KALIUM LAKES

Preston Consulting

BEYONDIE SULPHATE OF POTASH PROJECT

INTERIM MINE CLOSURE PLAN

REVISION 1

27 November 2018

PREPARED FOR KALIUM LAKES POTASH PTY LTD

BY PRESTON CONSULTING PTY LTD

DOC ID: KAL-BEY-MCP-02_Rev1

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MINE CLOSURE PLAN CHECKLIST

Q No	Mine Closure Plan Checklist	Y/N/NA	Section	Comments	Changes from previous version (Y/N)	Page No.	Summary
1	Has the Checklist been endorsed by a senior representative within the tenement holder/operating company? (See bottom of checklist.)	Y	N/A	N/A	N		
Public Availability							
2	Are you aware that from 2015 all MCPs will be made publicly available?	Y	N/A	N/A			
3	Is there any information in this MCP that should not be publicly available?	N	N/A	N/A			
4	If "Yes" to Q3, has confidential information been submitted in a separate document/section?	N/A	N/A	N/A			
Cover Page, Table of Contents							
5	Does the MCP cover page include: • Project Title • Company Name • Contact Details (including telephone numbers and email addresses) • Document ID and version number • Date of submission (needs to match the date of this checklist)	Y	Cover Page and Page ii	N/A	Y	Cover Page and Page ii	MCP cover page revised to include full project
Scope and Purpose							
6	State why the MCP is submitted (e.g. as part of a Mining Proposal, a reviewed MCP or to fulfil other legal requirements)	Y	1	As part of Mining Proposal	Y	11	MCP revised to include full project
Project Overview							
7	Does the project summary include: • Land ownership details (include any land management agency responsible for the land / reserve and the purpose for which the land / reserve [including surrounding land] is being managed) • Location of the project; • Comprehensive site plan(s); • Background information on the history and status of the project.	Y	2	Additional tenements added and revised site plans	Y	13	Additional tenements added and revised site plans

Q No	Mine Closure Plan Checklist	Y/N/NA	Section	Comments	Changes from previous version (Y/N)	Page No.	Summary
Legal Obligations and Commitments							
8	Does the MCP include a consolidated summary or register of closure obligations and commitments?	Y	3	N/A	Y	29	Additional closure obligations and commitments added
Stakeholder Engagement							
9	Have all stakeholders involved in closure been identified?	Y	4	All stakeholders identified	N	30	All stakeholders identified
10	Does the MCP include a summary or register of historic stakeholder engagement with details on who has been consulted and the outcomes?	Y	4.2	Register provided	N	32	Register provided
11	Does the MCP include a stakeholder consultation strategy to be implemented in the future?	Y	4.3	Consultation strategy provided	N	35	N/A
Post-mining land use(s) and Closure Objectives							
12	Does the MCP include agreed post-mining land use(s), closure objectives and conceptual landform design diagram?	Y	5	N/A	Y	37	Details updated to incorporate full project
13	Does the MCP identify all potential (or pre-existing) environmental legacies, which may restrict the post mining land use (including contaminated sites)?	N/A	N/A	N/A	N	N/A	N/A
14	Has any soil or groundwater contamination that occurred, or is suspected to have occurred, during the operation of the mine, been reported to DER as required under the Contaminated Sites Act 2003?	N/A	N/A	N/A	N	N/A	N/A
Development of Completion Criteria							
15	Does the MCP include an appropriate set of specific completion criteria and closure performance indicators?	Y	6	N/A	Y	39	Criteria and indicators updated to incorporate full project
Collection and Analysis of Closure Data							
16	Does the MCP include baseline data (including pre-mining studies and environmental data)?	Y	7	N/A	Y	42-85	Additional data provided
17	Has materials characterisation been carried out consistent with applicable standards and guidelines (e.g. GARD Guide)?	Y	7.4	Consistent with brine project	N/A	50	N/A
18	Does the MCP identify applicable closure learnings from benchmarking against other comparable mine sites?	Y	7.8	Closure learnings from Gold mining are	Y	80	Additional information provided

Q No	Mine Closure Plan Checklist	Y/N/NA	Section	Comments	Changes from previous version (Y/N)	Page No.	Summary
				applicable			
19	Does the MCP identify all key issues impacting mine closure objectives and outcomes (including potential contamination impacts)?	Y	8	N/A	Y	86	Additional key issues included
20	Does the MCP include information relevant to mine closure for each domain or feature?	Y	9	N/A	Y	94	Information provided
Identification and Management of Closure Issues							
21	Does the MCP include a gap analysis / risk assessment to determine if further information is required in relation to closure of each domain or feature?	Y	8, Appendix 1	N/A	Y	App 1	Risk assessment revised to include risks associated with full project
22	Does the MCP include the process, methodology, and has the rationale been provided to justify identification and management of the issues?	Y	8.1	N/A	Y	86	Additional information included
Closure Implementation							
23	Does the MCP include a summary of closure implementation strategies and activities for the proposed operations or for the whole site?	Y	9	N/A	Y	94	Additional strategies included
24	Does the MCP include a closure work program for each domain or feature?	Y	9	N/A	Y	94	Additional closure work programs included
25	Does the MCP contain site layout plans to clearly show each type of disturbance as defined in Schedule 1 of the MRF Regulations?	Y	Figure 37	N/A	Y	Fig 37	Site layout plans updated
26	Does the MCP contain a schedule of research and trial activities?	N	N/A	N/A	N	N/A	Activities included
27	Does the MCP contain a schedule of progressive rehabilitation activities?	N	N/A	N/A	N	N/A	Activities included
28	Does the MCP include details of how unexpected closure and care and maintenance will be handled?	Y	9.6	N/A	Y	104	Details updated
29	Does the MCP contain a schedule of decommissioning activities?	Y	9.7	N/A	Y	104	Schedule updated
30	Does the MCP contain a schedule of closure performance monitoring and maintenance activities?	Y	10	N/A	Y	106	Schedule updated
Closure Monitoring and Maintenance							
31	Does the MCP contain a framework, including methodology, quality control and remedial strategy for closure performance monitoring	Y	10	N/A	Y	106	Framework updated

Q No	Mine Closure Plan Checklist	Y/N/NA	Section	Comments	Changes from previous version (Y/N)	Page No.	Summary
	including post-closure monitoring and maintenance?						
32	Does the MCP include costing methodology, assumptions and financial provision to resource closure implementation and monitoring?	Y	10	N/A	Y	106	Details updated
33	Does the MCP include a process for regular review of the financial provision?	Y	11	N/A	N	11	N/A
34	Does the MCP contain a description of management strategies including systems and processes for the retention of mine records?	Y	12, Appendix 1	N/A	Y	112 App 1	Strategies updated

Corporate endorsement:

I hereby certify that to the best of my knowledge, the information within this Mine Closure Plan and checklist is true and correct and addresses all the requirements of the Guidelines for the Preparation of a Mine Closure Plan approved by the Director General of the Department of Mines and Petroleum.

**to be signed prior to submission to DMIRS*

Name: Brett Hazelden **Signed**:

Position: Managing Director **Date**: 27/11/2018

(*NB: The corporate endorsement must be given by tenement holder(s) or a senior representative authorised by the tenement holder(s), such as a Registered Manager or Company Director*)

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1 SCOPE AND PURPOSE

1.1 SCOPE

This Mine Closure Plan (MCP) has been prepared to accompany the Mining Proposal for the Beyondie Sulphate of Potash Project (the Project). The Project is located 160 km south-east of Newman in the Pilbara region of Western Australia (WA) (Figure 1).

This MCP addresses the planned closure and rehabilitation of the Project, including all disturbed areas, plant and other built infrastructure. It also addresses contingencies for temporary suspension of operations and unplanned closure.

Kalium Lakes Potash Pty Ltd (Kalium Lakes) has addressed the *Guidelines for Preparing Mine Closure Plans* (Department of Mines and Petroleum, 2015; the Guidelines) in preparing this MCP. The MCP details relevant background information, stakeholder consultation, post-mining land use, closure objectives and completion criteria, identification and management of closure issues, and closure implementation.

Consistent with the adaptive management approach recommended by DMIRS, the MCP will be a living document, regularly updated through the life of the Project to ensure changes in areas such as the regulatory environment, stakeholder expectations and developments in technical closure planning are captured and incorporated into decision-making until the ultimate relinquishment of the Project tenements.

1.2 PURPOSE

The purpose of this MCP is to demonstrate that the Project is able to be decommissioned, closed and rehabilitated in an environmentally acceptable manner consistent with agreed post-mining land uses, and without unacceptable liability to the State. It provides the information required by Kalium Lakes to progress toward closing the Project consistent with an agreed set of outcomes relevant to closure.

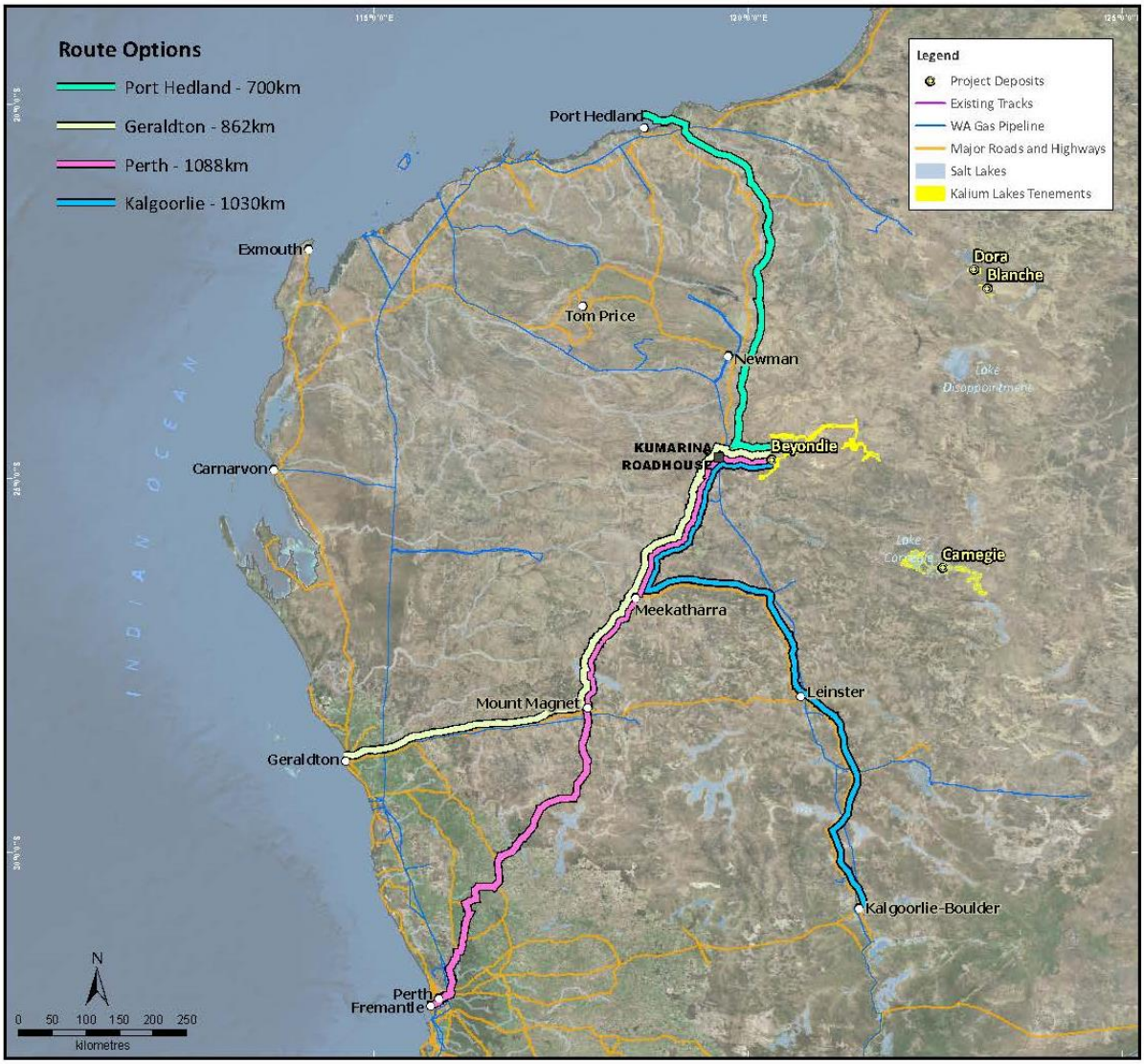


Figure 1: Regional location of the Project

2 PROJECT SUMMARY

2.1 LAND OWNERSHIP

Kalium Lakes is a public company (ASX listed KLL) with approximately 2,400 square kilometres (km^2) of granted exploration, mining and miscellaneous tenements at the eastern margin of the East Pilbara region of Western Australia (WA). Kalium Lakes is the proponent for the Project.

All Project tenements are held by Kalium Lakes Potash Pty Ltd. The Project will be operated by Kalium Lakes.

Kalium Lakes registered office and other details are:

Street Address:	Unit 1, 152 Balcatta Road, Balcatta, Western Australia 6021
Postal Address:	PO Box 610, Balcatta Western Australia 6914
Telephone:	(08) 9240 3200
Website:	www.kaliumlakes.com.au
ABN:	92 601 436 060

The key contact person for this MCP is:

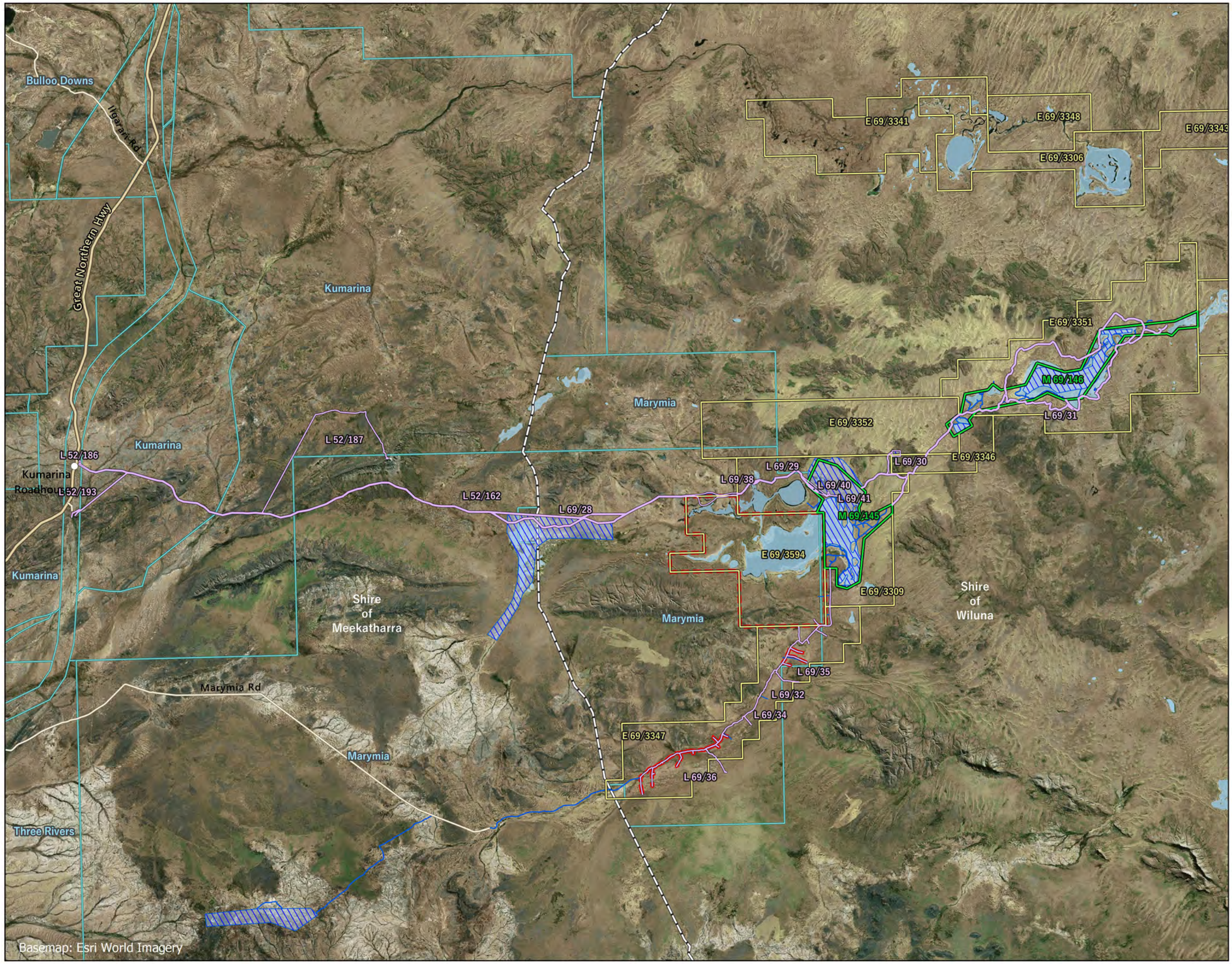
Brett Hazelden – Managing Director
Telephone: (08) 9240 3200
Email: brett.hazelden@kaliumlakes.com.au

2.2 LOCATION AND TENURE

The Project is located in the Shire of Wiluna at Beyondie Lakes, Ten Mile Lake and Sunshine Lake approximately 165 kilometres (km) south east from Newman in the East Pilbara region of Western Australia (Figure 1). The Great Northern Highway (GNH) provides the main logistical supply link between major supply and distributions centres of Port Hedland (700 km), Geraldton Port (862 km), Perth (1,088 km) and Kalgoorlie (1,030 km).

The works described in this MCP are relevant to the tenements documented in Table 1. Kalium Lakes Potash Pty Ltd is the current registered owner of these leases. These leases and licenses are shown in Figure 2.

The Project is located predominantly within the Shire of Wiluna, with the initial access road in the Shire of Meekatharra. The majority of the tenements are located within Unallocated Crown Land with the western portion located on the Marymia and Kumarina pastoral stations (Figure 3).



Kalium Lakes Tenements

- Exploration Licence
- Miscellaneous Licence
- Mining Lease
- Tenements Pending
- Local Government Boundaries
- Development Envelope
- Pastoral Leases

0 2 4 6 8 10 km

1:350000

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Figure 2: Project Tenure

Beyondie Sulphate Of Potash Project
Tenure, November 2018

D:¥KALIUM LAKES POTASH PTY LTD¥KL - GIS¥SPATIAL - KALIUM LAKES¥MAPS¥2018¥KLP 18019 KLP 18019 Tenure 350K November 2018.qgz

Table 1: Project Tenure

Tenement ID	Type	Grant date	Expiry date
L 52/186	Miscellaneous	30/05/2018	29/05/2039
L 52/162	Miscellaneous	30/03/2016	29/03/2037
L52/193	Miscellaneous	13/08/2018	12/08/2039
L 69/28	Miscellaneous	07/08/2018	06/08/2018
L 69/29	Miscellaneous	07/08/2018	06/08/2018
L 69/30	Miscellaneous	30/05/2018	29/05/2018
L69/31	Miscellaneous	07/08/2018	06/08/2018
L69/32	Miscellaneous	14/08/2018	13/08/2039
L69/34	Miscellaneous	14/08/2018	13/08/2039
L 52/187	Miscellaneous	30/05/2018	29/05/2018
M 69/145	Mining	06/06/2018	05/06/2039
M 69/146	Mining	06/06/2018	05/06/2039

2.3 PROJECT APPROVALS

Kalium Lakes referred the Project under Section 38 of the EP Act on 30 October 2017. The Project is currently being formally assessed (Assessment no. 2138) by the EPA under Part IV of the EP Act at the level of Environmental Review – no public review. Pursuant to Section 41A(3) of the EP Act Kalium Lakes applied for consent to Minor and Preliminary Works for the Project which was granted on 25 May 2018.

