LAKE WAY POTASH – DEMONSTRATION PROJECT

ENVIRONMENTAL MONITORING & MANAGEMENT PLAN

Prepared by Salt Lake Potash

11 June 2019

SALT LAKE POTASH LTD

Document Title	Lake Way Demonstration Plan Management and Monitoring Plan
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RevA	First draft issues for consultation	CP	KW	31st May 2019
Rev0	Final – for submission to DWER	CP	KW	11th June 2019

SUMMARY

This Environmental Monitoring and Management Plan (EMMP) was prepared as part of a Section 38 referral to the WA Environmental Protection Authority (EPA).

This document has been prepared in accordance with the *Instructions on how to prepare Environmental Protection Act 1986, Part IV Environmental Management Plans* (EPA, 2018). This is a live document that will be regularly updated throughout project development as further information becomes available.

Item	Description
Title of the proposal	Lake Way Project Demonstration Plant
Proponent name	Salt Lake Potash
Purpose	To provide a management framework for environmental monitoring to occur during the implementation of the Lake Way Demonstration Plant so as to avoid, minimise and mitigate potential adverse impacts potentially arising from implementation of the proposal.
Key provisions in the plan	As described in Table 2-1.

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Figures

TABLES

1 CONTEXT, SCOPE AND RATIONALE

1.1 PROPOSAL

Salt Lake Potash (SO4) proposes to develop and operate the Lake Way SOP Demonstration Plant (the Project). The Project will extract and evaporate natural brines to produce up to 50,000 tonnes per annum of Sulphate of Potash (SOP), a high-quality product used in the fertiliser industry. The Project is located in and around Lake Way, approximately 25 km south of the town of Wiluna, Western Australia.

The activities and infrastructure included in this referral are:

- On-playa infrastructure: brine extraction trenches, pond infrastructure and associated pipework.
- Off-playa infrastructure: processing plant, process water pipework and associated infrastructure.

Figure 1-1 shows the proposal layout.

This Project is to be constructed on existing mining tenure (Matilda Mining Operation) held by Kimba Resources, a wholly owned subsidiary of Blackham Resources Limited (Blackham). SO4 and Blackham have a services agreement that allows for the extraction of potassium-bearing brines from groundwater beneath Kimba Resources' tenements. The agreement also allows SO4 to establish infrastructure on Kimba's tenements at Lake Way, with agreed processes for managing liability associated with mine closure and rehabilitation. Lake Way has been a site of historical gold mining activity, with the Williamson Pit operating intermittently over the past twenty years. This pit is currently operated by Blackham as part of its Matilda gold mining operations.

1.2 OBJECTIVE & SCOPE

The objective of this Environmental Monitoring and Management Plan (EMMP) is to outline key monitoring and management practices to occur during the life of the Demonstration Plant project to inform and better delineate the potential impacts of operations on the surrounding environment.

This EMMP outlines planned management and monitoring activities associated with:

- *Tecticornia*-dominated riparian vegetation that occurs on the fringes of the Lake Way area; and
- Hydrological regimes of Lake way.

