation in watercourses	Possible	Major	High	Adverse	Long term	SEMP	SEMP	Moderate	Remote	Minor	Low	Adverse	Temporary	Risk reduced
	Contamination of regional surface waters (Hugh and Finke Rivers) through loss of containment	Remote	Major	Medium	Adverse	Short term	No pathway	No pathway	Moderate	Eliminated	Major	Eliminated	Adverse	Not applicable	Risk reduced

Risk identified by NT EPA during preliminary assessment	Hazard identified by the Proponent in the EIS	Pre-mitigated risks					Mitigation			Post-mitigated risks					Risk outcome
		Likelihood	Consequence	Risk ranking	Nature	Duration	Mitigation to reduce likelihood	Mitigation to reduce consequence	Confidence	Likelihood	Consequence	Risk ranking	Category	Duration	
	Contamination of Hugh River through loss of containment	Remote	Major	Medium	Adverse	Short term	Water Management Plan	SEMP	Moderate	Eliminated	Major	Eliminated	Not applicable	Not applicable	Risk reduced
	Contamination of Finke River through loss of containment	Remote	Major	Medium	Adverse	Short term	Water Management Plan	SEMP	Moderate	Eliminated	Major	Eliminated	Not applicable	Not applicable	Risk reduced
	Altered hydrology surrounding Maryvale Hills	Almost certain	Moderate	High	Adverse	Short term	Water Management Plan	SEMP	Moderate	Almost certain	Minor	High	Adverse	Short term	Risk reduced
	Altered hydrology surrounding the mine infrastructure area	Almost certain	Major	Extreme	Beneficial	Long term	Water Management Plan	SEMP	Moderate	Almost certain	Major	Extreme	Beneficial	Long term	Risk same
Historic and cultural heritage **(Chapter 10)**	Physical disturbance to known sites	Likely	Moderate	High	Adverse	Medium term	Cultural heritage field surveys / Cultural Heritage Management Plan (CHMP) /TO involvement	Cultural heritage field surveys / CHMP /TO involvement	Moderate	Eliminated	Moderate	Eliminated	Neutral	Short term	Risk reduced
	Physical disturbance to unknown sites	Remote	Moderate	Low	Adverse	Medium term	CHMP / TO involvement	CHMP / TO involvement	Moderate	Remote	Moderate	Low	Adverse	Temporary	Risk same
	Loss of trees (>5m) of value to traditional owners	Almost certain	Moderate	High	Adverse	Short term	Pre-clearance tree survey / TO involvement	Pre-clearance tree survey / TO involvement	Moderate	Almost certain	Minor	High	Adverse	Short term	Risk reduced
	Loss of scarred trees	Unlikely	Moderate	Medium	Adverse	Long term	CHMP/ TO involvement	CHMP / TO involvement	Moderate	Remote	Moderate	Low	Adverse	Temporary	Risk reduced
	Disturbance of sensitive land at the decline entry	Eliminated	Minor	Eliminated	Neutral	Not applicable	Vibration assessment	Blasting Management Plan	Moderate	Eliminated	Minor	Eliminated	Neutral	Not applicable	Risk same
Human health and safety **(Chapter 11)**	Exposure from dry waste	Unlikely	Moderate	Medium	Adverse	Long term	AQMP	AQMP	Moderate	Remote	Moderate	Low	Adverse	Temporary	Risk reduced
	Exposure from wet waste	Unlikely	Moderate	Medium	Adverse	Long term	AQMP	AQMP	Moderate	Remote	Moderate	Low	Adverse	Temporary	Risk reduced
	Exposure from fuel spills	Remote	Minor	Low	Adverse	Long term	Training	Emergency spill response	Moderate	Remote	Minor	Low	Adverse	Temporary	Risk same
	Exposure from surface traffic fumes	Remote	Minor	Low	Adverse	Long term	Enclosure air extraction	AQMP	Moderate	Remote	Minor	Low	Adverse	Temporary	Risk same
	Vehicle collision with pedestrians (above and below ground)	Likely	Catastrophic	Extreme	Adverse	Long term	Traffic Management Plan (TMP)	TMP	Moderate	Unlikely	Catastrophic	High	Adverse	Temporary	Risk reduced
	Vehicle accidents (above and below ground)	Likely	Catastrophic	Extreme	Adverse	Long term	TMP	TMP	Moderate	Unlikely	Catastrophic	High	Adverse	Long term	Risk reduced
	Exposure from mine gas extraction	Almost certain	Minor	High	Adverse	Long term	Emission design	AQMP	Moderate	Unlikely	Minor	Low	Adverse	Temporary	Risk reduced
	Ventilation failure	Likely	Moderate	High	Adverse	Medium term	Backup power supplies, management systems	AQMP	Moderate	Unlikely	Moderate	Medium	Adverse	Temporary	Risk reduced

Risk identified by NT EPA during preliminary assessment	Hazard identified by the Proponent in the EIS	Pre-mitigated risks					Mitigation			Post-mitigated risks					Risk outcome
		Likelihood	Consequence	Risk ranking	Nature	Duration	Mitigation to reduce likelihood	Mitigation to reduce consequence	Confidence	Likelihood	Consequence	Risk ranking	Category	Duration	
	Underground vehicle fire	Likely	Major	High	Adverse	Long term	Use of battery vehicles / isolation areas /	Emergency Response Management Plan (ERMP)	Moderate	Unlikely	Major	Medium	Adverse	Temporary	Risk reduced
	Underground vehicle exhaust exposure	Almost certain	Major	Extreme	Adverse	Long term	Ventilation design	ERMP	Moderate	Remote	Major	Medium	Adverse	Temporary	Risk reduced
	Heat stress above and below ground	Almost certain	Moderate	High	Adverse	Long term	Ventilation design and temperature controls	ERMP	Moderate	Unlikely	Moderate	Medium	Adverse	Long term	Risk reduced
	Construction accidents - surface infrastructure	Possible	Catastrophic	High	Adverse	Long term	Traffic Management Plan (TMP)	ERMP	Moderate	Remote	Catastrophic	Medium	Adverse	Long term	Risk reduced
	Construction accidents - underground infrastructure	Possible	Catastrophic	High	Adverse	Long term	TMP	ERMP	Moderate	Remote	Catastrophic	Medium	Adverse	Long term	Risk reduced
	Uncontrolled gas release - underground pressure release	Unlikely	Catastrophic	High	Adverse	Long term	Ventilation design / Health and Safety Plan / AQMP	ERMP	Moderate	Remote	Catastrophic	Medium	Adverse	Temporary	Risk reduced
	Uncontrolled gas release - underground ignition	Unlikely	Catastrophic	High	Adverse	Long term	Ventilation design / Health and Safety Plan / AQMP	ERMP	Moderate	Remote	Catastrophic	Medium	Adverse	Temporary	Risk reduced
	Uncontrolled gas release - underground asphyxiation	Unlikely	Catastrophic	High	Adverse	Long term	Ventilation design / Health and Safety Plan / AQMP	ERMP	Moderate	Remote	Catastrophic	Medium	Adverse	Temporary	Risk reduced
	Waste stability with heat	Unlikely	Major	Medium	Adverse	Long term	Waste Zoning Guide	Waste Zoning Guide	Moderate	Eliminated	Major	Eliminated	Neutral	Long term	Risk reduced
	Bites / stings	Almost certain	Catastrophic	Extreme	Adverse	Long term	Health and Safety Management Plan (HSMP)	HSMP	Moderate	Unlikely	Moderate	Medium	Adverse	Long term	Risk reduced
	Drugs and alcohol abuse	Almost certain	Major	Extreme	Adverse	Long term	HSMP	HSMP	Moderate	Remote	Major	Medium	Adverse	Long term	Risk reduced
	Strata / ground stability	Unlikely	Catastrophic	High	Adverse	Long term	Detailed geotechnical design	CEMP	Moderate	Remote	Catastrophic	Medium	Adverse	Long term	Risk reduced
	Mine drill and blasting	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Blasting Management Plan	CEMP	Moderate	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Risk same
	Ignition of flammable materials	Possible	Major	High	Adverse	Short term	HSMP	ERMP	Moderate	Unlikely	Major	Medium	Adverse	Short term	Risk reduced
	Fall from height	Possible	Catastrophic	High	Adverse	Medium term	HSMP	ERMP	Moderate	Unlikely	Catastrophic	High	Adverse	Medium term	Risk reduced
	Electrical incident	Possible	Major	High	Adverse	Short term	HSMP	ERMP	Moderate	Unlikely	Major	Medium	Adverse	Short term	Risk reduced
	Exposure from Naturally Occurring Radioactive Material (NORM)	Unlikely	Major	Medium	Adverse	Long term	Waste Zoning Guide	HSMP	Moderate	Eliminated	Major	Eliminated	Neutral	Not applicable	Risk reduced

Risk identified by NT EPA during preliminary assessment	Hazard identified by the Proponent in the EIS	Pre-mitigated risks					Mitigation			Post-mitigated risks					Risk outcome
		Likelihood	Consequence	Risk ranking	Nature	Duration	Mitigation to reduce likelihood	Mitigation to reduce consequence	Confidence	Likelihood	Consequence	Risk ranking	Category	Duration	
Socio economics **(Chapter 12)**	Community acceptance of the Proposal (Titjikala)	Possible	Major	High	Adverse	Long term	Community consultation	Community consultation	Moderate	Remote	Moderate	Low	Adverse	Short term	Risk reduced
	Community acceptance of the Proposal (Alice Springs)	Likely	Major	High	Adverse	Long term	Community consultation	Community consultation	Moderate	Unlikely	Moderate	Medium	Adverse	Short term	Risk reduced
	Regional acceptance of the Proposal (NT/Australia)	Unlikely	Major	Medium	Adverse	Long term	Community consultation	Community consultation	Moderate	Remote	Moderate	Low	Adverse	Temporary	Risk reduced
	Not mining salt (no product export)	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Community consultation	Community consultation	Moderate	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Risk same
	Not mining salt (no product local)	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Community consultation	Community consultation	Moderate	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Risk same
	Not mining salt (tourism)	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Community consultation	Community consultation	Moderate	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Risk same
	Not mining salt (employment)	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Community consultation	Community consultation	Moderate	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Risk same
	Not mining salt (royalties)	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Community consultation	Community consultation	Moderate	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Risk same
	Employment opportunities - construction	Almost certain	Major	Extreme	Beneficial	Long term	Community engagement and training programs	Community engagement and training programs	Moderate	Almost certain	Major	Extreme	Beneficial	Long term	Risk same
	Employment opportunities - operations	Almost certain	Major	Extreme	Beneficial	Long term	Community engagement and training programs	Community engagement and training programs	Moderate	Almost certain	Major	Extreme	Beneficial	Long term	Risk same
	Employment opportunities - ancillary employment	Almost certain	Moderate	High	Beneficial	Long term	Community engagement and training programs	Community engagement and training programs	Moderate	Almost certain	Major	Extreme	Beneficial	Long term	Risk reduced
Closure and rehabilitation **(Chapter 13)**	Room seal failure	Possible	Minor	Medium	Adverse	Long term	Design specifications	Rehabilitation Closure Plan	Moderate	Remote	Minor	Low	Adverse	Long term	Risk reduced
	Accident during surface to underground decommissioning	Remote	Catastrophic	Medium	Adverse	Short term	Health and Safety Mgmt Plan	Health and Safety Mgmt Plan	Moderate	Remote	Catastrophic	Medium	Adverse	Short term	Risk same
	Shaft seals fail	Remote	Major	Medium	Adverse	Short term	Design specifications	Rehabilitation Closure Plan	Moderate	Eliminated	Moderate	Eliminated	Adverse	Not applicable	Risk reduced
	Decline seals fail	Remote	Insignificant	Low	Neutral	Not applicable	Design specifications	Design specifications	Moderate	Eliminated	Insignificant	Eliminated	Neutral	Not applicable	Risk reduced
	No surface remediation (environmental)	Unlikely	Minor	Low	Adverse	Long term	Rehabilitation and Closure Plan	Rehabilitation and Closure Plan	Moderate	Remote	Minor	Low	Adverse	Long term	Risk reduced
	No surface remediation	Unlikely	Major	Medium	Adverse	Long term	Rehabilitation and Closure Plan	Rehabilitation and Closure Plan	Moderate	Remote	Major	Medium	Adverse	Long term	Risk reduced
	No groundwater monitoring	Remote	Moderate	Low	Adverse	Long term	Rehabilitation and Closure Plan	Rehabilitation and Closure Plan	Moderate	Remote	Minor	Low	Adverse	Long term	Risk reduced
	No gas monitoring is undertaken	Remote	Minor	Low	Adverse	Long term	Institutional control management	Institutional control management	Moderate	Eliminated	Minor	Eliminated	Adverse	Not applicable	Risk reduced

Risk identified by NT EPA during preliminary assessment	Hazard identified by the Proponent in the EIS	Pre-mitigated risks					Mitigation			Post-mitigated risks					Risk outcome
		Likelihood	Consequence	Risk ranking	Nature	Duration	Mitigation to reduce likelihood	Mitigation to reduce consequence	Confidence	Likelihood	Consequence	Risk ranking	Category	Duration	
	No institutional control period monitoring	Possible	Moderate	Medium	Neutral	Long term	Institutional control management	Institutional control management	Moderate	Unlikely	Minor	Low	Adverse	Long term	Risk reduced
	Future land uses (other land grazing)	Remote	Insignificant	Low	Adverse	Temporary	Institutional control management	Institutional control management	Moderate	Eliminated	Insignificant	Eliminated	Neutral	Temporary	Risk reduced
	Earthquakes	Remote	Insignificant	Low	Adverse	Long term	Geotechnical assessment	Detailed design	Moderate	Remote	Insignificant	Low	Adverse	Long term	Risk same
	Climate change	Possible	Insignificant	Low	Adverse	Long term	Post operational risk assessment	Detailed design /	Moderate	Possible	Insignificant	Low	Adverse	Long term	Risk same
	Human intrusion	Remote	Minor	Low	Adverse	Short term	Rehabilitation and Closure Plan	Institutional control management	Moderate	Eliminated	Minor	Eliminated	Not applicable	Not applicable	Risk reduced
Bushfire (Chapter 14)	Natural bushfires occurring	Possible	Major	High	Adverse	Short term	BFMP	BFMP	Moderate	Unlikely	Major	Medium	Adverse	Short term	Risk reduced
	Back burning on surrounding pastoral land	Possible	Major	High	Adverse	Short term	BFMP	BFMP	Moderate	Possible	Major	High	Adverse	Short term	Risk same
	Hot works resulting in spontaneous ignition	Possible	Major	High	Adverse	Short term	BFMP	BFMP	Moderate	Unlikely	Major	Medium	Adverse	Short term	Risk reduced
	Smoking cigarettes	Likely	Major	High	Adverse	Short term	BFMP	BFMP	Moderate	Likely	Major	High	Adverse	Short term	Risk same
	Increased ignition sources	Likely	Major	High	Adverse	Short term	BFMP	BFMP	Moderate	Unlikely	Major	Medium	Adverse	Short term	Risk reduced
	Flammable and/or volatile fuels	Likely	Major	High	Adverse	Short term	BFMP	BFMP	Moderate	Unlikely	Major	Medium	Adverse	Short term	Risk reduced
Air quality (Chapter 15) (A) (D) (E)	Construction phase impacts (construction traffic in Alice Springs)	Almost certain	Moderate	High	Adverse	Short-term	CEMP, mitigation measures identified	CEMP, mitigation measures identified	High	Almost certain	Insignificant	High	Adverse	Short-term	Risk reduced
	Emissions to air (combustion gases and particulates) from mining activities (NO2 at Chambers Pillar Campsite) (B) (F)	Likely	Major	High	Adverse	Long-term	AQMP, including stockpile management	USEPA Tier 4 emission standards, stockpile	High	Likely	Minor	Medium	Adverse	Long-term	Risk reduced
	Loss of containment of 1 TEU of product salt at the Chandler Facility impacting all receptors (C)	Possible	Insignificant	Low	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	waste handling procedures and restrictive load management to manage the volumes of similar materials	Moderate	Unlikely	Insignificant	Low	Adverse	Temporary	Risk reduced

Risk identified by NT EPA during preliminary assessment	Hazard identified by the Proponent in the EIS	Pre-mitigated risks					Mitigation			Post-mitigated risks					Risk outcome
		Likelihood	Consequence	Risk ranking	Nature	Duration	Mitigation to reduce likelihood	Mitigation to reduce consequence	Confidence	Likelihood	Consequence	Risk ranking	Category	Duration	
	Loss of containment of 1 TEU of solid waste (as beryllium) at the Chandler Facility affecting all receptors	Possible	Insignificant	Low	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	waste handling procedures and restrictive load management to manage the volumes of similar materials	Moderate	Unlikely	Insignificant	Low	Adverse	Temporary	Risk reduced
	Simultaneous loss of containment of 2 TEU of solid waste (as beryllium) at Chandler Facility	Unlikely	Insignificant	Low	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	waste handling procedures and restrictive load management to manage the volumes of similar materials	Moderate	Remote	Insignificant	Low	Adverse	Temporary	Risk reduced
	Loss of containment of 1 TEU liquid/sludge waste (as formaldehyde) at the Chandler Facility impacting Chambers Pillar Campground	Possible	Minor	Medium	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	waste handling procedures and restrictive load management to manage the volumes of similar materials	Moderate	Unlikely	Minor	Low	Adverse	Temporary	Risk reduced
	Simultaneous loss of containment of 2 TEU liquid/sludge waste (as formaldehyde) at Chandler Facility	Unlikely	Moderate	Medium	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	waste handling procedures and restrictive load management to manage the volumes of similar materials	Moderate	Remote	Moderate	Low	Adverse	Temporary	Risk reduced
	Loss of containment of 1 TEU of product salt at Apirnta Facility	Possible	Insignificant	Low	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	0	Moderate	Unlikely	Insignificant	Low	Adverse	Temporary	Risk reduced
	Loss of containment of 1 TEU of solid waste (as beryllium) at Apirnta Facility	Possible	Insignificant	Low	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	waste handling procedures and restrictive load management to manage the volumes of similar materials	Moderate	Unlikely	Insignificant	Low	Adverse	Temporary	Risk reduced

Risk identified by NT EPA during preliminary assessment	Hazard identified by the Proponent in the EIS	Pre-mitigated risks					Mitigation			Post-mitigated risks					Risk outcome
		Likelihood	Consequence	Risk ranking	Nature	Duration	Mitigation to reduce likelihood	Mitigation to reduce consequence	Confidence	Likelihood	Consequence	Risk ranking	Category	Duration	
	Simultaneous loss of containment of 2 TEU of solid waste (as beryllium) at Apirnta Facility	Unlikely	Insignificant	Low	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	waste handling procedures and restrictive load management to manage the volumes of similar materials	Moderate	Remote	Insignificant	Low	Adverse	Temporary	Risk reduced
	Loss of containment of 1 TEU liquid/sludge waste (as formaldehyde) at Apirnta Facility	Possible	Insignificant	Low	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	waste handling procedures and restrictive load management to manage the volumes of similar materials	Moderate	Unlikely	Insignificant	Low	Adverse	Temporary	Risk reduced
	Loss of containment of 1 TEU of product salt at Apirnta Facility	Possible	Insignificant	Low	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	0	Moderate	Unlikely	Insignificant	Low	Adverse	Temporary	Risk reduced
	Loss of containment of 1 TEU of solid waste (as beryllium) at Apirnta Facility	Possible	Insignificant	Low	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	waste handling procedures and restrictive load management to manage the volumes of similar materials	Moderate	Unlikely	Insignificant	Low	Adverse	Temporary	Risk reduced
	Simultaneous loss of containment of 2 TEU of solid waste (as beryllium) at Apirnta Facility	Unlikely	Insignificant	Low	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	waste handling procedures and restrictive load management to manage the volumes of similar materials	Moderate	Remote	Insignificant	Low	Adverse	Temporary	Risk reduced
	Loss of containment of 1 TEU liquid/sludge waste (as formaldehyde) at Apirnta Facility	Possible	Insignificant	Low	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	waste handling procedures and restrictive load management to manage the volumes of similar materials	Moderate	Unlikely	Insignificant	Low	Adverse	Temporary	Risk reduced

Risk identified by NT EPA during preliminary assessment	Hazard identified by the Proponent in the EIS	Pre-mitigated risks					Mitigation			Post-mitigated risks					Risk outcome
		Likelihood	Consequence	Risk ranking	Nature	Duration	Mitigation to reduce likelihood	Mitigation to reduce consequence	Confidence	Likelihood	Consequence	Risk ranking	Category	Duration	
	Simultaneous loss of containment of 2 TEU of solid waste (as beryllium) at Apirnta Facility	Unlikely	Insignificant	Low	Adverse	Temporary	EMS (including EMP), in-cab collision avoidance & communication	waste handling procedures and restrictive load management to manage the volumes of similar materials	Moderate	Remote	Insignificant	Low	Adverse	Temporary	Risk reduced
Noise and vibration) (Chapter 16	Blasting activities result in increased noise levels	Almost certain	Insignificant	High	Adverse	Temporary	Blasting Management Plan	Construction Environmental Mgmt Plan	Moderate	Likely	Insignificant	Medium	Adverse	Temporary	Risk reduced
	Blasting activities result in vibration	Almost certain	Major	Extreme	Adverse	Temporary	Blasting Management Plan	Construction Environmental Mgmt Plan	Moderate	Unlikely	Major	Medium	Adverse	Temporary	Risk reduced
	Blasting activities result in vibration on known items of cultural heritage significance	Possible	Major	High	Adverse	Long term	Blasting Management Plan	Construction Environmental Mgmt Plan	Moderate	Remote	Major	Medium	Adverse	Long term	Risk reduced
	Construction and operation noise	Almost certain	Moderate	High	Adverse	Temporary	Noise Mgmt Plan	Construction Environmental Mgmt Plan	Moderate	Possible	Minor	Medium	Adverse	Temporary	Risk reduced
Visual amenity (Chapter 17)	Visibility of above ground infrastructure	Almost certain	Minor	High	Adverse	Long term	Landscape Mgmt Plan	Consultation with Traditional Owners	Moderate	Unlikely	Minor	Low	Adverse	Long term	Risk reduced
	Visibility of decline entry	Almost certain	Minor	High	Adverse	Long term	Landscape Mgmt Plan	Consultation with Traditional Owners	Moderate	Unlikely	Minor	Low	Adverse	Long term	Risk reduced
	Visibility of spoil stockpiles	Almost certain	Minor	High	Adverse	Long term	Landscape Mgmt Plan	Consultation with Traditional Owners	Moderate	Unlikely	Minor	Low	Adverse	Long term	Risk reduced
	Visibility of run of mine salt stockpile	Almost certain	Minor	High	Adverse	Long term	Landscape Mgmt Plan	Consultation with Traditional Owners	Moderate	Unlikely	Minor	Low	Adverse	Long term	Risk reduced
	Visibility of detention/sedimentation ponds	Almost certain	Minor	High	Adverse	Long term	Landscape Mgmt Plan	Consultation with Traditional Owners	Moderate	Unlikely	Minor	Low	Adverse	Long term	Risk reduced
	Visibility of access roads	Almost certain	Minor	High	Adverse	Permanent	Landscape Mgmt Plan	Consultation with Traditional Owners	Moderate	Unlikely	Minor	Low	Adverse	Long term	Risk reduced
	Visibility of accommodation village	Almost certain	Minor	High	Adverse	Long term	Landscape Mgmt Plan	Consultation with Traditional Owners	Moderate	Unlikely	Minor	Low	Adverse	Long term	Risk reduced
	Subsidence causing changes to land form	Unlikely	Moderate	Medium	Adverse	Permanent	Landscape Mgmt Plan	Consultation with Traditional Owners	Moderate	Unlikely	Minor	Low	Adverse	Long term	Risk reduced

Note (A) Please note that Air Quality impacts have been assessed in the Technical Paper as risks for a range (or scale) of incidents, which are also categorised in terms of likelihood using industry definitions and statistical frequencies (defined as frequent, likely, occasional, unlikely, remote, incredible). Essentially the Air Quality Risk Assessment utilises a 3-dimensional risk assessment (sensitivity x consequence x likelihood), which for the purposes of presenting a holist EIS risk chapter, needs to be presented as a 2-dimenisonal risk assessment (likelihood x consequence).

