7 Identification and Assessment of Environmental Factors

7.1 Identification of factors

A number of baseline surveys have been commissioned to date for the Project, and for a range of other mining projects associated with the Lake Way Area; these include surveys completed by Toro Energy and Blackham. These historical surveys have been utilised to help support the knowledge for this project to obtain an understanding of the regional impact of the project. Surveys undertaken to date are listed in **Appendix B**.

Project implementation is unlikely to result in any adverse environmental impact.

Table 7-1 provides an assessment of the environmental factors identified as being relevant to the Project.

Table 7-1: Environmental Factors for the Lake Way SOP Demonstration Plant Project

Theme	Factor	On Playa Development Envelope	Off Playa Development Envelope
Sea	Benthic Communities Habitat	N/A	N/A
	Coastal Processes	N/A	N/A
	Marine Environmental Quality	N/A	N/A
	Marine Fauna	N/A	N/A
Land	Flora and Vegetation	N/A	✓
	Landforms	✓	N/A
	Subterranean Fauna	N/A	N/A
	Terrestrial Fauna	N/A	✓
	Terrestrial Environmental Quality	N/A	✓
Water	Hydrological Processes	✓	N/A
	Inland Waters Environmental Quality	✓	N/A
Air	Air Quality	N/A	N/A
Human Health	Social Surrounds	✓	✓
	Human Health	N/A	N/A

Table 7-2 summarises the reasoning behind the assessment of the environmental factors for the Project. Information regarding each of the environmental factors considered - including a description of the potential environmental impact and preliminary management and mitigation actions - is contained in this section.

When developing the mitigation and management measures for this project, the following hierarchy of control was considered:

- **Avoidance**: Significant avoidance and minimisation measures have been incorporated into decision making and project design.
- **Minimisation**: Measures that minimise an impact (for example by storing hydrocarbons in impermeable storage areas).
- **Reduction**: Measures that reduce or eliminate the impact of an activity (for example implementing measures to reduce dust emissions from vehicle travel on unsealed roads).
- **Correction**: Measures that correct or rectify an impact (for example via restoration, repair, or rehabilitation).
- **Compensation**: Measures to compensate for impacts from project activities (for example by replacing lost or damaged environmental components in kind or with agreed substitute resources).

The mitigation and management measures identified in this section will be included in the Environmental Management Plan associated with the Project. This plan will include monitoring programs, which will be used to verify impact predictions and the effectiveness of the mitigation and management measures.

An adaptive management framework will exist during implementation, and the plan will be updated as required according to new information or changing circumstances, experiences and lessons.

Table 7-2 : Summary of Assessment of Environmental Factors for the Lake Way Demonstration Plant Project

Theme	Factor	Relevant Section of this Document	Comment
Sea	Benthic Communities Habitat	-	Not applicable as the project is not coastal; no further assessment to these factors is included in this report.
	Coastal Processes	-	
	Marine Environmental Quality	-	
	Marine Fauna	-	
Land	Flora and Vegetation	7.2.1	A level 1 flora and vegetation assessment is provided as **Appendix C.** The Project will require a total disturbance of 804 ha, of which no greater than 47 ha (6%) of native vegetation will be impacted. The remaining area within the proposed disturbance footprint comprises bare playa surface. The disturbance On-playa will not require the clearing of native flora and vegetation. No vegetation of conservation significance will be impacted from the implementation of the project. The Project is not located within Environmentally Sensitive Areas, Schedule 1 Areas, DBCA managed land or within areas mapped as Threatened Ecological Communities. Priority Ecological Communities associated with Subterranean Fauna do occur within or near the Development Envelope, however these will not be impacted by the development of the Project. Potential impacts on fringing vegetation (such as *Tecticornia* spp.) have been considered, and modelling has been completed of groundwater drawdown for the project. This modelling has shown that there is a minimal change to groundwater contours from the abstraction of brine from the Lake (**Appendix D**). The hydrogeological zone of influence associated with brine abstraction will not extend to the riparian areas in which samphire vegetation occurs (Figure 7-2). Based on the above, impacts to Flora and Vegetation are not considered a significant factor for the project and any clearing can be managed under a Native Vegetation Clearing Permit under Part V of the *Environmental Protection Act 1986*