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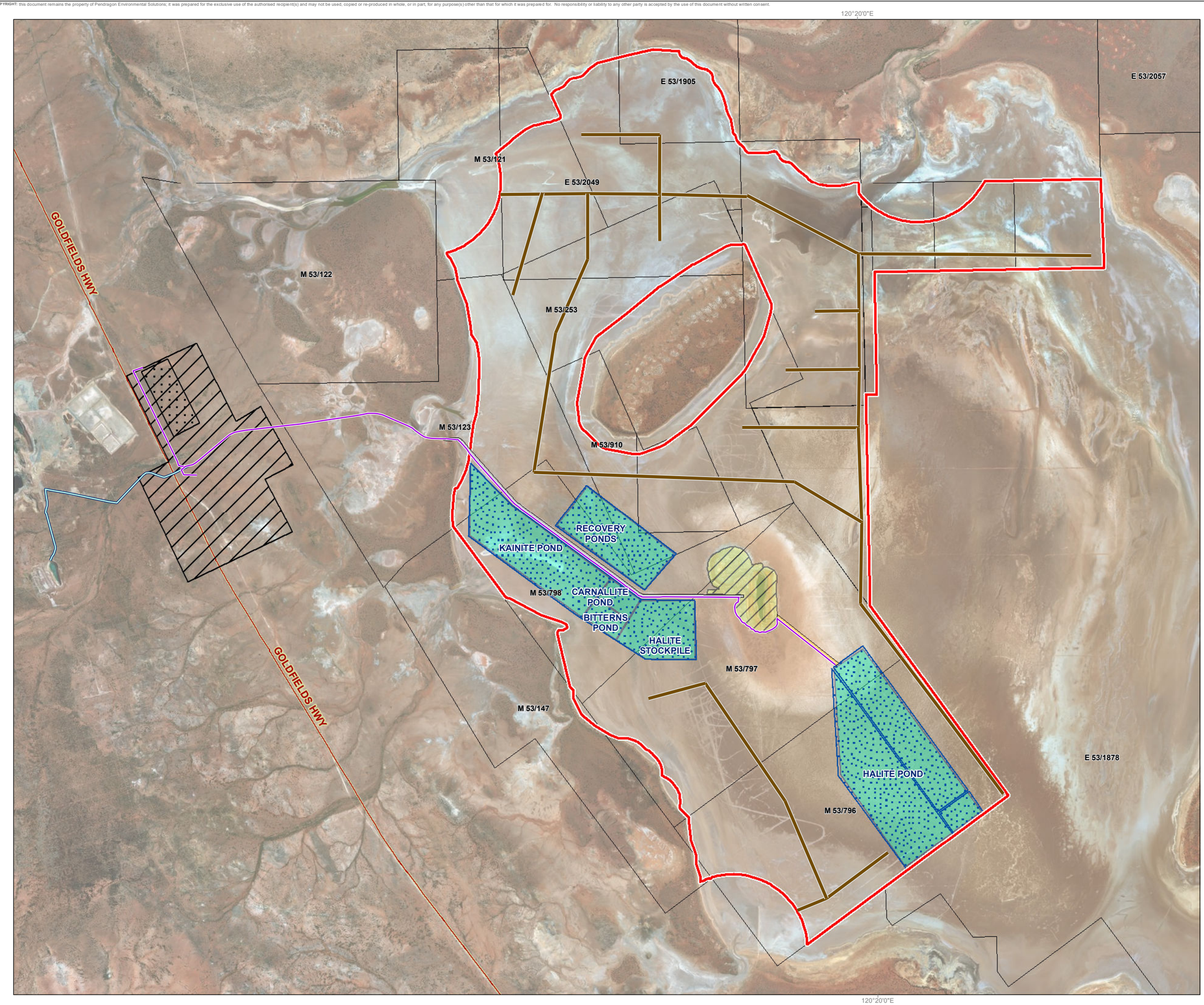

Legend

- Lake Development
- Tenement Boundary
- On Lake Ponds
- Indicative Pond
- Demonstration Process Plant Development Envelope
- Indicative Plant Site
- Williamson Pit
- Lake Way Causeway
- Access Road
- Process Water
- Brine Pipeline
- Trench

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED ESRI WORLD IMAGERY

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LOCALITY MAP

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FIGURE 1-1
PROJECT LAYOUT

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C:\GIS\Jobs\Pendragon\180025 - Salt Lake Potash Lakeway Referral\Figures\180025_F1-1 Project Layout_190301.mxd

1.3 ENVIRONMENTAL FACTOR – FLORA AND VEGETATION

The development of the proposal has the potential to indirectly impact *Tecticornia*-dominated vegetation on the fringes of the lake playa. The indirect impact can occur due to changes to the hydrological regimes of the lake, such as altered patterns of water flow and potentially increased extent, depth and duration of inundation after significant (i.e. 1% Annual Exceedance Proability, AEP) flood events.

Modelling by Knight Piezold (2019) has identified that approximately 138 ha of Tecticornia-dominated habitat (or 1.7% of the total Tecticornia habitat associated with Lake Way) would be indirectly impacted if a 1% AEP event was to occur.