The Department of Water and Environmental Regulation (DWER) issued Kalium Lakes with a Works Approval on 21 January 2016 for the Trial Extraction Programme (W5936/2015/1). This Trial Extraction Programme was designed to test the production of potassium sulphate via extraction of hypersaline groundwater and subsequent evaporation. A Works Approval amendment for W5936/2015/1 was approved by DWER on 5 May 2016 which provided an updated layout of the Trial Evaporation Ponds.

2.4 PROJECT DESCRIPTION

The Project is amongst Australia's highest grade Sulphate of Potash (SOP) deposits and is located close to key infrastructure, including the Goldfields Gas Pipeline and Great Northern Highway.

The Project differs from a conventional mining operation as there is no mine pit or underground mine. It relies on extraction of hypersaline groundwater that is pumped to ponds where the water is evaporated and the salts concentrated, with the different salts extracted prior to purification to a final SOP product. Hypersaline groundwater will be extracted from the deeper (~50 - 100 m) paleochannel aquifer by bores, and from the upper layers of lake sediments via trenches and pumps. SOP is the target product from the groundwater, although other salts may be able to be commercially produced as a by-product (e.g. magnesium salts, sodium chloride salts).

Kalium Lakes has completed a Bankable Feasibility Study (BFS) inclusive of drilling programs, geophysics surveys and initial test-pumping to confirm a 5.1 Million tonnes (Mt) Reserve and a 19.8 MT drainable SOP and an inferred mineral resource of 18.84 Mt drainable. A trial program

has included the development of a small camp, trial evaporation ponds, upgrade of existing access tracks, and long-term pump testing. The trial infrastructure will be absorbed into the Project (no longer a short term trial). On the basis of this trial work, Kalium Lakes is seeking approval for a 100 ktpa capacity project.

The Project will include:

- A combination of shallow trenches and deep production bores to extract hypersaline groundwater;
- Evaporation ponds;
- Purification plant;
- Product and excess salt storage areas;
- Accommodation, administration, utilities (communications, power, waste, fuel storage and water) and associated facilities;
- 78 km access road to the Great Northern Highway to include a gas pipeline to join the Goldfields Gas Pipeline; and
- Borefields to supply fresh water.

Kalium Lakes plans to export SOP to world markets via Geraldton and / or Fremantle Port.

The Project consists of several elements with different footprints and activities. A total disturbance limit of 1,433 hectares (ha) is proposed, within a total disturbance envelope of 12,272 ha.

The Disturbance Envelopes are shown in Figure 3, Figure 4, and Figure 5. The site plans showing specific infrastructure are shown on Figure 6 and Figure 7.

2.4.1 BORES AND TRENCHES

A series of deep production bores will be used to access the porous sediments within the paleochannel. This confined aquifer contains a significant portion of the resource and is similar in nature to paleochannel aquifers in the Goldfields that are used for process water supply to gold mines. The production bores will be accompanied by a network of monitoring bores that will be used to monitor the depressurization of the aquifer.

Shallow groundwater contained within the upper lenses of the salt lakes will be drained via a series of trenches up to 6 m deep and 3 - 4 m wide (Figure 6 & Figure 7). The spoil from these will be retained alongside the trenches for later use to backfill the trenches at closure.

Rev	Description	Drn	Chk	App
1	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH
0	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH

Datum: GDA94
Projection: MGA51

Scale at A3: 1:300000

0 2 4 6 8 10 km

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Beyondie Sulphate Of Potash Project Overview

KLP_18033	26/11/2018

Figure 3: Disturbance Envelope

Rev	Description	Drn	Chk	App
1	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH
0	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH

Datum: GDA94
Projection: MGA51
Scale at A3: 1:70000
0 0.5 1 1.5 2 km

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Beyondie Sulphate Of Potash Project
Lake Ten Mile Detail

KLP_18033 | 26/11/2018

Figure 4: Disturbance Envelope at Ten Mile Lake

Rev	Description	Drn	Chk	App
1	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH
0	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH

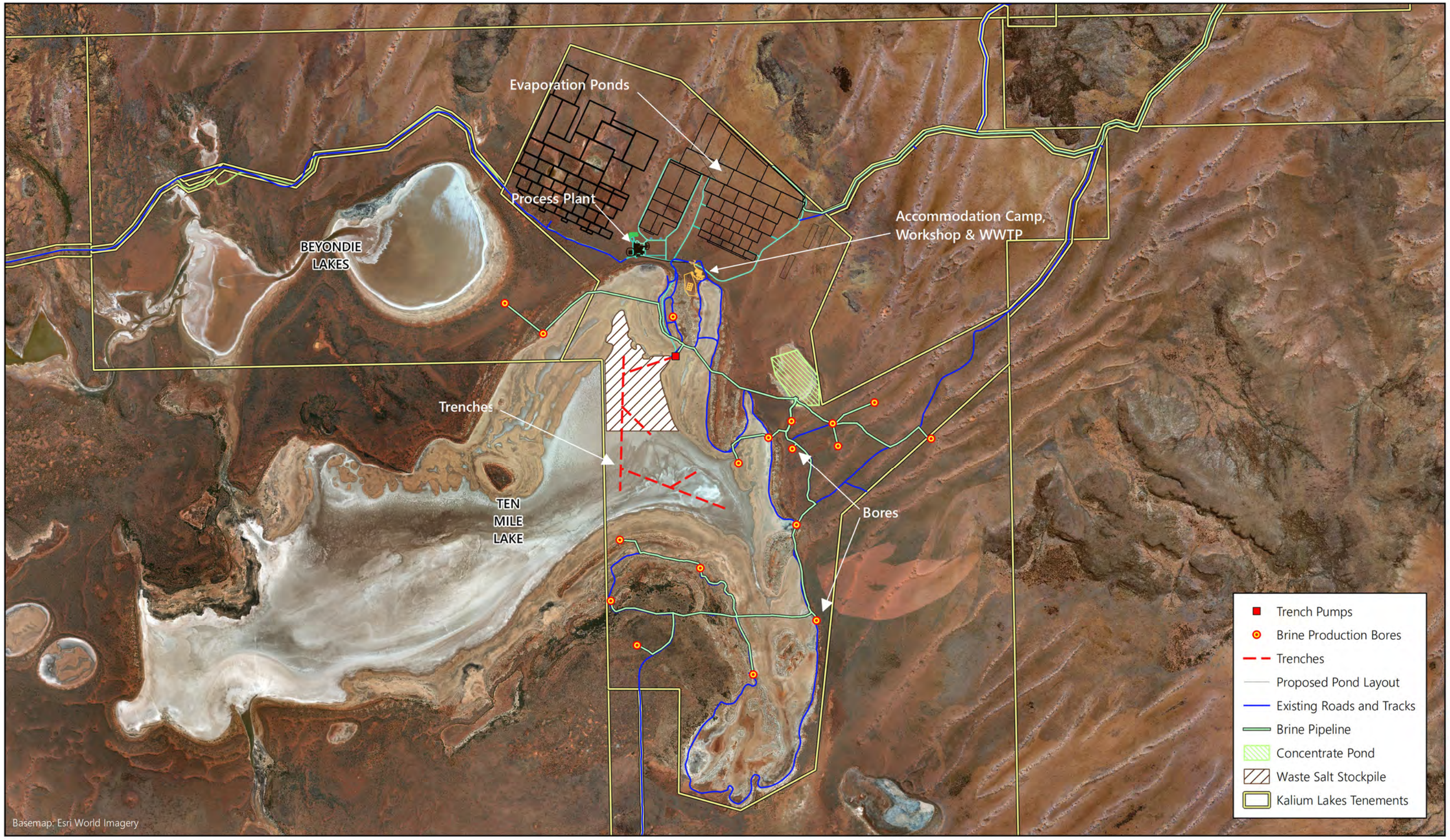
Datum: GDA94
Projection: MGA51
Scale at A3: 1:60000
0 0.5 1 1.5 2 2.5 km

KALIUM LAKES

Beyondie Sulphate Of Potash Project
Lake Sunshine Detail

KLP_18033	26/11/2018

Figure 5: Disturbance Envelope at Lake Sunshine



Rev	Description	Drn	Chk	App
3	UPDATED INFRASTRUCTURE	HR	RvN	BH
2	UPDATED INFRASTRUCTURE	HR	RvN	BH
1	ISSUED FOR INFORMATION	HR	GE	BH
0	ISSUED FOR INFORMATION	HR	GE	BH

Datum: GDA94
Projection: MGA51
Scale at A3: 1:60000

0 0.75 1.5 2.25 3 km

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Beyondie Sulphate Of Potash Project
Indicative Infrastructure
Lake Ten Mile

KLP_18037	27/11/2018

Figure 6: Ten Mile Lake Site Plan

L-69/31

M 69/146

LAKE SUNSHINE

E 69/3351

E 69/3352

E 69/3346

Basemap: Esri World Imagery

- Trench Pumps
- Production Bores
- Trenches
- Brine Pipeline
- Existing Roads and Tracks
- Concentrate Pond
- Kalium Lakes Tenements

Rev	Description	Drn	Chk	App
2	ISSUED FOR INFORMATION	HR	RvN	BH
1	ISSUED FOR INFORMATION	HR	RvN	BH
0	ISSUED FOR INFORMATION	HR	GE	BH

Datum: GDA94
Projection: MGA51
Scale at A3: 1:60000

0 0.75 1.5 2.25 3 km

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Beyondie Sulphate Of Potash Project
Indicative Infrastructure
Sunshine Lake

KLP_18038	26/11/2018

Figure 7: Lake Sunshine Site Plan

2.4.2 EVAPORATION AND CRYSTALLISATION

The natural evaporation process required for concentration and precipitation of salts is described as a circuit. It includes the use of natural topography (concentrator lakes) as hypersaline water is fed in to the circuit these features are used to reduce the volume of water (reducing pumping costs) and settle out sediments. From there, the concentrated water is pumped to constructed ponds (concentrator and crystalliser ponds). All the subsequent ponds will be constructed so that the brine from one pond overflows into the next pond in the circuit by gravity.

The initial brine is predominantly a mixture of sodium (Na), potassium (K) and magnesium (Mg) salts as chlorides or sulphates. The concentrator lakes and ponds are not intended to precipitate salts (although some will precipitate around the edges), but are designed to reduce the volume of brine via evaporation prior to pumping to the next pond. The concentrated brine is then fed into a series of crystalliser ponds, where the first of the salts, sodium chloride (NaCl), precipitates. NaCl will form a crystalline layer at the base of the pond which will be harvested every 12 - 18 months to maintain freeboard levels within the ponds.

The pond stages involved with the solar evaporation process are shown in the General Arrangement drawing in Figure 8 (initial 82 ktpa production).

1. **Concentrator Ponds & Lakes** - brine from the bore field and trenches will be pumped first into concentrator lakes and then into interconnected concentrator ponds. The Concentrators will hold brines and concentrate them as the density increases prior to the 'salting point' where precipitation commences.
2. **Sodium Chloride Crystalliser Ponds** - brines prior to reaching the NaCl saturation point in the concentrator ponds will be transferred to the NaCl Crystalliser Ponds where NaCl will be deposited. The NaCl Crystalliser Ponds specific gravity and magnesium content will be monitored and when the brine has reached the required control points, will be transferred to the Potassium Salt Crystalliser Ponds. At this point approximately 17% of the original brine volume remains. Periodic harvesting will leave a floor of approximately 100-300 mm thickness of NaCl.
3. **Potassium Salt Crystalliser Ponds** - the brine in the Potassium Salt Crystalliser Ponds will crystallise a combination of potassium mixed salts including Leonite (hydrated double sulfate of magnesium and potassium), Kainite (also a magnesium and potassium based salt) Type Mixed Salt (KTMS) and Carnallite (hydrated chloride of potassium and magnesium) in sequential ponds. These raw salts will be harvested and transported to the purification plant feed stockpile. Periodic harvesting operations will leave a potassium salt floor in place of approximately 100-200 mm thickness.
4. **Bittern storage pond** - following crystallisation of potassium salts the residual liquid will drain to the Bittern Storage Pond. The Bitterns liquid is a highly concentrated and dense suspension of the remaining ions, including magnesium. The bitterns is used as part of the process and is pumped to a mixing vessel for use in the recycling pond circuit.

The sizes and depths of the primary ponds are provided in Table 2.

Table 2: Pond sizing for nominal production of SOP

Name	Purpose	No. of Ponds	Depth (m)	Total Area (ha)
Concentrator Lakes	Primary brine solar concentrators to reduce pumping volume	3	0.9	149
Feed Pond	Concentrator Lake Brine Distribution	1	0.75	5
Concentrator Ponds	Concentrator Ponds	5	0.9	74
NaCl Pond 1	Crystallise Sodium salts	5	1.05	60
NaCl Pond 2	Crystallise Sodium salts	5	1.05	29
Leonite Pond 1	Crystallise Leonite Salts	5	0.85	25
Leonite Pond 2	Crystallise Leonite Salts	5	0.85	15
KTMS Ponds	Crystallise KTMS	5	0.8	16
Carnallite Ponds	Crystallise Carnallite Salts	5	0.8	11
Bitterns Ponds	Storage of Magnesium brine	1	0.85	1.5

The recycling pond circuit will involve additional pond types:

1. **Recycle Ponds** - The SOP purification process produces Schoenite End Liquor which contains a significant amount of dissolved potassium and sulphate ions. This liquor needs to be recycled to a separate series of ponds, called 'recycle' ponds, which are similar to the primary ponds. The end liquor from the purification plant is combined with the bitterns from the primary ponds in a tank. A reaction between these two streams will occur, producing astrakanite and sodium chloride salts. After these salts have settled, the remaining brine is gravity fed to two trains consisting of a series of four ponds each. In a similar way, the leonite is the first potassium containing salt to precipitate out, followed by kainite and carnallite. Once harvested, these recovered salts are combined with the primary pond salts on the ROM pad and fed back into the purification plant.
2. **Final Bittern storage pond** - following crystallisation of potassium salts the small amount residual liquid will drain to the Final Bittern Storage Pond. This magnesium rich brine is likely to be suitable for further processing to extract magnesium salts or to be used as a dust suppressant. Residual bitterns may also be transported to the excess salt stockpile as a dried salt or pumped as a brine or reinjected into old production wells or trenches.

The sizes and depths of the various recycle ponds are provided in Table 3.

Table 3: Recycle pond sizing for nominal production of SOP

Name	Purpose	No. of Ponds	Depth (m)	Total Area (ha)
Astrakainite Pond	Crystallize Astrakainite salt	2	0.75	1.5
Leonite Pond 1	Crystallise Leonite Salts	2	0.85	25
Leonite Pond 2	Crystallise Leonite Salts	2	0.85	23
KTMS Ponds	Crystallise KTMS	2	0.8	10
Carnallite Ponds	Crystallise Carnallite Salts	2	0.8	12
Bitterns Ponds	Storage of Magnesium brine	1	0.85	0.5

The ponds will be constructed using local materials with the aim of minimising cut and fill to achieve the required levels. A nominal 100 mm of topsoil will be removed and stored for use

during closure. The ponds will also have a minor working depth of 250 to 600 mm and storm freeboard of 250 mm. The concentrator ponds will have a nominal 1:2 grade while the remainder all have flat bottoms to allow even precipitation and safe harvesting. The embankment design between the ponds will follow one of three main design types shown in Figure 9.

Ponds will be constructed in areas away from potential flooding and with a sequential overflow system. The ponds will be similar to those used for salt production at other locations around WA. All ponds will be lined with 1 mm thick High-density Polyethylene (HDPE) liners to prevent seepage (Figure 10).

2.4.3 Process Plant

The SOP plant converts the mixed salt into a slurry comprising of schoenite and halite through mixing with water and internal recycling of the brines. The resultant slurry is processed through flotation to remove the halite, the resultant schoenite salts are decomposed into SOP. The plant will utilise a series of steps that requires tanks, pumps, pipes and control circuits constructed on a concrete pad. Stockpiles of input and output materials will be located adjacent to the process plant. The process plant General Arrangement is shown in Figure 11.

2.4.4 Excess Salt Stockpile

Over the life of the Project, approximately 50 Mt of NaCl and Mgwill be produced. The production of NaCl and Magensium Salts/Bittern is incidental to the SOP and the material is currently excess to any current commercial opportunity. WA Salt Koolyanobbing and Kalium Lakes have signed a Letter of Intent to evaluate and assess the recovery of NaCl salt products from the Project. The WA Salt Group, which produces high quality salt products for domestic and international customers will work with Kalium Lakes to determine which types of NaCl products can be recovered and may be suitable.

Following consultation with key stakeholders, the excess salt stockpile was thought best located on the playa surface, that being a location that is already devoid of vegetation, so that any saline leachate or runoff would move into an already saline basin where the biology is well adapted to saline conditions. An earthen bund will be constructed around the periphery of the stockpile to contain saline run off.

2.4.5 Support Infrastructure

Support infrastructure includes:

- Accommodation (100 person), administration, utilities (communications, power, waste and water) and associated facilities;
- 78 km access road to the Great Northern Highway to include a gas pipeline to join the Goldfields Gas Pipeline; and
- Approximately 1.5 GLpa freshwater extraction and monitoring bores, tanks, pumps, pipes and access tracks to supply fresh water.