Theme	Factor	Relevant Section of this Document	Comment
	Landforms	7.2.2	Lake Way is neither a unique nor an uncommon landform. The playa landform will not be significantly altered by project implementation. Proposed disturbance on the playa landform will modify less than 3.6% of the playa surface (including some areas previously disturbed by other mining activities).
	Subterranean Fauna	-	The most prospective land system in the general project locality to support subterranean fauna is the Cunyu land system (Outback Ecology 2012) (Abrams et al. 2012; Humphreys 2001; Karanovic 2008). The calcretes within this system have well-developed secondary porosity and high permeability, so associated aquifers are suitable for occupation by stygofauna and the vugs above the water table are suitable for utilisation by troglofauna. No part of the project development envelopes (including the groundwater drawdown cone associated with brine abstraction) intersects the Cunyu land system. The lake sediments from which brine will be abstracted is not considered suitable habitat for stygofauna and/or troglofauna due to the very high salinity (>100,000mg/L TDS) and, in parts of the system, low porosity. There are no impacts on subterranean fauna from the project implementation.
	Terrestrial Fauna	7.2.4	A terrestrial fauna level 1 assessment was completed as part of this proposal and is included as **Appendix E**. The assessment did not identify any significant impacts from the implementation of the proposal. Impacts to terrestrial fauna, if any, can be managed through controls (for example, egress matting in trenches and ponds) established under the Mining Proposal administered under the *Mining Act 1978* and the Native Vegetation Clearing Permit under Part V of the *Environmental Protection Act 1986 (for example, pre-clearing inspections of proposed clearing areas not more than 2 weeks prior to clearing to check for possible presence of conservation-significant fauna)*.
	Terrestrial Environmental Quality	7.2.3	The development of this project will require limited storage of dangerous or hazardous materials associated with plant operations (e.g. diesel fuel). The assessment did not identify any specific impacts from the development of the proposal on the surrounding environment. Impacts to terrestrial environmental quality, if any, can be managed through the Mining Proposal administered under the *Mining Act 1978* and Dangerous Goods Licensing requirements.

Theme	Factor	Relevant Section of this Document	Comment
Water	Hydrological Processes	7.2.5	Surface and groundwater hydrological processes will be altered at a local scale by the project, through the construction of infrastructure on the Lake surface and abstraction of groundwater from the on-playa aquifer. **Pond & Trench Construction** A flood study has been completed and is attached as **Appendix F**. Modelling shows that construction of ponds on the lake surface will result in negligible local increases in water levels, being less than a 0.05m rise in water level associated with a 1% Annual Exceedance Probability (AEP). This change in water level will not impact lake invertebrates or the fringing *tecticornia* vegetation. The development of the Project will have no material impact on hydrological processes. Hydrological processes can be managed under Part V of the *Environmental Protection Act 1986* (Prescribed Premise), the Mining Proposal under the *Mining Act 1978* and relevant licence conditions under the 5C abstraction licence administered under the *Rights in Water and Irrigation Act 1914*.
	Inland Waters Environmental Quality	7.2.6	SO4 engaged Pendragon to undertake an Acid Sulphate Soils assessment for the project (**Appendix L**). The analysis concluded that the sediments underlying the lake show no significant sulfidic or sulphuric materials and/or MBO's, and the lake system has significant buffering capacity to neutralise potential impacts, if any. Based on this, SO4 believes that there is insignificant impact from the implementation of the Project.
Air	Air Quality	7.2.7	The site is relatively remote, with the closest population centre being the town of Wiluna, approximately 25km northwest of the Project. **Construction** Dust from construction activities have the potential to occur, however will be appropriately managed through standard operating procedures. **Operations** Some dust may be generated by vehicular movements however this will be insignificant due to the small workforce and vehicle movement required.