It is unknown what species of *Tecticornia* occur within the flood zone due to the identification of *Tecticornia* species being complex and difficulty identifying *Tecticornia* species in the field (EPA 2019); however, consultation with DWER has identified that potentially at least 5 novel taxa, six potentially novel taxon and two priority species of Tecticornia occur within areas that may be effected by the changes to hydrology (Ecologia, 2016).

Flood modelling has been undertaken by Knight Piézold (2019) that shows the flood extents. Figure 1-3 shows the pre- and post-flood extents, as well as the *Tecticornia* vegetation mapping.

Due to the current environmental conditions at the time of this referral (being a period of extended drought), the majority of species observed during baseline surveys of the project were either sterile or dead (pers. comms Botanica Consulting, figure 1-2). The lack of vegetation available to sample directly impacts the knowledge available on the species to clearly delineate if any species may be of conservation significance.

Figure 1-2: Drought-affected vegetation, Lake Way – March 2019

The development of the flood model has been constructed on a conservative basis due to the lack of long-term hydrological data associated with the lake and the surrounding catchments. No flow gauging records were available to calibrate the model. A higher resolution of data allows for a clearer understanding of the potential risks to fringing vegetation.

The abstraction from the brine aquifer underlying the lake may also alter the storage calculations in a flood scenario, resulting in reduced ponding of surface water. This EMMP outlines a program of further investigations to improve the understanding of shallow sediment infiltration characteristics.

1.4 CONDITION REQUIREMENTS

This monitoring & management plan has been submitted as part of a S38 referral. No statutory conditions (Ministerial conditions, clearing permit conditions, etc) have been imposed in relation to the Lake Way demonstration project.

This management plan is intended to be implemented as part of the Mining Proposal to be submitted under the *Mining Act 1978*.

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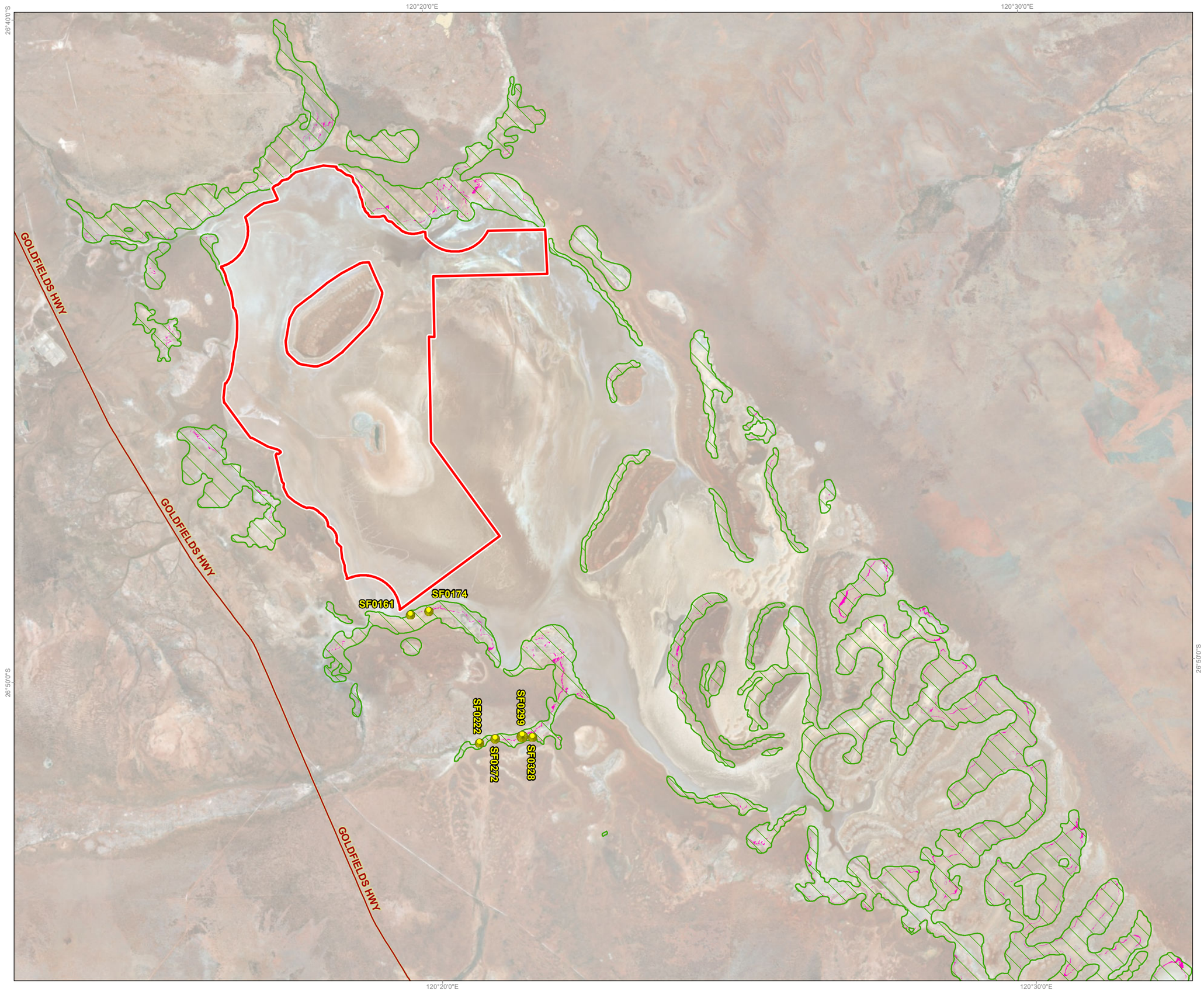