(B) The risk assessment for mining activities is evaluated against a 'likely' likelihood, as the relevant metrics are short-term in nature (hourly to annual average statistics) when compared to the life of mine and the risks associated with accidental loss of containment.

(C) The risks associated with loss of containment have been assessed against 'possible' and 'unlikely' likelihood events.

(D) The definitions of likelihood used in this Chapter and in the Air Quality Risk Assessment are marginally different. For clarity, the following equivalence has been used:

Table 6.2 descriptor	AQRA descriptor
Almost certain	Frequent
Likely	Likely
Possible	Occasional
Unlikely	Unlikely
Remote	Remote

(E) The definitions of consequence used in this Chapter and in the Air Quality Risk Assessment are marginally different. For clarity, the following equivalence has been used:

Table 6.3 descriptor	AQRA descriptor
Catastrophic	} Substantial (>100% ST criterion)
Major	} Substantial (>50% ST criterion)
Moderate	Moderate (<25% ST criterion)
Minor	Slight (>10% ST criterion)
Insignificant	Negligible (<10% ST criterion)

(F) The pre-mitigation risk of 'high' is derived from the predicted 1-hour NO_2 impact at Chambers Pillar Campsite. The post-mitigated risk of 'medium' is derived from a conservative prediction of the 24-hour PM_{10} impacts at a number of off-site locations. The post-mitigated NO_2 consequence is 'insignificant'.

6.7 Discussion of risks

The preliminary review of the Proposal undertaken by the NT EPA identified eight 'key environmental risks' and four 'other risks'. The risk assessment undertaken by the proponent quantified a total of 136 hazards after two Proposal risk workshops.

The presentation of pre-mitigation and post mitigation risks associated with the Proposal are summarised in Table 6-10.

As discussed in Section 6.3.1, in the context of the EIS, a 'hazard' is identified as impact of the Proposal, and may be of "beneficial", "neutral" or "adverse" in nature. Of the 136 hazards identified, the pre-mitigation and post-mitigation breakdown illustrated in Table 6-11 by nature is observed.

Table 6-11 Quantification of pre-mitigated and post mitigated risks by nature

Risk summary	Pre-mitigation	Post-mitigation
	Count	Count
Adverse	118	106
Neutral	14	26
Beneficial	4	4
Total	136	136

As may be deduced from Table 6-11 the number of 'adverse' nature risks reduce from 118 (pre-mitigation) to 106 (post mitigation) and the number of 'neutral' nature risks increases from 14 (pre-mitigation) to 26 (post mitigation). Essentially this illustrates that 12 adverse risks have been eliminated to become 'neutral' in nature.

All risks identified by the proponent have been quantified using the methods detailed above and summarised in Table 6-12 and Figure 6-1.

Table 6-12 Quantification of pre-mitigated and post mitigated risk

Risk summary	Pre-mitigation	Post-mitigation
	Count	Count
Extreme	11	4
High	54	12
Medium	31	38
Low	29	51
Eliminated	11	31
Total	136	136

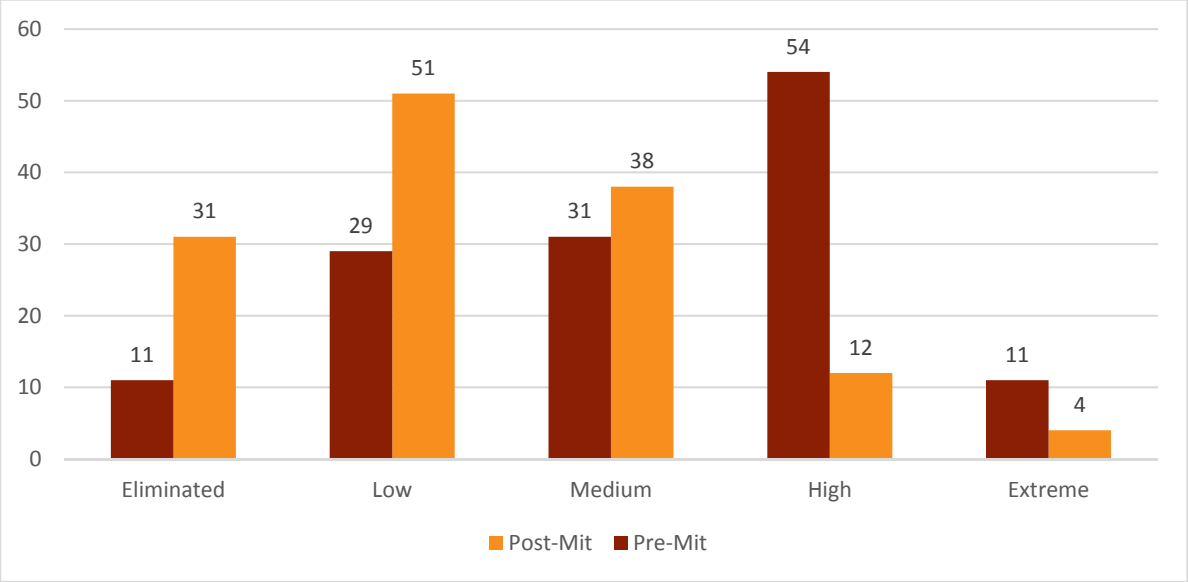


Figure 6-1 Risk summary of pre-mitigated and post mitigated risks

Figure 6-1 shows that with mitigation in place, a further 20 risks are eliminated from the total 136 risks identified at pre-mitigation stage. In addition, the number of low risks increased from 29 to 51, high risks decreased from 54 to 12 and extreme risks also decreased from 11 to 4. It is further noted that the 4 remaining 'extreme' risks are all "beneficial" in nature, relating to:

- Surface water: altered hydrology surrounding the infrastructure site.
- Socio-economics: employment opportunities – construction.
- Socio-economics: employment opportunities – operational.
- Socio-economics: employment opportunities – ancillary employment.

Following the analysis of mitigation and site specific environmental management measures and/or changes to design, the post mitigation assessment summarised in

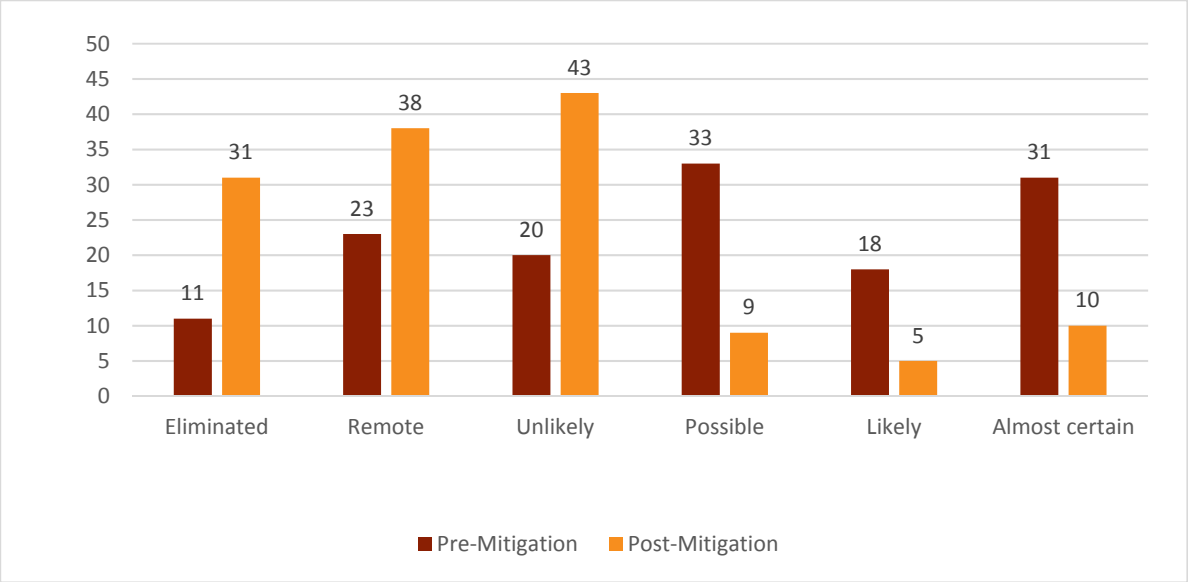


Figure 6-2 concludes the Proposal would:

- Increase the likelihood of 'eliminated' risk from 11 in pre-mitigation to 31 in post mitigation.
- Increase the likelihood of 'low' risk from 29 at pre-mitigation to 51 in post mitigation.
- Increase the likelihood of 'medium' risk from 31 at pre-mitigation to 38 in post mitigation.
- Decrease the likelihood of 'high' risk from 54 at pre-mitigation to 12 in post mitigation.
- Decrease the likelihood of 'extreme' risk from 11 at pre-mitigated risks to 4 in post mitigation

Generally there is a clear trend to reduce the majority of adverse nature 'high' and 'extreme' risks, and through targeted mitigation reduce these risks to 'medium', 'low' and 'eliminated'.

The risk summary outlined above is a product function of likelihood and consequence, and the mitigation identified targets either likelihood, consequence, or both factors to some degree (although not necessarily equally).

The effect of mitigation upon 'likelihood' is illustrated in Figure 6-2.

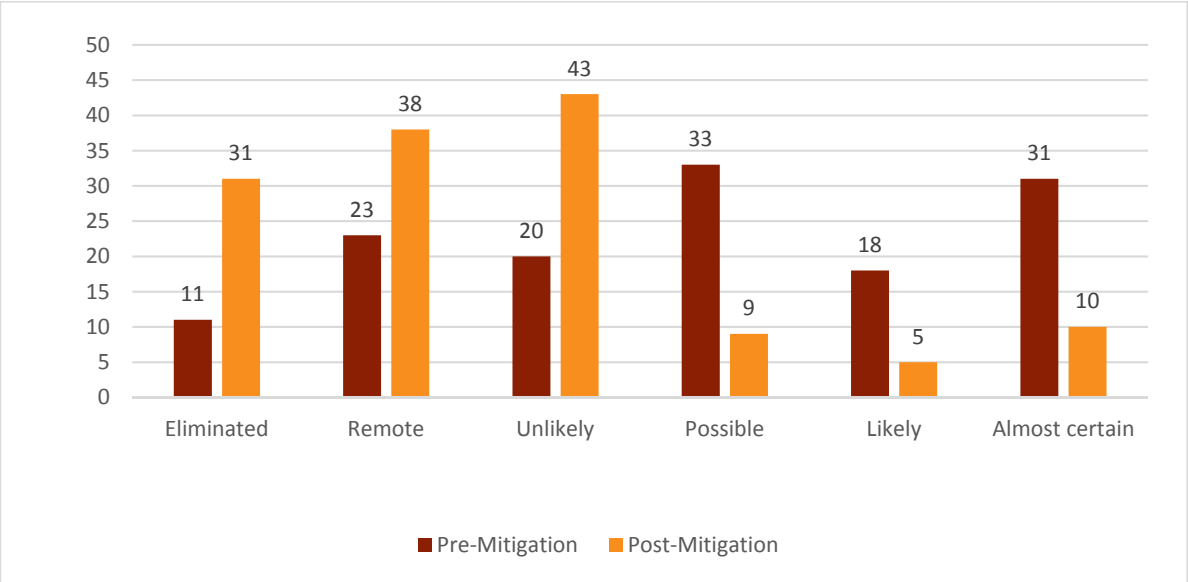


Figure 6-2 Likelihood of risks pre and post mitigation

Similarly, the consequence of the identified risks is reduced following the implementation of mitigation and environmental management measures (see Figure 6-3).

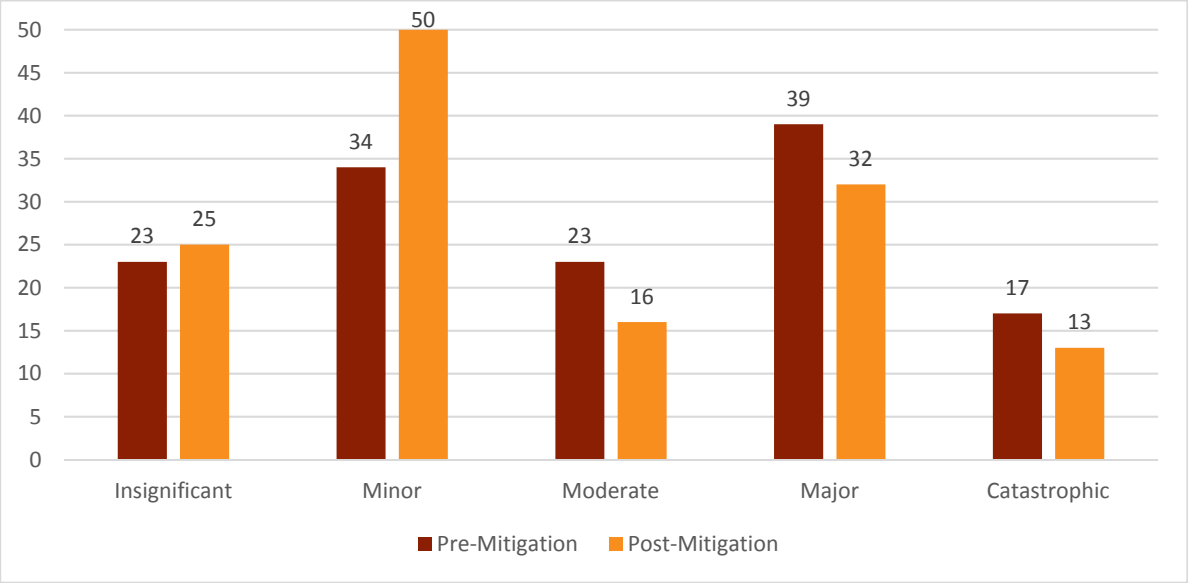


Figure 6-3 Consequence of risks pre and post mitigation

6.8 The Proposal's environmental impact assessment process

6.8.1 Background

A Notice of Intent was lodged on 16 November 2012 with the NT Government, Environment Protection Authority.

An EPBC Act referral was lodged December 2012 with the then Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now Department of the Environment and Energy). The Proposal was determined to be a controlled action under the EPBC Act. The relevant controlling provision is listed threatened species and communities (section 18 and 18A).

In March 2013, the NT EPA decided that the Proposal required assessment under the NT *Environmental Assessment Act* at the level of an EIS. Draft Guidelines for Preparation of an EIS were issued by the NT EPA for public comment on the 22 June, 2013. Comments closed 5 July, 2013, and Final Guidelines for the Preparation of an Environmental Impact Statement (the 'EIS Guidelines') were issued by the NT EPA on 19 July, 2013.

In 2016, a variation to the 2013 final EIS Guidelines was submitted to the NT EPA. This EIS has been prepared to address the requirements set out in the *Terms of Reference for the Preparation of an Environmental Impact Statement – Chandler Salt Mine* (the 'Terms of Reference') issued by the NT EPA on 23 September, 2016, under the EA Act.

6.8.2 What is Environmental Impact Assessment

Environmental Impact Assessment (EIA) is a process that aims to improve the environmental design of a development proposal and provide decision-makers with sufficient information about the environmental effects of implementing a proposal (IEMA 2008).

Development consent for projects that are likely to have significant effects on the environment should be granted only after an assessment of the likely significant environmental effects of those projects has been carried out.

An EIS sets out the results of the EIA process. The EIS is submitted with an application for planning permission and provides environmental information about the scheme, including a description of the development, its predicted environmental impacts and the measures proposed to amend any adverse effects.

6.8.3 The EIA process for the proposal

Volume 3 presents the core of the impact assessment contained within this EIS, covering a wide range of technical disciplines. To enable a valid comparison to be made of the significance of impacts, a generally consistent approach has been applied to each technical issue contained within Volume 2.

In summary, this process involved:

- Establishing baseline conditions for each issue being discussed.
- Using the proposal description plus the construction, operational and decommissioning methodologies to understandthe proposal, its potential impacts, but also the mitigation inherent in the design.
- Assessing the potential impacts of the proposal using a consistent methodology for describing impacts.
- Describing the impacts without any additional mitigation.
- Describing the proposed mitigation for the particular issue being discussed.
- Describing the residual impacts that are anticipated to remain once additional mitigation is implemented.

This translates to a chapter format that is generally as follows:

- Introduction.
- Methodology.
- Existing environment (baseline conditions).
- Assessment of risk during construction.
- Assessment of risk during operation.
- Assessment of risk during closure and rehabilitation.
- Mitigation and monitoring.
- Summary of risk assessment.
- Conclusion.

The mitigation and management measures are summarised in Chapter 21 (Environmental management). The mitigation and management measures would be included in the construction, operational and decommissioning environmental management plans for the proposal.

Overall, the approach taken through the process of developing the environmental impact assessment was to firstly prevent or avoid significant impacts through design changes early in the proposal process, then seek to reduce impacts through the implementation of mitigation prescribed in management plans and, finally, where impacts cannot be adequately mitigated and residual impacts predominate, to compensate for the impact (i.e. through the provision of offsets).

6.8.4 Scoping

Issues and risks to be assessed were identified using a number of related processes. The EIS Guidelines provide the overall framework of specific matters to be addressed by the EIS.

A risk assessment process was also undertaken at the start of the assessment to help prioritise key issues and to develop the scope of the specialist investigations to be undertaken to support the preparation of the EIS.

Government and community stakeholders were also consulted to help identify their key issues, attitudes and concerns regarding the Proposal. Details regarding consultation is provided in Chapter 5.

6.8.5 Existing environment

Establishing the existing environment or baseline conditions involved a wide range of activities including:

- Review of published material (databases, reports, journals, etc.) and mapping from a range of sources.
- Undertaking issue-specific site surveys for key issues identified in the Proposal's ToR.
- Consultation with local, state and Commonwealth government agencies.
- Consultation with Traditional Owners and pastoralists.

6.8.6 Approach to impact assessment

A specific set of descriptors were developed to describe impacts in the EIS. This involves two the following aspects:

- **Significance assessment** - a generic set of significance criteria is defined (see Table 6-4) and enables consistent description of adverse and beneficial impacts. In each chapter the significance criteria are made relevant to the topic being considered. This assessment also requires consideration of the duration of the impact (see Table 6-6), and the relevant EPBC Act Significant Impact Guidelines for Matters of National Environmental Significance.
- **Risk rating** - using the risk framework detailed in Table 6-5, the overall impact is assessed by assessing the consequence of a hazard and its likelihood.
- **Duration** – As described in Table 6-6.

The approach ultimately assesses the residual risk taking into consideration any proposed mitigation measures identified as necessary to lower the significance, frequency or risk of an impact occurring Table 6-10).

6.8.7 Mitigation

As stated previously, the mitigation inherent in the design is included in the initial assessment of impacts. Following this, where necessary, additional mitigation is proposed for the Proposal (i.e. during detailed design) in order to reduce the significance or likelihood of an identified impact occurring. In describing mitigation measures in each chapter of the impact assessment within this EIS, the following is considered:

- A description of the predicted effectiveness of the mitigation measures.
- Any statutory or policy basis for the mitigation measures or offsets (if required).
- Whether the mitigation could be implemented by the proponent, or whether other parties were necessary for it to take effect.

The mitigation information has been used to inform and develop the relevant draft management plans attached to the EIS including:

- Environmental Management Plan.
- Waste Management Plan.
- Water Management Plan.
- Biodiversity Management Plan.
- Social Impact Management Plan.
- Rehabilitation and Closure Plan.

6.9 Cumulative impacts

Cumulative impacts can be defined as impacts on the environment, which result from the incremental impact of an action when added to other past, present or reasonably foreseeable future actions, regardless of what agency or person undertakes those other actions (Carroll *et al*. 2009).

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time or from a combination of concurrent effects from a single action. They can be additive, synergistic or interactive and can result in impacts that are larger, more significant and longer lasting than is the case with individual impacts and their effects. There is no defined process for undertaking cumulative impact assessments within Australia. Considerations related to cumulative impacts are included in the Commonwealth Environment Protection and Biodiversity Conservation Regulations 2000. They state the need to assess cumulative impacts in relation to World Heritage Areas and Ramsar sites but do not provide any guidance on scoping and carrying out the CIA.

Table 6-13 describes the approach taken for the Proposal in determining potential cumulative impacts.



Table 6-13 Cumulative impact methodology

Method	Comment
Spatial boundaries	Setting boundaries is the process of establishing the limits of the area to be assessed for cumulative impacts and the identification of activities within this boundary. The primary spatial boundary for the CIA is the project footprint – this is the area that is under project control and responsibility, i.e. the Project Area. However, boundaries can vary from issue to issue and need to reflect ecosystem requirements rather than artificial boundaries.
Temporal boundaries	Cumulative impacts during the construction phase are likely to be short-term and localised to the Project footprint and immediate surrounds. Operation phase impacts are more likely to be medium to long-term (e.g. continuing for more than two years after the activity has ceased, or ongoing) and to extend beyond the Project footprint.
Project approach	Cumulative impacts have been addressed separately within each of the individual chapters in order to reflect the differing spatial and temporal boundaries of each environmental aspect.

6.10 Conclusion

This environmental impact assessment process undertaken for this EIS has included a comprehensive risk assessment. The outcomes of the detailed risk assessment, the methods used to identify Proposal risks and, initiatives taken by the proponent to mitigate them, can demonstrate that:

- The proponent is aware of risks associated with all predictable aspects of the Proposal.
- The proponent has or will continue to undertake necessary studies to quantify risks.
- Prevention and mitigation of risks have been addressed in conceptual design.
- Risks can and would be managed effectively during construction, operation, decommissioning, closure and post-closure phases of the Proposal.
- Risks will continue to be assessed through the development of the Proposal i.e. in detailed design.

The information contained in this Chapter and in Appendix S has been provided to assist the reader understand the likelihood and consequence of each risk presented by the Proposal. The ranking of risks has been justified by adopting National standards. Supporting EIS studies, such as the operational and post-closure risk assessments (refer to Appendix F and G respectively) have provided sufficient quantitative analysis to indicate whether level of risks is likely to be acceptable, tolerable or non-existent. As indicated in Section 6.7, the implementation of appropriate mitigation and/or environmental management measures has reduced both the likelihood and consequence of Proposal risks.

Where uncertainty did exist for some risks, the proponent adopted the precautionary principle to ensure a conservative level was assessed.



Part E

Environmental Assessment



Chapter 7
Biodiversity



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7 BIODVIVERSITY

7.1 Introduction

This chapter provides a review of biodiversity values that may be potentially affected by the Proposal. This chapter draws on a comprehensive terrestrial ecological assessment, which is included as Appendix O. This chapter describes the terrestrial flora and fauna, their habitats and the presence and likelihood of occurrence of conservation-significant and migratory species, populations and ecological communities within the proposed development footprint and vicinity of the Proposal. The potential impacts on terrestrial ecology are assessed and mitigation and management measures are identified to reduce potential impacts. A draft Biodiversity Management Plan is provided in Appendix O.

The assessment has been prepared in consultation with pastoralists and Traditional Owners. It has also been prepared with reference to the *Guidelines for Assessment of Impacts on Terrestrial Biodiversity* (NT EPA 2013a), *Guidelines on Environmental Offsets and Associated Approval Conditions* (NT EPA 2013b) and in accordance with the Terms of Reference (refer to Appendix A).

7.2 Methodology

The methodology for the terrestrial ecological assessment included a review of databases and relevant literature, field surveys and vegetation and habitat mapping. Impact calculations and an assessment of the significance of impacts were undertaken to determine the effect of the Proposal on terrestrial flora and fauna.

7.2.1 Database and literature review

A desktop assessment was undertaken to gain an understanding of the ecological context of the area (specifically, to gain an understanding of the flora and fauna species known to occur in the region, particularly those of conservation significance). Relevant biodiversity databases pertaining to the locality (defined as a 20 kilometre radius from the boundary of the mining lease area [EL29018], a 20 kilometre radius centred on the proposed Apirnta Facility and 20 kilometres either side of the proposed Chandler Haul Road and Maryvale Access Road) were reviewed. The database searches included:

- NT DENR Species Atlas (including the NT Flora Atlas and NT Fauna Atlas) – for threatened species listed under the TPWC Act that have been recorded in the locality and for Sites of Conservation Significance and Sites of Botanical Significance.
- DoEE Protected Matters Search Tool – for matters of national environmental significance listed under the EPBC Act that have been recorded in the locality.

