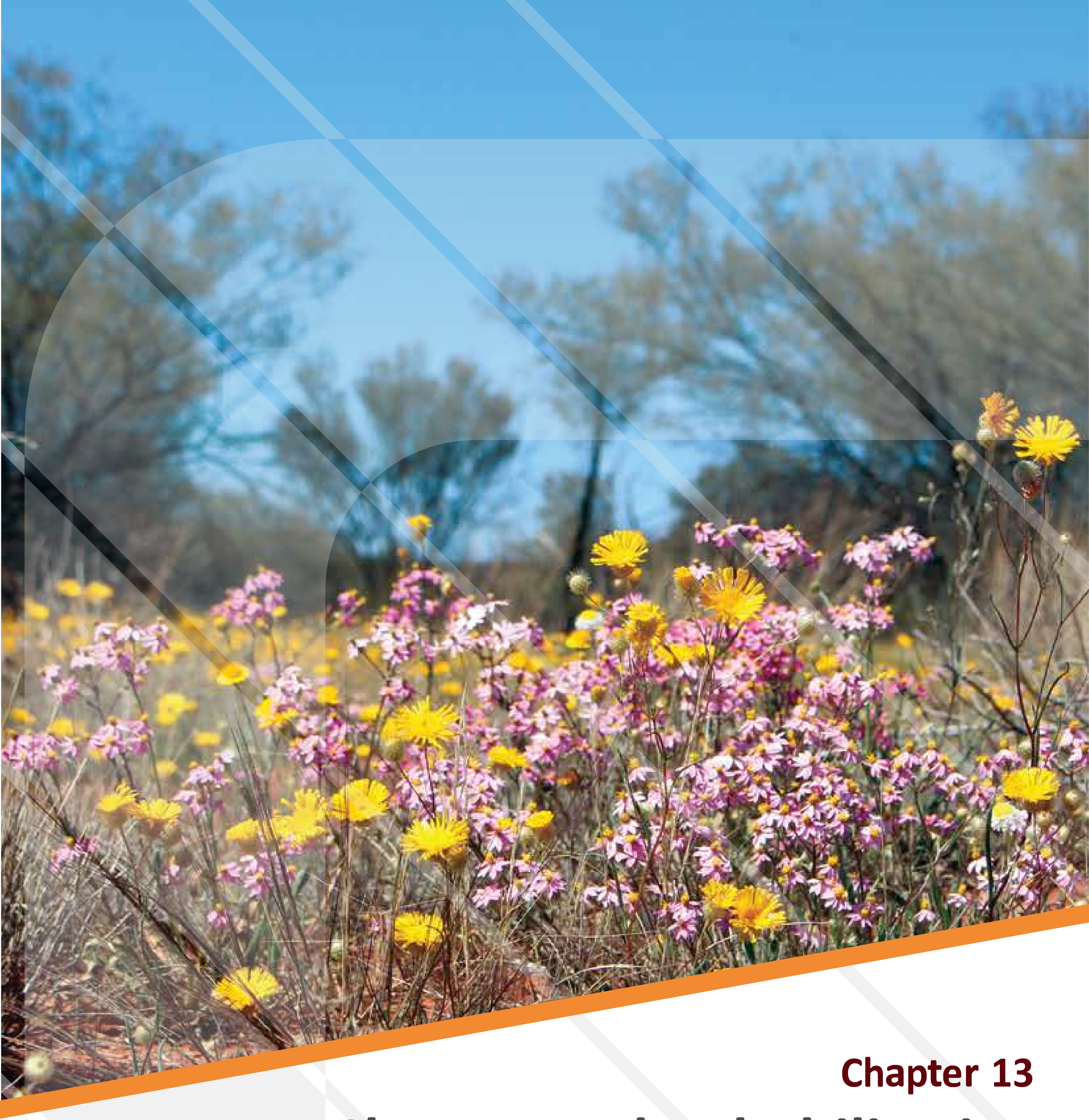

Chapter 13

Closure and Rehabilitation

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ABBREVIATIONS

AS	Australian Standards
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Authority
NT	Northern Territory
NZS	New Zealand Standard
PFS	Pre-Feasibility Study
RCP	Rehabilitation Closure Plan

13 CLOSURE AND REHABILITATION

13.1 Introduction

This chapter addresses additional risks identified by the proponent and by the NT EPA that may arise during closure and rehabilitation of the Proposal. The assessment of potential impacts resulting from the Proposal was undertaken using the risk assessment approach described in Chapter 6. The Proposal's rehabilitation strategy is described and mitigation and management measures are identified to reduce potential impacts. A draft Rehabilitation and Closure Plan is provided in Appendix J. This chapter has been prepared in accordance with the Terms of Reference (refer to Appendix A).