Legend

- Lake Development Envelope
- Toro Energy Exclusion Zone
- Tecticornia
- Indirect Impact From Flooding

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS
- LOCALITY MAP SOURCED LANDGATE 2006
- AERIAL PHOTOGRAPHY SOURCED ESRI WORLD IMAGERY

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Scale: 1:100,000 @ A3
GDA 1994 MGA Zone 51

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LOCALITY MAP

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FIGURE 1
INDIRECT IMPACT OF FLOODING

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1.5 RATIONALE AND APPROACH

The EMMP adopts a risk-based approach to impact management through better understanding of the assumptions made during the referral such that outcome-based monitoring and management can be implemented.

The management based monitoring detailed in this plan will provide additional information to help inform SO4 manage the environmental risks of the project by;

- Identifying the diversity of *Tecticornia* species associated with the Lake Way area; and,
- Improving knowledge associated with the hydrological regime of the Lake Way catchment area.

1.5.1 Survey and study findings

The following studies and survey works have been completed by SO4 and others at Lake Way in association with the development of the proposal:

- Knight Piézold Flood Study (2019)
- Botanica – Reconnaissance Flora and Vegetation Assessment Lake Way Demonstration Plant (2019)
- Ecologia – *Tecticornia* assessment; Toro project (2016)
- Actis – *Tecticornia* review: Wiluna uranium project (2012)
- Ground water science Groundwater abstraction model (2018)

Additional flora surveys and studies relating to the Project are listed in the references.

1.5.2 Key assumptions and uncertainties

Key assumptions

- There is some potential for conservation-significant flora to occur in the zone of indirect impacts.
- It is known that five novel taxa, six potentially novel taxa and two priority species of *Tecitcornia* occur in the terrestrial vegetation adjacent to Lake way, across the lake fringe profile (Ecologia 2016).
- *Tecticornia* species are able to produce sufficient material for identification and classification.
- We assume the key potential impact of riparian vegetation from SO4's proposed activities relate to altered surface water hydrology.
- *Tecticornia* are not groundwater dependent (Based on the large number of *Tecticornia* deaths noted in the level 1 survey).
- if *Tecticornia* are susceptible to groundwater effects, the cone of depression arising from SO4's activities will not extend to the riparian zone.