Additional databases that were reviewed to inform the terrestrial ecological assessment are listed in Appendix R.

The results of previous ecological assessments and scientific publications were also reviewed to determine the likely presence of terrestrial flora and fauna species and their habitats within the area and to determine potential impacts from the Proposal. These included relevant statutory plans such as action plans, recovery plans and threat abatement plants. A list of the literature that was reviewed is provided in Appendix R.

7.2.2 Likelihood of occurrence

Following the collation of database records, species and community profiles, and the results of previous ecological assessments within the locality, a 'likelihood of occurrence' assessment was prepared with reference to the habitats contained within the proposed development footprint and vicinity. This was further refined following field surveys and the identification and assessment of the habitats present.

7.2.3 Field surveys

Extensive field surveys have been undertaken within the proposed development footprint and vicinity over the past four years (between October 2012 and April 2016) (refer to Table 7-1 and Figure 7-1). Sixty-nine sites were surveyed in total. The survey sites were selected to provide a representative sample of the different habitats within the proposed development footprint and vicinity. They were also selected based on the habitat requirements of conservation-significant species predicted to occur within the proposed development footprint or vicinity. The surveys were undertaken over several seasons and in varying weather conditions.

The flora surveys were designed with reference to *Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping* (Brocklehurst *et al.* 2007) and *A resource assessment towards a conservation strategy for the Finke Bioregion* (Neave *et al*. 2004). The general fauna surveys were designed with reference to *Standard Terrestrial Vertebrate Survey Methods used by the DLRM* (NT EPA 2013c) and *A Resource Assessment towards a Conservation Strategy for the Finke Bioregion* (Neave *et al*. 2004).

Surveys for conservation-significant fauna species were undertaken with reference to *Survey Guidelines for Australia's Threatened Mammals* (Department of the Environment, Water, Heritage and the Arts 2010a), *Survey Guidelines for Australia's Threatened Birds* (Department of the Environment, Water, Heritage and the Arts 2010b) and *Survey Guidelines for Australia's Threatened Reptiles* (Department of Sustainability, Environment, Water, Population and Communities 2011).

The field surveys are summarised below with further detail provided in Appendix O.

Table 7-1 Survey effort (terrestrial flora and fauna surveys)

Location	Survey date	Focus	Survey type	Survey effort	Approximate field person hours
Chandler Facility and Chandler Haul Road	Oct 2012	Spring biodiversity survey	Trapping, bird survey, landscape and vegetation	Seven sites	360
Chandler Facility and Chandler Haul Road	Sept 2013	Spring biodiversity survey and soil survey	Trapping, mole trenches, bat surveys (SM2BAT+), bird survey, secondary sign, landscape, vegetation and soil	Eight sites	264
Chandler Facility and Chandler Haul Road, Apirnta Facility	June 2015	Winter biodiversity survey	Trapping, SM2BAT+, bird survey, secondary sign, landscape and vegetation	15 sites	276
Chandler Facility and Chandler Haul Road, Apirnta Facility	Oct 2015	Spring biodiversity survey	Trapping, SM2BAT+, bird survey, secondary sign, landscape and vegetation	10 sites	382
Henbury Access Road and Apirnta Facility	Nov 2015	Spring biodiversity survey	Trapping, bird survey, secondary sign, landscape and vegetation	14 sites	280
Henbury Access Road and Apirnta Facility	May 2016	Autumn biodiversity survey	Trapping, bird survey, secondary sign, landscape and vegetation	16 sites	280

Terrestrial flora surveys

Terrestrial flora surveys consisted of vegetation mapping and validation (via transect surveys). At each site, a 100 metre transect was surveyed within each distinctly different vegetation type present. Data recorded along each transect generally included vascular plant species present, vegetation structure and density, the presence of woody debris and weeds, the impact of disturbance and current vegetation condition. The presence of termite mounds and the soils and geology within each quadrat/transect were recorded. The location and extent of weed infestations within the proposed development footprint were also recorded.

Surveys were undertaken for those conservation-significant species likely to occur within the proposed development footprint or vicinity based on previous records (as found in the database and

literature review) and based on suitable habitat. One conservation-significant flora species was targeted during the flora surveys described above. This was Latz's wattle (*Acacia latzii*).

Terrestrial fauna surveys

Terrestrial fauna surveys consisted of a detailed habitat searches and targeted fauna surveys. The habitat searches included ground-truthing habitat in the field, paying particular attention to identify potentially suitable habitat for conservation-significant species within the proposed development footprint and vicinity.

The targeted fauna surveys consisted of trapping, secondary sign surveys, area search bird surveys, spotlighting, motion-sensing camera surveys, microchiropteran bat surveys, mole trench surveys and incidental observations. The fauna surveys focused on sites with suitable habitat for conservation-significant species and those that would be expected to be subject to direct disturbance during construction and operation of the Proposal. The fauna surveys involved:

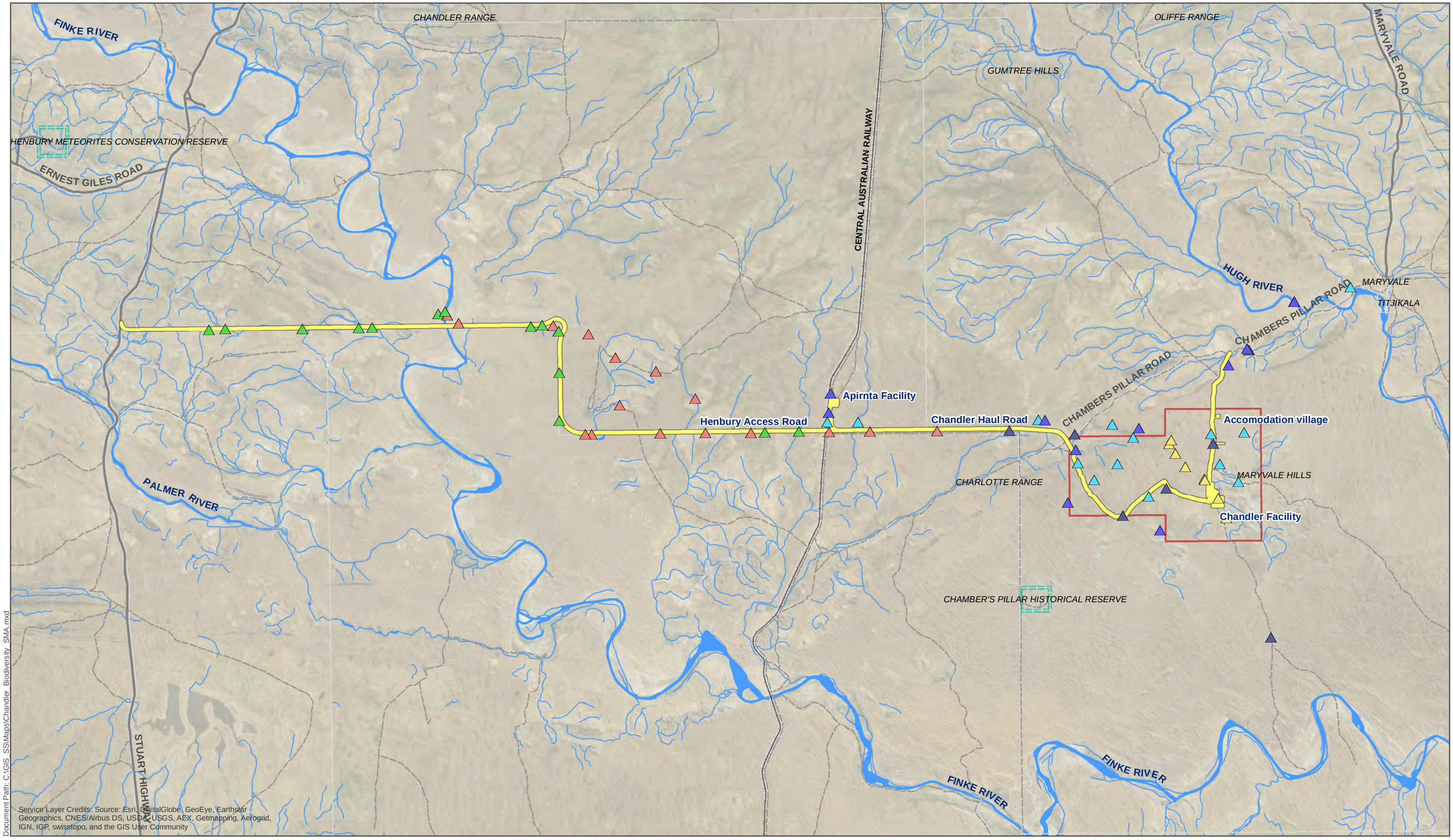
- **Trapping**. Trapping for small mammals and reptiles was undertaken at sites within each land system present within the proposed development footprint. A transect consisting of 25 Elliot traps (spaced 10 – 20 metres apart), two pitfall traps (placed adjacent to the Elliot trap transect with a 10 metre drift fence centred on top) and four funnel traps (one funnel trap placed at either end of each 10 metre drift fence) was established at each site. Cage trapping was not conducted, as there were no species likely to be present in the appropriate size range for cage trapping. Medium to large sized mammals (cats, foxes, dingoes and rabbit) presence and abundance was determined though secondry sign surveys (refer below).
- **Secondary sign surveys**. Searches for secondary signs of fauna species (e.g. tracks and scats) were undertaken within a 200 metre by 250 metre quadrat at each trapping site. Secondary sign surveys were also undertaken at additional sites within land systems not expected to be subject to direct disturbance during construction and operation of the Proposal.
- **Area searches**. Area search bird surveys were undertaken in the morning and afternoons. The surveys consisted of identifying birds by sight and call within 100 metre by 250 metre quadrats. Two targeted bird surveys were undertaken in habitat identified as potentially suitable for thick-billed grasswren (*Amytornis modestus indulkana*). For these surveys, call playback of thick-billed grasswren were broadcast. Area searches were also used to survey for desert sandskipper (*Croitana aestival*).
- **Spotlighting.** Spotlighting transects were undertaken opportunistically along established tracks at night to record nocturnal mammals and birds. The location of fauna species observed during spotlighting was recorded and where introduced/pest species were encountered, the number of animals was recorded.
- **Motion-sensing camera surveys.** Motion-sensing cameras were deployed at three sites to record cryptic species. Cameras were set to take pictures when triggered by movement.
- **Microchiropteran bat surveys**. Surveys for microchiropteran bats involved echolocation call recordings using a call detection unit (Song Meter 2). The call detection units were placed

near a dam and in an open area identified as a fly-way within the proposed development footprint. Calls were then analysed by a bat specialist.

- **Mole trench surveys**. Mole trenches were excavated at sites with suitable substrate (sandy or sandy clay). Trench survey techniques were used to detect signs for marsupial moles underground as traditional trapping techniques are ineffective for these subterranean species. The trenching methodology followed *Manual for Marsupial Mole Survey and Monitoring by Trenches, Version 1.0* (Benshemesh 2005). Trenches were approximatley 120 centimetres long, 40 centimetres wide and 80 centimetres deep. Trenches were excavated on the northern or western side of a dune to maximise drying by sunlight. The longest side of the trench faced north to maximise sunlight on the southern side. A step was dug into the northern wall to increase the sunlight reaching into the trench. The southern side of the trench was rubbed to make it smooth. Trenches were left for three days for the surface to dry. After this time, the surface of the southern wall was inspected for any symmetrical sand filled oval shaped structures larger the 25 millimetres.
- **Incidental observations.** Incidental observations of fauna species were recorded at all times during the field surveys.

Surveys were undertaken for those conservation-significant species likely to occur within the proposed development footprint or vicinity based on previous records (as found in the database searches and literature review) and based on suitable habitat. Conservation-significant fauna species targeted during the fauna surveys described above included:

- Great desert skink (*Liopholis kintorei*).
- Slater's skink (*Liopholis slateri slateri*).
- Desert sandskipper (*Croitana aestival*).
- Australian painted snipe (*Rostratula australis*).
- Night parrot (*Pezoporus occidentalis*).
- Princess parrot (*Polytelis alexandrae*).
- Thick-billed grasswren (*Amytornis modestus indulkana*).
- Black-footed rock-wallaby (*Petrogale lateralis,* MacDonnell Ranges race).
- Central rock-rat (*Zyzomys pendunculatus*).
- Greater bilby (*Macrotis lagotis*).
- Crest-tailed mulgara (*Dasycercus cristicauda*).
- Brush-tailed mulgara (*Dasycercus blythi)*.
- Southern marsupial mole (*Notoryctes typhlops*).



Document Path: C:\GIS_SSI\Maps\Chandler_Biodiversity_SMA.mxd

N

4 2 0 4 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Watercourse
- ML30612

Survey sites

- May 2016
- November 2015
- October 2015
- June 2015
- Septempber 2013
- October 2012

Figure 7-1
Terrestrial flora and fauna survey site locations

TELLUS

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Data source: DPI & F, Land systems polygons, 1989; Geoscience Australia, 250K Topo base data, 2006; USGS, SRTM elevation, 2000; AUSURV SURVEYORS, detailed elevation data, 2016.
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7.2.4 Impact calculations

Direct impacts on flora and fauna (the removal of vegetation and habitat loss) were quantified to determine the potential impacts during construction and operation of the Proposal. The amount of each vegetation type and fauna habitat type directly affected was recorded in a geographic information system.

7.2.5 Assessment of significance of impacts

The potential for significant impacts on matters of national environmental significance and on state-listed threatened species (defined as those listed as vulnerable, endangered or critically endangered under the TPWC Act) were assessed using the criteria set out in the *Significant Impact Guidelines 1.1-Matters of National Environmental Significance* (DoE 2013).[18] The potential for significant impacts were assessed for those species recorded during the field surveys and for those species considered to have a moderate to high likelihood of occurrence within the proposed development footprint or vicinity. Assessments of significance were prepared for eight threatened fauna species listed under the EPBC Act and/or TPWC Act and for eight migratory species listed under the EPBC Act.

7.3 Existing environment

This section describes the physical environment of the proposed development footprint and vicinity and the existing terrestrial flora, fauna and fauna habitat within the proposed development footprint and vicinity. Conservation-significant species known or predicted to occur within the proposed development footprint and vicinity, along with their conservation status, are described.

7.3.1 Physical environment

This section describes the climate, bioregion, land systems and soils within the proposed development footprint and vicinity.

Climate

The climate of the proposed development footprint and vicinity is characterised by distinct hot summers and cold winters, with a wide diurnal range in temperature. Rainfall in the area is highly variable, with a mean annual rainfall of 282.8 millimetres, varying from 76.8 millimetres to 782.5 millimetres. Rainfall is generally higher in the summer months. Summer months have mean maximum temperatures over 30 degrees Celsius. Winter months have mean minimum temperatures under 10 degrees Celsius.

[18] Threatened species listed under the TPWC Act were assessed using the criteria set out in the *Significant Impact Guidelines 1.1-Matters of National Environmental Significance* (DoE 2013). This was due to a lack of similar guidelines for assessing impacts on threatened species in the NT.

Bioregion

The Interim Biogeographic Regionalisation of Australia (IBRA) provides a division of Australia into geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information (Department of Sustainability, Environment, Water, Population and Communities 2012a). The proposed development footprint and vicinity lies within the NT section of the Finke IBRA Bioregion (refer to Figure 3-3 in Appendix R).

The Finke IBRA Bioregion is a geo-morphologically complex and varied area of low sandstone ranges, weathered tablelands and rounded metamorphic hills, laterite-capped mesas, saline depressions and sandplains. Dominant vegetation includes hummock grasslands, *Acacia* shrublands and saltbush/bluebush open shrublands.

Land systems

A total of nine broad land systems has been mapped within the proposed development footprint and vicinity (as per Perry *et al.* 1960). The dominant land systems within the area of the Chandler Facility are Singleton and Rumbalara. The dominant land system within the area of the Apirnta Facility is Singleton and the dominant land systems on the Maryvale Haul Road and Henbury Access Road are Chandler, Simpson, Angas and Singleton. Land systems within the proposed development footprint and vicinity are described in Table 7-2 and are also shown in Table 7-2.

Table 7-2: Land systems within the proposed development footprint and vicinity

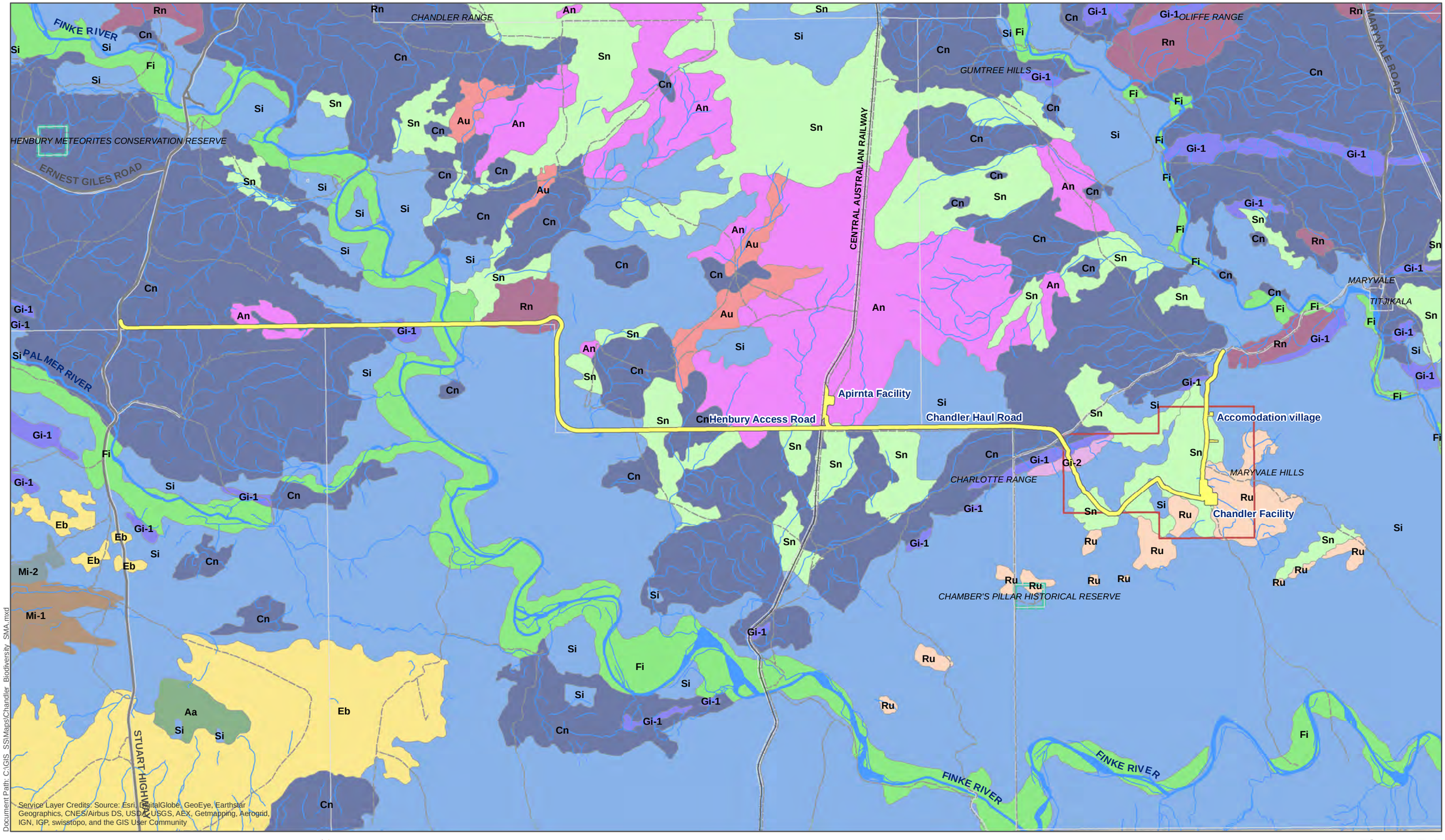
Code	Land system	Landform	Soil description	Vegetation	Photograph
An	Angas	Undulating sandy plains with sandstone and limestone ridges.	Reddish brown sandy loams and calcareous earths.	Open to scattered mulga and witchetty bush over emubush, cassia and bluebush. Understory consists of coppurburrs, sida and forbs.	
Au	Amulda	Sandy foothill fans with broad drainage depressions and creeks.	Red clayey sands and sandy clay loams.	Over storey of Mulga, blue mallee and ironwood over witchetty bush and emu bush. Understory of spinifex, woollybutt grass and kerosene grass.	

Code	Land system	Landform	Soil description	Vegetation	Photograph
Cn	Chandlers	Mesas, low ranges and stony plains with clayey stony slopes and silcrete or shale outcrop.	Stony clayey soils, and shallow calcareous soils.	Generally treeless, scattered bluebush emubush and cassia over copperburrs and sida.	
Fi	Finke	Sandy alluvial plains adjacent to major rivers including active floodplains and dunes.	Sand bed. Levees with loamy sands and fine sands. Dunes with reddish sands.	Tall open woodland of river red gum over colony wattle and sticky hopbush with an understory of buffel grass, couch and sand hill cane grass.	

Code	Land system	Landform	Soil description	Vegetation	Photograph
Gi-1	Gillen	Quartzite and sandstone ranges.	Rock and shallow stony soils.	Absent or scattered mulga and witchetty bush over low shrubs, spinifex and forbs.	
Gi-2	Gillen	Colluvial and alluvial fans and plains.	Red brown sandy clay loams and deep red loamy sands.	Ironwood, mulga, corkwood and witchetty over kerosene grass, mulga grass and other perennial grasses.	

Code	Land system	Landform	Soil description	Vegetation	Photograph
Rn	Renners	Undulating limestone slopes and rises.	Calcareous earths and shallow gravelly soils.	Sparsely vegetated. Mulga and witchetty bush with a shrub layer of dead finish, emu bush and bluebush over copperburrs, sidas and forbs.	
Ru	Rumbulara	Plateaux, mesas and stony slopes.	Rocky and stony surfaces, stony sandy clay loams, shallow calcareous earths.	Scattered mulga on the plateaux. Low shrubs – cassia, emu bush, bluebush over perennial grasses and forbs.	

Code	Land system	Landform	Soil description	Vegetation	Photograph
Si	Simpson	Sand dunes and swales.	Red sands on dunes, red clayey sands, sandy loams and calcareous earths in swales.	Desert oak over cassia and emu bush. Understory consists of spinifex and seasonal forbs.	
Sn	Singleton	Level to slightly undulating plain. Occasional low rises and very broad swales including broad drainage depressions.	Red clayey sands and red earths.	Sparse trees (mulga, mallee, desert oak, beefwood) and shrub layer over spinifex. Small areas with mulga over woolybutt and kerosene grass.	



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N

4 2 0 4 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Watercourse
- ML30612

Land systems unit

Aa, An, Au, Cn, Eb, Ed, Fi, Gi-1, Gi-2, Mi-1, Mi-2, Rn, Ru, Si, Sn

Figure 7-2
Distribution of land systems
within the proposed development footprint and vicinity

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Soils

Soils within the proposed development footprint and vicinity have been mapped in the *Atlas of Australian Soils* (Northcote *et al.* 1968). However, because the currently accepted classification system is the Australian Soil Classification (Isbell and National Committee on Soil and Terrain 2016), a conversion from the Atlas of Australian Soils to Australian Soil Classification was developed by Ashton and McKenzie (2001). Soils within the area of the Chandler Facility include Rudosol and Sodosols. Soils within the area of the Apirnta Facility include Tenosol and Sodosol. Soils within the area of the Chandler Haul Road and Henbury Access Road include Tenosol, Calcerosol and Sodosols.

Soils within the proposed development footprint and vicinity are described further in Chapter 8 and in Appendix E.