13.2 Methodology

A qualitative risk assessment has been undertaken for all aspects of mine and waste facility closure and rehabilitation, in accordance with the procedures outlined in the Australian and New Zealand Standards *AS/NZS ISO 31000:2009 Risk Management–Principles and Guidelines* and *HB 203:2012 (Managing Environment-Related Risk)*, using the proponent's risk assessment Matrix (refer to Chapter 6).

13.2.1 Decommissioning techniques

The intent of all decommissioning operations is to achieve the following:

- Isolate and protect all fresh water zones from ingress and egress from surface and subsurface.
- Isolate all hydrocarbon bearing zones.
- Prevent in perpetuity leaks from or into the well.
- Remove surface structures so that the landform can be rehabilitated back to its former use.

Progressive rehabilitation would be undertaken in accordance with requirements from:

- The NT *Mining Management Act*, which requires that mining companies pay a security deposit to provide for the rehabilitation of mineral leases. The deposit depends on the size of disturbed areas. The security bond (insurance) has been calculated by the proponent and would be a key factor in approving the Proposal's Mine Management Plan. The deposit is held by the NT Department of Primary Industry and Resources (DPIR). The deposit can be relinquished once the DPIR has issued a certificate of closure confirming that rehabilitation meets the agreed closure criteria.
- A mining agreement is yet to be reached between the proponent and the Central Land Council. The basis of the future agreement would be dependent on the proponent restoring disturbed areas to a condition that is reasonably compatible with the surrounding environment.

13.2.2 Rehabilitation objectives

Guiding principles for future rehabilitation of the Chandler mine and for all disturbed areas are listed in Table 13-1.

Table 13-1 Guiding rehabilitation principals

Objective	Guiding principal
Agree post-mining land use	Post mining landform should be reseeded with local native tree and shrub species using seeds from the areas of future disturbance.
Stable landform	Where necessary, stabilise slopes or disturbed ground with vegetation cover to prevent erosion and offsite sedimentation.
Pollution events	Contaminated soil would be remediated to prevent runoff and seepage.
Safe for future generations and the environment	• Mine voids would be backfilled using solid waste packaging and/or hydraulic backfill. In addition, mined salt would be used to fill in void spaces between wastes. • All disturbed areas would be stabilised to ensure they are safe for humans and fauna populations. • All hazardous materials would be removed.

13.2.3 Rehabilitation techniques

The following rehabilitation techniques would be adopted:

- Backfilling the mined salt voids with packaged and hydraulic backfill wastes. Any void space in the packaged storage rooms would be filled with fine salt.
- Internal access roads would be filled with salt.
- Backfilling mine shafts with overburden material.
- Contouring surface landforms to pre-mining levels.
- Allow for adequate drainage of surface water.
- Use original topsoil and re-instate to a depth of at least 300 millimetres. Topsoil should be used directly onto rehabilitation areas.
- Revegetation to occur following the installation of topsoil.
- Revegetation to include the use of native species.

13.3 Assessment of risk during closure and rehabilitation

Risks associated with closure and rehabilitation have been assessed throughout the environmental impact assessment chapters (refer to Chapter 7 through Chapter 19). Additional potential risks during closure and rehabilitation are discussed below.

13.3.1 Waste rock and acid mine drainage

Shaft and decline development will involve the removal of overburden which lies above the Chandler salt mining horizon.

Assessment of the overburden lithology was conducted by Tellus (2016) supported by consultant reports (Douglas Partners 2013, 2015) to determine whether the geo-chemical properties of the overburden posed any constraints to rehabilitation or necessitated specific handling and management practices.