Theme	Factor	Relevant Section of this Document	Comment
			Very little dust will be generated by brine extraction and processing, as solar salt production is fundamentally a wet process. Power supply will be through generators, however the volume of diesel burned will produce minimal greenhouse gas emissions. Overall impact to air quality is insignificant.
Human Health	Social Surrounds	7.2.8	A number of registered Aboriginal heritage sites are known to exist in the project locality, including in areas within the proposed off-playa development envelope. A number of heritage sites (or their buffers) appear to intersect the proposed process water pipeline route from the Matilda South pit (notwithstanding that the pipeline route follows an existing track). In addition, mining tenure is held by a third party and underlying pastoral operations and there is potential for project implementation to affect the interests of these stakeholders. The development of the project has been done in consultation with key local stakeholders, being native title holders, pastoralists, Shire of Wiluna and owners of mining tenure. To date, all issues raised have been addressed by SO4 and incorporated into the design of the Project. SO4 will continue to consult with the relevant stakeholders to optimise project layouts so that impacts of cultural heritage values can be avoided. If required, a consent will be sought to access/disturb heritage areas via Section 18 authorisation under the *Aboriginal Heritage Act 1972*.
	Human Health	7.2.9	The project is relatively remote, with the closest population centre being the town of Wiluna, approximately 25km northwest of the Project. The Blackham mining camp, Milliebillie and Lake Way stations are located between 15 and 20km from the Project. Implementation of the project is unlikely to result in any adverse impacts on the health or amenity of the Wiluna township or outlying communities. None of the products or by-products produced by the project are radioactive and there is no risk of exposure to radioactive products or wastes as a result of project implementation. An assessment of matters of national environmental significance, including radiation, has been undertaken and included as **Appendix H** to this report.

7.2 Preliminary Assessment of Environmental Factors

This section of the report provides a summary of the environmental factors considered for the proposal, potential impact, relevant management actions and predicted outcomes.

Relevant technical works have been provided in the Appendices of this report.