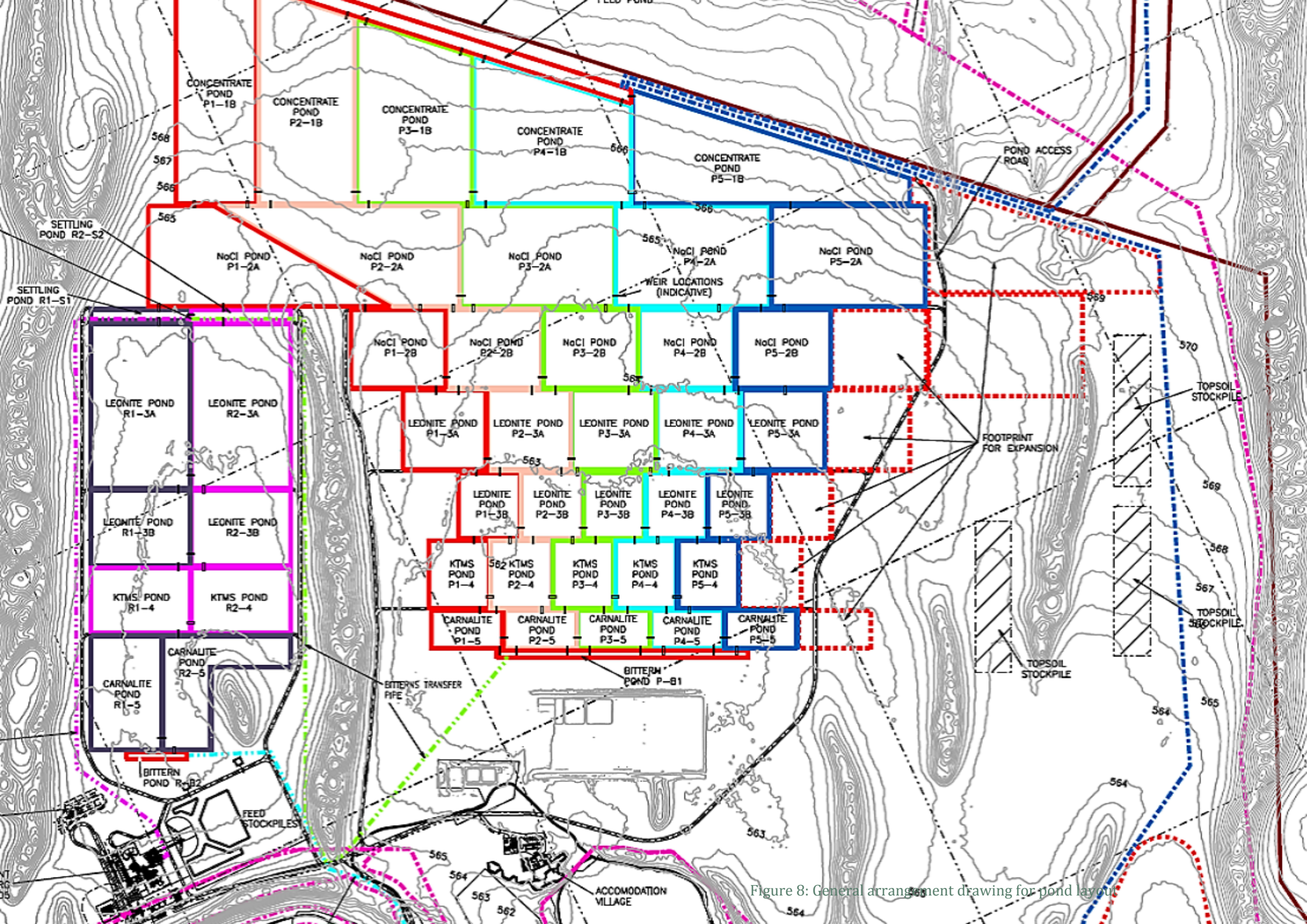
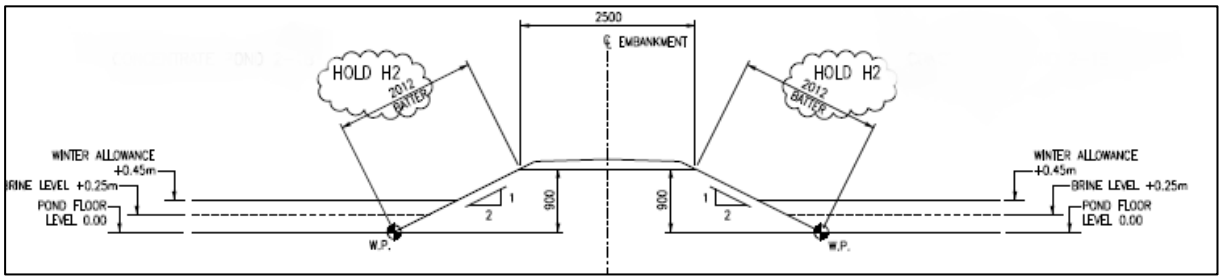
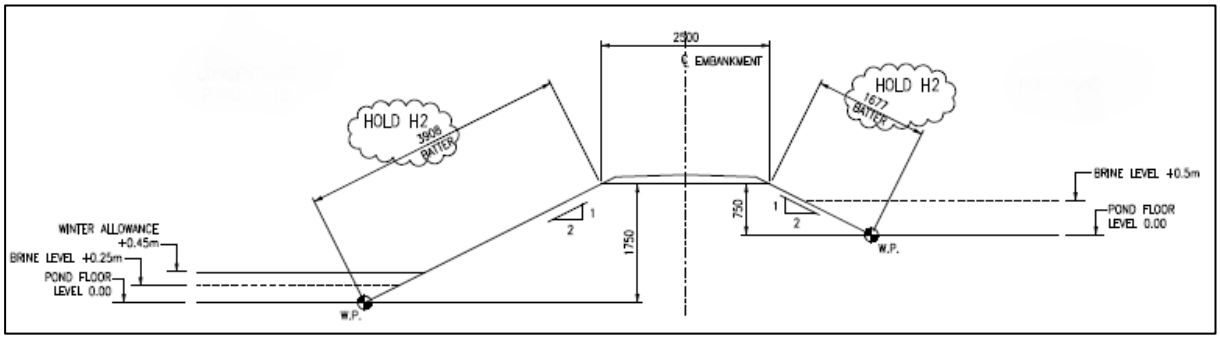


Figure 8: General arrangement drawing for pond layout

Embankment Design Type 1



Embankment Design Type 2



Embankment Design Type 3

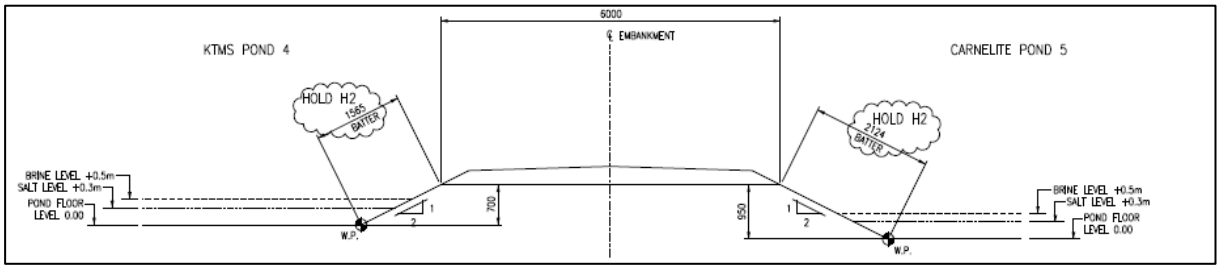
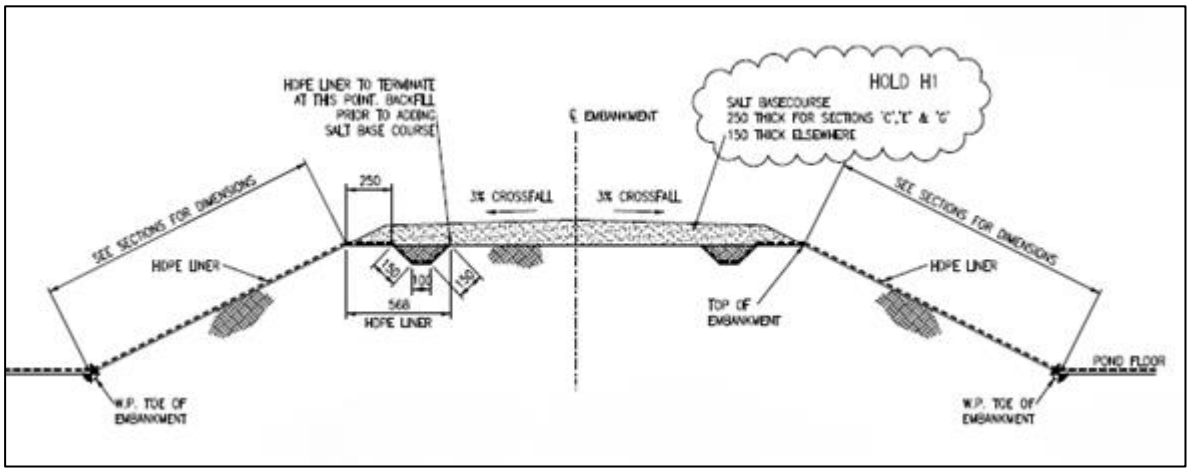


Figure 9: Embankment Design Types

Internal Embankment



External Embankment

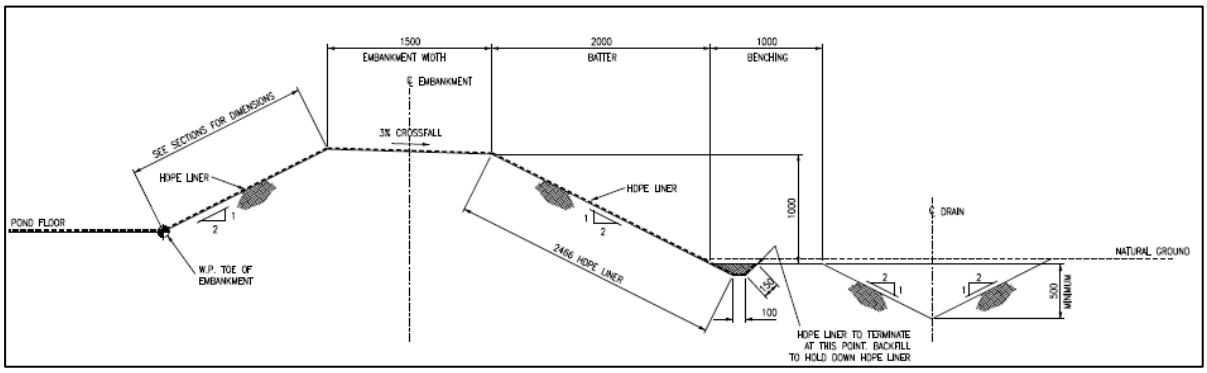
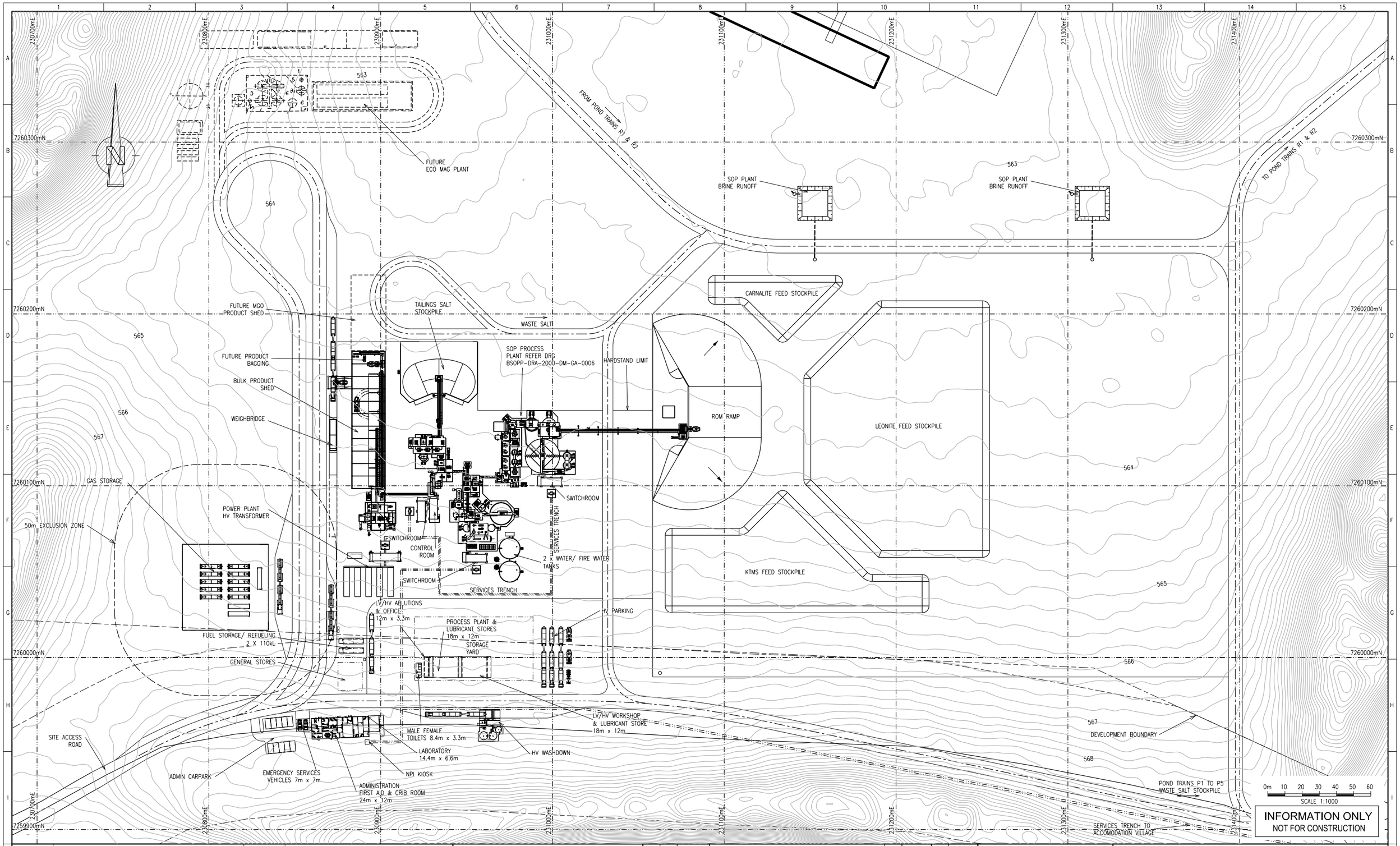


Figure 10: Typical liner terminations for pond embankments



DRAWING NO.	DESCRIPTION
2000-DM-G1-0015	SOP PROCESS PLAN MECHANICAL ARRANGEMENT ELEVATION SHEET 5 OF 5
2000-DM-G1-0014	SOP PROCESS PLAN MECHANICAL ARRANGEMENT ELEVATION SHEET 4 OF 5
2000-DM-G1-0013	SOP PROCESS PLAN MECHANICAL ARRANGEMENT ELEVATION SHEET 3 OF 5
2000-DM-G1-0012	SOP PROCESS PLAN MECHANICAL ARRANGEMENT ELEVATION SHEET 2 OF 5
2000-DM-G1-0011	SOP PROCESS PLAN MECHANICAL ARRANGEMENT ELEVATION SHEET 1 OF 5
2000-DM-G1-0010	SOP PROCESS PLANT MECHANICAL ARRANGEMENT PLAN SHEET 4 OF 4
2000-DM-G1-0009	SOP PROCESS PLANT MECHANICAL ARRANGEMENT PLAN SHEET 3 OF 4
2000-DM-G1-0008	SOP PROCESS PLANT MECHANICAL ARRANGEMENT PLAN SHEET 2 OF 4
2000-DM-G1-0007	SOP PROCESS PLANT MECHANICAL ARRANGEMENT PLAN SHEET 1 OF 4
2000-DM-G1-0006	SOP PROCESS PLANT LOCATION PLAN

DRAWING NO.	DESCRIPTION

REFERENCE DRAWINGS | REFERENCE DRAWINGS

KALIUM LAKES

DO NOT SCALE FROM DRAWINGS

REV.	BY	DATE	REVISIONS	CHK.	DATE	S.L.	DATE
–							
K	ALM	17/9/18	FOR USE IN STUDY				
J	GJC	31/8/18	FOR USE IN STUDY				
H	GJC	29/8/18	GENERAL REVISIONS				
G	GJC	2/8/18	HOLD H5 REMOVED, GENERAL REVISIONS				
F	GJC	30/7/18	REVISIONS AND ADDITIONS TO SOP PLANT & INFRASTRUCTURE				
			HOLD H1 REMOVED HOLD H5 ADDED				
E	GJC	2/7/18	LAYOUT REVISED POST CLIENT REVIEW				
D	GJC	29/6/18	LAYOUT REVISED POST CLIENT REVIEW				
C	GJC	27/6/18	LAYOUT REVISED				
B	GJC	21/6/18	INFRASTRUCTURE REVISED				
A	GJC	13/6/18	PRELIMINARY				

CLIENT		
PROJ. MANAGER		
PROF. ENG.		
PROJECT ENG.		
PROCESS ENG.		
D.O. MANAGER		
SECT LEADER		
CHECKED		
DRAWN	GJC	13/6/18
APPROVAL	SIGNATURE	DATE

DRA PACIFIC
LEVEL 8, 256 ADELAIDE TCE
PERTH WA 6000
TEL No (+618) 6163 5900

TITLE KALIUM BEYONDIE POTASH STUDY
SOP PROCESS PLANT AND INFRASTRUCTURE
GENERAL ARRANGEMENT

DWG NO.	REVISION	SCALE
A1 BSOPP-DRA-2000-DM-GA-0005	K	1:1000 U.O.S.

Figure 11: Process Plant General Arrangement

3 IDENTIFICATION OF CLOSURE OBLIGATIONS

Legal obligations relating to the closure of the Project are provided within Table 4.

Table 4: Legal obligations register – closure

Relevant DMP Tenement Conditions		
Tenement	**Condition No.**	**Closure conditions**
M 69/145 Ten Mile	2	All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program
	3	Unless the written approval of the Environmental Officer, DMIRS is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations.
M 69/146 Sunshine	3	Unless the written approval of the Environmental Officer, DMIRS is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations.
	4	The rights of ingress to and egress from Miscellaneous Licence 69/31 being at all times preserved to the licensee and no interference with the purpose or installations connected to the licence
Ministerial Statement		
Condition	**Date**	**Closure condition**
N/A	N/A	Ministerial Statement not yet granted
Commitment		**Aspect related to closure**
EP Act Part V Works Approval		
Condition		**Aspect related to closure**
N/A		Works Approval not yet granted, no closure conditions expected
EP Act Part V Licence		
Condition	**Date**	**Aspect related to closure**
N/A	N/A	Licence not yet granted
Licence to Take Water (5C) – GWL		
Tenement	**Condition**	**Closure conditions**
N/A	N/A	Licences not yet issued.
Beyondie Sulphate of Potash Project Mining Proposal		
Section No.		**Closure commitment**
N/A		Mining Proposal did not contain closure commitments as they were included in the MCP.
Beyondie Sulphate of Potash Project Preliminary Works Mining Proposal and Mine Closure plan		
Tenements		**Aspect related to closure**
M69/145, L52/162, L52/186, L52/187, L69/28, L69/29, L69/30		Management of mine closure to be undertaken in accordance with the mine closure plan (Reg ID: 74662) "Beyondie Sulphate of Potash Project – Preliminary Works Mine Closure Plan" dated 14 August 2018 signed by Brett Hazelden, Managing Director, and retained on Department of Mines, Industry Regulation and Safety file no.EARS-MPMCP-74662 as Doc ID 5966359.

	All topsoil and vegetation being removed ahead of all mining operations and being stockpiled appropriately for later respreading or immediately respread as rehabilitation progresses.
	On the completion of operations or progressively when possible, all waste dumps, tailings storage facilities, stockpiles or other mining related landforms must be rehabilitated to form safe, stable, non-polluting structures which are integrated with the surrounding landscape and support self-sustaining, functional ecosystems comprising suitable, local provenance species or an alternative agreed outcome to the satisfaction of the Executive Director, Resources and Environmental Compliance, DMIRS.
	The Lessee submitting to the Executive Director, Resource and Environmental Compliance Division, DMIRS, an Annual Environmental Report (AER) outlining the project operations during the previous 12 months, and the results of monitoring undertaken to demonstrate the level of achievement of the performance criteria from the approved Mining Proposal and the completion criteria from the approved Mine Closure Plan. The AER to be submitted each year in August
	A Mine Closure Plan is to be submitted in the Annual Environmental Reporting month specified in tenement conditions in the year specified below, unless otherwise directed by the Executive Director Resource and Environmental Compliance Division, Department of Mines, Industry Regulation and Safety. The Mine Closure Plan is to be prepared in accordance with the Department's "Guidelines for Preparing Mine Closure Plans".
Non-legally binding commitments and promises	
Document name	**Closure commitment**
Land Owner Agreements (LOAs)	Ongoing consultation regarding site closure and rehabilitation.
Native Title Land Access Agreement - Gingirana (LAA)	Ongoing consultation regarding site closure and rehabilitation.

In addition to the above, the legislation listed below will also be considered during closure:

- *Biosecurity and Agriculture Management Act 2007*;
- *Building Act 2011*;
- *Contaminated Sites Act 2003*;
- *Environmental Protection Act 1986*;
- *Land Administration Act*;
- *Mining Act 1978*;
- *Mines Safety and Inspection Act 1995*, and
- *Soil and Land Conservation Act 1945.*

4 STAKEHOLDER ENGAGEMENT

4.1 PRINCIPLE OF STAKEHOLDER ENGAGEMENT

The core principle of the stakeholder engagement strategy adopted for the Project is to identify relevant external stakeholders during the early stages of the Project and consult with them to determine their concerns, identify appropriate mitigation strategies and determine environmental outcomes. Stakeholder feedback has been considered in the development of the Project Risk Register.