Assessment commenced with a review of existing information relating to the geochemical and physical characteristics of overburden materials likely to be generated from the project. This included a review of all available geochemical data from the overburden sequence within a 10 kilometre radius of the proposed facility location. The assessment indicated that the overburden materials, consisting sandstones, siltstones, dolomitic siltstone and minor gypsum could be classified as Non-Acid Forming-Barren (NAF-Barren).

Examination of rock chip samples and core sample collected from the project site confirmed this assessment. The overburden materials have significant excess buffering capacity and considered to be a non-acid forming rock types with excess acid neutralising capacity.

The waste rock is chemically inactive and has no foreseeable detrimental impact to the environment (Atkins 2017).

Waste rock excavated in development will stockpiled and utilised on site for:

- Initial construction activities as common and select fill.
- Ongoing road maintenance.
- Backfilling and sealing if stockpiled material for end of mine closure.

13.3.2 Creation of ongoing environmental, social and/or economic legacy if operations cease ahead of schedule due to unforeseen circumstances, prior to planned closure and rehabilitation

Financial assurance ensures that funds are available to close and rehabilitate a site, regardless of whether the operator remains financially viable. The proponent would provide appropriate financial assurance for the expected closure and rehabilitation costs of the Proposal. The proponent intends on this financial assurance being via appropriate contributions to a security bond that is administered by the DPIR.

The proponent would agree to the final legal structure of the financial assurances to be put in place following detailed legal, tax and accounting advice and following consultation with relevant agencies within the NT Government. Such a financial assurance package would also be considered on a holistic basis with other financial assurances to be provided for the Proposal (e.g. the Institutional Control Period).

13.3.3 Changes in the assumptions used as a basis for the post-closure risk assessment

The assumptions used throughout the environmental impact assessment for the various risks considered (biodiversity, groundwater, surface water, historic and cultural heritage, economic and social, bushfire, air quality, noise and vibration, visual amenity, greenhouse gas emissions and traffic) have been worst case assumptions. Worst case assumptions are conservative and are the most commonly used method of dealing with uncertainty. Using worse case assumptions often overstates environmental impacts.

13.3.4 Natural events including earthquakes, rainfall, fire and flood

This section discusses risks from natural events (earthquakes, rainfall, fire and flood) during closure and rehabilitation of the Proposal.

Earthquakes

The risk of earthquakes during closure and rehabilitation of the Proposal is discussed in Chapter 8 and in Appendix H and Appendix M. The proposed development footprint is located within a tectonically stable plate interior, thousands of kilometres from the nearest tectonic plate boundaries that are characterised by frequent seismicity and on-going intense deformation (refer to Figure 8-19 in Chapter 8). Moreover, there have been no recorded large earthquakes within the immediate vicinity of the Proposal.

In the unlikely event that an earthquake were to occur, the proposed underground storage facility would not be affected significantly, since damaging vibrations from earthquakes occur only at the surface of the Earth. Extensive research undertaken in Japan has established the feasibility of siting geological disposal facilities for high-level radioactive waste at depths comparable to those proposed for the Chandler Facility. This research has shown that seismic vibrations are attenuated rapidly and would be very unlikely to be felt at 850 metres below ground level (the target depth for hazardous waste emplacement at the proposed Chandler Facility) (JNC 2000).

Earthquakes would only be of concern to the safety of a deep geological disposal facility if the moving fault that causes the earthquake were to intersect the facility. Seismic surveys have revealed no faulting within the proposed development footprint or in the vicinity of the Proposal (RPS 2013).

Rainfall

The site is in an arid environment which receives limited rainfall. For example, the total annual rainfall recorded at the Alice Springs Airport weather station (BoM 015590) ranges from 76 millimetres to 782 millimetres (over the 74-year monitoring period), with an annual mean of 283.5 millimetres.

Fire

The risk of bushfire during closure and rehabilitation of the Proposal is discussed in Chapter 14 and in Appendix R and Appendix X.

Mitigation and management measures proposed to reduce the incidence of bushfire during closure and rehabilitation of the Proposal are listed in Table 14-2 (refer to Chapter 14). These measures would include (but would not be limited to):

- Ensuing fuels and other flammable materials are stored appropriately and in accordance with applicable regulations.
- Ensuring bushfire suppression equipment is available on-site.
- Undertaking fuel load assessments annually to assess bushfire potential and the need for pro-active controls, e.g. back burning.
- Creating fire breaks/asset protection zones with reference to prevailing wind directions, highest wind speeds and vegetation types.