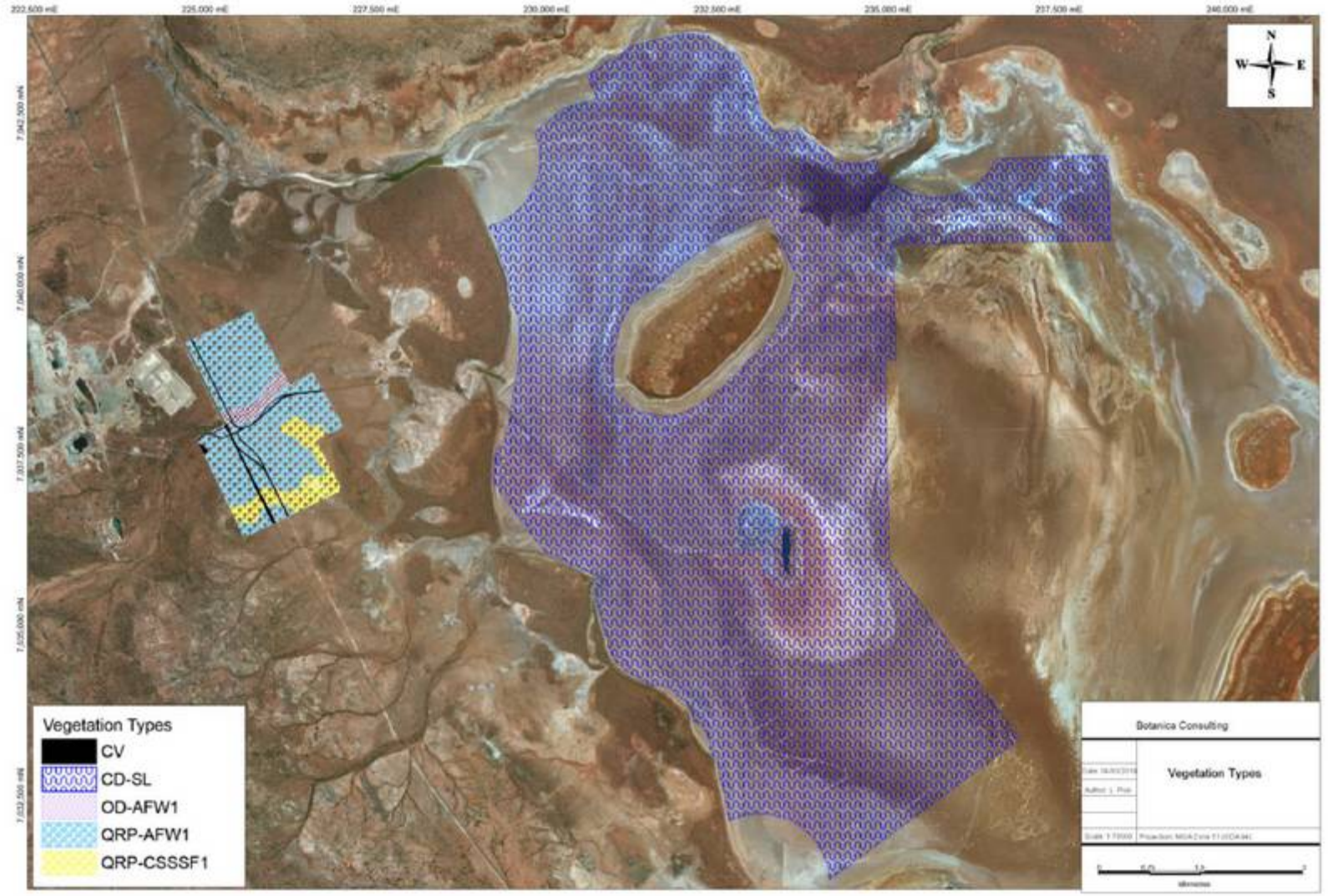
7.2.1 Flora and Vegetation

EPA Objective: To protect flora and vegetation so that biological diversity and ecological integrity are maintained	
Legislation, policy and Guidance	• EPA - Statement of Environmental Principles, Factors and Objectives (EPA 2016a). • Environmental Impact Assessment (EIA) (Part IV Divisions 1 and 2) Administrative Procedures 2016 (EPA 2016b). • EIA (Part IV Divisions 1 and 2) Procedures Manual 2016 (EPA 2016c). • EPA Factor Guideline – Flora (EPA 2016f). • Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016h). • *Environmental Protection Act 1986.* • *Agriculture and Related Resources Protection Act 1976.* • *Biosecurity and Agriculture Management Act 2007.* • *Wildlife Conservation Act 1950.* • *Biodiversity Conservation Act 2016.* • *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth).
Relevant Documentation	**Appendix C:** Level 1 Flora and Vegetation Report **Appendix F:** Hydrological Assessment
Receiving Environment	**On Playa:** • One broad vegetation type was identified in the survey area (Figure 7-1), classified as 'bare salt lake' (**Appendix C**) • No terrestrial or aquatic TECs or PECs are present within the on-playa Development Envelope. • No Commonwealth or State listed Threatened flora were recorded within the on-playa Development Envelopes. **Off Playa** • Three broad vegetation types were defined and mapped (Figure 7-1); with the major vegetation type for each being "Acacia Forest and Woodland" and "Chenopod, Shrulands, Samphire Shrublands and Forblands" • No TEC or PECs are present within the off-playa Development Envelope associated with the terrestrial flora. • No Commonwealth or State listed Threatened flora were recorded within the Development Envelopes. Flora and vegetation communities are widespread and well represented at a local and regional level. • The majority of the vegetation assessed was classified as 'very good'

EPA Objective: To protect flora and vegetation so that biological diversity and ecological integrity are maintained	
	
Potential Impacts	**On Playa:** • Alteration to drainage patterns due to the construction of ponds, trenches and associated infrastructure, resulting in drainage shadow/inundation impacts. • Alteration to the groundwater regime due to abstraction of saline water from trenches on the lake surface. • Loss of biological diversity and reduced regional representation of flora and vegetation communities. **Off Playa:** • Localised loss of vegetation from clearing (approximately 47 ha). • Introduction of new and/or spread of existing weed species due to increased activity in the local area. • Increased fire risk. • Death of vegetation due to saline water spills or leaks from pipe failures.
Mitigation and Management Measures	• Disturbance to native vegetation has been minimised, with the majority of the disturbance occurring on the salt flats which are devoid of vegetation.; and the utilisation of existing infrastructure (e.g. access roads). • The total disturbance impact off-playa has been reduced as far as practical, with the final off-playa Project footprint reduced to 47ha. • Monitoring of subsurface water levels to ensure that fringing tecticornia habitats are not impacted. • Flood modelling has been completed to show no flood inundation or shadow effects. • Flood modelling has identified that a minimal change in water level in extreme flood events (1% AEP) will occur from the implementation of this Project. Based on this, there will be no change on the fringing *tecticornia* habitat. • Trenches located a considerable distance (greater than 750 m) from the lake fringes; modelling has shown that the groundwater drawdown is minimal and will not alter the current groundwater levels in and around fringing vegetation (Refer **Appendix D**). • Off playa infrastructure is located such that There will be no direct impact on the mapped *Tecticornia* spp habitat (Refer Figure 7-1) through clearing. • Vehicles will be restricted to designated roads and tracks to minimise the potential distribution of weeds. • Project design has considered location of drainage lines and flood levels in off playa areas with the aim of minimising disturbance of these. • Saline pipelines will be bunded and inspected daily for leaks. • A dust management plan will be developed to outline dust control measures. These will include, but not be limited to speed limits, use of dust