Hydrology

The surface hydrology within the proposed development footprint and vicinity consists of ephemeral watercourses, claypans and swamps, all of which provide an important water source for flora and fauna during wet periods. There are two major watercourses in the area, the Hugh River and the Finke River. Both are ephemeral and can result in large-scale flows and associated flooding during high rainfalls. The head of these rivers are located in the West MacDonnell Ranges, approximately 250 kilometres north of the proposed development footprint and, as such, heavy rains in head water catchments can result in significant down stream flows affecting the proposed development footprint and vicinity.

Duck Swamp and associated coolabah swamps and claypans are considered environmentally and culturally important ephemeral wetlands. Duck Swamp is located approximately one kilometre north-east of the proposed Henbury Access Road. The associated coolabah swamps extend downstream across the proposed Henbury Access Road.

According to the Bureau Meteorology's (BoM) Atlas of Groundwater Dependent Ecosystems, there are no groundwater dependent ecosystems within the proposed development footprint or vicinity. In addition, there is a 'low potential for groundwater interaction in the area of interest'. The nearest groundwater dependent ecosystem is located approximately 250 kilometres to the west.

There are no Nationally Important Wetlands within the proposed development footprint or vicinity. The nearest Nationally Important Wetland is the Karinga Creek Paleodrainage System located approximately 130 kilometres to the south-west. There are no Ramsar Wetlands or Wetlands of National Significance located within the proposed development footprint or vicinity. The nearest Ramsar Wetland is Lake Pinaroo which is located approximately 860 kilometres to the south-east.

7.3.2 Terrestrial flora

This section describes the terrestrial flora within the proposed development footprint and vicinity, including the presence of conservation-significant species. A description of the fire history of the

area is provided. The location of Sites of Conservation Significance or Sites of Botanical Significance are also assessed in relation to the proposed development footprint.

Flora species

A total of 192 plant species (of which 185 were native and seven were introduced) from 37 families were recorded within the proposed development footprint and vicinity during the field surveys. The most diverse families recorded were Poaceae (34 native species including 2 introduced), Fabaceae (29 native species) and Chenopodiaceae (22 native species). A list of plant species recorded within the proposed development footprint and vicinity is provided in Appendix R. One conservation-significant species was recorded during the field surveys within the proposed development footprint and is discussed in further detail below.

Introduced species

A total of seven introduced species were recorded within the proposed development footprint and vicinity (refer to Table 7-3). With the exception of buffel grass, all weed species recorded occurred in very low densities. Of the seven species recorded, one species is listed as a weed of national significance by the Australian Weeds Strategy (2005). Three species are declared weeds under the *Weeds Management Act*.

Athel pine (*Tamarix aphylla*), the weed of national significance, was recorded in the Finke River during the surveys undertaken in November 2015.

Weeds within the proposed development footprint and vicinity would be managed in accordance with the mitigation measures listed in Section 7.9.

Table 7-3 Introduced flora species in the proposed development footprint and vicinity

Scientific Name	Common Name	Weed of National Significance	Declared weed in NT	Control requirements (*Weeds Management Act*)
Cenchrus ciliaris	Buffel grass	-	-	-
Citrullus coloynthis	Paddy melon	-	-	-
Cynodon dactylon	Couch grass	-	-	-
Datura leichhardtii	Native thorn apple	-	Class C under Datura spp.	Not to be introduced into the NT.
Solanum nigrum	Blackberry nightshade	-	-	-
Tamarix aphylla	Athel pine	×	Class B and Class C	Growth and spread to be controlled. Not to be introduced into the NT.
Tribulus terrestrus	Caltrop	-	Class B	Growth and spread to be controlled.

Vegetation communities

Field surveys confirmed the presence of six native plant community types within the proposed development footprint and vicinity, as mapped in the *Vegetation Survey of the Northern Territory*

(Wilson *et al*. 1990). The vegetation communities are described in Table 7-4 and their distribution is shown in Figure 7-3.

The proposed Chandler Facility is located on *Triodia* low hummock grassland and *Maireana* low open chenopod shrubland. The proposed Apirnta Facility is located on *Triodia* low hummock grassland. The proposed Chandler Haul Road and Henbury Access Road are located on predominantly *Triodia* low hummock grassland and *Maireana* low open chenopod shrubland with smaller areas of *Acacia* tall open shrubland and *Acacia* tall sparse shrubland.

Vegetation within the proposed development footprint and vicinity is generally in moderate to good condition. There is a high level of disturbance as a result of cattle (grazing, trampling and weed invasion) that is confined to watering points, ephemeral watercourses and tracks. Land has also been previously cleared for tracks and a small amount of land has been cleared previously for mining exploration by Central Petroleum.

Fire history

Mapping obtained from North Australia and Rangelands Information shows areas of fire scarring within the proposed development footprint and vicinity in 2011. The fire history of the proposed development footprint and vicinity is shown in Figure 7-4.

Table 7-4 Description of vegetation communities within the proposed development footprint and vicinity

Broad vegetation classification (vegetation community)	Structural formation	Fine vegetation classification	Description	Photographs
Hummock grassland (82)	*Triodia* low hummock grassland	*Acacia* tall sparse shrubland\ *Triodia* low hummock grassland	*Acacia aneura, Acacia kempeana, cassia,* over *Triodia pungens, Eragrostis eriopoda, Aristida holathera*, hummock grass, tussock grass	
Hummock grassland (83)	*Triodia* low hummock grassland	*Acacia* mid open mallee woodland\ *Acacia* mid sparse shrubland\ *Triodia* low hummock grassland	*Allolcasurina decasneana, Eucalyptus gamophylla, Acacia aneura, Acacia kempeana, Acacia ligulata, Senna artemisioides* subsp. *filifolia* over *Triodia basedowii, Triodia pungens, Eragrostis eriopoda* hummock grass tussock grass. Includes stands of *Allocasurina decasneana*	

Broad vegetation classification (vegetation community)	Structural formation	Fine vegetation classification	Description	Photographs
Open shrubland (66)	*Acacia* tall open shrubland	*Acacia* tall open shrubland\ *Eriachne* low sparse tussock grassland	*Acacia aneura, Acacia kempeana+/ Corymbia opaca* over *Enneapogon avenaceus,* tussock grass, forbs, fern	
Open shrubland (108)	*Maireana* low open chenopod shrubland	*Maireana* mid open chenopod shrubland\ *Sclerolaena* low forbland	*Maireana astrotricha, Atriplex vesicaria, Acacia* spp. over chenopod shrubs, *Sclerolaena cornishiana, Enneapogon cylindricus,* forb, tussock grass	

Broad vegetation classification (vegetation community)	Structural formation	Fine vegetation classification	Description	Photographs
Sparse shrubland (73)	*Acacia* sparse shrubland	*Acacia* mid sparse shrubland*Salsola* low forbland	*Acacia tetragonophylla, Acacia kempeana* +/- *Atalaya hemiglauca* over senna, tussock grass	
Sparse shrubland (110)	*Atriplex* low sparse chenopod shrubland	*Atriplex* mid sparse chenopod shrubland\ *Astrebla* mid open tussock grassland	*Saltbush* +/- *Acacia aneura* +/- *cassia*, chenopod shrubs over *sida, Portulaca oleracea*, forbs, tussock grass	

FINKE RIVER
CHANDLER RANGE
OLIFFE RANGE
MARYVALE ROAD
GUMTREE HILLS
HENBURY METEORITES CONSERVATION RESERVE
ERNEST GILES ROAD
CENTRAL AUSTRALIAN RAILWAY
HUGH RIVER
MARYVALE
TITJIKALA
CHAMBERS PILLAR ROAD
CHAMBERS PILLAR ROAD
Apirnta Facility
Henbury Access Road
Chandler Haul Road
Accomodation village
MARYVALE HILLS
CHARLOTTE RANGE
Chandler Facility
CHAMBER'S PILLAR HISTORICAL RESERVE
FINKE RIVER
FINKE RIVER
PALMER RI...

Vegetation communities

- *Acacia* mid open mallee woodland*Acacia* mid sparse shrubland\ *Triodia* low hummock grassland
- *Acacia* mid sparse shrubland*Salsola* low forbland
- *Acacia* tall open shrubland*Eragrostis* low tussock grassland
- *Acacia* tall open shrubland*Eriachne* low sparse tussock grassland
- *Acacia* tall sparse shrubland*Eriachne* low open tussock grassland
- *Acacia* tall sparse shrubland*Triodia* low hummock grassland
- *Allocasuarina* low open woodland*Acacia* mid sparse shrubland\ *Triodia* low hummock grassland
- *Atriplex* mid sparse chenopod shrubland*Astrebla* mid open tussock grassland
- *Eucalyptus* low open woodland*Acacia* mid open shrubland\ *Chrysopogon* low open tussock grassland
- *Maireana* mid open chenopod shrubland*Sclerolaena* low forbland
- *Melaleuca* low open woodland*Salsola* low open chenopod shrubland

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5 2.5 0 5 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

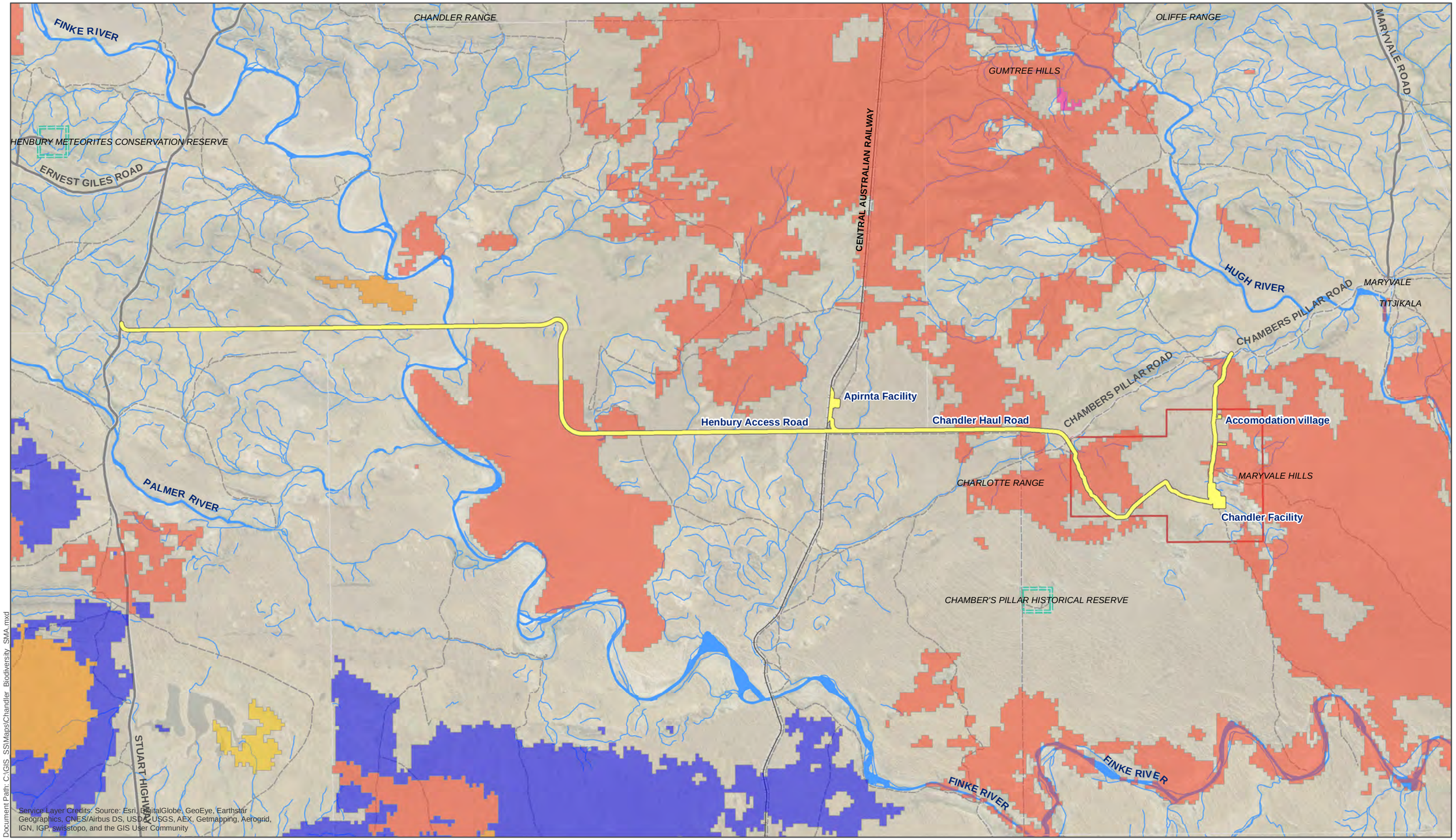
- Proposed development footprint
- Watercourse
- ML30612

Figure 7-3
Distribution of vegetation communities
within the proposed development footprint and vicinity

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N

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Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Watercourse
- ML30612

Years since last burnt

- 3
- 4
- 5
- 7
- 14

Figure 7-4
Fire history within the proposed development footprint and vicinity

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Conservation-significant flora species

Ten conservation-significant flora species listed under the TPWC Act and/or EPBC Act have been recorded or are predicted to occur within the proposed development footprint or within the locality. These species, along with their conservation status and likelihood of occurrence in the proposed development footprint or vicinity, are listed in Table 7-5No threatened flora species listed under the TPWC Act or EPBC Act have been recorded or are likely to occur within the proposed development footprint or vicinity.

Table 7-5. Of these, eight are considered to have a moderate to high likelihood of occurrence within the proposed development footprint or vicinity. The remaining species are considered to have a low likelihood of occurrence and are not considered further in this assessment.

Three conservation-significant flora species were recorded during the field surveys within the vicinity of the proposed development footprint. These included:

- Cottony bluebush (*Maireana carnosa*), listed as near threatened under the TPWC Act. This species was recorded on sandplains approximately 500 metres south of the proposed Apirnta Facility. It was also recorded in the vicinity of the proposed Henbury Access Road.
- *Crotalaria eremaea*, listed as data deficient under the TPWC Act. This species was recorded in sand dunes within the vicinity of the proposed development footprint, near the proposed Chandler Haul Road.
- *Calandrinia remota*, listed as data deficient under the TPWC Act. This species has not been previously recorded within the locality (that is, did not appear in any of the database searches – nether the NT DENR Flora Atlas or the DoEE Protected Matters Search Tool). This species was recorded approximately four kilometres north-east of the proposed Chandler Facility.

No threatened flora species listed under the TPWC Act or EPBC Act have been recorded or are likely to occur within the proposed development footprint or vicinity.

Table 7-5 Conservation-significant flora species either recorded or predicted to occur within the proposed development footprint or locality

Scientific name	Common name	Conservation status[1] TPWC Act	EPBC Act	Likelihood of occurrence
Acacia latzii	Latz's wattle	Vu	Vu	**Low**. Suitable habitat not present within the proposed development footprint or vicinity.
Acacia oswaldii	-	DD	-	**High**. Suitable habitat present within the proposed development footprint and vicinity.
Brachyscome ciliaris	Variable daisy	DD	-	**High**. Suitable habitat present within the proposed development footprint and vicinity. Numerous records of the species within the locality.
Calandrinia remota	-	DD	-	**High.** Species recorded within the proposed development footprint and vicinity during field surveys.
Crotalaria eremaea	Bluebush pea	DD	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Ixiochlamys nana	Small fuzzweed	DD	-	**Moderate.** Suitable habitat present within the proposed development footprint and vicinity.
Maireana carnosa	Cottony bluebush	Nt	-	**High**. Species recorded within the vicinity of the proposed development footprint during field surveys.
Potamogeton crispus	Curly pondweed	Nt	-	**Low**. Suitable habitat not present within the proposed development footprint or vicinity.
Sclerolaena longicuspis	-	Nt	-	**Moderate**. Suitable habitat present within the vicinity of the proposed development footprint.
Synapthantha tillaeacea	-	DD	-	**Moderate**. Suitable habitat present within the proposed development footprint and vicinity.

Notes: 1. Conservation status: Vu = Vulnerable, DD = Data deficient, Nt = Near threatened.

Conservation-significant flora populations and ecological communities

No threatened flora populations or endangered ecological communities listed under the TPWC Act and/or EPBC Act have been recorded or are predicted to occur within the proposed development footprint or within the locality.

Sites of conservation significance

There are no Sites of Conservation Significance or Sites of Botanical Significance as defined under the TPWC Act located within the proposed development footprint or vicinity. The nearest Sites of Conservation Significance are the:

- Greater MacDonnell Ranges, located approximately 30 kilometres to the north of the proposed Henbury Access Road.
- Rodinga Range and Adjacent Ranges, located approximately 35 kilometres to the east of the proposed Chandler Facility.
- Karinga Creek Palaeodrainage System, located approximately 39 kilometres to the south of the proposed Henbury Access Road.

The nearest Sites of Botanical Significance are the:

- Bacon Ranges, located approximately 15 kilometres from the western end of the proposed Henbury Access Road.
- Camel Creek, located approximately 24 kilometres north-north-east of the proposed Chandler Facility.
- Fox Salt Lakes, located approximately 25 kilometres south of the western end of the proposed Henbury Access Road.

7.3.3 Terrestrial fauna

This section describes the terrestrial fauna and fauna habitat within the proposed development footprint and vicinity, including the presence of conservation-significant species.

Fauna species

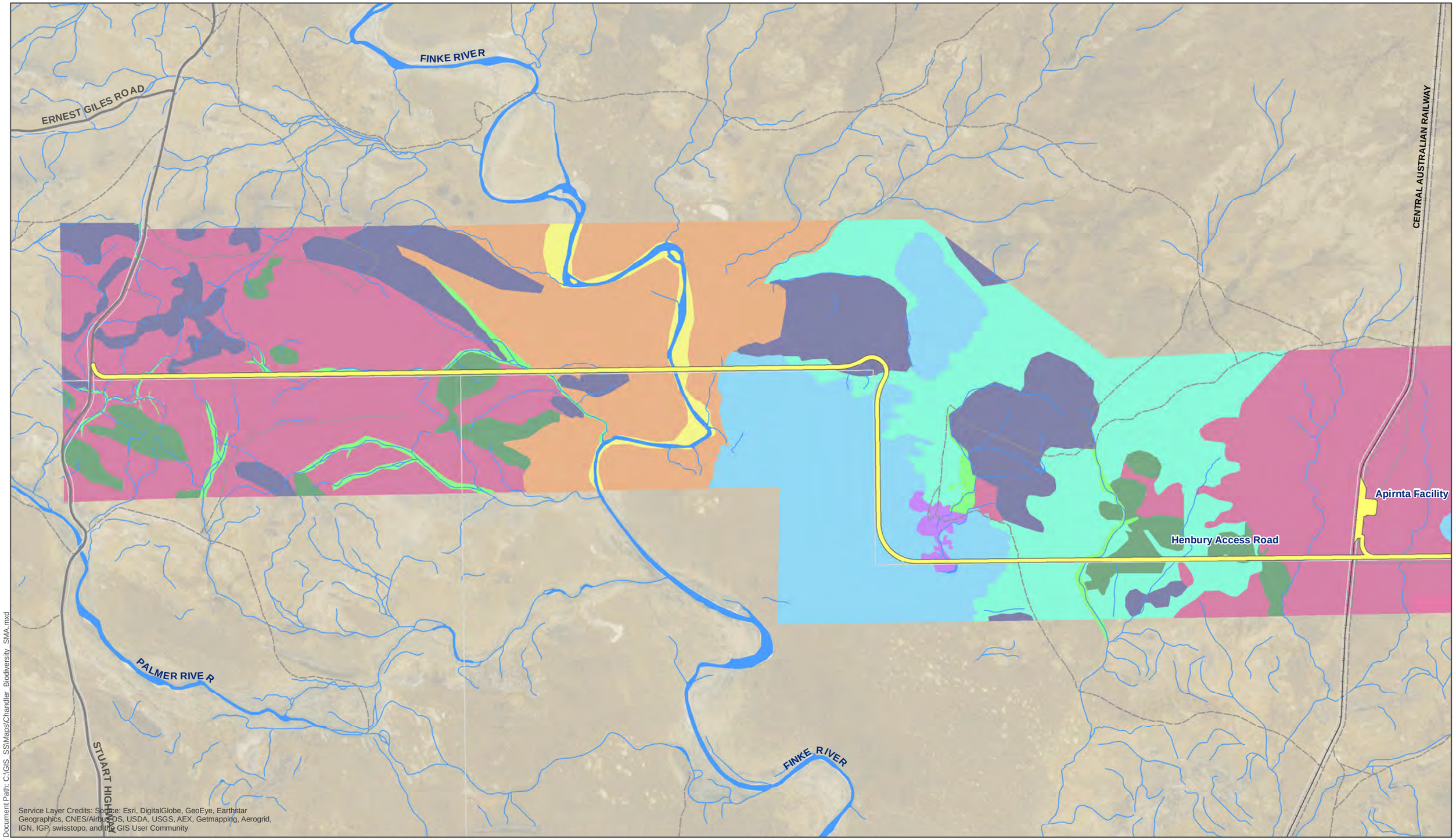
A total of 143 fauna species (25 native reptile species, 89 native bird species 19 mammal species [12 native and seven introduced] and 10 native bat species) were recorded within the proposed development footprint and vicinity during the field surveys. A list of animal species recorded within the proposed development footprint and vicinity is provided in Appendix R. Five conservation-significant species were recorded during the field surveys within the proposed development footprint and are discussed in further detail below.

Introduced species

Seven introduced fauna species were recorded within the proposed development footprint and vicinity during the field surveys. These included domestic cattle (*Bos taurus*), camel (*Camelus dromedaries*), donkey (*Equus asinus*), cat (*Felis catus*), house mouse (*Mus musculus*), rabbit (*Oryctolaugs cuniculus*) and red fox (*Vulpes vulpes*).

Fauna habitat

Eleven fauna habitat types were recorded within the proposed development footprint and vicinity. These habitats are described below and their distribution is shown in Figure 7-5.