4.2 TARGETED COMMUNITY AND ENGAGEMENT STRATEGY

Stakeholder consultation for the Project commenced in November 2014. Kalium Lakes engaged stakeholders early in Project planning, primarily in the interests of achieving a collaborative approach and to ensure that local knowledge is considered in the design and management of the Project.

The key stakeholders were provided with details of the Project characteristics, including mining and infrastructure requirements, the environmental studies undertaken, and mine closure and rehabilitation planning.

To date consultation has included:

- Written communications, including landholder notification of the scope and purpose of the technical studies, individual project briefings and meetings, landholder access arrangements for exploration, environmental investigations and eventual mining operations and notification of the Project environmental documentation;
- Meetings and project briefings delivered to various Ministerial offices;
- Local Government consultation including staff and councillors at the Shire of Wiluna and Shire of Meekatharra;
- Telephone and email discussions with local landholders regarding upcoming work programmes and access arrangements to facilitate field investigations;
- Media statements and interviews;
- Consultation with key Government agencies including Department of Mines, Industry Regulation and Safety (DMIRS), Department of Environment and Energy (DotEE), Department of Water and Environmental Regulation (DWER) and Department of Biodiversity, Conservation and Attractions (DBCA);
- Consultation with local Non-Government Organisations with an interest in achieving environmental objectives; and
- Engagement with indigenous stakeholders, including heritage surveys and the requirements for review of the EPA, EPBC and this Mining Proposal prior to submission.

Comments in the Stakeholder Engagement Register relating to rehabilitation and mine closure have been summarised in Table 5. While comments thus far on closure related aspects of the Project may not be extensive, this may simply reflect the current early development phase of the Project with greater interest in activities relating to Project start-up.

4.3 ONGOING COMMUNITY AND STAKEHOLDER ENGAGEMENT

Stakeholder engagement is a continuous process that has been and will continue to be conducted throughout the life of the Project. In particular, ongoing stakeholder engagement will be undertaken during the following components of the Project:

- During high risk activities (as required by the risk assessment);
- Prior to any major changes to proposed activities; and
- Upon identification by stakeholders of areas of concern.

The Stakeholder Engagement Register forms a component of the Kalium Lakes EMS. This register records consultation with key stakeholders and will remain as a live document updated as required throughout the life of the Project.

Table 6 summarises the planned stakeholder consultation relevant to Project closure, including specific topics of discussion and key issues.

Table 5: Stakeholder engagement register – rehabilitation and closure

Stakeholder	Date/s	Relevant issues / topics raised	Proponent response / outcome
DMIRS	January, March, April, June, July, December 2015 January, February 2016 June, November 2017 14-15 March 2018 (site visit) March, May 2018 Various emails & discussions 2015 - present	• Project assessment requirements • Project, future tenure and approvals • EIS Co-funding • Mining tenure application requirements • Mining Proposal and closure planning • Pre-referral discussions • Site Visit to Pilot Project (14 - 15 March 2018)	• Mining Proposal and MCP to be prepared in accordance with DMIRS guidelines • Mining Proposal and MCP to be submitted to allow parallel assessment with the Part IV EP Act process
EPA Services - DWER	November 2014 March, June, August 2015 January, April, June 2017 February, May, October 2018 Numerous emails & discussions 2015 - present	• Pre-referral meeting, level of assessment and Part IV assessment process • Minor or Preliminary Works Approval • Environmental survey effort requirements • Briefing on survey results • Briefing on trial ponds • Scoping document • Stygofauna management • Staging of the Proposal	• Kalium Lakes to continue to liaise with EPA Services during Part IV approval process • Minor or Preliminary Works approved • ERD includes recommended information and discussed management approaches • Kalium Lakes to organise site visit • ERD to cover stage 1 of the Proposal only
Department of Biodiversity, Conservation and Attractions (DBCA)	January, March, June, August 2015 April, June 2017 January, March, July, September 2018 Various emails & discussions 2015 - present	• Pre-referral project briefing • Environmental survey effort requirements and findings • Night parrot surveys	• Kalium Lakes to continue to liaise with DBCA during Part IV approval process • ERD to describe Night Parrot survey effort
Water - DWER	May, June 2015 April 2016 August, November 2017 May 2018 Various emails & discussions 2015 - present	• 26D and 5C requirements • 5C approval for 1.5 GL per annum pilot study • Provision of groundwater reports • Pre-referral discussions • Fresh water abstraction and stygofauna management	• Kalium Lakes to continue liaison during Part IV approval process • Kalium Lakes to provide information as required to allow the approval of 5C licences
Industry Regulation - DWER	2015 February, May, August 2018 Various emails & phone calls	• Pilot ponds project works approval and licence • Submission of works approvals for WWTP, landfill and solar salt manufacturing for full project • Compliance with trial ponds licence	• Kalium Lakes to provide information as required to allow the approval of WWTP works approval (submitted) • Kalium Lakes to apply for works approval for landfill and solar salt manufacturing for full project

Stakeholder	Date/s	Relevant issues / topics raised	Proponent response / outcome
Department of the Environment and Energy	October, November 2017 February, March 2018 Various emails & discussions 2017 - present	• Pre-referral meeting • EPBC Referral and assessment • Night parrot survey effort and findings • Bilby indirect impacts • Cost recovery • Night Parrot Management Plan requirement	• Kalium lakes to continue to liaise with DotEE regarding approval under the EPBC Act • Kalium lakes to respond to any additional queries from DotEE during their assessment
Department of Jobs, Tourism, Science and Innovation	July 2015 June, September 2017 April 2018 Various emails & discussions 2015 - present	EPA and EPBC referral documentation provided	Kalium Lakes to continue liaison during Part IV approval process
Minister of Mines and Petroleum; Commerce and Industrial Relations; Electoral Affairs; Asian Engagement.	September, December 2017 May 2018	Tenure and approvals strategy	None required
Minister for Environment; Disability Services / Deputy Leader of the Government in the Legislative Council	September, November 2017 May 2018	Future Ministerial Statement	None required
Local Government Authorities (Shire of Wiluna, Shire of Meekatharra, City of Geraldton, Shire of East Pilbara)	January, February, March, September 2017 February 2018 Various emails and phone calls	• Transport tonnages to and from mining operations • Septic tanks for accommodation village • Building Code requirements	Kalium Lakes to obtain required approvals and continue liaison with Shires.
Main Roads WA	January 2016 January, September 2018 Various emails & discussions 2016 - present	• Traffic Impact Statement • Road signage • Intersection approval • Simplifying intersection for 75,000 t operation	Kalium Lakes to obtain required approvals and continue liaison.
Mid-West Ports Authority	February, April, June 2015 January, November 2016 July 2017 March, November 2018 Various emails & discussions since 2015	• Site visit • Memorandum of Understanding for port access • Transport solutions	Kalium Lakes to continue liaison.
Marymia Pastoral Station	March, August 2015	• Consent letters to Grant of Tenements and to Grant of Miscellaneous Licences	Kalium Lakes to continue liaison.

Stakeholder	Date/s	Relevant issues / topics raised	Proponent response / outcome
	September 2017 January, September 2018 Various discussions since 2015	• Consent for licence applications • Beyondie Sulphate Of Potash Project – Notice of activities	
Kumarina Pastoral Station	August 2015 September 2017 January, September 2018 Various discussions since 2015	• Consent to licence applications • Beyondie Sulphate Of Potash Project – Notice of activities	Kalium Lakes to continue liaison.
Gingirana Native Title Claim Group	November, December 2014 March, May, October, November, December 2015 March, September, December 2016 January, August, October 2017 March, April, October 2018 Various emails & discussions 2015 – present	• Heritage surveys • Letter of Support • Land Access and mineral Exploration Agreement • Community Signing meeting • Annual community feedback meeting • Site visit and ethnographic consultation • Land Access Agreement • State Deeds • Review of environmental approval applications • Mining Lease and Miscellaneous Licence consent letters	• Kalium Lakes to provide draft copies of approval applications for review • Heritage surveys to be conducted as required • Kalium Lakes to continue regular liaison
MNR Determined Native Title	November, December 2014 February, March, June, November 2015 June 2016 May, August, September, October 2017 March 2018 Various emails & Discussions 2015 – present	• Heritage Surveys • Community meetings • Mining Land Access Agreement negotiations • Community Signing meeting • Annual community feedback meeting • Review of environmental approval applications • Site visit and ethnographic consultation • Land Access Agreement • State Deeds • Mining Lease letters	• Kalium Lakes to provide draft copies of approval applications for review • Heritage surveys to be conducted as required • Kalium Lakes to continue regular liaison
Wildflower Society of WA and Conservation Council of WA	September 2017	Project update briefing note	No response required

Table 6: Stakeholder engagement plan – rehabilitation and closure

Timing	Stakeholder	Type	Purpose of planned engagement	Issues to be raised
Q4 2018	DotEE	Telephone & email.	Correspondence to obtain approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).	• Potential impacts to MNES for the Project • Additional information requirements • Approval conditions • Night Parrot Management Plan
Q4 2018	EPA Services - DWER	Site visit. Telephone, email and meetings	Site familiarity during assessment process. Correspondence to obtain approval under Part IV of the EP Act). EPA Board meeting.	• Presentation of EIA • Review of ERD • Site visit • Draft conditions • EPA Board meeting
Q4 2018 Q1 2019	Industry Regulation - DWER	Telephone, email and meetings	Correspondence to obtain works approvals under Part V of the EP Act.	• Future Works Approvals and Licence requirements (evaporation ponds, landfill etc.) • Project Timing (i.e. construction) • Potential environmental impacts
Q4 2018 Q1 2019	Water - DWER	Telephone, email and meetings	Correspondence to obtain 5C Licences under the RIWI Act.	• RIWI Act approvals (5C & 26D) • Water requirements for the Project • Number and location of bores • Impacts • H3 assessment • Groundwater Operating Strategy • Management of stygofauna
Q4 2018 Q1 2019	DMIRS	Telephone, email and meetings	Correspondence to obtain grant of mining tenements and approval of Mining Proposal, MCP and Project Management Plan.	• Tenement applications • Mining Proposal and MCP assessment • Timing • Project specific requirements • Closure requirements • Project Management Plan assessment
2018, 2019	Main Roads WA	Letter	Letter summarising the Project status and future planning.	• Future applications • Site access • Timing (i.e. construction & operation) • Operating hours • Site access/routes
2018, 2019	Mid-West Port Authority	Letter	Letter summarising the Project status.	• Future applications • Export options

Timing	Stakeholder	Type	Purpose of planned engagement	Issues to be raised
				• Path forward for the full scale project
2018, 2019	Relevant Ministers	Letters	Letter summarising the Project status (i.e. approvals to date and path forward).	• Approvals and tenure status • Future applications • Studies undertaken • Key findings • Path forward for the full scale project
2018, 2019	Shires of Wiluna, Meekatharra and Geraldton	Letters	Letter summarising the Project status (i.e. approvals to date and path forward).	• Approvals status • Future applications • Path forward for the full scale project
2018, 2019	Gingirana Native Title claim group Birriliburu (MNR) Native Title claim groups	Letter and copies of draft approval documents	Feedback on project design.	• Approvals to date • Future applications • Studies undertaken and key findings • Path forward for the full scale project • Potential for indigenous opportunities • Bush tucker/ bush medicine
2018, 2019	Kumarina and Marymia Pastoral Stations, Kumarina Road House	Letters	Letters summarising the Project status and timing on pathway forward.	• Project summary, status, timing • Invitation for comment • Tenement applications
2018, 2019	Affected mining and infrastructure companies	Letters and access agreements	Letters summarising the Project status and timing on pathway forward.	• Project summary, status, timing • Invitation for comment • Tenement applications

5 POST-MINING LAND USE AND CLOSURE OBJECTIVES

5.1 POST-MINING LAND USE

Most of the Project Disturbance Envelope is located on Unallocated Crown Land (UCL) (Figure 3). In a general sense, UCL is maintained with little management as native vegetation for no particular purpose. As no particular land use is identified for UCL, is assumed that post-mining, the land will be returned to UCL and henceforth UCL will be used as the identified post-mining land use.

With UCL relying on native vegetation, soil and land needs to be able to be retained in a condition that protects the land from becoming degraded, rehabilitated areas need to be sufficiently safe, stable and non-erodible to allow for the re-establishment of native vegetation appropriate to the area.

The western portion of the Project is located on the Marymia and Kumarina pastoral stations where the land is suitable for livestock grazing. In pastoral lease areas the post-mining land use will be pastoralism.

Kalium Lakes recognises that both land uses rely upon sustainable native vegetation and may include a broad range of landforms, soils and habitat.

Kalium Lakes also recognises that post-mining land use must be suitable for use by the traditional landowners.

5.2 CLOSURE OBJECTIVES

The overarching objective for the closure and rehabilitation of the Project is to make the disturbed area safe, stable, non-polluting and capable of sustaining the agreed post-mining land uses. This objective is consistent with the Guidelines. The closure objectives reflect the fact that the type of mining is different from traditional open cut pit or underground mining. The main areas of disturbance include salt lake playa with no plants, salt lake fringes supporting salt tolerant species and dune/swale systems supporting spinifex.

More detailed closure objectives have been developed based on the current understanding of the Disturbance Envelope, the proposed mining activities and materials characteristics using the structure proposed in the Guidelines. The objectives may be further refined following additional stakeholder engagement, completion of further activities to address information gaps, and in the event that the Project is expanded.

For the purpose of this MCP, 'landforms' refers to the following major landforms present within the disturbance envelope:

- Dunes;
- Sandplain;
- Stony hills; and
- Salt lake.

Compliance

1. All legally binding obligations, conditions and commitments relevant to rehabilitation and closure shall be met.

Landforms and Soils

2. All constructed landforms shall be physically safe.
3. Target landforms and rehabilitation surfaces shall be planned and implemented for all broad-scale areas disturbed for the evaporation ponds (excluding retained infrastructure).

Revegetation

4. Revegetation areas shall be rehabilitated with local native species and be suitable for the resumption of post-mining land use without additional management actions.
5. No new weed species are introduced by closure activities and native vegetation is not impeded by weed species.

Fauna

6. Rehabilitated areas provide similar habitat opportunities for local native fauna as surrounding areas.

Surface water

7. Landforms shall be designed to support hydrological patterns and flows for agreed design events.
8. Any water run-off or leaching from rehabilitated areas or the excess salt disposal area shall not cause plant deaths within the surrounding native vegetation.

Groundwater

9. Closure does not result in saline water entering freshwater systems.
10. Groundwater level recovery is not impeded by closure activities.

Infrastructure and Waste

11. As part of decommissioning and closure related activities, waste materials shall be removed from site for recycling or to an approved waste treatment/disposal facility.
12. The landfill area shall be decommissioned and closed according licence requirements.
13. All bores, pipes, tanks, roads and other infrastructure shall be decommissioned and made safe or else legal responsibility will be assumed by a third party.

6 COMPLETION CRITERIA

Indicative completion criteria have been developed for the Project based on post-mining land use and closure objectives, baseline environmental data, environmental obligations and the expectations of relevant stakeholders to enable rehabilitation success to be quantified and to demonstrate that closure objectives have been met. The criteria will be the subject of further consultation and development over the life of this MCP to meet the 'SMART principle' (Specific, Measurable, Achievable, Relevant and Time-bound).

The indicative completion criteria developed for the Project are provided in Table 7.

Table 7: Completion criteria

Aspect	Objective	Indicative completion criteria	Measurement tool	Evidence of completion
Compliance	All legally binding obligations, conditions and commitments relevant to rehabilitation and closure shall be met.	Site obligations fulfilled or new owner identified and accepted.	Letters of acceptance for responsibility, tenure or ownership certificates for any retained infrastructure. Post-closure audit of legal obligations, conditions and commitments.	Third party audit demonstrates full compliance.
Landforms and Soils	Target landforms and rehabilitation surfaces shall be planned and implemented for all significantly disturbed areas (excluding retained infrastructure).	Rehabilitation plan identifies target landforms (playa, claypan, lake fringe and dune/swale), specifies soil profile characteristics and drainage for the ponds and lake surfaces. Constructed rehabilitation areas are implemented according to rehabilitation plan.	Rehabilitation plan covering ponds and lake surfaces. Annual reporting of topsoil/subsoil volumes, disturbed areas and rehabilitated areas. As-built survey. Auger holes to check soil profile.	As-built survey report. Soil profile report.
Revegetation	Revegetation areas shall be rehabilitated with local native species and be suitable for the resumption of post-mining land use without additional management actions.	Revegetation density and species diversity consistent with or trending towards selected analogue sites.	Revegetation monitoring designed and conducted by suitably qualified professional in the fifth year (or later) following completion of rehabilitation earthworks.	Site inspection records and/or rehabilitation report.
	No new weed species introduced by closure activities and native vegetation is not impeded by weed species.	Revegetation areas not carrying significantly greater weed burden than surrounding vegetation. No new weed species present.	Weed cover assessment designed and conducted by suitably qualified professional in the fifth year (or later) following completion of rehabilitation earthworks.	Site inspection records and/or rehabilitation report.
Fauna	Rehabilitated areas provide similar habitat opportunities for local native fauna as surrounding areas.	Revegetation areas have sufficient diversity of vegetation species and structure to promote native fauna recolonisation. Un-vegetated rehabilitation areas have similar characteristics to analogue landform areas.	Post-rehabilitation fauna habitat assessment designed and conducted by suitably qualified professional in the fifth year (or later) following completion of rehabilitation earthworks.	Post-rehabilitation fauna habitat assessment report
Surface water	Landforms shall be designed to support hydrological patterns and flows for agreed design events.	Agreed design basis for landforms. Surface water designs for key closure landform features. Landforms constructed consistent	Surface water designs and surface water modelling for key closure landform features. As-built survey.	Surface water modelling report. As built survey.

Aspect	Objective	Indicative completion criteria	Measurement tool	Evidence of completion
		with surface water designs.		
	Any water run-off or leaching from rehabilitated areas or the bunded excess salt stockpile area shall not cause significant off-site impacts.	Operational period shows lake fringing vegetation characteristics are not significantly impacted. Excess salt stockpile runoff is demonstrated to be adequately contained and not cause significant off-site impacts.	Lake fringing vegetation monitoring. Surface water modelling. Surface water quality and lake biota monitoring.	Lake fringing vegetation monitoring, surface water modelling and surface water quality and lake biota monitoring reports.
Groundwater	Closure does not result in saline water entering freshwater systems.	No noticeable increase in salinity in freshwater source areas.	Groundwater quality monitoring.	No change in salinity above background levels.
	Groundwater level recovery is not impeded by closure activities.	Closure activities are demonstrated to not effect groundwater levels through impeding recharge.	Groundwater level monitoring.	Groundwater levels remain the same or increase post-closure.
Infrastructure and Waste	As part of decommissioning and closure related activities, waste materials (excluding excess salt) shall be identified and removed from site for recycling or to an approved waste treatment / disposal facility.	Waste disposal plan prior to decommissioning and closure. All waste materials have been removed from site for recycling or to an approved waste treatment / disposal facility.	Waste disposal plan. Verification of removal from site. Verification of appropriate disposal.	Waste disposal plan. Site waste audit. Disposal verification audit.
	The landfill area shall be decommissioned and closed according licence requirements.	Closure requirements agreed. Closure actions implemented.	Licence reporting. Audit.	Audit report. Licence relinquishment.
	All bores, pipes, tanks and other ancillary infrastructure will be decommissioned and made safe or else legal responsibility will be assumed by a third party.	All bores, pipes, tanks and other ancillary infrastructure has been decommissioned, or legal responsibility agreement finalised.	Inspection and audit.	Audit report.