EPA Objective: To protect flora and vegetation so that biological diversity and ecological integrity are maintained	
	suppressants to minimise dust lift-off, use of water carts and restricting works during high-wind conditions. • Implementation of a vegetation health monitoring program during operations to monitor and assess vegetation health through to closure.
Predicted Outcome	The project will disturb up to approximately 804 ha, of which 47 ha (6%) is native vegetation. Vegetation that will be impacted is not threatened or of high conservation significance and are well represented locally and regionally. Secondary impacts, through groundwater drawdown or alteration of surface flows, can be effectively managed to minimise the impact on receiving environment. The project has been developed such that: • There will be no direct impact to the fringing *Tecticornia* spp. through clearing • Drawdown has been mapped from the trench infrastructure and will not impact the fringing vegetation (Figure 7-2). • Flood study has been completed and shows no impact on fringing vegetation (Figure 7-3). Based on the above, SO4 has assessed that the impact is minimal and can be managed through supplementary approvals processes, being a Native Vegetation Clearing Permit and Mining Proposal / Mine Closure Plan administered through the DMIRS.

Figure 7-1 : Vegetation Condition associated with the Proposal



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Legend

- Lake Development Envelope
- Tenement Boundary
- Tecticornia
- On Lake Ponds
- Lake Way Causeway
- Access Road
- Williamson Pit
- Brine Pipeline
- Trench

Maximum Drawdown Contour (m)

- 0.5
- 1.0
- 1.5
- 2.0
- 2.5

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- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

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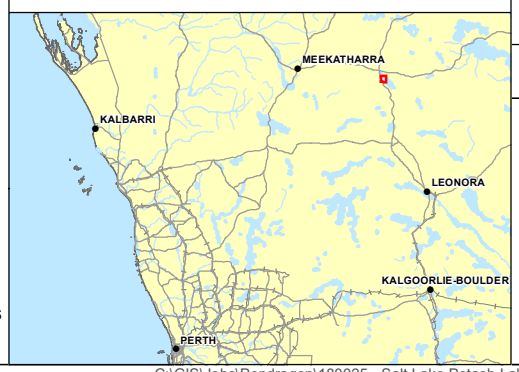

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
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Legend

- Lake Development Envelope
- Tenement Boundary
- Tecticornia
- On Lake Ponds
- Lake Way Causeway
- Access Road
- Williamson Pit
- Brine Pipeline
- Trench
- 100 Year Pre 491.716 mAHD
- 100 Year Post 491.760 mAHD

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
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- AERIAL PHOTOGRAPHY SOURCED ESRI WORLD IMAGERY

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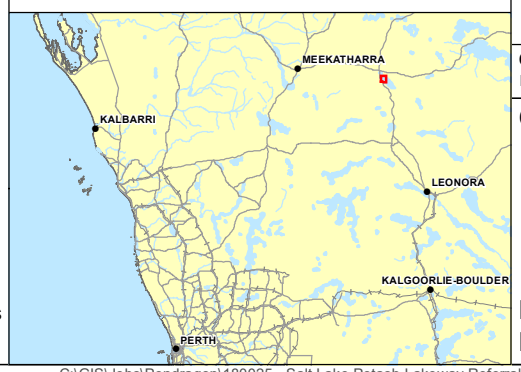
- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS