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N

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Legend

- Proposed development footprint
- Watercourse
- ML30612

Habitat type

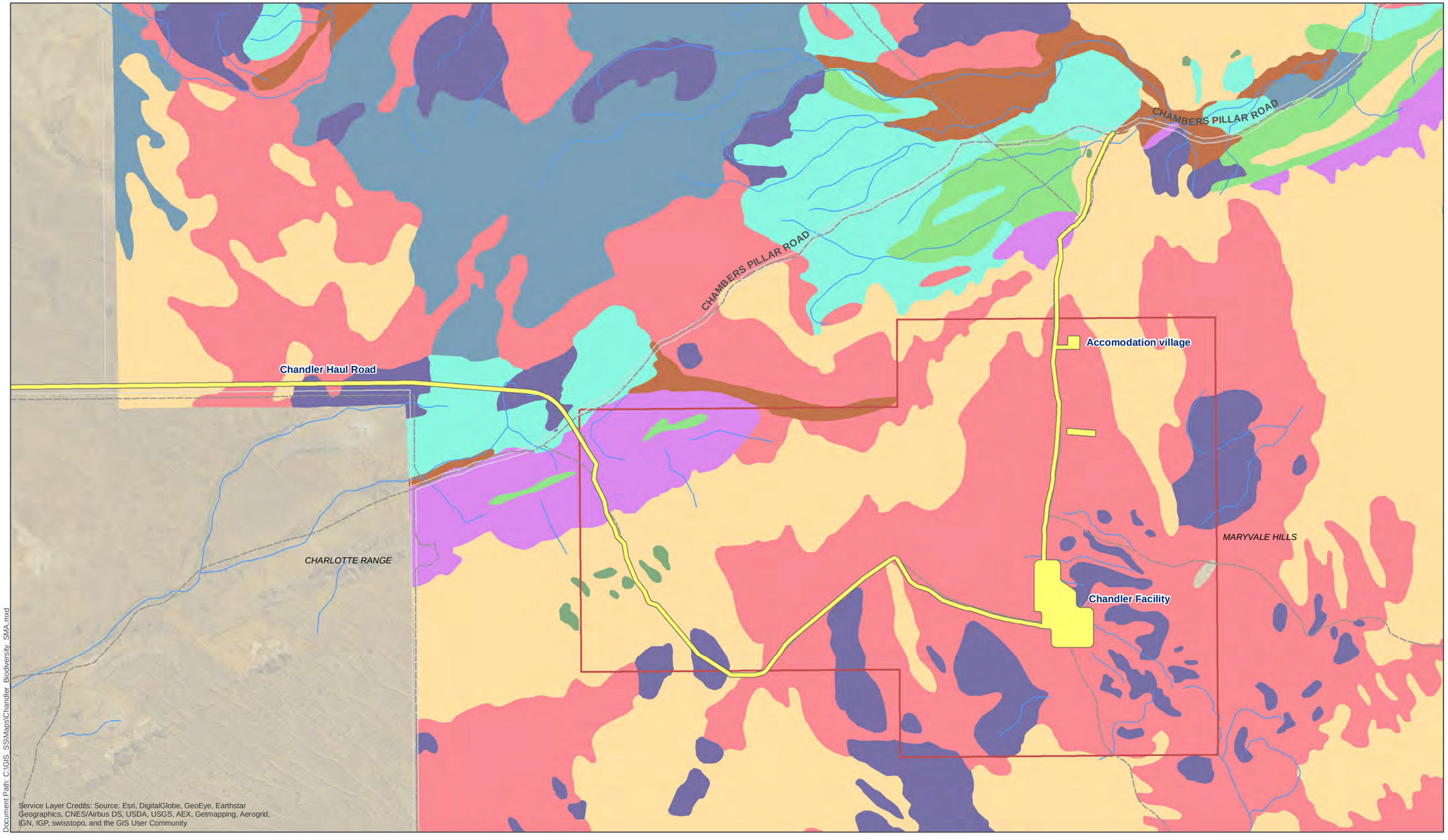
- Alluvial plain
- Coolabah/ lignum swamp
- Creekline/ drainage depression
- Dunefield
- Mesa terrain
- Plain
- Prominant hills and low ranges
- Riverine/ dunes
- Sandplain

Figure 7-5
Distribution of fauna habitat within the proposed development footprint and vicinity (Sheet 1)

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N

1 0.5 0 1 Kilometers

Coordinate System:
GDA 1994 MGA Zone 53

Legend

- Proposed development footprint
- Watercourse
- ML30612

Habitat type

- Tertiary conglomerate
- Prominant hills and low ranges
- Plains
- Sandplain
- Tall rocky outcrops and valleys
- Mesa terrain
- Limestone outcrops and plains
- Dune fields
- River
- amoeba
- Claypan
- sandy creek

Figure 7-5
Distribution of fauna habitat within the proposed development footprint and vicinity (Sheet 2)

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Dunefield



Plate 7-1 Dunefield habitat

Dunefields support mulga (*Acacia aneura*) open to low open-woodland with a mixed *Acacia* midstorey and a grassy understorey. The overstorey at some sites included desert oak (*Allocasuarina decaisneana*), ironwood (*Acacia estrophiolata*) and whitewood (*Atalaya hemiglauca*). The midstorey consisted of *Acacia* spp. and narrow-leaved hop bush (*Dodonea viscosa* subsp. *angustissima*). The grassy understorey included woollybutt grass (*Eragrostis eriopoda*), soft spinifex (*Trioda pungens*), sandhill canegrass (*Zygochloa paradoxa*) and erect kerosene grass (*Aristida holathera*). Termite mounds were not observed at survey sites, and there was little cover of fallen logs. An example of dunefield habitat is provided in Plate 7-1.

Allocasuarina decaisneana provides important habitat for birds, reptiles and bats. Sandy inland mouse (*Pseudomys hermannsburgensis*), central netted dragon (*Ctenophorus nuchalis*), canegrass dragon (*Diporiphora winneckei*), perentie (*Varanus giganteus)*, sand goanna (*Varanus gouldii*), and short-tailed pygmy monitor (*Varanus brevicauda*) were recorded in dunefield habitat during the field surveys. Bat species recorded in this habitat included Gould's wattled bat (*Chalinolobus gouldii*) and chocolate wattled bat (*Chalinolobus morio*), lesser long-eared bat (*Nyctophilus geoffroyi*) and western broad-nosed bat (*Scotorepens balstoni*). All bat species recorded are tree hollow dwelling. Roosting in this habitat is likely (Churchill 2008). Nineteen species of birds were recorded in this habitat type, including zebra finch (*Taeniopygia guttata*), Torresian crow *(Corvus orru*), black-faced woodswallow *(Artamus cinereus*) and crested pigeon (*Ocyphaps lophotes*).

Secondary signs of macropod, rodent, dasyurid, bird and reptile were common during all seasons in this habitat type. Secondary signs of introduced species was also commonly recorded and species identified were donkey, cattle, house mouse, camel and red fox.

Although not detected, the dunefield habitat has the potential to support threatened species including brush-tailed mulgara (*Dasycercus blythi*), crest-tailed mulgara *(Dasycercus cristicauda),* greater bilby *(Macrotis lagotis)* and southern marsupial mole (*Notoryctes typhlops).* Other non-threatened species potentially occurring within the dunefield habitat are spinifex hopping mouse (*Notomys alexis*), hairy-footed dunnart (*Sminthopsis hirtipes*), lesser hairy-footed dunnart (*Sminthopsis youngsoni*) and frog species such as *Neobatrachus* spp.

Sandplain

Sandplains support mulga (*Acacia aneura*) tall to tall-open shrubland or low open woodland with a midstorey of emu bush (*Eremophila* spp.) and cassia (*Senna aremisioides* subspp.) and a grassy

understorey. Witchetty bush (*Acacia kempeana*), desert bloodwood (*Corymbia terminalis*) and *Acacia decaisneana* were present at some but not all sandplain sites. Grasses in the understorey included woolybutt grass (*Eragrostis eriopoda*), soft spinifex (*Triodia pungens*), *Aristida* spp. and bandicoot grass (*Monachather paradoxus*). Flora species diversity was low on the sandplains relative to the dunefields. Vegetation cover was also relatively low (approximately 35%), with the remaining cover being mainly represented by bare ground. Introduced buffel grass (*Cenchrus ciliaris*) was common along the railway. An example of sandplain habitat is provided in Plate 7-2.

Mammals recorded in the sandplain habitat were sandy inland mouse (*Pseudomys hermannsburgensis*) and house mouse (*Mus musculus*). Reptiles were common during summer and included wedge-snouted ctenotus (*Ctenotus schomburgkii*), leopard ctenotus *(Ctenotus pantherinus*), common desert ctenotus (*Ctenotus leonardhii*), central military dragon (*Ctenophorus isolepis*), knob-tailed gecko (*Nephrurus levis*) and short-tailed pygmy monitor (*Varanus brevicauda*). Twenty species of bird were recorded in the sandplain habitat, with common species including zebra finch (*Taeniopygia guttata*), southern whiteface (*Aphelocephala leucopsis*), willie wagtail (*Rhipidura leucophrys*) and grey-crowned babbler (*Pomatostamus temporalis*).

There were no threatened species or secondary signs of threatened species recorded within the sandplain habitat. Despite this, sandplain habitat has the potential to support brush-tailed mulgara (*Dasycercus blythi*), crest-tailed mulgara (*Dasycercus cristicauda*) and southern marsupial mole (*Notoryctes typhlops).* Other non-threatened species potentially occurring within the sandplain habitat include desert mouse (*Pseudomys desertor*), sandplain gecko (*Lucasium stenodactylum*) and kultarr (*Antechinomys laniger*).



Plate 7-2 Sandplain habitat (left) and sandplain with watercourses (right)

Mesa terrain

Mesa terrain includes low mesa terrain and high mesa terrain. Vegetation in the low mesa terrain (the plains between mesas) consist of mixed *Acacia* tall open-shrubland with a mixed species shrubby midstorey and a grassy understorey. Overstorey species include mulga (*Acacia aneura)*, ironwood (*Acacia estrophiolata*) and dead finish (*Acacia tetragonophylla*). The midstorey contains *Senna artemisioides subsp. filifolia*, rock fuschia (*Eremophila freelingii*) and narrow-leaved hop bush

(*Dodonea viscosa* subsp. *angustissima*). Common fringe-rush (*Fimbristylis dichotomoa*) was the predominant understorey species. An example of low mesa terrain habitat is provided in **Plate 7-3**.

Vegetation on the high mesa terrain (the slope and top of the mesas) consisted of mulga (*Acacia aneura*) open-scrub over a rock fuschia (*Eremophila freelingii*) and dead finish (*Acacia tetragonophylla*) midstorey and a forb and low shrub understorey. Species in the understorey included wild tomato (*Solanum quadriloculatum*), golden bluebush (*Maireana georgeii*), goathead burr (*Sclerolaena bicornis*) and silver mulla mulla (*Ptilotus obovatus*). An example of high mesa terrain habitat is provided in Plate 7-3.

Four bird species were recorded in the mesa terrain habitat of which the chestnut-rumped thornbill (*Acanthiza uropygialis*) was the most common. Secondary signs of reptiles (dragons) and macropods were recorded in the low mesa terrain habitat.

Secondary signs of macropods and echidna (*Tachyglossus aculeatus*) were common in the high mesa terrain habitat. In addition, small caves (common in the high mesa terrain habitat) may provide shelter for a range of bird and mammal species, including bats. Fat-tailed false antechinus (*Pseudantechinus macdonnellensis*) and an unknown rodent were recorded within one of these caves during the field surveys (via motion sensing camera). The calls of Finlayson's cave bat (*Vespadelus finlaysoni*) were also recorded in the high mesa terrain habitat.

Secondary signs of introduced species were recorded in the low mesa terrain habitat and species identified were camels, donkeys and rabbits. Secondary signs of cattle and camel were recorded in the high mesa terrain habitat.




Plate 7-3 Low mesa terrain habitat (left) and high mesa terrain habitat (right)

Riverine dunes/river



Plate 7-4 Riverine dune/river habitat

Riverine dunes/river includes the river channel and banks associated with the Hugh River. The river channel consists of soft sand and is unvegetated. The river banks and dunes consists of deep yellow sands dominated by a river red gum (*Eucalyptus camaldulensis*) and desert honey myrtle (*Melaleuca glomerata*) open-woodland over a mixed *Acacia* midstorey and shrub and grass understorey. Midstorey species included prickly wattle (*Acacia victoriae*), umbrella wattle (*Acacia ligulata*), sandplain wattle (*Acacia murrayana*), narrow-leaved hop bush (*Dodonea viscosa* subsp. *angustissima*) and needle bush (*Vachellia farnesiana*). The understorey included *Euphorbia wheeleri*, *Euphorbia australis*, tall saltbush (*Rhagodia eremaea*) and currant bush (*Scaevola spinescens*). *Zygochloa paradoxa,* buffel grass *(Cenchrus ciliaris*) and *Cenchrus dactylon* were also common along the banks of the Hugh River. An example of riverine dunes/river habitat is provided in Plate 7-4.

Sandy inland mouse (*Pseudomys hermannsburgensis*) was the only mammal species recorded in this habitat. Secondary signs of echidna (*Tachyglossus aculeatus*) were recorded on the river bank. Reptiles recorded included two-toed lerista *(Lerista bipes*), yellow-face whip-snake (*Demansia psammophis*), tree dtella (*Gehyra ariegate*) and sand goanna (*Varanus gouldii*). Eight bird species were recorded in this habitat, including white-plumed honeyeater (*Lichenostomus penicillatus*) and zebra finch (*Taeniopygia guttata*). River channels are often used as flyways and foraging sites by bats and a number of species likely occur here. There were no records or secondary signs of threatened species in the riverine dune/river habitat.

Introduced species recorded in the riverine dune/river habitat were cat, red fox, cattle and donkey.

Prominent hills and low ranges



Plate 7-5 Prominent hill and low range habitat

Prominent hills and low ranges (with slopes between 5-8%) support desert bloodwood (*Corymbia terminalis*) and mulga (*Acacia aneura*) low open-woodland over a mixed species shrub midstorey and grass understorey. Dead finish (*Acacia tetragonophylla*) was present in the overstorey at some sites. Midstorey species included *Senna artemisioides* subsp*. filifolia*, *Eremophila* spp., *Ptilotus* spp. and saltbushes. Bunched kerosene grass (*Aristida contorta*), woolybutt grass (*Eragrostis eriopoda*) and *Enneapogon* spp. were common in the understorey. An example of prominent hills and low ranges habitat is provided in Plate 7-5.

Both direct observations and secondary signs of red kangaroo (*Macropus rufus*), *Varanus* sp., common wallaroo (*Macropus robustus*) and dingo (*Canis lupus dingo*) were recorded in this habitat. Introduced species recorded included donkey and cattle.

There were no threatened species recorded in the prominent hills and low ranges habitat and it was assessed as not being suitable for any of the threatened species identified in the desktop study.

Alluvial plains

Alluvial plains are located at the base of low mesas. Vegetation consists of *Atalaya hemiglauca* low open-woodlands over a mixed shrub midstorey and grass understorey. Midstorey species include narrow-leaved hop bush (*Dodonea viscosa* subsp. *angustissima*), sandplain wattle (*Acacia murrayana*) and mulga (*Acacia aneura*). Understorey species include soft spinifex (*Triodia pungens*), *Enneapogon avenaceus* and introduced buffel grass (*Cenchrus ciliaris*). An example of alluvial plains habitat is provided in Plate 7-6.

Secondary signs of red kangaroo (*Macropus rufus*), *Varanus* sp., perentie (*Varanus giganteus*) and skinks were common within the alluvial plains habitat. Nine species of bird, including brown falcon (*Falco berigora*), were recorded in this habitat. Introduced species recorded in the alluvial plains habitat were cattle, red fox, donkey and camel.



Plate 7-6 Alluvial plain habitat

The deep sands and hummock grasses associated with the alluvial plain habitat may provide suitable habitat for threatened fauna including great desert skink (*Liopholis kintorei*) and Slater's skink (*Liopholis slateri slateri*). These species were not recorded during the field surveys, however.

Claypans

Claypans are devoid of vegetation. Vegetation surrounding the claypans consist of mulga (*Acacia aneura*), witchetty bush (*Acacia kempeana*) and dead finish (*Acacia tetragonophylla*) tall open-shrubland over a mixed shrub midstorey and erect kerosene grass (*Aristida holathera*) understorey. Midstorey species include emu bush (*Eremophila duttoni*), *Sclerolaena* sp. And wild tomato (*Solanum quadriloculatum*). An example of claypan habitat is provided in Plate 7-7.

Claypans hold water after rain and are, therefore, an important habitat type for fauna. Secondary signs of red kangaroo (*Macropus rufus*), emu (*Dromaius novaehollandiae*), dingo (*Canis lupus dingo*) and *Varanus* sp. Were recorded in the claypan habitat. The emu is listed as near threatened under the TPWC Act. Three bird species were observed in the vegetation surrounding the claypan habitat – black-faced woodswallow (*Artamus cinereus*), singing honeyeater (*Lichenostomus virescens*) and zebra finch (*Taeniopygia guttata*). Introduced species recorded in this habitat include cattle, camels and donkeys.



Plate 7-7 Claypan habitat

Claypans may provide ephemeral habitat for migratory birds following rainfall and, as discussed above, provide water for a range of other species.

Plains

Plains support mulga (*Acacia aneura*) open to tall open-shrubland over a midstorey of dead finish (*Acacia tetragonophylla*) and witchetty bush (*Acacia kempeana*) and an understorey of shrubs, grasses and forbs. *Acacia decaisneana* and *Atalaya hemiglauca* are present in the overstorey in some areas. An overstorey is occasionally not present. Midstorey species may also include *Eremophila sturtii, Senna artemisioides subsp. filifolia,* spiney saltbush (*Rhagodia spinescens*) and lignum (*Muehlenbeckia cunninghammii*). Understorey species include wild tomato (*Solanum quadriloculatum*), *Sclerolaena* spp., *Ptilotus sessfolius,* buffel grass *(Cenchrus ciliaris*), *Enneapogon cylindricus, Eragrostis setifolia,* woolybutt grass (*Eragrostis eriopoda*) and *Aristida* spp. An example of plains habitat is provided in Plate 7-8.

Sandy inland mouse (*Pseudomys hermannsburgensis*), bearded dragon (*Pogona vitticeps*), and Leonard's ctenotus (*Ctenotus leonardii*) were trapped at survey sites within the plains habitat. Recent mulgara (*Dasycercus* sp.) tracks were also recorded within this habitat approximately 0.5 kilometres north of the proposed Chandler Haul Road (about midway along the proposed route). It is likely that the tracks were from brush-tailed mulgara (*Dasycercus blythi*). Sand goanna (*Varanus gouldii*) was observed in this habitat. Secondary signs of reptiles (dragons), rodents, red kangaroo (*Macropus rufus),* common wallaroo (*Macropus robustus*) and dingo (*Canis lupus dingo*) were also recorded in the plains habitat. Eleven species of bird, including emu (*Dromaius novaehollandiae*), crested bellbird (*Oreioca guttarlis*), willie wagtail (*Rhipidura leucophrys*), zebra finch (*Taeniopygia guttata*), mulga parrot (*Psephotus varius*) and black-faced woodswallow (*Artamus cinereus*), were recorded in the plains habitat. Introduced species recorded in the plains habitat were house mouse, rabbit, cat, cattle and camel.



Plate 7-8 Plains habitat

Tall rocky outcrops and valleys

This habitat consisted of two distinct habitats; tall rocky outcrops and valleys. Vegetation consists of coolibah (*Eucalyptus intertexta*) low open-woodland over a mixed shrub midstorey and an understorey dominated by *Tecticornia* spp. Midstorey species include desert cassia (*Senna artemisioides. filifolia*), *Acacia tetragonophylla,* needlewood (*Hakea leucoptera*) and hareliquin fuchsia (*Eremophila duttonii*). Additional understorey species include bottlewashers (*Enneapogon avenaceus*), fairy grass (*Sporobolus actinocladus*) and introduced buffel grass (*Cenchrus ciliaris*).

Five bird species, including zebra finch (*Taeniopygia guttata*) and weebill (*Smicrornis brevirostris*), were recorded.

Creekline/drainage depression



Plate 7-9 Creekline/drainage depression habitat dominated by mulga (*Acacia aneura)*

Creekline/drainage depressions support woodland to open-woodland over a mixed species shrub midstorey and a grass/forb understorey. The overstorey is dominated by mulga (*Acacia aneura*), coolabah (*Eucalyptus intertexta*) or *Eucalyptus camaldulensis* with *Acacia hemiglauca* also present. Midstorey species include witchetty bush (*Acacia kempeana*), dead finish (*Acacia tetragonophylla*), *Senna artfilifolia,* crimson turkey bush (*Eremophila latrobei*), emu bush (*Eremophila duttoni*) and *Eremophila sturtii*. Understorey species include *Acacia holathera,* desert Chinese lantern (*Abutilon otocarpum*), buffel grass (*Cenchrus ciliaris*), *Fimbristylis dichotoma,* woolybutt grass (*Eragrostis eriopoda*), *Maireana astrotricha* and *Solanum quadriloculatum.* An example of creekline/drainage depression habitat is provided in Plate 7-9.

Reptiles were the dominant group recorded within the creekline/drainage depression habitat, with species including central netted dragon (*Ctenophorus nuchalis*), lined firetail skink (*Morethia ruficauda*) and tree dtella (*Gehyra variegata*). House mouse (*Mus musculus*) was also trapped in this habitat. Secondary signs of reptiles (dragons) and skinks was abundant. Sixteen bird species, including white-browed babbler (*Pomatostomus superciliosus*) and mulga parrot (*Psephotus varius*), were recorded in the creekline/drainage depression habitat.

Coolabah and lignum swamp

Coolabah and lignum swamp habitat is found in Duck Swamp (and associated claypans). This habitat incorporates an area of approximately 50 hectares and experiences irregular ephemeral inundation. The vegetation community is a low-open woodland of coolabah (*Eucalyptus coolabah arida*) over a midstory of mixed species including lignum (*Muehlenbeckia cunninghamii*), *Euphorbia biconvexa* and spiney saltbush (*Rhagodia spinescens*). Understory species include short grasses and forbs including salty heath (*Frankenia cordata*), spear-fruit copper burr (*Scleroleana patenticuspis*), tall copper burr *(Scleroleana convexula*), lifesaver burr (*Sida platycalyx*), bindieye (*Tribulus eichlerianus*), narrow-leaf neverfail (*Eregrostis setifolia*) *and* woolybutt grass (*Eragrostis eriopoda*). Buffel grass (C*enchrus ciliaris*) was recorded around the fringes of the swamp above the flood line. Vegetation within this habitat type is dependent on ephemeral and infrequent inundation. An example of coolabah and lignum swamp habitat is provided in Plate 7-10.

Four bird species were recorded in this habitat including mulga parrot (*Psephotus varius*), white-plumed honeyeater (*Lichenostomus penicillatus*), crested bellbird (*Oreoica gutturalis*) and willie wagtail (*Rhipidura leucophrys*). Reptile species recorded included central netted dragon (*Ctenophorus nuchalis*), fat-tailed gecko (*Diplodactylus conspicillatus*) and tree dtella (*Gehyra variegata)*. Mammal species recorded included red kangaroo (*Macropus rufus*) and dingo (*Canis lupus dingo*). Bat species recorded are tree hollow dwelling and roosting in this habitat is likely.

While there were no threatened species recorded in this habitat, coolabah and lignum swamps are potentially suitable habitat for conservation-significant species including the red-tailed cockatoo (*Calyptorhynchus samueli*), scarlett chested parrot (*Neophema splendida*) and princess parrot (*Polytelis alexandrae*).

Secondary signs of introduced species including donkey and cattle were recorded in this habitat.



Plate 7-10 Coolabah lignum swamp habitat

Conservation-significant species

Thirty-two conservation-significant fauna species listed under the TPWC Act and/or EPBC Act have been recorded or are predicted to occur within the proposed development footprint or within the locality. This includes one invertebrate, four reptiles, 17 birds and 10 mammals. These species, along with their conservation status and likelihood of occurrence in the proposed development footprint or vicinity, are listed in Table 7-6. Of these, 22 are considered to have a low to moderate, moderate, or high likelihood of occurrence within the proposed development footprint or vicinity. The remaining species are considered to have a low likelihood of occurrence and are not considered further in this assessment.

Six conservation-significant fauna species were recorded during the field surveys within the proposed development footprint or vicinity. These included:

- Australian bustard (*Ardeotis australis*), listed as near threatened under the TPWC Act. This species was recorded in spinifex hummock grassland in the vicinity of the proposed Chandler Facility.

- Bush-stone curlew (*Burhinus grallarius*) listed as near threatened under the TPWC Act. This species was recorded in spinifex hummock grassland and low sparse shrubland in the vicinity of the proposed Chandler Facility.
- Red-tailed cockatoo (*Calyptorhynchus samueli*) listed as near threatened under the TPWC Act. This species was recorded on the proposed Henbury Access Road.
- Emu (*Dromaius novaehollandiae*), listed as near threatened under the TPWC Act. This species was recorded in spinifex hummock grassland in the vicinity of the proposed Henbury Access Road and Apirnta Facility.
- Scarlett chested parrot (*Neophema splendida*) listed as near threatened under the TPWC Act. This species was recorded in spinifex hummock grassland in the vicinity of the proposed Chandler Facility.
- Redthroat (*Pyrrholaemus brunneus*), listed as near threatened under the TPWC Act. This species was recorded in low sparse-shrubland in the vicinity of the proposed Chandler Facility.

In addition, secondary signs of three conservation-significant species were also recorded within the vicinity of the proposed development footprint. These included:

- Brush-tailed mulgara (*Dasycercus blythi*) listed as vulnerable under the TPWC Act. This species has not been previously recorded within the locality (that is, did not appear in any of the database searches – neither the NT DENR Fauna Atlas nor the DoEE Protected Matters Search Tool). Mulgara (*Dasycercus* sp.) tracks were observed approximately 0.5 kilometres north of the proposed Chandler Haul Road (about midway along the proposeed route) during the field surveys. The tracks may belong to either this species, or the crest-tailed mulgara (*Dasycercus cristicauda*).
- Crest-tailed mulgara (*Dasycercus cristicauda*) listed as vulnerable under the TPWC Act and the EPBC Act. As stated above, *Dasycercus* sp. tracks were observed approximately 0.5 kilometres north of the proposed Chandler Haul Road during the field surveys. The tracks may belong to either this species or the brush-tailed mulgara (*Dasycercus blythi*).
- Southern marsupial mole (*Notoryctes typhlops*) listed as vulnerable under the TPWC Act. Secondary signs of this species were recorded on the banks of the Finke River (approximately 850 metres north of the proposed Henbury Access Road) (refer to Plate 7- 11Plate 7-11).