7 COLLECTION AND ANALYSIS OF CLOSURE BASELINE DATA

The closure data provided in this section includes information on the existing environment, environmental management and rehabilitation requirements for setting the closure completion criteria for the proposed disturbance footprints of the Project.

Relevant scientific reports referred to in the following sections have been attached as appendices.

7.1 CLIMATE

The Gascoyne bioregion has an arid climate with and summer rainfall in the east. Spatially averaged median (1890–2005) rainfall is 202 millimetres (mm) (DEWHA, 2008a). The climate of the Little Sandy Desert bioregion is also arid with summer-dominant rainfall. Spatially averaged median (1890–2005) rainfall is 178 mm (DEWHA, 2008b). The climate of south-western Little Sandy Desert has also been described as desert tropical with predominant summer rainfall (van Leeuwen, 2002).

The nearest Bureau of Meteorology (BoM) weather station with long-term data averages is Three Rivers, approximately 120 km to the south-west of the Project. Three Rivers records the highest maximum mean monthly temperature (39.3°C) in January and the lowest maximum mean annual temperature (21.0°C) in July. The lowest mean minimum temperature is recorded in July (4.8°C) and the highest in January (24.1°C). Average annual rainfall is 232.8 mm with January, February and March recording the highest monthly averages (35.5, 44.3, and 37.7 mm respectively) (BoM, 2018) (Figure 12).

The nearest BoM weather station with current daily observations is Newman Airport (No. 7176, Latitude: 24.42°S Longitude: 119.80°E), approximately 150 km north-northwest of the study area. Newman records the highest maximum mean monthly temperature (39.0°C) in January and the lowest maximum mean annual temperature (22.9°C) in July. The lowest mean minimum temperature is recorded in July (6.4°C) and the highest in January (24.9°C). Average annual rainfall is 327.7 mm with January, February and March recording the highest monthly averages (67.5, 71.7, and 44.0 mm respectively) (BoM, 2018).

Pan evaporation for the south-western Little Sandy Desert bioregion ranges from 16.1 mm/day in January to 4.5 mm/day in June at an annual daily average of 10.2 mm (van Leeuwen, 2002). The predominant wind direction is from the east.

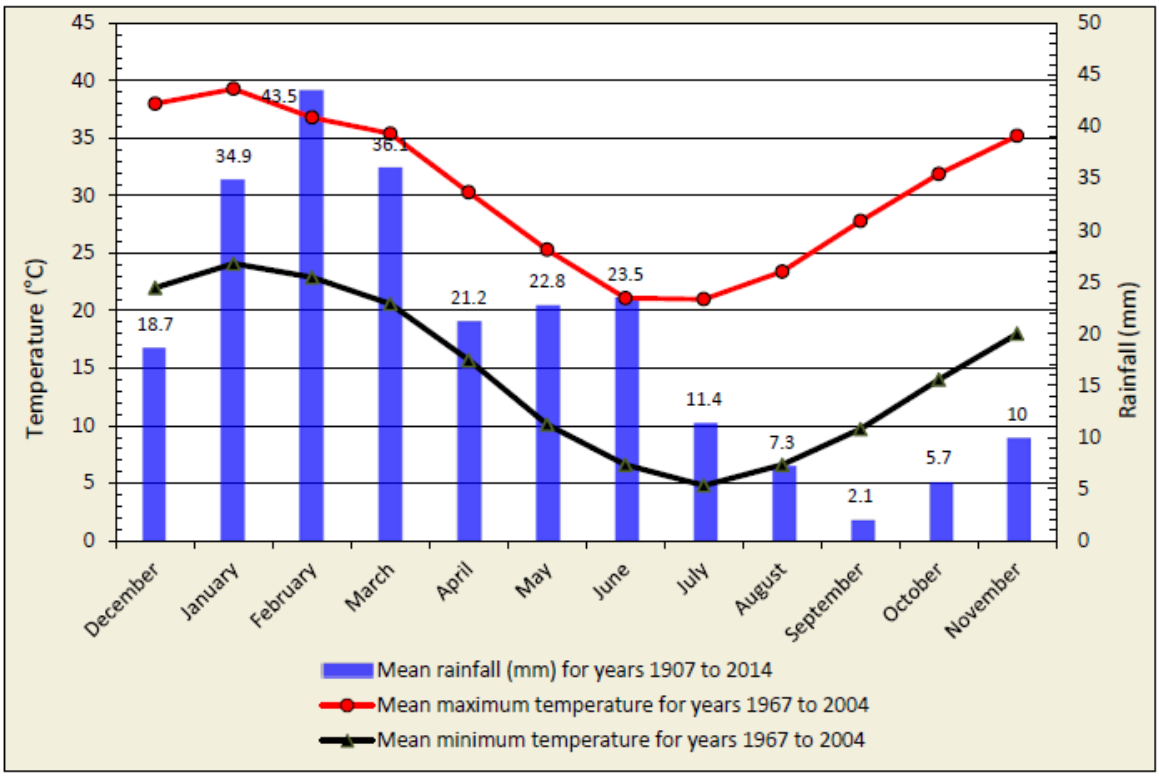


Figure 12: Mean monthly rainfall and mean daily maximum temperature at Three Rivers, WA

7.2 LAND USE

The Project is located predominantly within the Shire of Wiluna, with the initial access road in the Shire of Meekatharra. The majority of the tenements are located within UCL with the western portion located on the Marymia and Kumarina pastoral stations. At a local scale, little information is available in relation to land use near the Project. Apart from camel harvesting operations and some four-wheel-drive tourism, the area has been described as 'economically inconsequential' (van Leeuwen, 2002; Phoenix 2018a).

The Project is located 78 km east of the Great Northern Highway. The Great Northern Highway provides the main logistical supply link between major supply and distributions centres of Port Hedland (700 km), Geraldton Port (862 km), Perth (1,088 km) and Kalgoorlie (1,030 km). The nearest town is Kumarina, located on the Great Northern Highway 78 km east of the Project. Kumarina town consists of Road house, caravan park and small wildlife sanctuary.

The region around the project has been mined for other minerals including Methwin Diamond located 30 km to the south, Karin Manganese mine located 30 km to the west and Plutonic Gold mine is located 133 km to the south west. No SOP producers are currently in the region.

Collier Range National Park 60 km to the west was established in 1978. The park is little managed with annual wild dog baiting, but otherwise only occasional visits by Karratha staff (Desmond et al., 2001). Giles Nature Reserve covering the south-western parts of the Little Sandy Desert was proposed in 2002 (van Leeuwen, 2002). This proposed A-class reserve does not cover the study area; however, is likely to provide refugial habitats for local and regional fauna and flora. The Birriliburu Indigenous Protected Area includes the sandstone Carnarvon Ranges (Phoenix, 2018a).

7.3 LANDSCAPE AND GEOLOGY

7.3.1 LANDSCAPE

The Project is located on the edge of Ten Mile and Sunshine Lakes and extends into the Little Sandy Desert, which is characterised by dry salt lakes, extensive sand dunes and flat plains. The playa lakes are located in a broad, easterly trending valley, which hosts a non-perennial water course. The Project is situated at the junction of the Augustus subregion (GAS3) of the Gascoyne bioregion and Trainor subregion (LSD2) of the Little Sandy Desert bioregion as defined by the Interim Biogeographic Regionalisation of Australia.

The Augustus subregion (GAS3) is characterised by (Desmond et al., 2001):

- Low Proterozoic sedimentary and granite ranges divided by flat broad valleys;
- Mulga woodland with *Triodia* on shallow stony loams on rises with mulga parkland on shallow earthy loams over hardpan on the plains;
- Extensive areas of alluvial deposits;
- Calcrete aquifers of the Carnegie drainage system; and
- Desert climate with bimodal rainfall.

The Trainor subregion (LSD2) is characterised by (Cowan & Kendrick, 2001):

- Red centre desert on Neoproterozoic sedimentary basement (Officer Basin);
- Red Quaternary dune fields with abrupt Proterozoic sandstone ranges of Bangemall Basin;
- Shrub steppe of acacias, *Aluta maisonneuvei* and grevilleas over *Triodia schinzii* on sandy surfaces;
- Sparse shrub-steppe over *Triodia basedowii* on stony hills;
- Eucalypt and coolabah communities and bunch grasses on alluvial deposits and drainage lines associated with ranges; and
- Arid climate with episodic summer rainfall.

The Department of Agriculture and Food (DAFWA) has mapped the Land Systems in the Little Sandy Desert and Gascoyne bioregions (Figure 13) (DAFWA, 2014). The majority of the Project is located within the AB44 Land System. The Beyondie Road traverses a number of other Land Systems in the area. A brief description of the major features typical of these Land Systems is presented below:

- **AB44**: Plains with a variable, but usually high, proportion of longitudinal sand dunes, and with some clay pans; scattered sandstone hills and laterite residuals are fairly common;
- **Oc49**: Partially dissected pediments with some low stony hills on fine-grained sedimentary rocks and basic dykes, frequently flanking areas of unit Fa8;
- **BB9:** Narrow plain associated with the major river systems, usually occurring upstream of unit Oc47 and characterized by frequent outcrops of calcrete (kunkar);
- **BE6**: Extensive flat and gently sloping plains, which sometimes have a surface cover of gravels and on which red-brown hardpan frequently outcrops;
- **Bryah System:** Stony plains and reticulated internal drainage flats with sparse tall acacia shrublands and low chenopod shrublands;
- **SV5**: Saline soils associated with salt lakes; sand and kopi gypsum dunes, and intervening plains;
- **Frederick System**: Hardpan wash plains with broad, reticulate mulga groves and wanderrie banks supporting acacia tall shrublands with grassy understorey; and

- **Jamindie System :** Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey.

7.3.2 GEOLOGY

Regional geology for the Beyondie Lakes area is presented in Figure 14. The playa lakes identified under the Project are located just off the south-western edge of the Northwest Officer Basin (previously named Savory Basin). Among others, the Northwest Officer Basin contains the amended Sunbeam Group. The Beyondie Lake area is underlain by rocks of the Sunbeam Group, consisting mostly of sedimentary sandstones, siltstones, conglomerates and shales.

The formations making up the Sunbeam Group (Grey et al, 2005) are:

- **Watch Point Formation**: brown to grey, fine- to medium-grained sandstone interbedded with grey to olive-green siltstone and silty sandstone and brown to blue-grey shale. Some fine-grained sandstone is glauconitic;
- **Coondra Formation**: coarse grained sandstone interbedded with pebble to boulder conglomerate in part matrix supported;
- **Spearhole Formation**: Coarse- to medium-grained sandstone, pebbly sandstone and conglomerate lenses;
- **Mundadjini Formation**: Fine- to coarse-grained sandstone, conglomerate, siltstone, minor shale, mudstone, dolomite (some stromatolitic) and evaporites;
- **Skates Hill Formation**: contains dolomite, commonly stromatolitic, medium- to fine-grained sandstone, siltstone and thick, discontinuous basal conglomerates; and
- **Boondawari Formation**: diamictite, fine- to coarse grained sandstone, conglomerate, siltstone, mudstone, dolomitic siltstone and dolomite, in part stromatolitic.

Intruded into the bedrock are dolerite intrusions (dykes and sills), while palaeochannel have been incised into the bedrock. Within the lakes, Quaternary lacustrine deposits are mainly clay, mud and silt which are usually saline and commonly gypsiferous. This region also contains a mixed sequence of Quaternary lacustrine and eolian deposits, characterised by saline clay, mud, silt and sand with gypsiferous (kopi) dunes. Surrounding the lakes are expanses of Quaternary eolian sand and sand sheets. Longitudinal (seif), chain and net dunes are abundant and there are some areas of ironstone pebble veneer. Areas of valley calcrete, sheet carbonate and opaline silica are also present, especially to the south-east and west of Ten Mile.

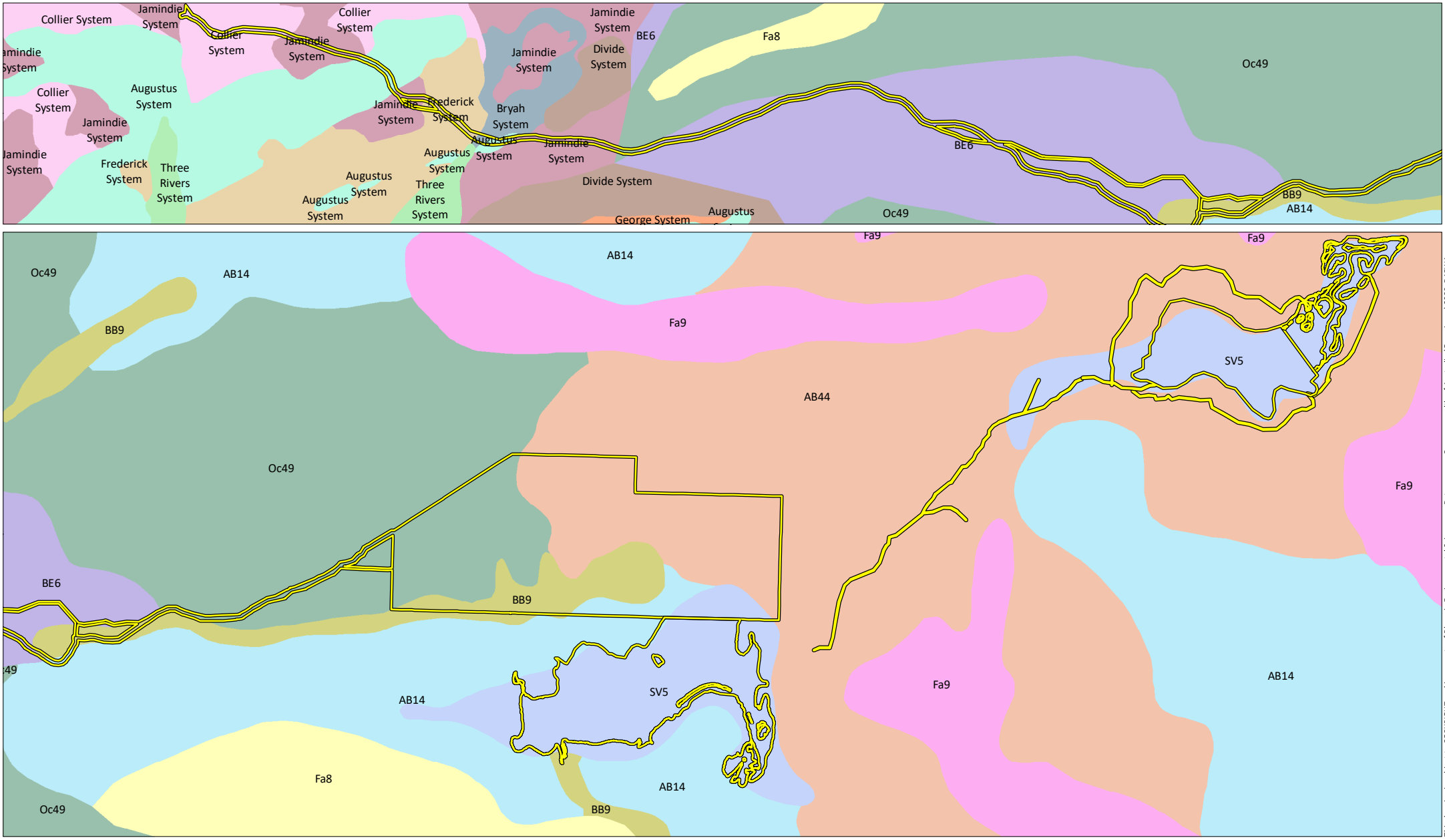


Figure 3–2
Land systems of the study area

PHOENIX ENVIRONMENTAL SCIENCES

Figure13: Land systems of the study area (Phoenix,

Kumarina Roadhouse

Marymia Rd

Great Northern Hwy

1:1000K Geology (DMIRS)

State Road
Local Road
Disturbance Envelope
Kalium Lakes Tenements

Rev	Description	Drn	Chk	App
1	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH
0	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH

Datum: GDA94
Projection: MGA51
Scale at A3: 1:300000

0 2 4 6 8 10 km

KALIUM LAKES

Beyondie Sulphate Of Potash Project
Regional Geology

KLP_18053	26/11/2018

Figure 14: Regional Geology

7.3.3 PALAEOCHANNEL GEOLOGY

The geology of the material infilling the palaeochannels in the Beyondie area is uncertain. To the north (250 km), the Paterson Demonstration site has identified palaeochannels filled with older Permian sediment of the Paterson Formation, while palaeochannels around Wiluna (250 km to the south) are infilled with younger Tertiary sediments. It is not clear as to what material fills the Beyondie palaeochannel system. The Paterson Formation sediments consist of poorly sorted sandstone, claystone, conglomerate, tillite and siltstones, all deposited in glacial, lacustrine, to fluvioglacial environments. At the Paterson Demonstration site (English *et al*, 2012), the palaeochannel infill consisted of Cenozoic alluvium, overlying tillic clay and basal sands/conglomerates of the Paterson Formation.

The composition of Tertiary palaeovalley infill is remarkably uniform across Australia (Magee, 2009). It generally consists of fluvial sand overlain by lucastrine, fine-grained sediments (clays), underlain by a basal horizon of fluvial sands/conglomerates/gravels. The basal gravels/sands are usually carbonaceous with lignites and finer-grained interbeds representing swamp and valley lacustrine deposits. Basal sands can be up to 40 m thick in the thalweg of the palaeochannels (Johnson, et al., 1999). Reward Minerals (2014b) have recorded the occurrence of a basal Tertiary sand, underlain by Patterson Formation in the palaeochannel in the Lake Dora West palaeochannel system (400 km north-east of Beyondie Lake). It appears likely, that the palaeochannel will be filled with an upper alluvium, an intermediate clay layer and a basal sandy/gravelly horizon, no matter whether the deposits are Permian or Tertiary in age. A conceptual cross section has been developed through the Ten Mile lake system as seen in Figure 15.

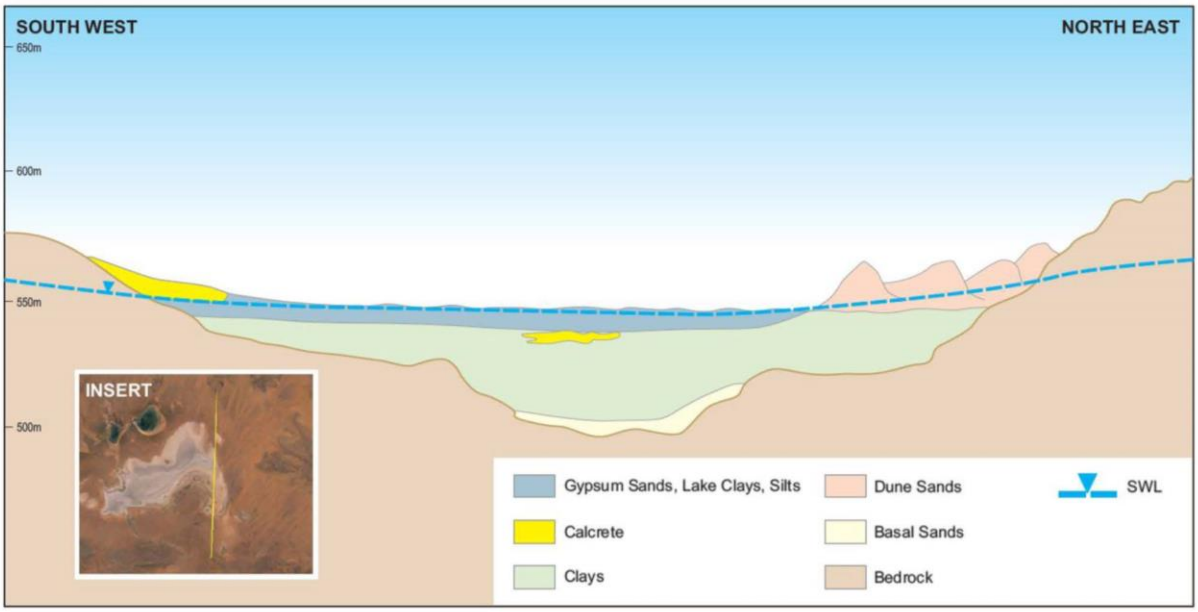


Figure 15: Conceptual cross-section of Ten Mile Lake

7.4 MATERIALS CHARACTERISATION

7.4.1 SOILS

Soils are classified according to the WA Soil groups outlined in Schoknecht and Pathan (2013). The Project is dominated by deep sandy and sandy earth soils (Beyondie Road, workshop, accommodation camp, ponds and processing facilities). These soils present little risk from disturbance and provide good construction materials. Construction of the ponds requires only minor earthworks with cut to fill balances being achieved to minimise cost and depth of disturbance. The low rainfall environment, lack of defined surface drainage, high infiltration soils and minimal need for earthmoving for the ponds provides little erosion risk.