- *Tecticornia* may be adversely affected by prolonged inundation (Konnerup *et al.* 2015).
- The germination and establishment of *Tecticornia* species may be affected by altered surface water extent, duration, velocity and depth
- We assume that Blackham will continue its operations, such that any impacts arising from SO4's activities will be superimposed on impacts already occurring from Blackham's mining activities.
- Sufficient rainfall events will occur over the 5-year project period to inform both flora and vegetation monitoring, and modelling.

Uncertainties

- Species composition of riparian vegetation communities.
- River and flow levels associated with specific storm events and durations.
- Permeability and infiltration characteristics of lake surface and shallow sediments.

1.5.3 Management approach

The following management measures have been incorporated into the project development:

- Abstraction trenches have been located a considerable distance (greater than 750m) from the lake fringes; modelling has shown that the brine drawdown is minimal and won't alter the brine levels in and around the *Tecticornia* community.
- Abstraction trenches are not protected from flood events by any form of bund and will be allowed to flood.
- Lake infrastructure has been located on the higher points of the lake to minimize impact to lake surface-water flow.
- Flood modelling has been completed to show that the on-playa infrastructure is positioned to allow for movement of water to minimize water shadow and inundation.
- On playa roads and access tracks will be constructed with appropriate surface water drainage measures to minimize impacts to lake surface water flows.
- Where necessary, suitable floodways, drains and culverts will be installed to transfer flow post infrastructure and return it to its natural flow path.
- No direct disturbance or impact to *Tecticornia* habitat.

1.5.4 Rationale for choice of provisions

The rationale for the proposed management approach is as follows:

- The identification of *Tecticornia* species is complex and identifying *Tecticornia* species in the field is difficult (EPA 2019).
- It is known that five novel taxa, six potentially novel taxa and two priority species of *Tecitcornia* occur in the terrestrial vegetation adjacent to Lake way, across the

lake fringe profile (Ecologia 2016). It is unknown if any of these species occur within the indirect impact area.

- We cannot predict when a major flood might occur.
- The design incorporates best management practices to limit backwater effects and to minimize increases in flood depth.
- The hydrological model is conservative and overestimates the risk of inundation in riparian zones.
- There is limited published research on the effect of inundation on the *Tecticornia* species that occur at Lake Way.
- We do not know whether any of the *Tecticornia* species in the possible impact zone are 'conservation significant'.
- An extended drought in the area has resulted in no viable *Tecticornia* specimens to obtain identification.
- Gathering of operational data (e.g. infiltration) will inform the hydrological model.

2 EMP PROVISIONS

2.1 FLORA & VEGETATION

Table 2-1 Flora and Vegetation Management Provisions

EPA factor and objectives: To protect *Tecticornia*-dominated vegetation so that biological diversity and ecological integrity are maintained			
Outcomes: Identifying the diversity of *Tecticornia* species associated with the Lake Way area; and, Improving knowledge associated with the hydrological regime of the Lake Way catchment area.			
Key risks and associated impacts: vegetation inundation			
Management-based provisions			
Management actions	**Management targets**	**Monitoring / evidence**	**Reporting**
Management action 1: Vegetation survey of *Tecticornia*-dominant habitat in accordance with the EPA's *technical guidance: flora and vegetation surveys for Environmental Impact Assessment*	Complete a minimum of two seasons of flora surveys to record species zonation and collect sufficient voucher specimens for identification of species.	A detailed survey shall be undertaken. The survey approach will include: • quadrats along transects from the terrestrial vegetation adjacent to the lake, across the lake fringe profile. • Recording of species zonation will be recorded, including the collection of voucher specimens • The collection methodology shall allow for recollection of the same individual at a later date. To optimise the identification of Tecticornia, two sampling events will be undertaken for each quadrat. • In accordance with the EPA guidance note, for the Eremaean province surveys shall occur during the dry season following suitable rainfall and 6-8 weeks post wet season. • All *Tecticornia* will be identified by a relevant specialist at the herbarium.	Management commitment is included within performance outcomes detailed in the mining proposal. Reporting of outcomes within the Annual Environmental report under the *Mining Act 1978*