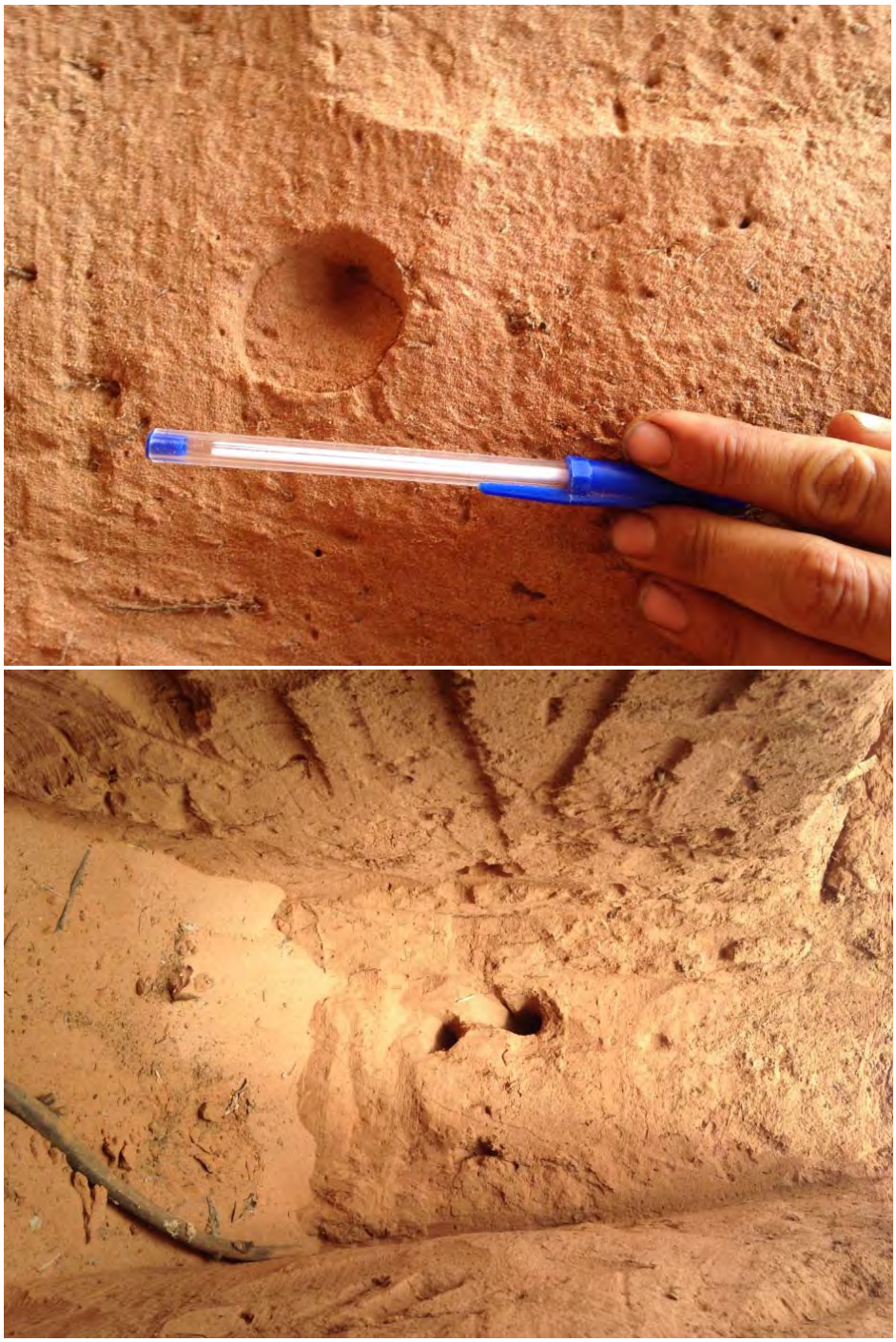


Plate 7-11 Southern marsupial mole backfilled tunnels in a mole trench on the bank of the Finke River

Table 7-6 Conservation-significant fauna species either recorded or predicted to occur within the proposed development footprint or locality

Scientific name	Common name	Conservation status[1]		Likelihood of occurrence
		TPWC Act	EPBC Act	
Invertebrates				
Croitana aestiva	Desert sand-skipper	En	En	**Low**. Suitable habitat not present within the proposed development footprint or vicinity.
Reptiles				
Delma demosa	Desert delma	DD	-	**High.** Suitable habitat present within the proposed development footprint and vicinity.
Liopholis kintorei	Great desert skink	Vu	Vu	**Low to moderate**. Suitable habitat present within the proposed development footprint and vicinity.
Liopholis slateri	Slater's skink	Vu	En	**Low to moderate.** Suitable habitat present within the proposed development footprint and vicinity.
Pseudechis australis	King brown snake	Nt	-	**High.** Suitable habitat present within the proposed development footprint and vicinity.
Birds				
Acanthiza iredalei	Slender thornbill	ER	Vu	**Low**. Considered regionally extinct.
Amytornis modestus indulkana	Thick-billed grasswren	Cr	Vu	**Low to moderate**. Suitable habitat present within the proposed development footprint and vicinity.
Amytornis striatus	Striated grasswren	Nt	-	**Moderate.** Suitable habitat present within the proposed development footprint and vicinity.
Ardeotis australis	Australian bustard	Nt	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Burhinus grallarius	Bush stone-curlew	Nt	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Calyptorhynchus samueli	Red-tailed black cockatoo	Nt	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Canopophila whitei	Grey honeyeater	DD	-	**High**. Suitable habitat present within the proposed development footprint and vicinity.
Cinclosoma castanotum	Chestnut quail-thrush	Nt	-	**High**. Suitable habitat present within the proposed development footprint and vicinity.
Dromaius novaehollandiae	Emu	Nt	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Elanus scriptus	Letter-winged kite	Nt	-	**High**. Suitable habitat present within the proposed development footprint and vicinity after heavy rainfall.

Scientific name	Common name	Conservation status[1]		Likelihood of occurrence
		TPWC Act	EPBC Act	
Leipoa ocellata	Malleefowl	Cr	Vu	**Low**. Considered regionally extinct.
Lophoictinia isura	Square-tailed kite	Nt	-	**High**. Suitable habitat present within the proposed development footprint and vicinity.
Neophema splendida	Scarlet-chested parrot	Nt	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys. Suitable habitat present within the proposed development footprint and vicinity after heavy rainfall.
Pezoporus occidentalis	Night parrot	Cr	En	**Low**. Considered regionally extinct.
Polytelis alexandrae	Princess parrot	Vu	Vu	**Moderate.** Suitable habitat is present in the proposed development footprint and vicinity after heavy rainfall (particularly around the Finke River).
Pyrrholaemus brunneus	Redthroat	Nt	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Rostratula australis	Australian painted snipe	Vu	En	**Moderate**. Suitable habitat is present in the proposed development footprint and vicinity after heavy rainfall.
Mammals				
Antechinomys laniger	Kultarr	Nt	-	**High**. Suitable habitat present within the proposed development footprint and vicinity.
Dasycercus cristicauda	Crest-tailed mulgara	Vu	Vu	**High**. Suitable habitat present within the proposed development footprint and vicinity. Tracks of *Dasycerus* spp. recorded during field surveys.
Dasycercus blythi	Brush-tailed mulgara	Vu	-	**High**. Suitable habitat present within the proposed development footprint and vicinity. Tracks of *Dasycerus* spp. recorded during field surveys.
Isoodon auratus	Golden bandicoot	Vu	En	**Low**. Suitable habitat not present within the proposed development footprint or vicinity. Has not been recorded in central Australia since 1952.
Macrotis lagotis	Greater bilby	Vu	Vu	**Low**. Suitable habitat is present within the proposed development footprint and vicinity, but species not been recorded in central Australia since 1969.
Notomys cervinus	Fawn hopping-mouse	ER	-	**Low**. Suitable habitat not present within the proposed development footprint or vicinity. Species considered extinct in the NT.
Notoryctes typhlops	Southern marsupial mole	Vu	-	**High.** Secondary signs of the species were recorded at two sites on the Finke River during the field surveys.

Scientific name	Common name	Conservation status[1]		Likelihood of occurrence
		TPWC Act	EPBC Act	
***Petrogale lateralis,* MacDonnell Ranges race**	Black-footed rock-wallaby	Nt	Vu	**Low**. Suitable habitat not present within the proposed development footprint or vicinity. No historical records of the species in the locality.
Rattus tunneyi	Pale field-rat	Vu	-	**Low**. Species has not been recorded in central Australia since 1975. Not thought to currently persist in central Australia.
Zyzomys pedunculatus	Central rock-rat	En	En	**Low**. Suitable habitat not present within the proposed development footprint or vicinity. Has not been recorded in central Australia since before 1971.

Notes: 1. Conservation status: En = Endangered, Vu = Vulnerable, ER = Extinct regionally, Cr = Critically Endangered DD = Data deficient, Nt = Near threatened.

Migratory species

Eleven migratory species listed under the EPBC Act have been recorded or are predicted to occur within the proposed development footprint or within the locality. These species, along with their conservation status and likelihood of occurrence in the proposed development footprint or vicinity, are listed in Table 7-7. Of these, eight are considered to have a moderate to high likelihood of occurrence within the proposed development footprint or vicinity. The remaining species are considered to have a low likelihood of occurrence and are not considered further in this assessment.

Three migratory species were recorded during the field surveys within the proposed development footprint or vicinity. These were:

- Sharp-tailed sandpiper (*Calidris acuminata*). This species was recorded in the vicinity of the proposed Chandler Facility.
- Rainbow bee-eater (*Merops ornatus*). This species was recorded in a range of habitats within the proposed development footprint and vicinity.
- Marsh sandpiper (*Tringa stagnatilis*). This species has not been previously recorded within the proposed development footprint or vicinity (that is, did not appear in any of the database searches – nether the NT DENR Fauna Atlas or the DoEE Protected Matters Search Tool). This species was recorded incidentally in a small ephemeral waterhole in the Finke River.

Table 7-7 Migratory species either recorded or predicted to occur within the proposed development footprint or locality

Scientific name	Common name	Conservation Status		International agreements	Likelihood of occurrence
		TPWC Act	EPBC Act		
Apus pacificus	Fork-tailed swift	-	Mi, Ma	J, C, R	**Moderate**. Suitable habitat is present in the proposed development footprint and vicinity after heavy rainfall.
Ardea alba	Great egret	-	Mi, Ma	-	**Moderate**. Suitable habitat is present in the proposed development footprint and vicinity after heavy rainfall.
Calidris acuminata	Sharp-tailed sandpiper	-	Mi, Ma	B, J, C, R	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Charadrius veredus	Oriental plover	-	Mi, Ma	B, J, C, R	**Moderate**. Suitable habitat is present in the proposed development footprint and vicinity after heavy rainfall.
Glareola maldivarum	Oriental pratincole	-	Mi, Ma	J, C, R	**Moderate**. Suitable habitat is present in the proposed development footprint and vicinity after heavy rainfall.
Merops ornatus	Rainbow bee-eater	-	Mi, Ma	-	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.
Motacilla cinerea	Grey wagtail	-	Mi, Ma	J, C, R	**Low**. Suitable habitat not present within the proposed development footprint or vicinity.
Motacilla flava	Yellow wagtail	-	Mi, Ma	J, C, R	**Low**. Suitable habitat not present within the proposed development footprint or vicinity.
Pandion haliaetus	Osprey	-	Mi, Ma	B	**Low.** Suitable habitat not present in the proposed development footprint or vicinity.
Tringa nebularia	Common greenshank	-	Mi, Ma	B, J, C, R	**High.** Suitable habitat is present in the proposed development footprint and vicinity. Likely to occur particularly during the non-breeding season.
Tringa stagnatilis	Marsh sandpiper	-	Mi, Ma	B, J, C, R	**High**. Species recorded within the proposed development footprint and vicinity during field surveys.

Notes: 1. Conservation status: Mi = Migratory, Ma = Marine. International agreements: J = Japan-Australia Migratory Bird Agreement (JAMBA), C = China-Australia Migratory Bird Agreement (CAMBA), R = Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), B = Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

7.3.4 Other matters of national environmental significance

There are no other matters of national environmental significance within the proposed development footprint or vicinity. The closest matter of national environmental significance is Witjira-Dalhousie Springs National Heritage Place, located approximately 230 kilometres south-east of the proposed Chandler Facility.

7.3.5 NT Reserves

Chambers Pillar Historical Reserve is located approximately 6.8 kilometres from the proposed Chandler Facility. It is not a matter of national environmental significance.

7.4 Assessment of risk during construction

This section presents the potential impacts (both direct and indirect) on terrestrial flora and fauna during construction of the Proposal. Mitigation measures to avoid or reduce these impacts are discussed in Section 7.9.

7.4.1 Direct impacts

Direct impacts on flora and fauna during construction include the removal of vegetation and the loss of fauna habitat. These impacts are discussed below.

Removal of vegetation

Approximately 397.5 hectares of vegetation would be removed during construction of the Proposal. This would include approximately 85.5 hectares for the proposed Chandler Facility, 39 hectares for the Apirnta Facility, 180 hectares for the Henbury Access Road and 93 hectares for the Chandler Haul Road. The estimated amount of land system that would be cleared for construction is presented in **Table 7-8**. The estimated amount of vegetation removed by vegetation type is presented in Table 7- 9.

Both the land systems and vegetation types that would be impacted by vegetation removal during construction are well represented in the surrounding undeveloped land in the Finke Bioregion and/or in the neighbouring MacDonnell Ranges Bioregion, as shown graphically in Figure 7-2 and Figure 7-3.

The removal of native vegetation is highly unlikely to threaten the persistence of any populations of native plants or vegetation communities, including those conservation-significant flora species recorded or considered likely to occur within the proposed development footprint or vicinity (refer to Section 7.3.2). As discussed in Section 7.3.2, no threatened flora species listed under the TPWC Act and/or EPBC Act were recorded or are predicted to occur within the proposed development footprint or vicinity. Therefore, no threatened flora species would be impacted during vegetation removal for the construction of the Proposal.

One flora species listed as near threatened and two listed as data deficient under the TPWC Act were recorded within the vicinity of the proposed development footprint during the field surveys. An additional five near threatened or data deficient species listed under the TPWC Act have a moderate

to high likelihood of occurrence within the proposed development footprint or vicinity (refer to Section 7.3.2). Some of these species may be impacted during construction of the Proposal. However, none of these species are considered to have conservation significance within the proposed development footprint or vicinity, or within the wider locality. All species are locally common with a widespread distribution and there is no critical habitat for any of these species within the proposed development footprint or vicinity.

Table 7-8 Estimated amount of land system cleared for construction of the Proposal.

Land systems	Chandler Facility (ha)	Apirnta Facility (ha)	Henbury Access Road (ha)	Chandler Haul Road (ha)	Total (ha)
Angas	0	39	22.5	2.28	**63.78**
Amulda	0	0	0	0	**0**
Chandler	0	0	63.9	19.94	**83.84**
Finke	0	0	7.92	0	**7.92**
Gillen (1)	0	0	6.3	1.88	**8.18**
Gillen (2)	0	0	0	2.90	**2.90**
Renners	0	0	15.61	1.61	**17.22**
Rumbulara	34.2	0	0	1.71	**35.91**
Simpson	0	0	47.34	33.86	**81.2**
Singleton	51.3	0	14.84	30.41	**96.55**
Total	**85.5**	**39.0**	**180.0**	**93**	**397.5**

Table 7-9 Estimated vegetation removal by vegetation type for construction of the Proposal

Vegetation type	Chandler Facility (ha)	Apirnta Facility (ha)	Henbury Access Road (ha)	Chandler Haul Road (ha)	Total (ha)
***Maireana* low open chenopod Shrubland (type 110)**	43.5	39	0	3.42	**85.92**
***Triodia* low hummock grassland (type 83)**	42	0	95.68	69.10	**206.78**
***Triodia* low hummock grassland (type 82)**	0	0	32.06	3.08	**35.14**
***Maireana* low open chenopod shrubland (type 108)**	0	0	47.72	0	**47.72**
Mulga tall sparse shrubland with low sparse shrubland understorey (Type 70)	0	0	0	17.40	**17.40**
***Acacia* tall open shrubland (type 66)**	0	0	4.54	0	**4.54**
Total	**85.5**	**39.0**	**180.0**	**93**	**397.5**

Loss of fauna habitat

The proposed development footprint and vicinity provides habitat for a range of fauna including reptiles, birds and mammals (refer to Section 7.3.3). The removal of vegetation within the proposed

development footprint would result in a loss of fauna foraging, breeding, roosting, sheltering and/or dispersal habitat. The loss of fauna habitat (and the potential conservation-significant fauna species that rely on that habitat) is summarised in **Table 7-10**. Habitat loss would be minimal when compared to the amount of available, undisturbed habitat in the vicinity of the proposed development footprint, and in the locality.

As discussed in Section 7.3.3, eight threatened fauna species listed under the TPWC Act and/or EPBC Act and eight migratory species listed under the EPBC Act were recorded or are predicted to occur within the proposed development footprint or vicinity. Potential impacts on these species are discussed in Section 7.7.1 and 7.7.2.

An additional 14 species listed as near threatened or data deficient under the TPWC Act were recorded or are predicted to occur with the proposed development footprint or vicinity (refer to Section 7.3.3). None of these species are considered to have conservation significance within the proposed development footprint or vicinity, or within the wider locality. All species are locally common with a widespread distribution and there is no critical habitat for any of these species within the proposed development footprint or vicinity.

Table 7-10 Estimated loss of habitat from construction of the Proposal

Habitat type	Dependant on groundwater	Dependant on surface water	Potentially supports threatened or migratory species	Chandler Facility (ha)	Apirnta Facility (ha)	Chandler Haul Road (ha)	Henbury Access Road (ha)	Total (ha)
Dune fields	No	No	*Dasycercus blythi, D. cristicauda, N. typhlops, Polytelis alexandrae* and *Merops ornatus*	0.36	0	27.98	39.78	**68.12**
Sand plains	No	No	*Dasycercus blythi, D. cristicauda (D. cristicauda is predominantly found on sand dunes),* and *Notoryctes typhlops, polytelis alexandrae* and *Merops ornatus*	59.74	0	23.25	8.32	**91.31**
Mesa terrain	No	No	*Amytonris modestys indulkana* and *Merops ornatus*	0.76	0	15.06	15.81	**31.63**
Riverina dunes/river	No	Yes – ephemeral river flows	*Notoryctes typhlops, Polytelis alexandrae* and *Merops ornatus*	0	0	0	2.09	**2.09**
Prominent hills and low ranges	No	No	*Polytelis alexandrae* and *Merops ornatus*	24.64	0	6.4	14.77	**45.81**
Alluvial plains	No	No	*Liopholis kintorei, Liopholis slaeri slateri, Polytelis alexandrae* and *Merops ornatus*	0	0	0	75.11	**75.11**
Clay plans	No	Yes	*Merops ornatus* and may support migratory birds after high rainfall - *Rostularia australis, Apus pacificus, Ardea modesta, Caladris acuminata, Charadrius veredus, Glareola maldivarum, Tringa nebularia* and *Tringa stagnatilis*	0	0	0	0	**0**
Plains	No	No	*D. blythi* and *Merops ornatus*	0	39	10.71	20.30	**70.01**
Tall rocky out crops and valleys	No	No	*Merops ornatus*	0	0	9.6	0	**9.6**
Creek lines and drainage depressions	No	Yes - ephemeral	*P. alexandrae* and *Merops ornatus*	0	0	0	0	**0**
Coolabah and lignum swamps	No	Yes – infrequent flooding	*P. alexandrae* and *Merops ornatus*	0	0	0	3.82	**3.82**
Total				**85.5**	**39**	**93**	**180**	**397.5**

7.4.2 Indirect impacts

Potential indirect impacts on flora and fauna during construction may include: habitat fragmentation; fauna displacement, injury or mortality; fauna strike; edge effects; altered hydrology; groundwater abstraction; contamination; erosion and sedimentation; dust; increased light, noise and vibration; the introduction and spread of weeds and invasive species; increased predator species; increased introduced fauna use; and an increased incidence of bushfire. These impacts are discussed below.

Habitat fragmentation

Habitat fragmentation is the process of habitat loss whereby large continuous habitat is broken down into smaller, more isolated sections (Fahrig 2003). There may be some small-scale, localised fragmentation of habitat created during construction of the Proposal. However, most habitat types that would be directly impacted during construction are well represented and interconnected in the vicinity of the proposed development footprint and all are well represented the wider locality (within the Finke Bioregion and/or in the neighbouring MacDonnell Ranges Bioregion).

Fauna displacement, injury or mortality

The removal of vegetation has the potential to result in fauna displacement, injury or mortality. This would be particularly the case for less mobile species such as invertebrates and small reptiles and mammals. More mobile species such as birds and larger mammals would be able to avoid vegetation removal and other construction activities, seeking refuge in nearby alternative habitat outside of the proposed development footprint.

Fauna strike

Increased vehicle movements within the proposed development footprint and vicinity during construction may result in an increased incidence of fauna strike (resulting in injury or mortality). Initially, access to the site would be via the Stuart Highway and Maryvale Road. Both of these roads are already heavily trafficked and well established, hence the increased risk of fauna strike along these roads would be minimal.

Construction of the proposed Henbury Access Road and Chandler Haul Road would be undertaken early in the construction phase to improve site access. Construction of these new roads may result in an increased incidence of fauna strike, particularly during the hours of dusk and dawn, which coincides with high activity for crepuscular species (those species active primarily during twilight hours) accompanied with low visibility (Rowden *et al*. 2008). Vehicle movements would be restricted during these times, as far as practicable.

Edge effects

'Edge effects' are the result of a disturbance or development that results in two contrasting habitats to meet without any gradient or gradual change between. Edge effects can occur due to clearing,



decreasing ecosystems resilience to external pressures such as weeds, erosion, and invasive pests, reducing the ability of the remnant vegetation to buffer against these factors (May and Norton 1996). Generally, it is more prevalent where the remnant vegetation has a larger perimeter to area ratio, (for example, a long narrow rectangular block). The level of risk is dependent on clearing type (bare soil or top vegetation only), location and cumulative impacts from surrounding developments.

The biggest risk to biodiversity due to edge effects is the establishment of weed species and the increased ease of access for introduced fauna (May and Norton 1996, Parendes and Jones 2000).

Due to the remote location, lack of developments in the surrounding area and the majority of land systems and vegetation types being well represented locally, there is unlikely to be a long term impact on biodiversity in the vicinity of the proposed development footprint as a result of edge effects.

Altered hydrology

The existing landform and hydrology within the proposed development footprint and vicinity would be altered during construction of the Proposal. These alterations have the potential to adversely affect the hydrological regime downstream, including associated aquatic and riparian communities. These impacts would, however, be localised and short term. As the surface hydrology is ephemeral and because important wetlands or dry season water refuges would not be impacted during construction, the changes and modifications impacting downstream flora and fauna would be low. A water management plan has been developed, which outlines provisions for establishing surface water detention basins located on the perimeter of hardstand areas to (a) retain surface water runoff and (b) separate dirty water from clean water. This would be done to minimise impacts on downstream water quality (refer to Chapter 9).

Groundwater abstraction

There would be no drawdown impacts on vegetation as the target horizon for water supply is between 140 metres below ground level and 170 metres below ground level.

Contamination

Potential contamination may occur from the accidental release of fuel, oil or other hazardous materials during the handling, use and storage of such materials within the proposed development footprint and vicinity during construction of the Proposal.