The Beyondie Road traverses a number of other soil groups, but it is a linear feature requiring a small area of surface disturbance.

Soil groups relevant to the Project are listed below and shown in Figure 16:

- Deep sandy and sandy earth soils- red soils;
- Texture contrast soils (sandy and loamy duplexes- red soils;
- Soils with shallow water tables – salt lakes and saline wet soils;
- Loamy earth soils;
- Rocky stony soils; and
- Clayey soils – red/brown non-cracking clays.

Phoenix (2018a) recorded broad soil categories as a component of the flora and vegetation survey. The results relevant to the main disturbance area (where the ponds are to be located) show predominantly sandy textured soils with sandy clay loams in some of the swale areas. The access road and lake fringes through to playas show a range of finer textured soils including clays found in some lower landscape positions.

The volume or characterisation of the topsoil and subsoil are unlikely to pose any major problems during stripping, stockpiling and eventual re-application as the area of disturbance is low and stripping will be limited to shallow excavations. The earthworks associated with the trial ponds stripped approximately 100mm of topsoil. Soils will be stored in the immediate area of stripping and reapplied to the same area to ensure the soil profile is correctly reconstructed.

The lake surface area is mapped as having potential for acid sulphate soils (PASS) (CSIRO, 2014). Fitzpatrick and Shand (2008) outlined that "whether or not sulphide deposits are also acid sulfate soils is dependent on the acid neutralising capacity stored in the soils or sediments. In particular, many of the disposal basins with high SCr concentrations also had elevated ANC and do not appear to be at risk of acidification at the scale of the whole wetland. This is consistent with the endorheic surface water hydrology of disposal basins, where the alkalinity produced during sulfate reduction over time should have remained largely stored within the system (Lamontagne et al 2006)". The precipitation of gypsum ($CaCO_3$) in the lake sediments shows that a key neutralising agent is in supply at saturation levels.

However, the potential for acid-producing behaviour is expected to be low based on:

- The site is located above the Menzies line – a line identified by Geoscience Australia south of which salt lake sediments have a tendency to be more acidic

(http://www.ga.gov.au/metadata-gateway/metadata/record/79059 accessed June 2018);

- The excavated trenches from the trial and the dunal areas surrounding the lakes have revealed significant calcium precipitation in the form of gypsum and calcrete;
- There has been no evidence of low pH water in lake surface water or groundwater samples, including those taken from trenches;
- Lake water and sediment chemistry shows considerable neutralising capacity, and
- X-ray diffraction analysis of alluvial sediment at Ten Mile Lake and Lake Sunshine have not identified any sulphide minerals.

The lake surfaces are often devoid of any vegetation due to occasional flooding and waterlogging events. The fringes of the lakes support species adapted to saline conditions with sporadic flooding and waterlogging. Hydrological characteristics are presented in Section 7.6.

7.4.2 Implications for Site Rehabilitation and Closure

The sandy soils of the Project suggest high infiltration rates will follow the sporadic rainfall events typical for the area. The materials characterisation baseline data suggests two key environmental risk issues for the mine throughout both operational and closure phases:

- Management of topsoil and subsoil materials from the off-lake footprints will need to be completed to ensure that rehabilitation of the disturbed areas is able to support a sustainable cover and diversity of native flora species;
- A portion of the ground disturbance is on the lake surfaces, which are devoid of vegetation. These areas are not intended to be vegetated in the mine closure and rehabilitation phase;
- Lake trenches should be backfilled at closure to return soil hydrological regimes back to pre-mine conditions; and
- Rehabilitated landforms are safe and stable without significant erosion gullies and soil loss.

These risks are the subject of a series of control measures that apply during both operations and closure.

Great Northern Hwy

Kumarina Roadhouse

Marymia Rd

Disturbance Envelope

Kalium Lakes Tenements

Characteristic Soils WA

- Soils with Shallow Water Tables
- Rocky or Stony Soils
- Deep Sandy Soils - Calcareous
- Deep Sandy and Sandy Earth Soils
- Gravelly Soils - Sandy or loamy and shallow
- Loamy Earth Soils - Red loamy earths (some red sands, red loamy duplexes & gravels)
- Loamy Earth Soils - Calcareous earths and red loamy earths
- Texture Contrast Soils - Sandy and loamy duplexes
- Texture Contrast Soils - Sandy and loamy duplexes
- Soils with Shallow Water Tables - Saline watertables

Rev	Description	Drn	Chk	App
1	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH
0	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH

Datum: GDA94
Projection: MGA51

Scale at A3: 1:300000

0 3 6 9 12 15 km

KALIUM LAKES

Beyondie Sulphate of Potash Project
Disturbance Envelope with WA Soil Characteristics

KLP_18028 | 26/11/2018

Figure 16: WA Soil Groups for the Project Area

7.5 HYDROLOGY

The Project is located on and around Ten Mile Lake and Lake Sunshine within the Little Sandy Desert, which is characterised by dry salt lakes, extensive sand dunes and flat plains. The playa lakes are located in a broad, easterly trending valley, which hosts a remnant water course. The areas rarely flood and there is very limited drainage definition. There are no surface water management areas intersected by the Disturbance Envelope.

7.5.1 PROJECT INTERACTION WITH SURFACE WATER FLOWS

The Disturbance Envelope of the Project intersects a number of surface water features (Figure 4 & Figure 5), the key intersections being:

- Ten Mile Lake and Lake Sunshine: These areas will support surface trenches, bores, pumps and pipes to enable the extraction and transport of hypersaline groundwater. The eastern section of Ten Mile Lake is also the location of the excess salt disposal area;
- Two small unnamed salt lakes to the east of Ten Mile Lake are to be used as a concentrator lakes and will be partially inundated with brine; and
- Several other small ephemeral creek lines intersected by access roads and pipelines.

Ten Mile Lake forms the western end of a chain of ephemeral salt lakes which extend eastwards and include Lake Sunshine, Yanneri Lake and Terminal Lake. This suite of lakes do not connect above ground but they form part of the Ilgari palaeoriver which is a remnant of an extensive river system from the tertiary period (Gentilli, 1979). The Ilgari palaeoriver is a tributary of the Disappointment palaeoriver, which includes Lake Disappointment at the head of the catchment, 140 km northeast of Lake Aerodrome (Beard 2005). The lakes are interspersed with small, unnamed salt lakes and clay pans (playas).

The Beyondie Lakes are located immediately north of Ten Mile Lake, outside the Disturbance Envelope (Figure 4). These lakes are a suite of wetlands consisting of a freshwater marsh area to the west, two circular salt playas and interconnecting channels.

7.5.2 DRAINAGE AND FLOODING

A surface water assessment inclusive of flood modelling has been undertaken for the Project by Advisian (2018) provided in Appendix 2. A summary of the results of these studies is provided below.

The Project falls within the arid desert climate zone. Most of the strongly seasonal rainfall occurs in the period between December and June. A large percentage of the annual total precipitation occurs over short periods, associated with thunderstorm activity and cyclonic lows. Mean annual rainfall has been estimated (based on the nearest meteorological station at Three Rivers Station) at 238.4 mm, with annual evaporation much higher, at 4,100 mm (Advisian, 2017a). Evaporation maps illustrate the Proposal is located in an area expected to experience some of the lowest humidity and highest evaporation rates in Australia (http://www.bom.gov.au/watl/evaporation/ accessed 8 June 2018).

The lakes in the present landscape are a function of the low rainfall and high evaporation experienced in the region. Beyondie Lakes, Ten Mile Lake and Lake Sunshine are the western-most catchment lakes in a chain that stretches for some 220 km west to east.

Ten Mile Lake and Lake Sunshine have individual catchments that sit within the upper reaches of a much larger system. The catchment areas associated with Ten Mile Lake and Lake Sunshine are shown in Figure 17 . The combined Ten Mile and Beyondie Lakes catchment area covers an area of 3,160 km^2 and the Lake Sunshine catchment area covers an area of 745 km^2. The ephemeral creeks associated with these catchments flow into the lake systems, however analysis of aerial imagery and topographic survey data suggests there is significant storage within the catchment areas, which limits the volume of runoff reaching the lakes. The storages are in the form of parallel dune systems and salt pans (Advisian, 2018, 2017a; Appendix 1).

Surface water is expected to be present on the lakes for periods of time following heavy rainfall events, however these events are rare. Approximately 60 mm of rainfall fell over a 48-hour period during a rainfall event in late January 2018. Based on the IFD data this is equivalent to between a 50% and 20% Annual Exceedance Probability (AEP) event (equivalent to 2 yr and 5 yr Annual Recurrence Interval (ARI) event respectively). No creek flow was seen entering the lakes and surface water depth on Lake Sunshine was estimated to be less than approximately 0.1 m. The locations of the lakes within the catchment, their size and catchment run off characteristics determine the individual lake surface water regime (Advisian, 2018).

Extreme rainfall events are expected to result in significant volumes of surface water, with 32 GL held within Ten Mile Lake and 22 GL within Lake Sunshine during a 1% AEP rainfall event. However given the size of the Ten Mile Lake and Lake Sunshine, even a 1% AEP rainfall event is unlikely to result in flood depths greater than 1.2 m. Figure 18 shows the predicted flood levels for various rainfall events at Ten Mile Lake (Advisian, 2018).

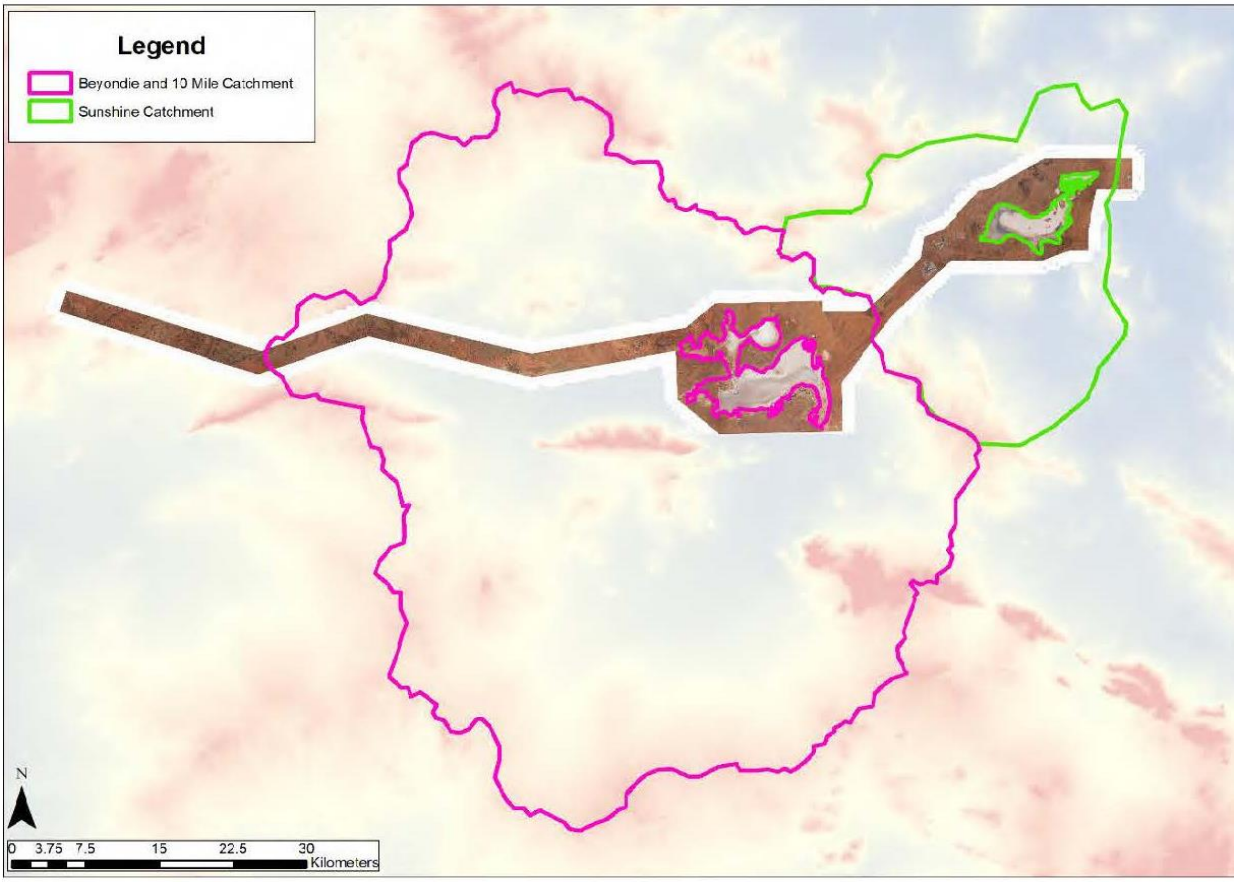


Figure 17: Catchments Relevant to the Project (Advisian, 2018)

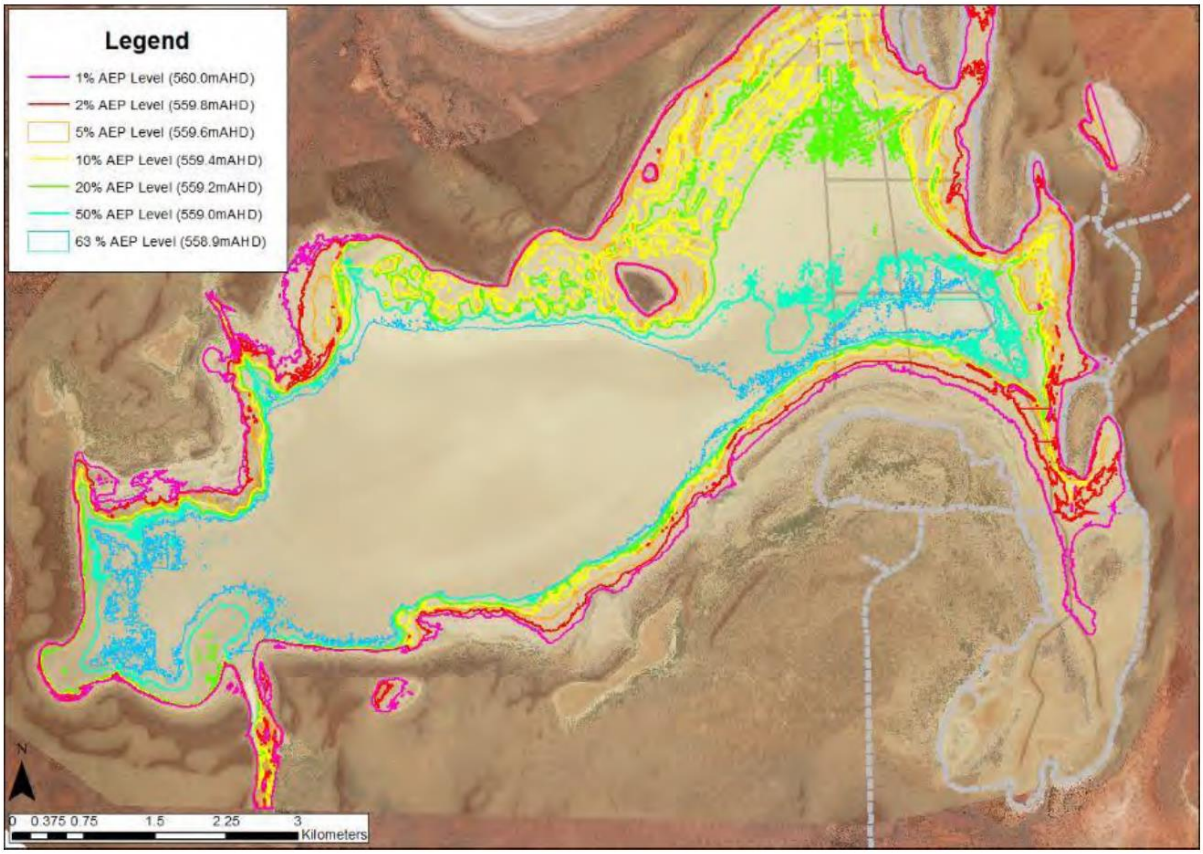


Figure 18: Estimated flood levels for rainfall events at Ten Mile Lake

7.5.3 GROUNDWATER

Groundwater investigations, including a preliminary water supply assessment and hydrogeological brine abstraction assessment were undertaken for the Project by Advisian (2017a &2017b) provided in Appendix 1. A summary of the results of these studies is provided below.

Regional and Local Hydrogeology

Two regional aquifer units have been identified within the Cenozoic sediments, the palaeochannel sand aquifer of Eocene age that is located at the base of the palaeo-drainage system, and the shallow surficial aquifer comprising Pliocene and Quaternary evaporites, calcrete and silt. These aquifers are considered to be hydrogeologically separated from one another by a thick sequence of stiff lacustrine clay that forms an aquitard.

The regional bedrock is considered to generally be of low aquifer potential, however deep weathering profiles and regional structural features have enhanced the aquifer transmissivity in the sandstone and basalts within the Sunshine Lake area.

Where bedrock aquifers are encountered below lacustrine clay the groundwater system is confined in nature. However, where bedrock is exposed outside of the palaeovalley groundwater is unconfined and would flow according to local groundwater table flow patterns.

The target aquifers for the Project are the Palaeogene aged, high-energy fluvial basal sand unit, the Quaternary surficial sequence of the salt lakes, and Proterozoic sandstones and basalt where heavily weathered and fractured. Overlying the basal sand unit is a generally thick sequence (~10

– 60 m) of low energy, lacustrine, fine silt and clay with a high degree of plasticity. A third shallow valley infill layer has been logged as <25 m in thickness, and is a highly variable unit, both compositionally and texturally, which represents a fluctuating fluvial environment during the Quaternary, this is to be a second, brine aquifer. The third brine aquifer is related to permeable zones within the weathered sandstone and basalt within the Sunshine Lake area.

The surficial aquifer contains saturated clay sediments, with an upper portion that contains excess 'extractable' water (approximately 10% by volume). As depth increases this extractable water decreases to 1 – 2% by volume.

The conceptual hydrology of the brine aquifers is shown in Figure 19 (Advisian, 2017a).

Calcrete aquifers occur to the west and south of Ten Mile Lake. These aquifers generally contain fresher groundwater that becomes increasingly more saline towards Ten Mile Lake (Advisian, 2017b). The calcrete is typically thin (<10 m) and in many places is not inundated (Advisian, 2017b). Accordingly, yields are typically low.