		SO4 will consult with the relevant technical specialist at DWER with respect ot the survey design, including quadrat size and transect length.	
Management action 2: Implement vegetationconditio n monitoring and determine success of germination and seedling establishment .	Complete annual vegetation condition monitoring and record germination and seedling establishment from the quadrats and transects established under Management action 1.	Vegetation condition monitoring utilizing the vegetation condition scale referenced in the EPA guidance note. Monitoring germination and seedling establishment.	Management commitment is included within performance outcomes detailed in the mining proposal. Reporting of outcomes within the Annual Environmental report under the *Mining Act 1978*
Management action 3: Undertake research on the impacts to *Tecticornia* from changes to the hydrological regime	Complete research project on changes to the hydrological regime and potential impacts to *Tecticornia* species found at Lake Way.	Research report	Reporting of outcomes within the Annual Environmental report under the *Mining Act 1978*
Management action 4: install and monitor gauging sites to calibrate flood model	Establish six gauging sites to be located on lake and major creek systems. Monitoring during rainfall events.	Continuous data logging during rainfall events. Data logger downloaded monthly and after rainfall events.	Management commitment is included within performance outcomes detailed in the mining proposal. Reporting of outcomes within the Annual Environmental report under the *Mining Act 1978*
Management action 5: Install piezometers at regular intervals across the lake surface.	Confirm brine profile associated with brine abstraction	Quarterly monitoring and calibration of the brine abstraction model.	Annual aquifer report to DWER under the *Rights in Water and Irrigation Act 1914*
Management action 6 Undertake infiltration testing of the lake playa to inform sediment recharge post-rainfall event	Undertake quarterly infiltration testing using an appropriate testing method.	Infiltration results	Management commitment is included within performance outcomes detailed in the mining proposal. Reporting of outcomes within the Annual Environmental report under the *Mining Act 1978*

Management Action 7: Assessment of flood levels after rainfall events	Aerial satellite imagery (subscription service). Survey to identify flood levels, duration and extent of wetting post storm event	Survey at key locations and calibration of model to event	Management commitment is included within performance outcomes detailed in the mining proposal. Reporting of outcomes within the Annual Environmental report under the *Mining Act 1978*
Management Action 8: Assessment of surface water quality	Undertake surface water quality monitoring in and around infrastructure including waste stockpiles.	Water quality monitoring undertaken following significant storm events.	Management commitment is included within performance outcomes detailed in the Mining Proposal. Reporting of outcomes within the Annual Environmental report under the *Mining Act 1978*

3 ADAPTIVE MANAGEMENT AND REVIEW OF THE EMMP

The provisions outlined in the previous section rely on the following key assumptions:

- Uncertainty whether local *Tecticornia* populations are adversely affected by periods of inundation.
- *Tecticornia* species are poorly identified due to lack of rain during the period when SO4 conducted baseline surveys.
- The hydrogeological and flood model can be calibrated with on-ground data to reduce uncertainty.

Given these assumptions, SO4's adaptive management regime focuses on actions to minimize indirect and direct impacts to *Tecticornia* habitat that may be identified due to new information.

Adaptive management responses to new information include:

a) Amending trench locations to minimize drawdown and flow diversion impacts to vegetation.

b) Changing brine abstraction regime to minimise cone of depression impacts.

c) If *Tecticornia* communities of conservation significance are present, vegetation health monitoring will be targeted at significant areas.

d) Ongoing development of management measures to minimize indirect and direct impacts based on findings from management actions.

Findings that will trigger review of this EMMP include:

- Evidence that no conservation significant vegetation is likely to be impacted by the proposal.
- Updated hydrological modelling predicts significant changes in the extent, duration or magnitude of flood events.

4 STAKEHOLDER CONSULTATION

As part of the implementation of this proposal, SO4 will work with a range of stakeholders to ensure that the works are undertaken effectively and in compliance with relevant state and federal legislation.

Key stakeholder consultation includes:

- Engagement with pastoralists, tenure holders and traditional landholders.
- Department of Water and Environment Regulation.
- Department of Mines, Industrial Regulation and Safety.
- Department of Biodiversity, Conservation and Attractions.

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5.1 REFERENCE TO ADDITIONAL SURVEYS AND STUDIES

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