Mitigation and management measures to reduce the risk of bushfires during closure and rehabilitation of the Proposal would be developed in consultation with the NT Fire and Rescue Service.

A draft Bushfire Management Plan has been prepared for the Proposal (refer to Appendix R).

Flood

A detailed assessment of flood risk is provided in Chapter 9 and Appendix R of the EIS.

13.3.5 Water supply

Water used during closure and rehabilitation would be sourced from dedicated production bores located within the mine infrastructure area.

13.3.6 Room, shaft or decline seal failure

Geological barrier

A geo-mechanical evaluation of the salt horizon, taking into consideration the time-dependent mechanical behaviour of the Chandler Halite formation, was carried out by implementing appropriate numerical investigations (refer to Appendix K).

The objective of the geo-mechanical studies of the planned Chandler mine was achieved by employing engineering judgement in analysing the results of the geo-mechanical modelling, by making use of established experience and knowledge in utilising appropriate parameters concerning the strength and the constitutive response of the Chandler Halite mining horizon, and by realistically modelling the geometry, the *in situ* geostatic stresses and the boundary conditions that characterise the planned room and pillar mine layout.

The finite difference method was successfully used for the numerical simulation of the Proposal in investigating the development of the subsurface stress concentrations and creep response of the Chandler Halite that surrounds the planned room and pillar mine layout. With respect to the geo-mechanical response of the planned Chandler Facility, a significant element is the Jay Creek Limestone strata that overlay the Chandler formation, which have an average thickness of more than

250 metres. Provided that no major faults or prevalent systems of significant discontinuities exist, the Jay Creek Limestone will act as an enormous thick plate, with built-in-ends, that is expected to contribute significantly to the stability of the planned excavations (Atkins 2017).

Examination of the distribution of the principal stresses, for the first 23 years, indicates that the minor principal stress is essentially very close to the compressive regime. Consequently, during the first 23 years following the excavation of the panels, the possibility of developing in the roof of the rooms tensile stresses that may exceed the tensile strength of the Chandler Halite is almost unlikely (Atkins 2017). However, the excessive creep closure that has been identified in the roof of the rooms next to edge of the panels will, in all probability, result in the development of tensile cracks.

Calculation of the *Strength Factor* against shear failure for the salt pillars has shown that, even at the early life of the mine, the *Strength Factor* values indicate no shear failure. The identified *Strength Factor* values demonstrate that the Chandler Halite of the pillars, when subjected to the stress concentrations caused by the excavations, is able to endure shear stresses over a period of thirty years.

Moreover, assessment of the distribution of the minor principal stress and the Von Mises stress above the salt mine provided evidence that the 20 metre thickness of salt, which is left between the roof of the rooms and the top of the Chandler Halite, prevents the establishment of a pathway to the biosphere. Essentially, the roof salt above the underground excavations constitutes an adequate barrier that prevents the development of migration paths for potential contaminants (associated with the underground storage operations) towards the non-salt formations.

Practical experience from *in situ* measurements and observations concerning underground openings in salt formations, suggests that the identified order of magnitude of the rates of creep displacements, both along the vertical and horizontal directions, are excessive and they are expected to have a long term negative effect on the serviceability limit state of the underground excavations. The identified rates of room creep convergence are very high, indicating that the roof of the rooms (especially those rooms located near the edges of the panel) may be unstable in the long term.

In summary, the preliminary assessment of the geo-mechanical conditions of the planned Chandler Facility indicates that, although the 15 metre wide rib pillars are expected to accept the high stress concentrations while maintaining their long term stability, the 15 metre width of the roof span of the rooms is considered to be too large and will potentially result in unacceptable creep convergence of the rooms.

It is important of course to take into consideration that the derived preliminary conclusions are based on the use of assumed material parameters for the Chandler Halite which clearly have an effect both on the creep convergence of the rooms and the shear strength of the pillars. Although the assumed material parameters are based on well-established practical experience derived from designing and monitoring underground openings in salt formations, once laboratory test results from the Chandler Halite will be made available, there will be a need to re-evaluate the investigated geo-mechanical conditions.