LOCALITY



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7.2.2 Landforms

EPA Objective: To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected	
Legislation, policy and Guidance	• EPA - Statement of Environmental Principles, Factors and Objectives (EPA 2016a). • Environmental Impact Assessment (EIA) (Part IV Divisions 1 and 2) Administrative Procedures • 2016 (EPA 2016b). • EIA (Part IV Divisions 1 and 2) Procedures Manual 2016 (EPA 2016c).
Relevant Documentation	**Appendix I:** Pond Design
Receiving Environment	• The landform and surrounding area is disturbed due to historical mining and exploration activity • No landforms within the Lake Way Potash Project Development Envelopes are listed on the Western Australian Geoheritage Sites database. • The Lake Way playa is not classified as a nationally important wetland
Potential Impacts	**On Playa** • Temporary and permanent changes to the On-Playa environment due to the construction of ponds, trenches and associated infrastructure. **Off Playa** • Changes to the surrounding landform due to the construction of infrastructure.
Mitigation and Management Measures	The project will have an on-playa development envelope of 5,290 ha, with a disturbance footprint of 757 ha. The total lake area is approximately 20,850 ha, and therefore the overall area of the on-playa disturbance footprint is 3.6%. Off-playa footprint has been sited near existing infrastructure and parts have been previously been disturbed. Impacts related to landforms will be managed through the following management actions: • Limiting the height of constructed landforms such that they blend with the natural landscape. • On Playa infrastructure to be constructed from materials sourced from the Lake, including naturally-occurring clays and waste halite materials. • Progressive construction of on-lake ponds and trenches limits overall disturbance. • Clearing activities will be managed to ensure clearing is strictly limited to that necessary for the operations.
Predicted Outcome	Final landform design for the Lake Way Potash Project will be developed as part of the Mine closure Plan. The main aim being the creation of a safe, stable, non-polluting landform that blends in with the surrounding landscape. SO4 considers that the EPA Objective for this factor can be achieved.

7.2.3 Terrestrial Environmental Quality

EPA Objective: To maintain the quality of land and soils so that environmental values are protected	
Legislation, policy and Guidance	• EPA - Statement of Environmental Principles, Factors and Objectives (EPA 2016a). • Environmental Impact Assessment (EIA) (Part IV Divisions 1 and 2) Administrative Procedures 2016 (EPA 2016b). • EIA (Part IV Divisions 1 and 2) Procedures Manual 2016 (EPA 2016c). • EPA Factor Guideline – Terrestrial Environmental Quality (EPA 2016m). • *Environmental Protection Act 1986* (Part V – Works Approvals and Licencing). • *Contaminated Sites Act 2003*.
Relevant Documentation	**Appendix C:** Level 1 Flora and Vegetation Report
Receiving Environment	• The project lies within the Murchison province and the Ashburton province of Western Australia. These land systems consist of hardpan wash plains, sand plains and stony plains • The on-playa infrastructure is located within the Carnegie landscape system (salt lakes with fringing saline alluvial plans). • The off-playa infrastructure is located within the Gabanintha and Killara landscape systems (greenstone ridges, basalt hills with patchy acacia and spinifex vegetation).
Potential Impacts	• Contamination of soils through spillage of reagents, chemicals, hydrocarbons or saline water. • Increased erosion following rainfall events.
Mitigation and Management Measures	• Saline pipelines in off playa areas will be located within bunds to prevent uncontrolled discharge of saline water to the environment. • Regular inspections of pipelines will allow early detection of pipe failure. • Reagents and hydrocarbons will be stored within bunded areas. • Solid process residues will be used for on playa embankment raises. • Liquid process residues will be either re-used for dust suppression within on playa roads or disposed of within the On-Playa Bitterns Pond. • Spill kits will be located at strategic locations throughout the Lake Way Potash Project area and employees trained in their use. • Appropriate drainage design to manage runoff and surface flow to prevent erosion. • Flood study (Knight Piezold, 2019) identified that the construction of the infrastructure (post-development model) will not increase flow velocities such that scoring may occur, upto the 1% AEP flood level.
Predicted Outcome	Impacts to terrestrial environmental quality are expected to be minimal due to location of 94% of project disturbance being within the on playa hypersaline environment. Implementation of standard industry practices for transport, storage and handling of hydrocarbons, reagents will ensure adverse impacts to terrestrial environmental quality are prevented or minimised. Operations shall be in accordance with the approved Operating Strategy and 5C licences held under the *RIWI Act*, the approved Mining Proposal under the *Mining Act* and Environmental Licence under Part V of the *EP Act*. For these reasons, SO4 believe that the EPA Objective for this factor can be met.