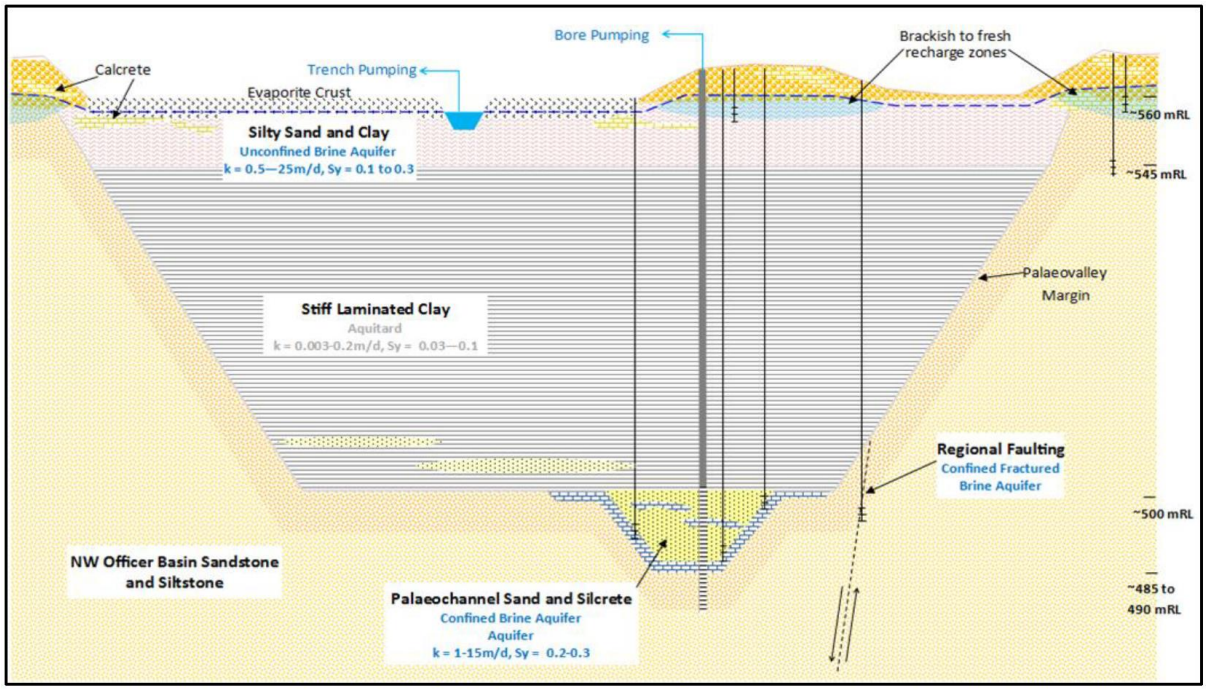


Figure 19: Conceptual hydrology of brine aquifers at Ten Mile Lake and Lake Sunshine

Groundwater contours

Water levels contours across the area drilled show an overall regional flow from the west to the east, with a gradient from the station bore at the old Beyondie farmstead to the bores on the eastern edge of Ten Mile Lake, of 0.0001 (4 m drop over 32 km) (Figure 21). The contours also show water levels below the lake surface to be elevated compared to water levels in bores adjacent to the lake - this is presumed to be an abnormal situation, related to the rains that occurred during early 2015.

Under the presumption that water levels are 1 m below surface at the lakes downstream of Ten Mile Lake, the regional gradient for the Ilgarari Palaeochannel system from Ten Mile Lake to Aerodrome Lake is 0.0004 (86 m drop over 210 km). These gradients are low, but are in line with gradients measured in the Northern Goldfields of 0.0008 between playa lakes and 0.0002 across

lakes (Johnson et al, 1999). Annual recharge to the shallow aquifer in the Beyondie Lakes and Ten Mile Lake catchments is estimated to range between 0.06 and 0.2 GLpa (Advisian, 2017b).

Groundwater and Surface Water Interaction

Flow within the palaeochannel is expected to be controlled (on a local playa lake scale) by evaporative discharge. Deflation of exposed lakebeds along palaeovalleys results in the lowering of the topographic elevation of lakebeds, thereby effectively bringing the groundwater level closer to the surface, promoting evaporation. The evaporative 'pumping' increases groundwater discharge at the lake surface, thus promoting groundwater flow towards the playa lakes. The evaporative pumping, together with the development of dense brines below the evaporative surface, results in the development of density-driven flow circulation of groundwater around the lakes (Figure 20). Evaporation at the phreatic surface increases the brine density causing it to sink through the aquifer (CQG, 2014). This sinking results in reduced heads with depth in the centre of the playa lake, promoting inflow from the edge of the playa lake (Advisian, 2017a).

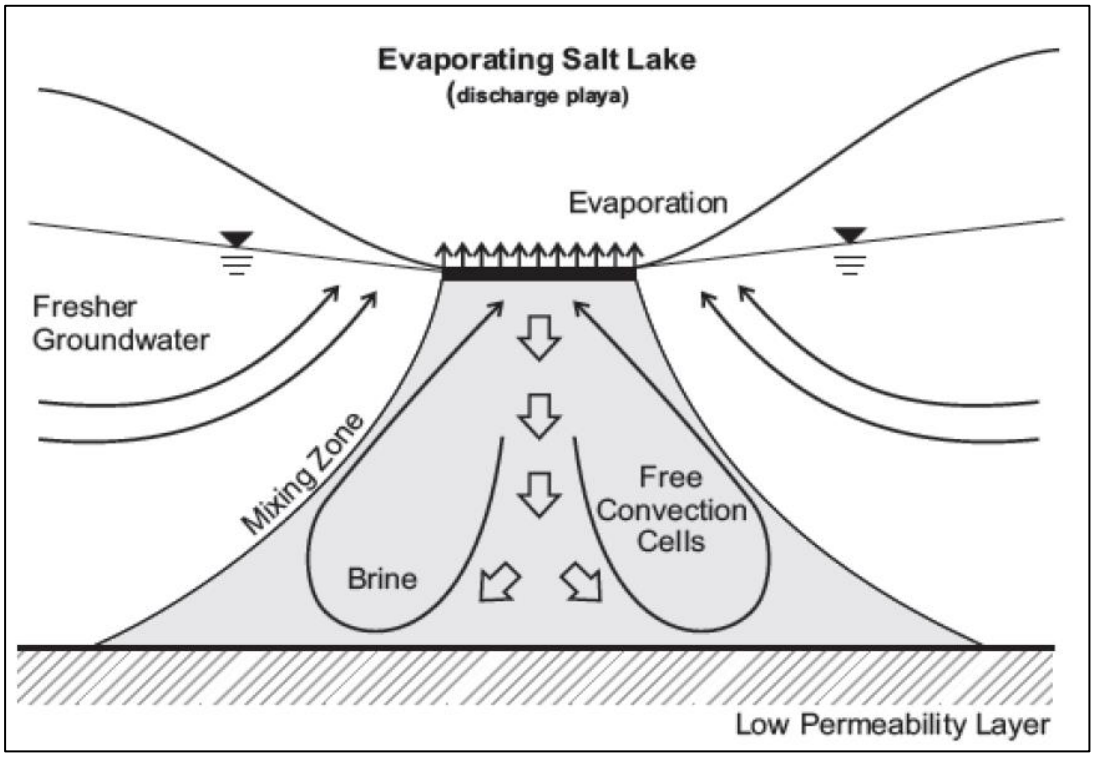


Figure 20: Example of density-driven flow patterns on a salt lake surface (AQ2, 2016)

230000
260000
7280000
7260000
N
LAKE SUNSHINE
BEYONDIE LAKES
TEN MILE LAKE
530
532
534
536
538
540
542
544
546
548
550
552
554
556
558
560
562
564
566
0
5
10
Kilometers
Advisian
WorleyParsons Group
KALIUM LAKES

Legend
Aircore Exploration Hole
Diamond Drilled Hole
Monitoring Bore
Production Bore
Kalium Lakes Tenement
Port Hedland
Newman
Title
WATER TABLE ELEVATION
Rev
C
Document Path: I:\Projects\612320-14824 Kalium Lake potash\5_Engineering\GIM-Geomatics\03\Projects\Workspaces_SKYPE\5_Figures\Rev4\Fig7-Water Table Rev4C.mxd

Figure 21: Groundwater level contours

7.5.4 GROUNDWATER QUALITY

The groundwater chemistry of the salt lake systems is dominated by sodium, chloride, sulphate and potassium. Total dissolved solids (TDS) content in the groundwater typically ranges from 100,000 - 250,000 milligrams /litre (mg/L) in the vicinity of the salt lakes, which decreases slowly away from the lake edges over a number of kilometres. The TDS in the surficial aquifer to the east of Ten Mile decreases from approximately 250,000 mg/L at the lake edge to approximately 20,000 mg/L at approximately 3 km away, indicating a salinity gradient of 1:80. Within the deep palaeochannel aquifer the TDS at depth near the lake edge is approximately 250,000 mg/L and at 3 km from the lake is approximately 200,000 mg/L, indicating a salinity gradient of 1:17, a much shallower gradient than that of the surficial aquifer due to the impacts of lower recharge volumes to the deep system. The distribution of TDS in the surficial and deep aquifers is shown in Figure 22 to Figure 25 (Advisian, 2017a).

TDS in the Ten Mile Lake calcrete aquifers varies from more than 200,000 mg/L close to Ten Mile Lake, to less than 1,000 mg/L at the southern extent (Figure 26; Advisian, 2017a).

Assay samples taken from surficial bores in Ten Mile Lake and Lake Sunshine show the groundwater to be hypersaline, with the quality generally in the range of 150,000 – 250,000 mg/L TDS and relatively neutral pH (Advisian 2017). The paleochannel aquifer contains water generally in the range 140,000 – 280,000 mg/L.

More broadly, regional groundwater salinities as Total Dissolved Solids (TDS) range between 340 - 4,500 mg/L in the WIR regional bores (Advisian, 2017). In the vicinity of the salt lakes TDS content typically ranges from 100,000 - 250,000 mg/L and decreases slowly away from the lake edges over a number of kilometres.

Recorded groundwater salinities are variable between fresh to brackish in the shallow alluvium with the lower salinities occurring at break of slope areas within small catchment divides and near direct surface recharge zones whereas the higher salinities are recorded closer to the palaeodrainage. In general terms the closer to the salt lake the higher the salinity (Advisian, 2017b).

Brine chemistry within the lakes is dominated by the elements Cl, Na, SO_4, K, S, Mg and Ca. The excess salt constituents from processing of the brine will include Sodium chloride, Sulphate of Potash, Magnesium hydroxide, Bioschofite, Epsomite and Gypsum.