Taking into consideration that the 15 metre width of the roof span of the rooms is considered to be too large, it is recommended to undertake a series of parametric studies to determine the maximum permissible roof span that will provide the requisite long term stability while satisfying the requirements of the serviceability limit state.

Engineered barrier

Once a decision has been taken to permanently dispose of waste fine salt will placed around the waste packages using a "snow blower" type machine to fill any voidage present. This fine salt will re-constitute around the waste packages over time due to the self-healing nature of rocksalt and the surrounding strata converging back in a controlled manner into the opening created by mining, this process is known as salt creep.

After loose salt backfilling has been completed an engineered seal or wall will be constructed at the entrance to the disposal room to permanently isolate the wastes. During the next phases of the project and particularly when operations commence further work will be undertaken to determine the appropriate room seal designs for Chandler but there are many examples of such seals in operation in evaporite mines around the world.

Underground storage and disposal rooms will have been progressively sealed during operations at the point when materials have been deemed not to have any further potential use. At the point of closure of the overall facility the remaining access roadways will be backfilled with salt and engineered seals will be placed in the shaft to control any potential pathway into the underground working.

The precise position and design of these seals will be determined during future work stages but it would be normal to include major seals towards the bottom of the shafts and decline above the salt horizon and adjacent to any aquifers encountered in the shafts. This is a well proven process and technique in similar repositories to Chandler which operate in Europe.

13.3.7 Accident during surface to underground decommissioning

Potential risks of accidents during the surface to underground decommissioning phase may occur (refer to risk assessment table in Chapter 6). To ensure accidents are avoided and minimised during surface to underground decommissioning, the proponent would administer three primary areas of regulation. They include:

1. Safety.
2. Environment.
3. Resource management (which includes groundwater bore integrity).

Under the *Mining Management Act* and associated Regulations, for a mining operation, the following would be reported to the DPIR (compliance division):

- Accidents involving injury to persons.
- Occurrences (commonly referred to as notifiable incidents for reporting purposes).

13.3.8 Climate change

The risk of climate change impacts with respect to the proposed Chandler Facility is addressed in detail in the Post Closure Risk Assessment provided in Appendix I. The preservation of the salt in the

Chandler Formation for approximately 520 million years (during which time there have been profound environmental changes) provides evidence that future climate change would not cause significant environmental changes at the level of the Chandler Facility.

13.3.9 Accidental human intrusion

Accidental human intrusion into the proposed Chandler Facility is addressed in detail in the Post Closure Risk Assessment provided in Appendix I. Inadvertent human intrusion would consist of drilling a borehole into the proposed Chandler Facility. Such human intrusion could cause an increase in the likelihood that humans and ecosystems might be exposed to levels of contamination in excess of groundwater standard and guideline values.

Accidental human intrusion cannot be ruled out entirely, however, the remote geographical location of the Chandler Facility and the lack of any obvious natural resources at the depth of the Chandler Facility make this scenario unlikely. It cannot be assumed that records of the Chandler Facility location and characteristics (e.g. emplaced wastes) will be available to future generations.

However, it is technically demanding to drill boreholes or undertake excavations to the depth of the Chandler Facility. It is a reasonable assumption that any future society with the technical capability to undertake such activities would also undertake prior investigations (e.g. seismic surveys) that would identify the Chandler Facility, thereby enabling intrusion to be avoided.

Surface monuments would be installed after closure and rehabilitation at the site of the proposed Chandler Facility. The purpose of the surface monuments would be to identify the isolation/disposal area and to prevent human intrusion and non-compatible land use in the future. A graphical representation of the type of surface monument that would be erected at the site of the proposed Chandler Facility is presented in Plate 13-1.

Plate 13-1 Graphical representation of surface monument

13.3.10 Final landform

After closure, the land surface within the proposed development footprint would be rehabilitated to as near to pre-existing conditions as possible - no voids or depressions would be left post closure of the Proposal. The creation of a stable landform would involve ripping, grading and the redistribution of topsoil from topsoil stockpiles to mimic the natural landform within the proposed development footprint. The creation of a stable landform would also require revegetation with native species and reinstatement of pre-existing drainage lines.