Accidental spills or leaks of fuel, oil or hazardous materials could result in contamination of soil or watercourses. Contamination of soil or watercourses can impact vegetation and also downstream receptors through direct or indirect pathways (Donaldson and Bennet 2004). Direct impacts may occur through inhalation, dermal contact or ingestion; and indirect impacts may occur through root uptake or water contamination.

There would only be minimal amounts of fuel, oil or hazardous materials stored on-site for general construction use and these materials would be stored in designated bunded areas. These materials

would be stored and handled on-site in accordance with AS 1940-2004 *Storage and Handling of Flammable and Combustible Liquids.*

Erosion and sedimentation

Erosion and thus sedimentation may occur from activities such as vegetation removal, excavations and earthworks during construction of the Proposal. This could result in reduced habitat quality in the vicinity of the proposed development footprint, and downstream of the proposed development footprint. Erosion and sedimentation controls would be established prior to construction to manage the potential impacts associated with vegetation removal, excavations and earthworks during construction of the Proposal.

Dust

Dust from vegetation removal, excavation and earthworks has been shown to reduce plant and animal health. Dust can affect photosynthesis, respiration and transpiration in plants, and allow the penetration of gaseous pollutants. This can lead to decreased productivity and in the long term can alter community structure. Dust has also been shown to impact the health of fauna, such as through respiratory disease, and the reduction in health of animals can be exacerbated by changes to plant health and community structure.

Impacts on the surrounding flora and fauna due to a temporary increase in dust would be minimal, however. The heterogeneous nature of dust and the difference in plant response means that dust issues for local flora and fauna is site specific (Turner 2013). Flora and fauna in the arid environment are adapted to periods of 'boom and bust', where it is possible to experience several years of drought and high amounts of dust. This natural occurrence of dust in the arid environment has increased species resilience to impacts related to dust deposition on leaves, bark, flowers, etc.

Light, noise and vibration

An increase in light within the proposed development footprint and vicinity from vehicles and machinery could affect nocturnal fauna, potentially disrupting movement and behaviour. An increase in light would likely increase the number of insects within the vicinity of the proposed development footprint, attracting native and introduced fauna to the proposed development footprint and vicinity (insects provide a valuable food source for many native and introduced fauna species). An increase in light may attract more predator fauna species, increasing the pressure on native prey.

Construction activities would also result in an increase in noise levels within the proposed development footprint and vicinity, which may affect fauna species. Some fauna species would likely tolerate an increase in noise, while others may not, causing them to leave the affected area or making the area less desirable for foraging, nesting and breeding.

Vibration from construction activities such as from blasting and heavy vehicle movements may deter native fauna from using the area near the vibration sources. This may potentially interrupt dispersal within the vicinity of the proposed development footprint if an individual is unwilling to travel

through an area where vibration is detectable, or may cause some species to abandon an area in search of areas where vibration is not detectable.

Introduction and spread of weeds and invasive species

There is a potential to introduce or spread weeds and other invasive species within the proposed development footprint or vicinity via vehicle movements, imported material and through vegetation removal (disturbance) during construction of the Proposal. Weeds and invasive flora species can readily establish in disturbed areas after rain, quickly out competing native vegetation and colonising. Weeds and invasive flora species are currently confined to small localised areas within the proposed development footprint and vicinity and there is a risk that the current populations could be expanded during construction of the Proposal.

Increased predator species

There is a potential to increase predator species access, and hence predation success, within the proposed development footprint and vicinity via the creation of new roads and through vegetation removal (disturbance) during construction of the Proposal. This may result in increased stress on native prey species within the proposed development footprint or vicinity.

The creation of artificial water sources, heat and shade, and food sources (from staff and rubbish bins) may also cause predators to habituate the proposed development footprint and vicinity, increasing stress on native prey species.

Increased introduced fauna use

Introduced species may use the proposed development footprint and vicinity more frequently due to the creation of artificial water sources, new roads and vegetation removal (disturbance). This may result in increased fauna strike, increased pressure on native flora and fauna (through competition and predation) and the potential spread of weeds.

Bushfire

There may be an increase in the incidence of fire from the accidental ignition of combustible fuels. Fire can benefit some disturbance-tolerant species, but can be detrimental to other species if it occurs at the wrong time of year or in habitats that do not respond well to fire. Fire could result in the injury or mortality of flora and fauna within the proposed development footprint and vicinity, or within the wider locality.

7.5 Assessment of risk during operation

This section presents the potential impacts (both direct and indirect) on flora and fauna during operation of the Proposal. Mitigation measures to avoid or reduce these impacts are discussed in Section 7.9.

7.5.1 Direct impacts

There would be no direct impacts on flora or fauna during operation of the Proposal. Impacts to biodiversity would be limited to indirect impacts which are discussed below.

7.5.1 Indirect impacts

Potential indirect impacts on flora and fauna during operation may include: fauna strike; altered hydrology; groundwater abstraction; contamination; increased light, noise and vibration; the introduction and spread of weeds and invasive species; an increased incidence of bushfire; and potential impacts associated with salt runoff and windblown salt from stockpiles. These impacts are discussed below.

Fauna strike

Vehicles traveling along the proposed Henbury Access Road and Chandler Haul Road may result in an increased incidence of fauna strike (resulting in injury or mortality), particularly during the hours of dusk and dawn during operation of the Proposal.

Altered hydrology

Alterations to the surface hydrology within the proposed development footprint would occur during operational phase of the Proposal.

Drainage would be established on the proposed Chandler Haul Road and Maryvale Access Road. Drainage would also be established at the Chandler Facility and Apirnta Facility and would be designed to divert clean water around the proposed infrastructure located at the Chandler Facility and Apirnta Facility. Where possible, newly constructed drainage would either align with existing drainage lines or look to re-connect to them downstream.

New drainage has the potential to concentrate natural surface flow into the receiving environment, causing erosion (Costantini *et al*. 1999). Water pooling due to blocked drains or poorly designed drainage channels can attract fauna and potentially breed mosquitos. These risks would be mitigated through appropriate road construction design and monitoring.

If in the unlikely event surface waters pool for long periods of time and cause predator species to habituate to an area, this can, in turn, place stress on fauna species (DeStafano *et al*. 2000). The installation of river crossings can also cause follow-on erosion or sedimentation issues on the banks of the watercourse and on surrounding watercourses. To manage potential downstream erosion or sedimentation risks, the proponent has prepared a draft Sedimentation and Erosion Management Plan (refer to Chapter 9 and Appendix L).

Groundwater abstraction

As discussed above, there would be no drawdown impacts on vegetation as the target horizon for water supply is between 140 metres below ground level and 170 metres below ground level.

Contamination

Potential contamination may occur from the accidental release of fuel, oil or other hazardous materials during the handling, use and storage of such materials at the proposed Apirnta Facility and Chandler Facility. In addition, potential contamination may occur from the accidental release of waste materials that are being transported to the proposed Apirnta Facility along the Henbury Access Road and to the proposed Chandler Facility along Chandler Haul Road during operation of the Proposal.

Accidental spills or leaks of fuel, oil or hazardous materials or the accidental release of waste materials could result in contamination of soil or watercourses. Contamination of soil or watercourses can impact vegetation and also downstream receptors through direct or indirect pathways (Donaldson and Bennet 2004). Direct impacts may occur through inhalation, dermal contact or ingestion; and indirect impacts may occur through root uptake or water contamination.

There would only be minimal amounts of fuel, oil or hazardous materials stored on-site for general operations and these materials would be stored in designated bunded areas. These materials would be stored and handled on-site in accordance with AS 1940-2004 *Storage and Handling of Flammable and Combustible Liquids.* In addition, all hazardous and intractable wastes brought to site for storage (either temporarily at the Apirnta Facility or for permanent storage and isolation at the Chandler Facility) would be packaged and transported in accordance with a strict Waste Acceptance Criteria (refer to Appendix C). The risk of contamination from the accidental release of waste materials that are being transported to the proposed Apirnta Facility and Chandler Facility would, therefore, be very low.

Light, noise and vibration

The risks associated with light and noise and vibration during operation of would be similar to those during construction of the Proposal (ref to Section 7.4.2). Operational light and noise would be more consistent with less variation in source, location and timing. Blasting during operation would have minimal impact due to the infrequent short period of duration.

Introduction and spread of weeds and invasive species

There is the potential to introduce or spread weeds and other invasive species within the vicinity of the proposed Chandler Facility, Apirnta Facility, Chandler Haul Road and Henbury Access Road via vehicle movements during operation of the Proposal. This risk would be much reduced, however, compared to construction.

Bushfire

There may be an increase in the incidence of fire from the accidental ignition of combustible fuels. In addition, there may be a need to conduct controlled burns in the vicinity of the proposed Chandler Facility and Apirnta Facility to reduce fuel loads. Fire can benefit some disturbance-tolerant species, but can be detrimental to other species if it occurs at the wrong time of year or in habitats that do not respond well to fire. Fire could result in the injury or mortality of flora and fauna within the proposed development footprint and vicinity, or within the wider locality.

Salt

There is a low risk that salt would be released to the environment (via rain or wind) from the salt stockpiles located at the proposed Chandler Facility. The salt stockpiles would be established on an impervious clay base to block saline leachate from draining into the soil and groundwater. During low intensity rainfall events, water would interact with the salt on the surface of the stockpiles naturally forming an impervious crust that would impede run-off and also prevent the occurrence of windblown salt. Dish drains would also be constructed around the perimeter of the salt stock piles to control runoff during high intensity rainfall events.

There is the risk that salt may be released to the environment during transportation from the proposed Chandler Facility to the proposed rail siding at the Apirnta Facility via accident. As the area is semi-arid with only ephemeral watercourses, the off-site migration of accidentally spilled salt would be minimal.

7.6 Assessment of risk during closure and rehabilitation

This section presents the potential impacts (both direct and indirect) on flora and fauna during closure and rehabilitation of the Proposal. Mitigation measures to avoid or reduce these impacts are discussed in Section 7.9.

7.6.1 Direct impacts

There would be no direct impacts on flora or fauna during closure and rehabilitation of the Proposal. Impacts to biodiversity would be limited to indirect impacts which are discussed below.

7.6.2 Indirect impacts

Potential indirect impacts on flora and fauna during closure and rehabilitation may include: fauna strike; altered hydrology; contamination; erosion and sedimentation; dust; increased light, noise and vibration; the introduction and spread of weeds and invasive species; and an increased incidence of bushfire. These impacts would generally be the same as those during construction of the Proposal (refer to Section 7.4.2).

Indirect impacts on flora and fauna during closure and rehabilitation may also include soil compaction and topsoil loss. Soil left compacted and not deep ripped has a reduced ability to rehabilitate due to difficulties for flora to re-establish. Compacted soil has a lower infiltration rate

and this makes it more difficult for seedlings to emerge. Compacted soil also increases surface runoff and decreases staggered sediment loss, resulting in large sediment loads running downstream.

Nutrient-rich topsoil containing the seed bank required for rehabilitation can be lost post rehabilitation through rain and wind. The loss of topsoil can reduce the rehabilitated surfaces ability to re-vegetate.

7.7 Assessments of significance – impacts on threatened and migratory species

This section discusses impacts on matters of national environmental significance and on state-listed threatened species from the construction, operation, and closure and rehabilitation of the Proposal.

7.7.1 Impacts on matters of national environmental significance

Assessments of significance for matters of national environmental significance have been prepared for six threatened fauna species and eight migratory bird species in accordance with the *Significant Impact Guidelines 1.1-Matters of National Environmental Significance* (DoE 2013). The assessments of significance are included in Appendix R.

Threatened species

Two fauna species listed as endangered under the EPBC Act have a low to moderate likelihood of occurrence within the proposed development footprint or vicinity. These are:

- Slater's skink (*Liopholis slateri slateri*).
- Australian painted snipe (*Rostratula australis*).

In addition, four fauna species listed as vulnerable under the EPBC Act have a low to moderate or high likelihood of occurrence within the proposed development footprint or vicinity. These are:

- Great desert skink (*Liopholis kintorei*).
- Thick-billed grasswren (*Amytornis modestus indulkana*).
- Princess parrot (*Polytelis alexandrae*).
- Crest-tailed mulgara (*Dasycercus cristicauda*).

All of these species are also listed as threatened species under the TPWC Act (refer to Table 7-6). Assessments of significance were prepared for these species, the results of which are summarised below.

Slater's skink (*Liopholis slateri slateri*)

Slater's skink (*Liopholis slateri slateri*) is listed as endangered under the EPBC Act (and also under the TPWC Act). Scattered populations of Slater's skink occur on depositional alluvial plains under shrubs in shrublands and open-shrublands close to drainage lines, and minor drainages among stony hills in

catchments of the Finke, Hugh and formerly Todd Rivers emanating from the central Ranges (McDonald 2012). Slater's skink was not recorded during the field surveys. There is a low to moderate likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of suitable habitat. Marginally suitable habitat occurs on the proposed Henbury Access Road at the crossing of the Finke River.

The closest record of the species to the proposed devleopment footprint is approximately 67 kilometres north-east of the western end of the proposed Henbury Access Road.

If the species is present within the proposed development footprint, it is possible that an isolated population of the species would be significantly impacted through habitat loss and by the potential encroachment of buffel grass into suitable habitat following the removal of vegetation. Surveys would be undertaken of the proposed access road alignment prior to construction to determine the presence/absence of this species. If the species is found to be present, significant impacts would be avoided through changes to the proposed alignment of the Henbury Access Road. Alternatively, a program of trapping and relocating would be implemented to avoid significant impacts to the species. If significant impacts could not be avoided, the need for offsets would be assessed in consultation with the DoEE.

Australian painted snipe (*Rostratula australis*)

The Australian painted snipe (*Rostratula australis*) is listed as endangered under the EPBC Act (and as vulnerable under the TPWC Act). It inhabits shallow inland wetlands. The Australian painted snipe was not recorded during the field surveys. There is a low to moderate likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat, but only during times of high rainfall. If it were to occur, this migratory species would occur in low numbers.

The closest record of the species to the proposed development footprint is approximately 85 kilometres north-west of the western end of the proposed Henbury Access Road.

Considering that this species is only likely to occur within the proposed development footprint and vicinity in low numbers (not constituting a population) and ephemeral wetlands would not be impacted, there would be no long-term decrease in the size of a population of Australian painted snipe resulting from the construction, operation, or decommissioning and rehabilitaiton of the Proposal. There would be no reduction in the area of occupancy of the species, no fragmentation of a population into two or more populations, and no impact on habitat critical to the survivial of the Australian painted snipe. There are no important breeding sites within the proposed development footprint or vicinity for the species. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to interfere with the recovery of the Australian painted snipe.

For the reasons listed above, there would be no significant impact on the Australian painted snipe during construction, operation, or closure and rehabilitation of the Proposal.

Great desert skink (*Liopholis kintorei*)

The great desert skink (*Liophlis kintorei*) is listed as vulnerable under the EPBC Act (and also under the TPWC Act). It is predominantly found in low dunes on sandplains and adjacent swales containing *Triodia* grassland vegetation and scattered shrubs, but can occupy a range of vegetation types such as lateritic palaeodrainage lines within *Melaleuca* shrubs. The great desert skink was not recorded during the field surveys. There is a low to moderate likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat, as much of the proposed development footprint and vicinity consists of sandplain habitat with *Triodia* grassland vegetation.

The closest record of the great desert skink to the proposed development footprint is approximately 100 kilometres south-west of the western end of the proposed Henbury Access Road.

Potentially suitable habitat for the great desert skink is widespread regionally as well as within the proposed development footprint and vicinity and no populations are known within the region. Consequently, the localised construction, operation, and rehabilitation and decommissioning activities are highly unlikely to cause a long term decrease in the size of an important population of the species. For the same reasons, it is highly unlikely that there would be a reduction in the area of occupancy of the species, no fragmentation of a population into two or more populations, and no impact on habitat critical to the surivial of the great desert skink. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to disrupt the breeding cycle of the species, impact the availabiliy or quality of habitat for the species, or interfere with the recovery status of the great desert skink.

For the reasons listed above, there would be no significant impact on the great desert skink during construction, operation, or closure and rehabilitation of the Proposal.

Thick-billed grasswren (*Amytornis modestus indulkana*)

The thick-billed grasswren (*Amytornis modestus indulkana*) is listed as vulnerable under the EPBC Act (and as critically endangered under the TPWC Act). It inhabits low sparse shrublands of predominanly saltbush and cottonbush vegetation on bare and rocky ground. The thick-billed grasswren was not recorded during the field surveys. There is a low to moderate likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat. However, the nearest known population of this northern South Australia species being approximately 167 kilometres to the south-east suggests this northern habitat is marginal and likelihood of the species moving into the area would only occur under extremely good conditions. The potentially suitable habitat occurs on the proposed Henbury Access Road.

If the species is present within the proposed development footprint, it is possible that the species would be significantly impacted because a population within the proposed development footprint or vicinity would be at the northern limit of it's range. This population would, therefore, meet the criteria of an important population. Given this, there is the potential for a long-term decrease in the

size of an important population of this species. There is also a possibilitiy of a slight reduction in the occupancy of an important population. If the species is present within the proposed development footprint, there is the potential to fragment an existing population into two or more populations or to disrupt the breeding cycle of an important population. There is also a possibility that invasive species harmul to the thick-billed grasswren become established in it's habitat.

Surveys would be undertaken prior to construction to confirm the presence/absense of this species. If the species is found to be present, significant impacts would be avoided through changes to the proposed alignment of the Henbury Access Road. Alternatively, a program of trapping and relocating would be implemented to avoid significant impacts to the species. If significant impacts could not be avoided, the need for offsets would be assessed in consultation with the DoEE.

Princess parrot (*Polytelis alexandrae*)

The princess parrot (*Polytelis alexandrae*) is listed as vulnerable under the EPBC Act (and also under the TPWC Act). It inhabits sandplain environments with vegetation characterised by large *Eucalyptus gongylocarpa* or other large northern desert species of Eucalypts, *Eremophila , Grevillea* and *Hakea* shrubs with scattered trees, and less often in riverine forest, woodland and shubland habitats. The princess parrot was not recorded during the field surveys. There is a moderate likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat, but only when extended seasonal resources are suitable. Marginally suitable habitat types within the proposed development foorprint and vicinity include sandplain, hill/low ranges areas and creekline/drainage depressions with hollow bearing trees and *Eremophila*/*Grevillea*/*Hakea* shrubs, and to a lesser extent the alluvial areas around the Finke River. These habitats may provide potential breeding habitat for the princess parrot during irruptions.

The closest record of princess parrot to the proposed development footprint is approximately 57 kilometres to the south-west where they were once common near Umbeara Creek.

As a population of princess parrot within the proposed devleopment footprint or vicinity would not meet the criteria for being an important population, activities associated with construction, operation, and decommissioning and rehabiliation would not impact an important population of this species. For the same reasons, it is highly unlikely that there would be a reduction in the area of occupancy of the species, no fragmentation of a population into two or more populations, and no impact on habitat critical to the surivial of the princess parrot. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to interfere with the recovery of the princess parrot. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to disrupt the breeding cycle of the species, impact the availabiliy or quality of habitat for the species, or interfere with the recovery of the princess parrot.

There is a potential for encroachment of buffel grass into disturbed areas where it is not currently established, which may negatively impact food plants and breeding trees for the princess parrot. Though as this species is highly mobile and there is suitable habitat outside the proposed development footprint, it is unlikely that this would significantly impact princess parrot.

For the reasons listed above, there would be no significant impact on the princess parrot during construction, operation, or closure and rehabilitation of the Proposal.

Crest-tailed mulgara (*Dasycercus cristicauda*)

The crest-tailed mulgara (*Dasycercus cristicauda*) is listed as vulnerable under the EPBC Act (and also under the TPWC Act). This species occurs in sand dune habitats, and is found predominantly on the slopes and crests of dunes with *Zygochloa paradoxa* and *Triodia* spp. vegetation.

There is a high likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat and because mulgara tracks (belonging either to the crest-tailed mulgara or brush-tailed mulgara) were recorded within the vicinity of the proposed development footprint during the field surveys. *Triodia* sp. sand dunes are present and widespread within the proposed development footprint and vicinity.

As potentially suitable habitat for the crest-tailed mulgara is widespread within the proposed development footprint and vicinity (and in the region) and the construction, operation, and rehabilitation and decommissioning activities would be localised, it is highly unlikely that there would be a long term decrease in the size of an important population of the species. For the same reasons, it is highly unlikely that there would be a reduction in the area of occupancy of the species, no fragmentation of a population into two or more populations, and no impact on habitat critical to the surivial of the crest-tailed mulgara. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to disrupt the breeding cycle of the species, impact the availabiliy or quality of habitat for the species, or interfere with the recovery of the crest-tailed mulgara.

For the reasons listed above, there would be no significant impact on the crest-tailed mulgara during construction, operation, or closure and rehabilitation of the Proposal.

Migratory species

Three migratory species were recorded during the field surveys within the proposed development footprint or vicinity. These were:

- Sharp-tailed sandpiper (*Calidris acuminata*).
- Rainbow bee-eater (*Merops ornatus*).
- Marsh sandpiper (*Tringa stagnatilis*).

A further five migratory species have a moderate to high likelihood of occurrence within the proposed development footprint or vicinity during good seasons. These are:

- Fork-tailed swift (*Apus pacificus*).
- Great egret (*Ardea alba).*
- Oriental plover (*Charadrius veredus).*

- Oriental pratincole (*Glareola maldivarum).*
- Common greenshank (*Tringa nebularia*) (refer to Table 7-7).

A combined assessment of significance was prepared for these species and is presented in Appendix R. The proposed development footprint and vicinity is not considered important habitat for any of these migratory species, according to the significant impact criteria for migratory species. The proposed development footprint and vicinity would not support an ecologically significant proportion of the population of these species, is not of critical importance to these species at particular life-cycle stages, is not at the limit of these species ranges, and is not within an area where these species are declining.

Conclusion

At present, no biodiversity offsets are deemed necessary as there would be no significant impact to matters of national environmental significance during construction, operation, or closure and rehabilitation of the Proposal.

Surveys would be undertaken prior to construction to confirm the presence/absence of two matters of national environmental significance (threatened species) considered to have a low to moderate likelihood of occurrence within the proposed development footprint or vicinity. These are and Slater's skink (*Liopholis slateri slateri*) and the thick-billed grasswren (*Amytornis modestus indulkana*). Potential habitat for these species is located within the vicinity of the proposed Henbury Access Road. If these species are found to be present, significant impacts would be avoided through changes to the proposed alignment of the Henbury Access Road. Alternatively, a program of trapping and relocating would be implemented to avoid significant impacts to these species. If significant impacts could not be avoided, the need to calculate and deliver biodiversity offsets would be assessed in accordance with the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC 2012b) and in consultation with the DoEE.

7.7.2 Impacts on state-listed threatened species

Assessments of significance for state-listed threatened species have been prepared for two fauna species in accordance with the *Significant Impact Guidelines 1.1-Matters of National Environmental Significance* (DoE 2013). The assessments of significance are included in Appendix R.

Threatened species

Secondary signs of two threatened fauna species listed as vulnerable under the TPWC Act were recorded within the proposed development footprint or vicinity. These were:

- Brush-tailed mulgara (*Dasycercus blythi*).
- Southern marsupial mole (*Notoryctes typhlops*) (refer to Table 7-6).

Assessments of significance were prepared for these species, the results of which are summarised below.

Brush-tailed mulgara (*Dasycercus blythi*)

The brush-tailed mulgara (*Dasycerus blythi*) is listed as vulnerable under the TPWC Act. This species inhabits sandplain, gibber plain and cracking clay habitats supporting tussock or hummock grasslands, or sparse chenopod shrubland (Dickman *et al*. 2001; Pavey *et al*. 2011; L. Young, unpublished data).

As discussed above, there is a high likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat and because mulgara tracks (belonging either to the brush-tailed mulgara or crest-tailed mulgara) were recorded within the vicinity of the proposed development footprint during the field surveys.