7.2.4 Terrestrial Fauna

EPA Objective: To protect terrestrial fauna so that biological diversity and ecological integrity are maintained	
Legislation, policy and Guidance	• EPA - Statement of Environmental Principles, Factors and Objectives (EPA 2016a). • Environmental Impact Assessment (EIA) (Part IV Divisions 1 and 2) Administrative Procedures 2016 (EPA 2016b). • EIA (Part IV Divisions 1 and 2) Procedures Manual 2016 (EPA 2016c). • EPA Factor Guideline – Terrestrial Fauna (EPA 2016g). • Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016n). • Technical Guidance – Terrestrial Fauna Surveys (EPA 2016o). • Technical Guidance – Sampling of Short Range Endemic Invertebrate Fauna (EPA 2016p). • Environment Protection Act 1986. • Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth).
Relevant Documentation	**Appendix E**: Fauna Survey **Appendix M:** Lake Way Ecological Monitoring Report **Appendix K**: Matters of National Environmental Significance Report
Receiving Environment	• Five fauna habitats have been recorded in the development envelopes (Figure 7-4). • A matters of National Environmental Significance search identified a range of migratory and non-migratory species associated with the area, including the night parrot, malleefowl • Vertebrate fauna has limited diversity within the lease area, with the lake bed and surrounding flats having limited complexity and productivity during dry periods. • Productivity within the project area is likely to increase dramatically following high rainfall events, in particular the macroinvertebrate fauna associated with the lake. • Surveys and monitoring of the macroinvertebrate fauna has been undertake for by a range of consultants, with the last survey being completed by Focus Vision Consulting in 2017.
Potential Impacts	• Bamford (2019) noted that the aquatic macroinvertebrate of Lake Way appears to be lower than at the similar Lake Wells. • Bamford (2019) identified that the project would have negligible impact on Night Parrot, as no mature spinifex grasslands would be impacted by the proposal. • Alteration of lake hydrology resulting in habitat modification/loss. Localised alteration to subsurface hydrology could impact invertebrate fauna; many of these species are considered widespread. • Ongoing mortality (vehicle interactions; entrapment) from operations. • Habitat loss. • Species interactions including feral and overabundant native species. • Disturbance (dust, light, noise).

EPA Objective: To protect terrestrial fauna so that biological diversity and ecological integrity are maintained	
Mitigation and Management Measures	• The change in lake hydrology is negligible, with the construction of the on-playa infrastructure will result in a 0.24m in a 1% AEP event (Knight Peizold, 2019). • Fauna egress structures to be constructed on the pond and trench edges • Inmplementation of standard Feral animal monitoring and management procedures, including awareness and induction. • Project to be designed with minimal lighting and noise to reduce impacts to fauna. • Disturbance to habitat has been minimised, with the majority of the disturbance occurring on the salt flats which are devoid of vegetation and the utilisation of existing infrastructure (e.g. access roads). • The total disturbance impact off-playa has been reduced as far as practical, with the final processing plant footprint reduced to 40ha in total. • Flood modelling has been completed and infrastructure has been sited to minimise the alteration of flows. • Trenches located a considerable distance (greater than 750 m) from the lake fringes; modelling has shown that the groundwater drawdown is minimal and will not alter the current groundwater levels in and around fringing vegetation (Refer **Appendix D**). • Vehicles will be restricted to designated roads and tracks to minimise the potential distribution of weeds. • Project design has considered location of drainage lines and flood levels in off playa areas with the aim of minimising disturbance of these. • Saline pipelines will be bunded and inspected daily for leaks. • A dust management plan will be developed to outline dust control measures. These will include, but not be limited to speed limits, use of dust suppressants to minimise dust lift-off, use of water carts and restricting works during high-wind conditions. • Implementation of a vegetation health monitoring program during operations to monitor and assess vegetation health through to closure.
Predicted Outcome	No significant direct and indirect impacts on fauna are likely to result from the implementation of the project. The direct disturbance of about 47 ha for project implementation will not cause material loss of biological diversity or ecological integrity as the fauna habitats to be cleared are not of conservation significance and are well represented locally and regionally. The impact on the on-lake playa will be minimal, with the lake construction and drawdown having a minor impact (3.6% of the total lake surface). Project infrastructure has been located to use existing disturbed areas where possible and to use parts of the playa that do not support vegetation. With the implementation of conventional management and mitigation measures the EPA Objective for this factor will be met.