Rehabilitation would be guided by a detailed Closure and Rehabilitation Plan (a draft Rehabilitation and Closure Plan is included in Appendix K). Rehabilitation would also be supported through a financial security established under the *Mining Management Act 2001*.

To create the final landform, the techniques described in

13.3.11 Re-vegetation

As discussed above, the creation of a stable landform post-closure would require revegetation with native species (e.g. native grasses and shrubs). Revegetation (and monitoring of revegetation success including the potential effects of weeds) would be undertaken in accordance with a detailed Rehabilitation and Closure Plan (a draft Rehabilitation and Closure Plan is included in Appendix K).

The methodology appropriate for monitoring vegetation post-closure would be based on best industry practice at the time. The method chosen would be repeatable (and auditable) and supported by studies and scientific literature. The methodology would also be discussed with the appropriate regulatory agencies prior to implementation.

Re-vegetation during closure and rehabilitation of the Proposal would be best achieved by conserving top soil in protected locations (low windrows) at the beginning of the project development and any opportunity throughout the life of the mine. These storage mounds can be used as windrows controlling water flow around car parks or lay down areas, etc. Even 20 yr old top soil is better for re-vegetating sites than using subsoil, fertilizer and seed (LES 2017). If topsoil is not available, top soil can be harvested with a grader or front end loader from adjacent areas of the same land form in a mosaic pattern, on the contour, to a depth of about five centimetres and spread over the site being re-vegetated.

Re-vegetation would be undertaken after the site has been decommissioned, cleared, ripped to remediate compacted areas, levelled to match local contours and available top soil spread at a shallow thickness, (up to five centimetres) and tined into the subsoil. If there is concern that seed will not be viable in the top soil, local native seed may be collected over the previous year and broadcast spread over the site at the time of scarifying the top soil.

Low dosage of standard blood and bone or fertiliser rich in nitrogen, phosphorus and potassium may also be spread at the time the seed is spread. This exercise should be completed before the summer rainy period, up till October or November. If dead shrubbery or dried grasses are available to scatter over the re-vegetating sites it will be an advantage.

After a year, the re-vegetating sites would be monitored and compared with adjacent areas to assess success of the re-vegetation. If adequate rainfall has occurred and there are holes in the distribution of vegetation due to inadequate soils, more intensive effort to re-vegetate these areas can be undertaken using additional mature seed and fertiliser raked into the soil. Correcting any run-off problems should also be undertaken at this time.

Collection of native grasses, shrubs and tree seeds should be undertaken a year or so ahead of closure to allow seed to mature. Seed should be collected from the local area or plants which are growing in similar land forms to those that are being re-vegetated. Seed should be stored in paper bags in air conditioned premises. Planting of root stock nursery plants is not normally appropriate for these conditions, but may have occasional specialised need

13.3.12 Final land use

The same or similar land use capabilities would exist after closure and rehabilitation to those that existed prior to the development of the Proposal. Land use would be restricted to pastoral (grazing) through a covenant unless other beneficial land uses are pre-determined and agreed upon with the NT Government.

13.4 Mitigation and monitoring

Mitigation and management measures proposed to minimise impacts during closure and rehabilitation of the Proposal are listed in Chapter 7 through Chapter 19. Additional mitigation and management measures proposed to minimise impacts during closure and rehabilitation of the Proposal are listed in Table 13-2. These measures would be incorporated into a RCP. A draft RCP has been prepared for the Proposal (refer to Appendix J).

Table 13-2 Mitigation and management measures (closure and rehabilitation)

ID	Outcome	Mitigation/management measure	Timing
CR.1	Return of the development footprint to near original condition.	Adopt the principles set out in the draft RCP (refer to Appendix L). Such principals would include (but would not be limited to): • Decontaminate structures (if necessary) and wash down prior to the commencement of demolition works. • Determine safe and efficient dismantling procedures and prepare a demolition plan. • Pull structures to ground and dismantle. • Break down concrete slabs and footings to a depth of one metre below the finished ground surface. • Remove or bury services at a depth of at least one metre below the final ground surface. • Leave buried pipes *in situ* and flush and seal each end. • Dispose of non-recyclable and inert waste in an on-site landfill, or similar. • Ensure access roads required to be left for post closure monitoring purposes are defined and retained. All areas are ripped to break compaction prior to overburden and/or topsoil application.	Closure and rehabilitation
CR.2	Monitoring of rehabilitation and annual reporting on performance and objectives	Undertake monitoring of rehabilitation (including vegetation regrowth) and annual reporting on performance and objectives. Includes monitoring of vegetation regrowth and surface water and groundwater monitoring as per the requirements of the Water Management Plan (refer to Appendix O).	Closure and rehabilitation