As potentially suitable habitat for the brush-tailed mulgara is widespread within the proposed development footprint and vicinity (and in the locality) and the construction, operation, and rehabilitation and decommissioning activities would be localised, it is highly unlikely that there would be a long term decrease in the size of an important population of the species. For the same reasons, it is highly unlikely that there would be a reduction in the area of occupancy of the species, no fragmentation of a population into two or more populations, and no impact on habitat critical to the survival of the brush-tailed mulgara. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to disrupt the breeding cycle of the species, impact the availabiliy or quality of habitat for the species, or interfere with the recovery of the brush-tailed mulgara.

For the reasons listed above, there would be no significant impact on the brush-tailed mulgara during construction, operation, or closure and rehabilitation of the Proposal.

Southern marsupial mole (*Notoryctes typhlops*)

The southern marsupial mole (*Notoryctes typhlops*) is listed as vulnerable under the TPWC Act. This species occupies dune flanks, sandy plains and river flats (Pavey 2015).

There is a high likelihood of occurrence of this species within the proposed development footprint or vicinity based on the presence of potentially suitable habitat and because secondary signs of this species were recorded in the riparian floodplain alongside the Finke River (approximately 850 metres north of the proposed Henbury Access Road) during the field surveys.

As potentially suitable habitat for the southern marsupial mole is widespread within the proposed development footprint and vicinity (and in the locality) and the construction, operation, and rehabilitation and decommissioning activities would be localised, it is highly unlikely that there would be a long term decrease in the size of an important population of the species. For the same reasons, it is highly unlikely that there would be a reduction in the area of occupancy of the species, no fragmentation of a population into two or more populations, and no impact on habitat critical to the surivial of the southern marsupial mole. Activities associated with construction, operation, and decommisioning and rehabilitation are highly unlikely to disrupt the breeding cycle of the species,

impact the availabiliy or quality of habitat for the species, or interfere with the recovery of the southern marsupial mole.

For the reasons listed above, there would be no significant impact on the southern marsupial mole during construction, operation, or closure and rehabilitation of the Proposal.

Conclusion

The outcome of the assessments is that there would be no significant impact on state-listed threatened species recorded or predicted to occur within the proposed development footprint or vicinity during construction, operation or closure and rehabilitation of the Proposal.

7.8 Key threatening processes

Key threatening processes threaten, or have the potential to threaten, the survival or evolutionary development of a species, population or ecological community. They are listed under the EPBC Act. Three key threatening processes are of relevance to the Proposal. These are:

- Competition and land degradation by rabbits.
- Predation by the European red fox.
- Predation by feral cats.

Key threatening processes have been considered in the assessment of risks and assessments of significance for the threatened and migratory species recorded or predicted to occur within the proposed development footprint or vicinity. Mitigation measures to limit the potential impacts of the above key threatening processes are discussed in Section 7.9.

7.9 Mitigation and monitoring

Mitigation and management measures proposed to minimise the impacts on flora and fauna (including conservation-significant species) during construction, operation, and closure and rehabilitation of the Proposal are listed in Table 7-11. These measures would be incorporated into the CEMP, OEMP and/or RCP for the Proposal. A draft Biodiversity Management Plan and draft Bushfire Management Plan have also been prepared for the Proposal (refer to Appendix O and Appendix W).

The mitigation and management measures listed in Chapter 9 (Surface water), Chapter 11 (Human Health and Safety), Chapter 15 (Air quality) and Chapter 16 (Noise and vibration) would be implemented to minimise potential impacts associated with erosion and sedimentation, contamination, altered hydrology, dust, and noise and vibration on flora and fauna.

Surveys would be undertaken prior to construction to confirm the presense/absense of two matters of national environmental significance (threatened species) considered to have a low to moderate likelihood of occurrence within the propsoed development fooprint or vicinity. These are and Slater's skink (*Liopholis slateri slateri*) and the thick-billed grasswren (*Amytornis modestus indulkana*). Potential habitat for these species is located within the vicinity of the proposed Henbury

Access Road. If these species are found to be present, significant impacts would be avoided through changes to the proposed alignment of the Henbury Access Road. Alternatively, a program of trapping and relocating would be implemented to avoid significant impacts to these species. If significant impacts could not be avoided, the need to calculate and deliver biodiversity offsets would be assessed in accordance with the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC 2012b) and in consultation with the DoEE.

Table 7-11 Biodiversity mitigation and management measures

ID	Outcome	Mitigation/management measure	Timing
B.1	Preservation of biodiversity	Finalise draft Biodiversity Management Plan prior to construction and incorporate into the CEMP, OEMP and/or RCP for the Proposal. The plan collates measures to mitigate and manage potential impacts on biodiversity.	Pre-construction
B.2	Reduced incidence of bushfire	Finalise draft Bushfire Management Plan prior to construction and incorporate into the CEMP, OEMP and RCP. The plan collates measures to mitigate and manage potential impacts on biodiversity.	Pre-construction
B.3	Preservation of biodiversity	Provide workers with an environmental induction prior to starting construction activities. This would include information on the ecological values of the site and protection measures to be implemented to protect biodiversity during construction.	Pre-construction and construction
B.4	Protection of threatened species	Undertake pre-clearance surveys for threatened species by a qualified ecologist.	Pre-construction and construction
B.5	Minimisation of vegetation removal and habitat loss	Defer vegetation removal until necessary.	Pre-construction and construction
B.6	Minimisation of vegetation removal and habitat loss	Locate site offices and stockpiles in already cleared and disturbed areas, where possible.	Pre-construction and construction
B.7	Minimisation of vegetation removal and habitat loss	Provide maps to construction staff clearly showing vegetation clearing boundaries.	Pre-construction and construction
B.8	Minimisation of vegetation removal and habitat loss	Leave mature trees, where possible, especially desert oaks, bloodwoods and bush tucker species.	Construction
B.9	Minimisation of vegetation removal and habitat loss	Leave fallen logs greater than 15 cm diameter or relocate to surrounding environment.	Construction
B.10	Minimise vegetation removal and habitat loss	Relocate bird nests found in trees or shrubs to be cleared to surrounding environment.	Construction
B.11	Reduced incidence of fauna injury/mortality	Ensure fauna is removed from areas intended to be cleared by a qualified ecologist.	Pre-construction and construction
B.12	Reduced incidence of fauna injury/mortality	Avoid driving during high risk times; dawn, dusk and at night, where possible.	Construction, operation, closure and rehabilitation
B.13	Reduced incidence of fauna injury/mortality	Prohibit off-road driving.	Construction, operation, closure and rehabilitation

ID	Outcome	Mitigation/management measure	Timing
B.14	Reduced incidence of fauna injury/mortality	Develop and maintain a fauna strike register.	Construction, operation, closure and rehabilitation
B.15	Reduced incidence of fauna injury/mortality	Limit access of third parties on-site.	Construction, operation, closure and rehabilitation
B.16	Reduced incidence of fauna injury/mortality	Ensure traffic adheres to speed limits and local road rules.	Construction, operation, closure and rehabilitation
B.17	Reduced incidence of fauna injury/mortality	Ensure speed limit and potential fauna crossing signs clearly are displayed on Chandler Haul Road, Henbury Access Road and other access tracks, as necessary.	Construction, operation, closure and rehabilitation
B.18	Reduced habitat fragmentation and edge effects	Implement weed and invasive species mitigation measures listed above.	Construction, operation, closure and rehabilitation
B.19	Reduced habitat fragmentation and edge effects	Implement introduced fauna mitigation measures listed above.	Construction, operation, closure and rehabilitation
B.20	Reduced habitat fragmentation and edge effects	Undertake routine inspections for weeds and invasive species.	Construction, operation, closure and rehabilitation
B.21	Elimination of waste left uncontained on-site	Develop and implement a Waste Management Plan.	Pre-construction
B.22	Elimination of waste left uncontained on-site	Ensure domestic waste stored in fauna proof bins.	Construction, operation, closure and rehabilitation
B.23	Elimination of waste left uncontained on-site	Ensure waste stored is stored in appropriately labelled containers.	Construction, operation, closure and rehabilitation
B.24	Elimination of waste left uncontained on-site	Bund liquid waste, where required.	Construction, operation, closure and rehabilitation
B.25	Elimination of waste left uncontained on-site	Implement waste hierarchy of avoid/minimise, reuse, recycle, recovery, and then disposal.	Construction, operation, closure and rehabilitation
B.26	Elimination of waste left uncontained on-site	Ensure waste is disposed off-site by licensed contractor(s).	Construction, operation, closure and rehabilitation
B.27	Elimination of waste left uncontained on-site	Ensure hazardous waste and hydrocarbons are stored separately in bunding, with appropriate signage.	Construction, operation, closure and rehabilitation
B.28	Minimised dust	Stage vegetation removal (clearing) to reduce total exposed cleared surface at any one time.	Construction
B.29	Minimised dust	Avoid clearing during dry windy conditions.	Construction
B.30	Minimised dust	Clear with blade up, where possible.	Construction
B.31	Minimised dust	Leave vegetation 10 centimetres in height on firebreaks and non-crucial tracks.	Construction

ID	Outcome	Mitigation/management measure	Timing
B.32	Minimised dust	Use water trucks during construction and closure and rehabilitation to control dust.	Construction, closure and rehabilitation
B.33	Elimination of unnecessary lighting in surrounding environment	Use lower intensity lights, e.g. yellow or red lighting, where possible. This would reduce impacts on nocturnal species and limit insect attraction.	Construction
B.34	Elimination of unnecessary lighting in surrounding environment	Only have minimal lights on needed for safe operation of facilities.	Operation
B.35	Elimination of unnecessary lighting in surrounding environment	Direct lights towards the ground (where possible) or use shields to direct lights to only where light is required. Have lights positioned as low as possible.	Construction, operation, closure and rehabilitation
B.36	Elimination of unnecessary lighting in surrounding environment	Turn lights off when not in use.	Construction, operation, closure and rehabilitation
B.37	Elimination of unnecessary lighting in surrounding environment	Restrict work to daylight hours, where possible.	Construction, operation, closure and rehabilitation
B.38	Reduce noise and vibration	Turn off machinery when not in use.	Construction, operation, closure and rehabilitation
B.39	Reduce noise and vibration	Maintain and regularly service all generators, engines and vehicles on-site.	Construction, operation, closure and rehabilitation
B.40	Reduce noise and vibration	Ensure vehicles carry full loads were possible to limit the number of vehicles on the Chandler Haul Road and Henbury Access Road.	Construction, operation, closure and rehabilitation
B.41	Prevention of the introduction and spread of weeds and invasive species	Vehicle/machinery wash-down prior to leaving Alice Springs or entering an area uncontaminated by weeds.	Construction, operation, closure and rehabilitation
B.42	Prevention of the introduction and spread of weeds and invasive species	Avoid contact with weed or invasive species seed, plant matter or soil potentially contaminated with weed seeds.	Construction, operation, closure and rehabilitation
B.43	Prevention of the introduction and spread of weeds and invasive species	Avoid clearing or removal of any weed or invasive species during seeding, or put plastic bag over seed heads before removing plant.	Construction, operation, closure and rehabilitation

ID	Outcome	Mitigation/management measure	Timing
B.44	Prevention of the introduction and spread of weeds and invasive species	Remove seed and mud from vehicle tyres and front grill daily.	Construction, operation, closure and rehabilitation
B.45	Prevention of the introduction and spread of weeds and invasive species	Undertake annual weed mapping in the vicinity of the proposed development footprint.	Construction, operation, closure and rehabilitation
B.46	Prevention of the introduction and spread of weeds and invasive species	Remove weeds following specialist advice from qualified ecologist or Weeds Branch, NT Government.	Construction, operation, closure and rehabilitation
B.47	Prevention of the introduction and spread of weeds and invasive species	Remove weed or invasive species before seeding times, where possible.	Construction, operation, closure and rehabilitation
B.48	Prevention of the introduction and spread of weeds and invasive species	Avoid driving in wet and muddy conditions, where possible.	Construction, operation, closure and rehabilitation
B.49	Prevention of an increase in the number or frequency of introduced fauna	Prevent access to artificial water and heat sources through construction of fences.	Construction, operation, closure and rehabilitation
B.50	Prevention of an increase in the number or frequency of introduced fauna	Dispose of all waste in predator-proof bins.	Construction, operation, closure and rehabilitation
B.51	Prevention of an increase in the number or frequency of introduced fauna	Develop and implement a no tolerance policy to the introduction of pest species by contractors, suppliers and personnel.	Construction, operation, closure and rehabilitation
B.52	Prevention of an increase in the number or frequency of introduced fauna	Place brush or vegetation stockpiles across linear developments no longer required (access tracks etc.) to inhibit movement of predators and introduced herbivores.	Construction, operation, closure and rehabilitation
B.53	Prevention of an increase in the number or frequency of introduced fauna	Undertake annual flora and fauna survey to record numbers of introduced fauna species.	Construction, operation, closure and rehabilitation
B.54	Prevention of an increase in the number or frequency of introduced fauna	Develop, implement and maintain fauna sighting register.	Construction, operation, closure and rehabilitation

ID	Outcome	Mitigation/management measure	Timing
B.55	Prevention of an increase in the number or frequency of introduced fauna	Develop and implement an introduced fauna control program.	Construction, operation, closure and rehabilitation
B.56	Prevention of an increase in the number or frequency of introduced fauna	Carry out feral animal control as required in consultation with stakeholders.	Construction, operation, closure and rehabilitation
B.57	Prevention of an increase in the number or frequency of introduced fauna	Install fauna proof fence around all infrastructure.	Construction
B.58	Prevention of an increase in the number or frequency of introduced fauna	Reduce artificial standing water.	Construction, operation, closure and rehabilitation
B.59	Prevention of an increase in the number or frequency of introduced fauna	Close off and rehabilitate any cleared areas no longer required for safe operation.	Construction, operation, closure and rehabilitation
B.60	Prevention of an increase in the number or frequency of introduced fauna	Ensure waste receptacles are fauna proof.	Construction, operation, closure and rehabilitation
B.61	Prevention of an increase in the number or frequency of introduced fauna	Do not feed fauna.	Construction, operation, closure and rehabilitation
B.62	Prevention of an increase in the number or frequency of introduced fauna	Remove any dead fauna or insects and either dispose off-site or bury greater than 50 centimetres deep to avoid predators uncovering.	Construction, operation, closure and rehabilitation
B.63	Prevention of an increase in the number or frequency of introduced fauna	Trap and relocate predator species if they are noticed to have increased in numbers and habituate around facilities. Trapping and relocating of fauna would be undertaken by a qualified ecologist.	Construction, operation, closure and rehabilitation
B.64	Prevention of fires resulting from the Proposal	Keep up to date with bushfire website and state services.	Construction, operation, closure and rehabilitation
B.65	Prevention of fires resulting from the Proposal	Construct and maintain firebreaks around infrastructure and significant habitats.	Construction, operation, closure and rehabilitation
B.66	Prevention of fires resulting from the Proposal	No open flames outside of designated areas unless hot works permit is approved.	Construction, operation, closure and rehabilitation

ID	Outcome	Mitigation/management measure	Timing
B.67	Prevention of fires resulting from the Proposal	Ensure flammable material is clearly labelled.	Construction, operation, closure and rehabilitation
B.68	Prevention of fires resulting from the Proposal	Ensure adequate firefighting equipment is stored on-site and staff trained in use.	Construction, operation, closure and rehabilitation
B.69	Prevention of fires resulting from the Proposal	Provide designated smoking area.	Construction, operation, closure and rehabilitation
B.70	Prevention of fires resulting from the Proposal	Organise and implement strategic back burning with traditional owners and Central Land Council.	Construction, operation, closure and rehabilitation
B.71	Prevention of fires resulting from the Proposal	Implement and carry out annual fuel load surveys before high risk fire season.	Construction, operation, closure and rehabilitation
B.72	Prevention of impacts to surrounding flora or watercourses from salt	Survey/monitor flora in dominant down wind direction from salt stockpiles for impacts.	Construction, operation, closure and rehabilitation
B.73	Prevention of impacts to surrounding flora or watercourses from salt	Cover all salt during transport.	Construction, operation, closure and rehabilitation
B.74	Prevention of impacts to surrounding flora or watercourses from salt	Monitor dust and airborne particles.	Construction, operation, closure and rehabilitation
B.75	Prevention of impacts to surrounding flora or watercourses from salt	Store salt in open stockpile for minimum time required.	Construction, operation, closure and rehabilitation
B.76	Prevention of unauthorised third party access	Inspect site for signs of unauthorised entry.	Construction, operation, closure and rehabilitation
B.77	Prevention of unauthorised third party access	Record all access to site in a site register.	Construction, operation, closure and rehabilitation
B.78	Prevention of unauthorised third party access	Ensure visitors complete induction or are accompanied by Tellus employee whilst on-site.	Construction, operation, closure and rehabilitation
B.79	Prevention of unauthorised third party access	Dog leg smaller access tracks when joining larger roads to limit third party access by reducing access tracks visibility from the main road.	Construction
B.80	Prevention of unauthorised third party access	Mark access tracks and roads as private property.	Construction
B.81	Prevention of unauthorised third party access	Erect clear signage indicating prohibition of unauthorised entry.	Construction

ID	Outcome	Mitigation/management measure	Timing
B.82	Prevention of soil compaction and topsoil loss	Locate roads, access tracks and required operational areas on solid surfaces, where possible.	Construction
B.83	Prevention of soil compaction and topsoil loss	Limit compacted areas to minimum required.	Construction
B.84	Successful rehabilitation of disturbed areas	Develop and implement a closure and Rehabilitation Management Plan.	Pre-closure and rehabilitation
B.85	Successful rehabilitation of disturbed areas	Install erosion and sediment control temporary structures to assist with rehabilitation.	Closure and rehabilitation
B.86	Successful rehabilitation of disturbed areas	Respread spoil first, then top soil and last cleared vegetation over surfaces.	Closure and rehabilitation
B.87	Successful rehabilitation of disturbed areas	Leave any infrastructure, plant or cleared area as so detailed in a land use agreement with the land manager.	Closure and rehabilitation
B.88	Successful rehabilitation of disturbed areas	Remove all infrastructure, plant, machinery and operational and construction wastes.	Closure and rehabilitation
B.89	Successful rehabilitation of disturbed areas	Re-contour all cleared surfaces to match surrounding topography, as close as possible.	Closure and rehabilitation
B.90	Successful rehabilitation of disturbed areas	Rip any compacted areas.	Closure and rehabilitation
B.91	Successful rehabilitation of disturbed areas	Ensure final surface is rough to increase infiltration.	Closure and rehabilitation
B.92	Successful rehabilitation of disturbed areas	Block all access points to roads and tracks, unless agreed with land manager.	Closure and rehabilitation
B.93	Successful rehabilitation of disturbed areas	Fill in sumps or turkey nest, unless agreed otherwise with land manager.	Closure and rehabilitation
B.94	Successful rehabilitation of disturbed areas	Close off and seal all groundwater wells.	Closure and rehabilitation
B.95	Successful rehabilitation of disturbed areas	Re-spread top soil.	Closure and rehabilitation

7.10 Summary of risk assessment

A summary of the risk assessment undertaken for terrestrial biodiversity during construction, operation, and closure and rehabilitation of the Proposal is provided in Table 7-12.

Table 7-12 Summary of risk assessment (biodiversity)

Hazard	Pre-mitigated risk			Post-mitigated risks			Risk outcome
	Likelihood	Consequence	Risk ranking	Likelihood	Consequence	Risk ranking	
Loss of habitat and/or mortality of threatened fauna species	Possible	Major	High	Unlikely	Major	Medium	Risk reduced
Removal of vegetation	Almost certain	Moderate	High	Almost certain	Minor	High	Risk reduced
Loss of fauna habitat from removal of vegetation	Almost certain	Moderate	High	Almost certain	Minor	High	Risk reduced
Habitat fragmentation from removal of vegetation	Almost certain	Moderate	High	Possible	Moderate	Medium	Risk reduced
Fauna displacement injury or mortality from removal of vegetation	Possible	Moderate	Medium	Unlikely	Minor	Low	Risk reduced
Fauna strike (vehicle)	Possible	Catastrophic	High	Unlikely	Catastrophic	High	Risk reduced
Removal of vegetation resulting in edge effects	Almost certain	Minor	High	Possible	Minor	Medium	Risk reduced
Altered hydrology leading to flora mortality and loss of habitat	Possible	Minor	Medium	Unlikely	Minor	Low	Risk reduced
Groundwater abstraction (at 50 m below ground level) impacting vegetation	Remote	Minor	Low	Eliminated	Insignificant	Eliminated	Risk reduced
Contamination of soil and water	Possible	Minor	Medium	Eliminated	Minor	Eliminated	Risk reduced
Erosion and sedimentation of soils	Likely	Major	High	Unlikely	Major	Medium	Risk reduced
Dust deposition from vehicle traffic and earthworks	Almost certain	Minor	High	Possible	Minor	Medium	Risk reduced
Construction light, noise and vibration	Almost certain	Minor	High	Likely	Minor	Medium	Risk reduced
Operational light, noise and vibration	Almost certain	Minor	High	Likely	Minor	Medium	Risk reduced
Introduction and spread of weeds and invasive species	Likely	Minor	Medium	Unlikely	Minor	Low	Risk reduced
Increased predator species	Likely	Minor	Medium	Unlikely	Minor	Low	Risk reduced
Increased introduced fauna	Likely	Minor	Medium	Unlikely	Minor	Low	Risk reduced
Bushfire	Possible	Catastrophic	High	Possible	Minor	Medium	Risk reduced
Salt erosion and spoil erosion	Likely	Catastrophic	Extreme	Remote	Major	Medium	Risk reduced

Soil compaction and topsoil loss	Possible	Minor	Medium	Unlikely	Minor	Low	Risk reduced

7.11 Conclusion

Construction of the Proposal would result in the removal of approximately 397.5 hectares of vegetation. The removal of this vegetation would result in the loss of fauna foraging, breeding, roosting, sheltering and/or dispersal habitat. Construction of the Proposal may also result in indirect impacts including habitat fragmentation; fauna displacement, injury or mortality; fauna strike; edge effects; altered hydrology; contamination; erosion and sedimentation; dust; increased light, noise and vibration; the introduction and spread of weeds and invasive species; increased predator species; increased introduced fauna use; and an increased incidence of fire.

Operation of the Proposal may result in indirect impacts including fauna strike; altered hydrology; contamination; increased light, noise and vibration; the introduction and spread of weeds and invasive species; an increased incidence of fire; and potential impacts associated with salt runoff and windblown salt from stockpiles.

Potential impacts on flora and fauna during closure and rehabilitation of the Proposal would generally be the same as those during construction of the Proposal.

There would be no significant impact on species listed as near threatened or data deficient under the TPWC Act. None of the species are considered to have conservation significance within the proposed development footprint or vicinity, or within the wider locality. All species are locally common with a widespread distribution and there is no critical habitat for any of the species listed as near threatened or data deficient recorded or predicted to occur within the proposed development footprint or vicinity.

There would be no significant impacts on species listed as threatened under the TPWC Act and/or EPBC Act. At present, no biodiversity offsets are deemed necessary as there would be no significant impact to matters of national environmental significance during construction, operation, or closure and rehabilitation of the Proposal.

Surveys would be undertaken prior to construction to confirm the presense/absense of two matters of national environmental significance (threatened species) considered to have a low to moderate likelihood of occurrence within the propsoed development fooprint or vicinity. These are and Slater's skink (*Liopholis slateri slateri*) and the thick-billed grasswren (*Amytornis modestus indulkana*). Potential habitat for these species is located within the vicinity of the proposed Henbury Access Road. If these species are found to be present, significant impacts would be avoided through changes to the proposed alignment of the Henbury Access Road. Alternatively, a program of trapping and relocating would be implemented to avoid significant impacts to these species. If significant impacts could not be avoided, the need to calculate and deliver biodiversity offsets would be assessed in accordance with the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC 2012b) and in consultation with the DoEE.

Mitigation and management measures would be implemented to reduce potential impacts on biodiversity during construction, operation, and closure and rehabilitation of the Proposal. These measures would be incorporated into the CEMP and OEMP for the Proposal. A draft Biodiversity Management Plan and draft Bushfire Management Plan have been prepared and would be finalised prior to the construction of the Proposal.