ID	Outcome	Mitigation/management measure	Timing

CR.3	Maintenance works/remedial action taken, if needed.	Should visual inspections or monitoring results indicate the need for maintenance works or remedial action to be undertaken, mobilise contractors to site to undertake these works. Works may include:
		• Vegetation – if rehabilitation is failing, additional application of fertiliser, additional seeding or planting may be required.
		• Erosion - if significant erosion is identified or rehabilitation is not progressing towards a self-sustaining community, the following remedial actions may be considered:
		  o Construct, improve, or repair drainage control measures to reduce water movement down outer slopes of the landform.
		  o Remediate areas of deep erosion and/or instability with appropriate material.
		• Access - remedial works would be required if access prevention measures fail to restrict unauthorised access.
			Closure and rehabilitation

CR.4	Notification of accidents	Any one of the following events would become a notifiable incident: • Extensive subsidence, settlement or fall of ground or any major collapse of any part of the operations of a mine, or any earth movement caused by a seismic event. • Outbreak of fire above or below ground in any mine. • Breakage of a rope, cable, chain or other gear by which persons are raised or lowered. • Inrush of water from old underground operations or other sources. • Accidental ignition of dust below ground; The discovery of the presence of potentially harmful or asphyxiant gas, or an outburst of such gas in any part of a mine. • Accidental ignition or detonation of explosives, or any delayed or fast ignition of explosives. • Explosion or bursting of compressed air receivers, boilers, or pressure vessels. • Every electric shock or burn to a person and every dangerous occurrence involving electricity. • Incidence of a person being affected by poisoning or exposure to toxic gas or fumes.	Closure and rehabilitation

ID	Outcome	Mitigation/management measure	Timing
		• Loss of control of heavy earth-moving equipment, including failure of braking or steering.	

13.5 Summary of risk assessment

A summary of the risk assessment undertaken for closure and rehabilitation of the Proposal is provided in Table 13-3.

Table 13-3 Summary of risk assessment (closure and rehabilitation)

Hazard	Pre-mitigated risk			Post-mitigated risks			Risk outcome
	Likelihood	Consequence	Risk ranking	Likelihood	Consequence	Risk ranking	
Room seal failure	Possible	Minor	Medium	Remote	Minor	Low	Risk reduced
Accident during surface to underground decommissioning	Remote	Catastrophic	Medium	Remote	Catastrophic	Medium	Risk same
Shaft seals fail	Remote	Major	Medium	Eliminated	Moderate	Eliminated	Risk reduced
Decline seals fail	Remote	Insignificant	Low	Eliminated	Insignificant	Eliminated	Risk reduced
No surface remediation (environmental)	Unlikely	Minor	Low	Remote	Minor	Low	Risk reduced
No surface remediation	Unlikely	Major	Medium	Remote	Major	Medium	Risk reduced
No groundwater monitoring	Remote	Moderate	Low	Remote	Minor	Low	Risk reduced
No gas monitoring is undertaken	Remote	Minor	Low	Eliminated	Minor	Eliminated	Risk reduced
No institutional control period monitoring	Possible	Moderate	Medium	Unlikely	Minor	Low	Risk reduced
Future land uses (other land grazing)	Remote	Insignificant	Low	Eliminated	Insignificant	Eliminated	Risk reduced
Earthquakes	Remote	Insignificant	Low	Remote	Insignificant	Low	Risk same
Climate change	Possible	Insignificant	Low	Possible	Insignificant	Low	Risk same
Human intrusion	Remote	Minor	Low	Eliminated	Minor	Eliminated	Risk reduced

13.6 Conclusion

Risks associated with closure and rehabilitation have been assessed throughout the environmental impact assessment chapters (refer to Chapter 7 through Chapter 19). Additional potential risks during closure and rehabilitation include:

- **Creation of ongoing environmental, social and/or economic legacy if operations cease ahead of schedule due to unforeseen circumstances, prior to planned closure and rehabilitation.** To avoid these risks, the proponent would provide appropriate financial assurance for the expected closure and rehabilitation costs of the Proposal.

- **Changes in the assumptions used as a basis for the post closure risk assessment.** Worst case assumptions were used throughout the environmental impact assessment for the various risks considered. Worst case assumptions are conservative and the most commonly used method of dealing with uncertainty (and often overstate environmental impacts)
- **Natural events including earthquakes, rainfall, fire and flood.** The proposed development footprint is located within a tectonically stable plate interior and there have been no recorded large earthquakes within the immediate vicinity of the Proposal. In the unlikely event that an earthquake were to occur, the proposed underground storage facility would not be affected significantly, since damaging vibrations from earthquakes occur only at the surface of the Earth.

  The potential for rainfall and flooding delaying or disrupting closure and rehabilitation activities has been assessed as having low risk. The continual monitoring of rainfall at the Chandler and Aprinta Facilities is recommended to determine annual average monthly rainfall. During months with higher average rainfall, it is recommended to avoid undertaking large scale closure and/or rehabilitation works.

  The risk of bushfire would be mitigated by ensuring fuels and other flammable materials are stored appropriately on-site; ensuring bushfire suppression equipment is available on-site; undertaking annual fuel load assessments to assess the potential need for pro-active controls (e.g. back burning); and creating fire breaks/asset protection zones.
- **Water supply.** Water used during closure and rehabilitation would be sourced from a dedicated production bore located within the mine infrastructure area.
- **Room, shaft or decline seal failure.** The geological and geotechnical properties of the Halite Formation has been quantitatively and qualitatively assessed (Atkins 2016). Spontaneous roof collapse is regarded as having low risk. However, recommendations have been made by Atkins (2016) to reduce the width of the current design of the waste emplacement rooms (currently 15 metres wide). The proponent is committed to undertaking further geotechnical drilling and analysis of the Chandler Halite Formation. During the next phases of the project and particularly when operations commence further work will be undertaken to determine the appropriate room, shaft and decline seal designs for the proposed Chandler facility. Sealing of evaporite mines is well proven process and technique in similar repositories to Chandler which operate in Europe and elsewhere in the world.
- **Accident during surface to underground decommissioning**. With appropriate management measures in place, the risks of accidents occurring during surface to underground decommissioning are reduced. However, the proponent has identified three key areas of governance for this stage of work (see above). In addition, the proponent has identified the different types of accidents that may occur and be notifiable under the NT *Mining Management Act* and associated Regulations.
- **Climate change.** The preservation of the salt in the Chandler Formation for approximately 520 million years (during which time there have been profound environmental changes)

provides evidence that future climate change would not cause significant environmental changes at the level of the Chandler Facility.

- **Accidental human intrusion.** Inadvertent human intrusion would consist of drilling a borehole into the proposed Chandler Facility. It is technically demanding to drill boreholes or undertake excavations to the depth of the Chandler Facility. It is a reasonable assumption that any future society with the technical capability to undertake such activities would also undertake prior investigations (e.g. seismic surveys) that would identify the Chandler Facility, thereby enabling intrusion to be avoided. Surface monuments would be installed after closure and rehabilitation at the site of the proposed Chandler Facility. The purpose of the surface monuments would be to identify the isolation/disposal area and to prevent human intrusion and non-compatible land use in the future.
- **Final landform.** After closure, the land surface within the proposed development footprint would be rehabilitated to as near to pre-existing conditions as possible - no voids or depressions would be left post closure of the Proposal.
- **Re-vegetation**. Revegetation would be undertaken using native species (e.g. native grasses and shrubs). Monitoring of revegetation success, including the potential effects of weeds, would be undertaken post-closure. The methodology for monitoring vegetation would be based on best industry practice at the time.
- **Final land use**. The same or similar land use capabilities would exist after closure and rehabilitation to those that existed prior to the development of the Proposal. Land use would be restricted to pastoral (grazing) through a covenant unless other beneficial land uses are pre-determined and agreed upon with the NT Government.
- Closure and rehabilitation would be undertaken in accordance with the Rehabilitation and Closure Plan that would be finalised following completion of detailed design.