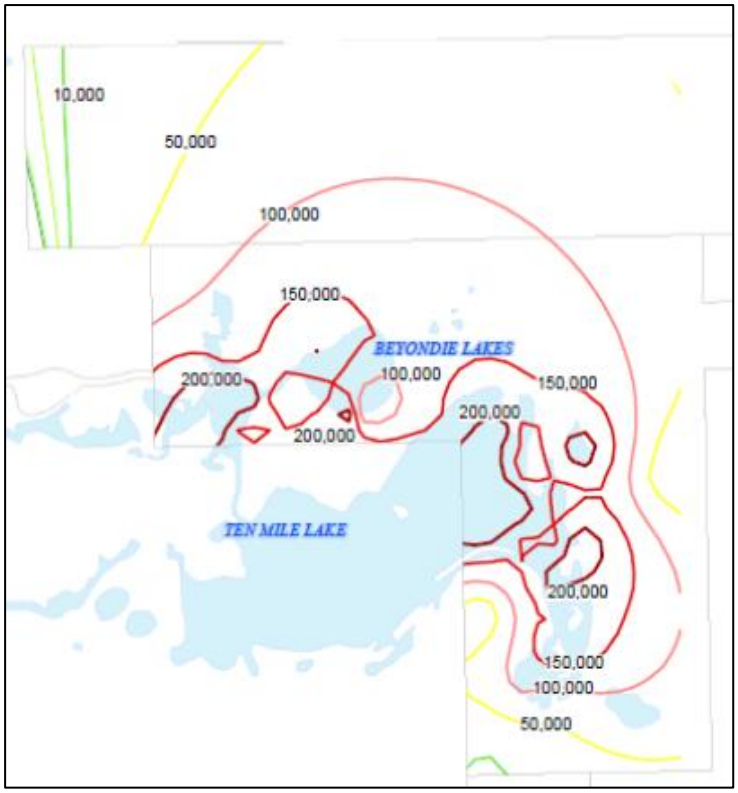


Figure 22: Surficial aquifer TDS distribution at Ten Mile Lake

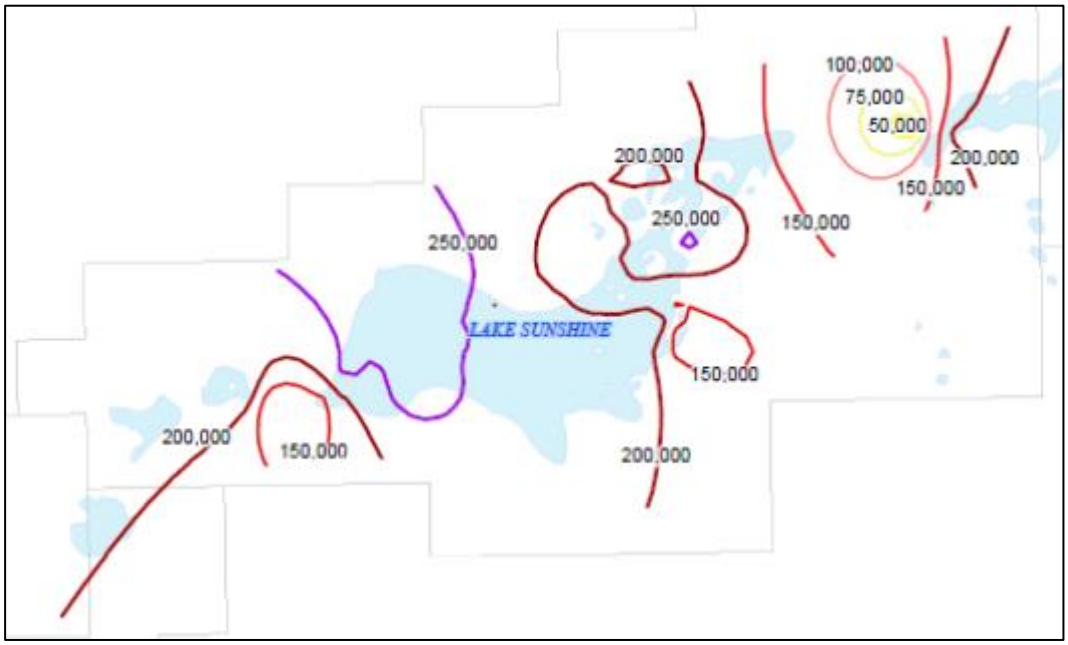


Figure 23: Surficial aquifer TDS distribution at Lake Sunshine

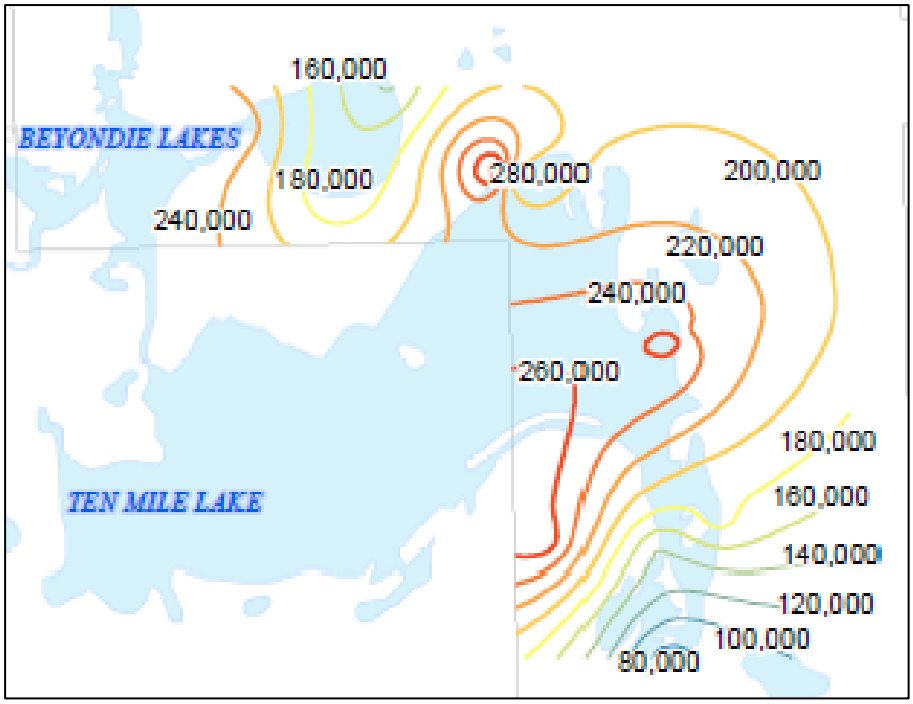


Figure 24: Palaeochannel aquifer TDS distribution at Ten Mile Lake

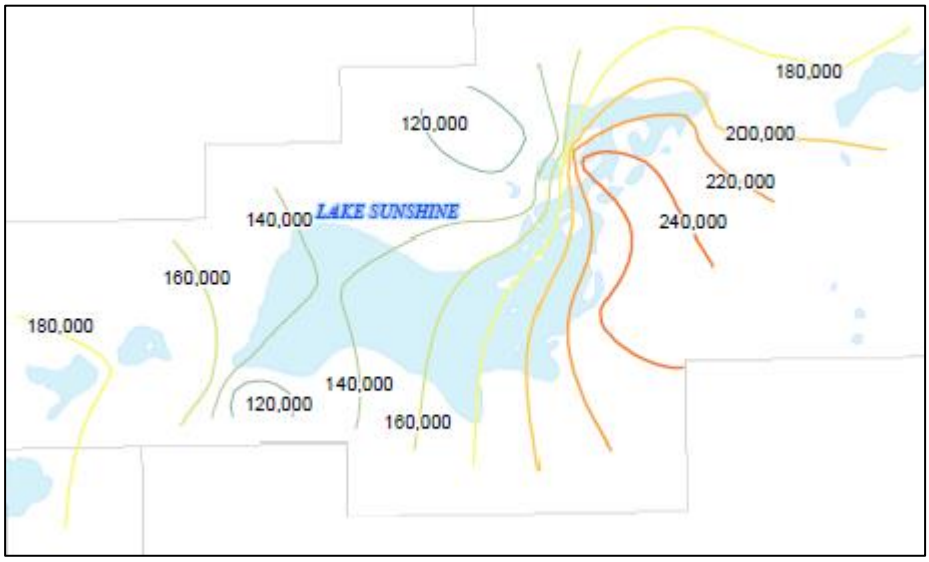


Figure 25: Palaeochannel aquifer TDS distribution at Lake Sunshine

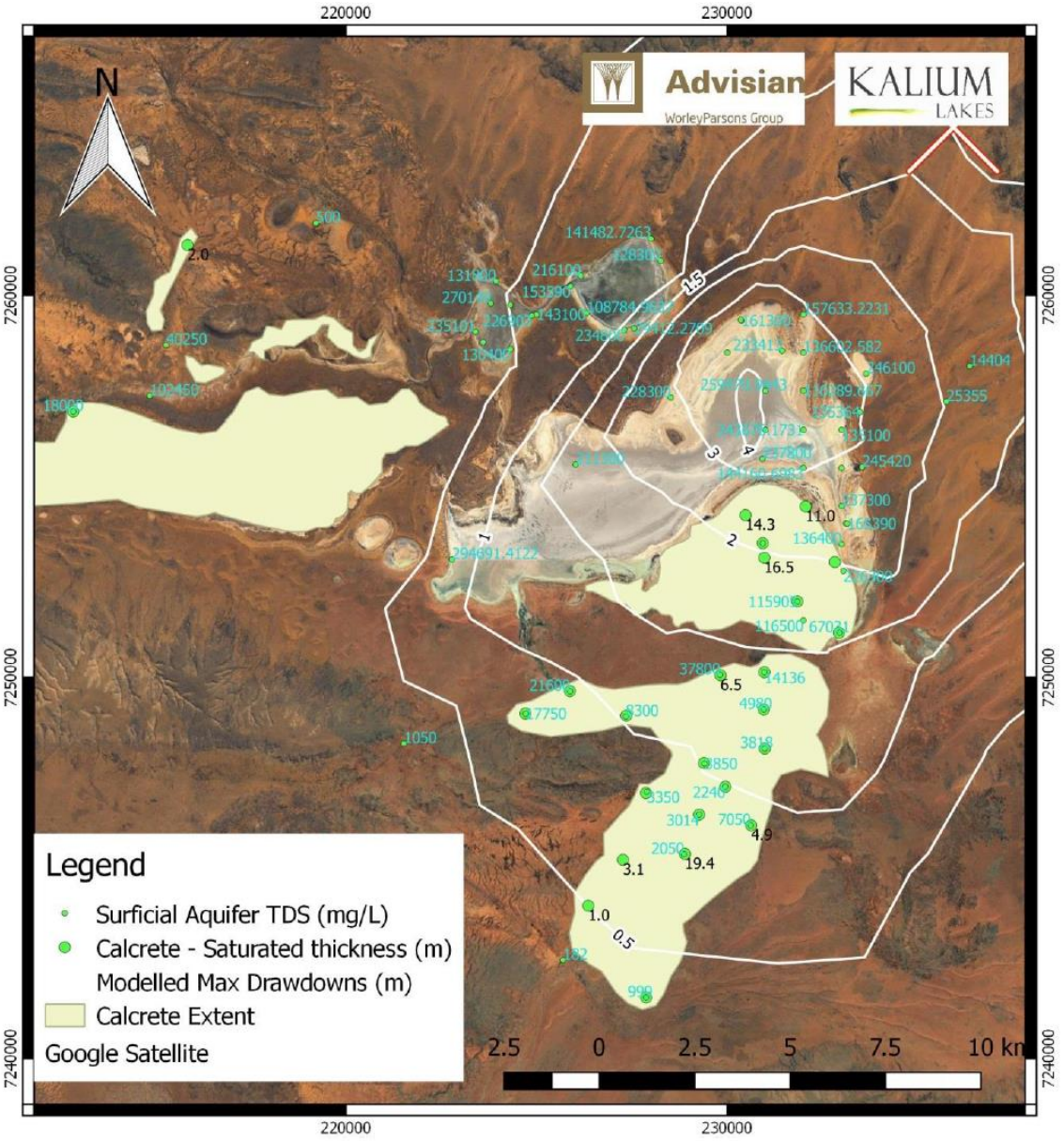


Figure 26: TDS distribution at Ten Mile Lake calcrete aquifers

7.5.5 Environmental Values and Beneficial Uses of Groundwater

The DWER Water Information Reporting database records 36 regional bores in the vicinity of the Project, within a search radius of approximately 100 km. These are generally shallow (4 - 22 m below ground level (mbgl)), low yielding stock bores, and provide limited information on the seasonal groundwater flow regime. There are no pastoral bores within 10 km of the proposed brine abstraction areas of the Proposal with the exception of 12 Mile well which is currently unused.

The Groundwater Dependent Ecosystems (GDE) Atlas (BoM, 2018) does not indicate any GDEs of concern within the Disturbance Envelope. There are unlicensed bores within the search area believed to be constructed in the shallow alluvium and calcrete aquifer. Bore construction details, downhole geology, borehole logs and abstraction volumes are mostly unknown (Advisian, 2017a,b).

The Project does not intersect with any groundwater management areas.

7.6 FLORA AND VEGETATION

The section below has been sourced from Phoenix Environmental Sciences (2018a, 2018b) with reports provided in Appendix 3.

A desktop review and field survey has been conducted of the majority of the disturbance areas. The study area for the survey covered approximately 19,113 ha (Figure 27) and included riparian vegetation fringing Beyondie Lakes, Ten Mile Lake and Lake Sunshine.

Database searches and literature reviews of relevant publications were undertaken to compile a list of conservation significant flora species and ecological communities that may occur within the study area based on the proximity of previous records.

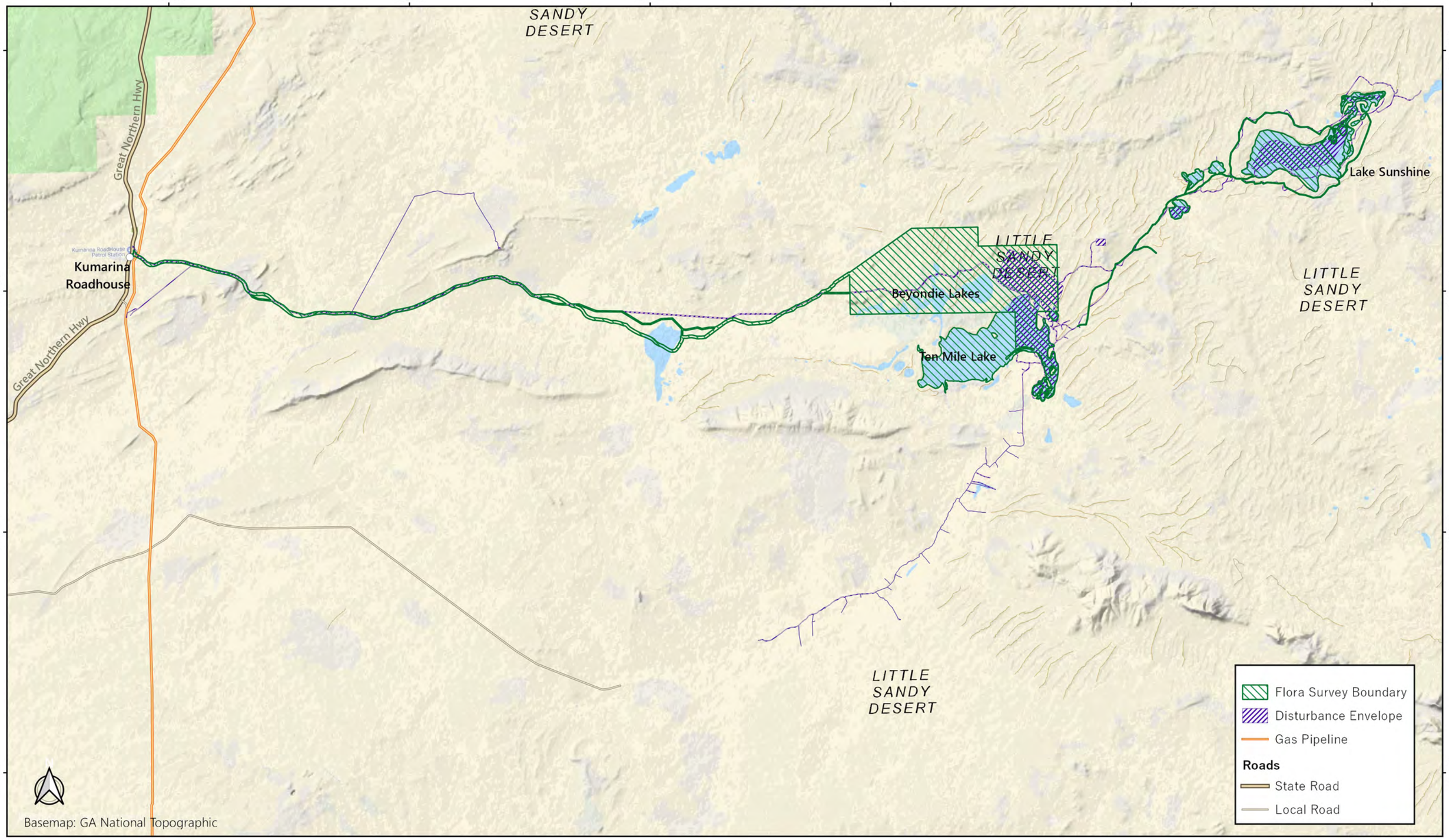
The field survey effort can be summarised as follows:

- **Beyondie Lakes and Ten Mile Lake**: The first phase of a two phase Level 2 flora and vegetation field survey for Beyondie and Ten Mile Lakes was undertaken by from 13 – 23 April 2015 and supplemented from 22 – 23 July 2015 in response to changes in the proposed project layout. The second phase of the Level 2 flora and vegetation field survey for Beyondie and Ten Mile Lakes was undertaken from 7 - 14 October 2015 and included additional areas not previously surveyed. Additional samphire mapping was conducted in 2017;
- **Lake Sunshine**: The single phase Level 2 flora and vegetation field survey for Lake Sunshine was undertaken from 2 - 9 November 2015; and
- **Un-named concentrator lakes**: A single season detailed flora and vegetation survey was conducted in October 2017 and covered four small salt lakes between Ten Mile Lake and Lake Sunshine.

Searches for conservation significant flora and declared plants were undertaken simultaneously with the flora and vegetation surveys to determine whether any of the conservation significant species or declared plants identified from the desktop review occurred in the study area.

During the second season survey it was noted that there were inaccuracies in the mapping of *Tecticornia* vegetation boundaries on the lake playas as a result of limitations of the available aerial imagery. Subsequently, a further field survey was conducted on 16 August 2017. The boundaries of the *Tecticornia* shrublands at Ten Mile Lake and Sunshine Lake were accurately mapped by tracking on a hand held GPS as the boundaries were flown by a helicopter at low altitude.

The survey boundaries are provided in Figure 27.



Rev	Description	Drn	Chk	App
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0	ISSUED FOR ENVIRONMENTAL REVIEW	HR	GE	BH

Datum: GDA94
Projection: MGA51
Scale at A3: 1:300000

0 5 10 15 20 km

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Beyondie Sulphate Of Potash Project

Flora Survey Boundary

KLP_18040	26/11/2018

Figure 27 Flora and vegetation study areas

7.6.1 FLORA

Thirty eight conservation significant flora species were identified in the desktop review as potentially occurring in the study area, including one Threatened species (*Thryptomene wittweri*; EPBC – VU, WA Act VU). Of these, two Priority species, *Tecticornia* sp. Sunshine Lake (P1) and *Stackhousia clementii* (P3) were previously recorded within the Lake Sunshine section of the study area.

A total of 487 flora species and subspecies (478 native and nine introduced) representing 57 families and 181 genera were recorded during the field survey of Beyondie Lakes, Ten Mile Lake and Lake Sunshine. A total of 110 flora species and subspecies representing 25 families and 64 genera were recorded during the field survey of the un-named concentrator lakes.

No Threatened Flora listed under the EPBC Act or *Wildlife Conservation Act 1950* were recorded during the field surveys. Four Priority 1 flora species were recorded in the study area (Figure 28). located on the lakes (Beyondie, Ten Mile and Sunshine) playa:

1. ***Tecticornia globulifera*** - recorded from five locations at the Beyondie Lakes. The species was not identified in the field and therefore the size and distribution of the populations was not recorded. Cover values recorded for the species ranged from 0.3 – 13% with recorded cover values exceeding 5% at two locations indicating potentially large populations of the species. It is highly likely that further populations are present in the study area.
   The five locations in the current study area bring the total number of records for the species to 19 and represent 26.3% of all records;
2. ***Tecticornia* sp. Christmas Creek** (K.A. Shepherd & T. Colmer et. al. KS 1063) - recorded from five locations at Beyondie Lakes, one location on Ten Mile Lake and within two of the un-named concentrator lakes. The species was not identified in the field and therefore the size and distribution of the populations were not recorded. Recorded cover values for the species ranged from 0.1 – 12% with recorded cover values exceeding 5% at two locations; one site at Beyondie Lakes and one location at Ten Mile Lake indicating potentially large populations of the species. It is highly likely that further populations are present in the study area;
   The species was also recorded at seven locations in subsequent surveys conducted for the Proposal (Phoenix, 2018) bringing the total number of records for the species to 36. A total of 13 records of the species have been recorded at the Proposal, representing 36.1% of all known records;
3. ***Tecticornia* sp. *willisii*** (Shepherd, K.A. 2018) - recorded from six locations on the beach and fringes of the lake playa on Beyondie and Ten Mile lakes and at all four un-named concentrator lakes. The species was not identified in the field and as such the size and distribution of the populations were not recorded. Cover values for the species ranged from 0.1% (scattered individuals) to 18%, with the species dominant in the community. It is highly likely that further populations are present in the study area.
   The species was also recorded at 24 locations in subsequent surveys conducted for the Proposal (Phoenix, 2018) bringing the total number of records for the species to 34. A total of 30 records of the species have been recorded at the Proposal, representing 88.2% of all known records; and
4. ***Tecticornia* sp. Sunshine Lake** (K.A. Shepherd et al. KS 867) - recorded from three locations; on the playa of Ten Mile Lake in red-orange sand to sandy clay in *Tecticornia* spp. dominated shrubland, on the playa of Lake Sunshine and within one of the un-named

concentrator lakes. The species was not identified in the field and as such the size and distribution of the populations were not recorded. Cover values of 9% and 10% recorded at Ten Mile Lake, and 14% at Lake Sunshine, indicate potentially large populations. It is possible that the species may occur elsewhere on the lake playa. Notably, the species co-occurred with *Tecticornia* sp. Christmas Creek both of which were recorded at the same location at Willie Soak approximately 25 km to the north.

It is not possible to determine what proportion of total individuals of the species above occur within the Project as population numbers were not recorded during the surveys and are not provided for all records from the desktop review. Difficulties in identifying the *Tecticornia* species in the field due to their cryptic habits and similarity to other species makes ascertaining population numbers problematic. This difficulty is underlined by the requirement by EPA Services for all *Tecticornia* identifications to be conducted by Dr Kelly Shepherd at the WA Herbarium. The mapping completed is necessarily constrained to identify only positively identified species that were sampled as examples of the surrounding plants. It is considered unlikely that any of the Priority 1 *Tecticornia* species would only be found in distinct areas around the lakes, with broader zones more likely to occur, based on the combined effects of salinity and waterlogging (van Etten and Vellekoop, 2009). Ecophysiology studies of *Tecticornia* communities on the Fortescue Marsh by the University of Western Australia (Moir-Barneston *et al.,* 2013; Marchesini *et al.,* 2013) demonstrated that the more flood and salinity tolerant *Tecticornia* species tended to occur in the interior of the Marsh while the more drought tolerant species occurred on the outer margins of the Marsh fringe where soil conditions were drier (less saturated).

There was a record of *Stackhousia clementii* (P3) on Lake Sunshine however this record could not be re-located during the current survey. The presence of the species somewhere on the lake however cannot be discounted. The species is known from 37 records (DBCA, 2018b) with the single record in the study area representing 2.7% of all records.

A total of 31 taxa could not be identified to species level, in most instances due to insufficient taxonomic characters as plants were sterile (lacking reproductive structures); notably this includes a large number of *Tecticornia* species. Two of the unidentified *Tecticornia*, *Tecticornia* sp. nov. 1 (aff. pruinosa/ laevigata) and *Tecticornia* sp. nov. 2 (aff. pruinosa/undulata), potentially represent undescribed taxa. None of the unnamed taxa closely resemble any of the Priority Flora identified by the desktop review.

Most of the vegetation in the study area was free of introduced flora; however, nine introduced species were recorded. These species all have wide distributions in WA and there were no apparent range extensions. None of the introduced species recorded are declared pests.

215000 220000 225000 230000 235000 240000 245000 250000 255000 260000

7275000 7270000 7265000 7260000 7255000

Lake Sunshine

Beyondie Lakes

Ten Mile Lake

Priority Flora

- *Tecticornia globulifera*
- *Tecticornia sp. Christmas Creek* (K.A Shepherd & T.Colmer et al. KS 1063)
- *Tecticornia sp. Sunshine Lake* (K.A Shepherd et al.KS 867)
- *Tecticornia willisii*

- Trenches
- 0.5m Drawdown Contour (5 Year)
- Indicative Disturbance
- Disturbance Envelope

Rev	Description	Drn	Chk	App
1	PRIORITY FLORA UPDATED AND REISSUED	HR	GE	BH
0	ISSUED FOR ENVIRONMENTAL REVIEW DOCUMENT	HR	GE	BH

Datum: GDA94
Projection: MGA51
Scale at A3: **1:120000**

0 1 2 3 4 5 km

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Location of Conservation Significant Flora

KLP_18045 | 26/11/2018

Figure 28: Location of Priority Flora recorded during the field survey

7.6.2 VEGETATION

The study area is situated on the border of two Interim Biogeographic Regionalisation of Australia bioregions; the Gascoyne bioregion and Little Sandy Desert bioregion. The study area is situated at the junction of the Augustus subregion (GAS3) of the Gascoyne bioregion and Trainor subregion (LSD2) of the Little Sandy Desert bioregion.

None of the vegetation defined for the study area resembles any listed Threatened or Priority Ecological Communities. A single State-listed Priority Ecological Community (PEC) (Priority 1) was identified in the desktop review, Lee Steere Range vegetation complexes (banded ironstone formation). The 90 km buffer zone of this PEC passes through the study area; however, no banded ironstone formations occur within the study area.

Regional vegetation mapping by Shepherd *et al.* (2002) identifies seven vegetation associations in the study area (Figure 29). With the exception of '676: Succulent steppe; samphire' (discussed further below) all vegetation associations have the status of 'Least Concern' with more than 90% of their pre-European extent remaining.

A total of 53 vegetation types were defined for the study area during the field survey at Beyondie Lakes, Ten Mile Lake and Lake Sunshine (Figure 30 & Figure 31). These comprised eight woodlands, 16 shrublands, eight grasslands and 21 samphire shrublands of *Tecticornia* species present on the lake playas and beaches. In total, 35 vegetation types were mapped across the four un-named concentrator lakes comprising of two grasslands, six shrublands, one woodland and 26 *Tecticornia* samphire shrublands.

The majority of the vegetation in the study areas represents widespread communities and is well represented at a regional level. The paucity of information for the region precludes more detailed assessment of the regional significance of the vegetation.

The *Tecticornia* shrubland vegetation is considered locally significant as they represent habitat for the Priority 1 *Tecticornia* flora species, and two potentially undescribed *Tecticornia* species. 4,183 ha of this vegetation type was mapped within the study area (Figure 32).

Woodland 9 may be considered locally significant as it was recorded at only one of the four un-named concentrator lakes and not recorded in previous surveys (Phoenix 2018a). Vegetation type (Shrubland 18) may also represent locally significant vegetation due to restricted distribution as it covered less than 1% of the study area and was not recorded in previous surveys (Phoenix 2018a).

Vegetation condition in the study area was recorded as excellent to good with 67% of the area recorded as excellent. There was no evident disturbance in most areas. Animal tracks from domestic stock and feral animals were observed occasionally. Vegetation where condition was recorded as very good (0.6% including patches within Woodland 2 and Grassland 1) had weed infestation, evidence of light grazing and occasional vehicle tracks. Vegetation in good condition (1.7% patches within Woodland 2 and Woodland 3) had large weed infestations with multiple weed species, greater soil disturbance from domestic stock, a greater level of grazing and the presence of vehicle tracks.

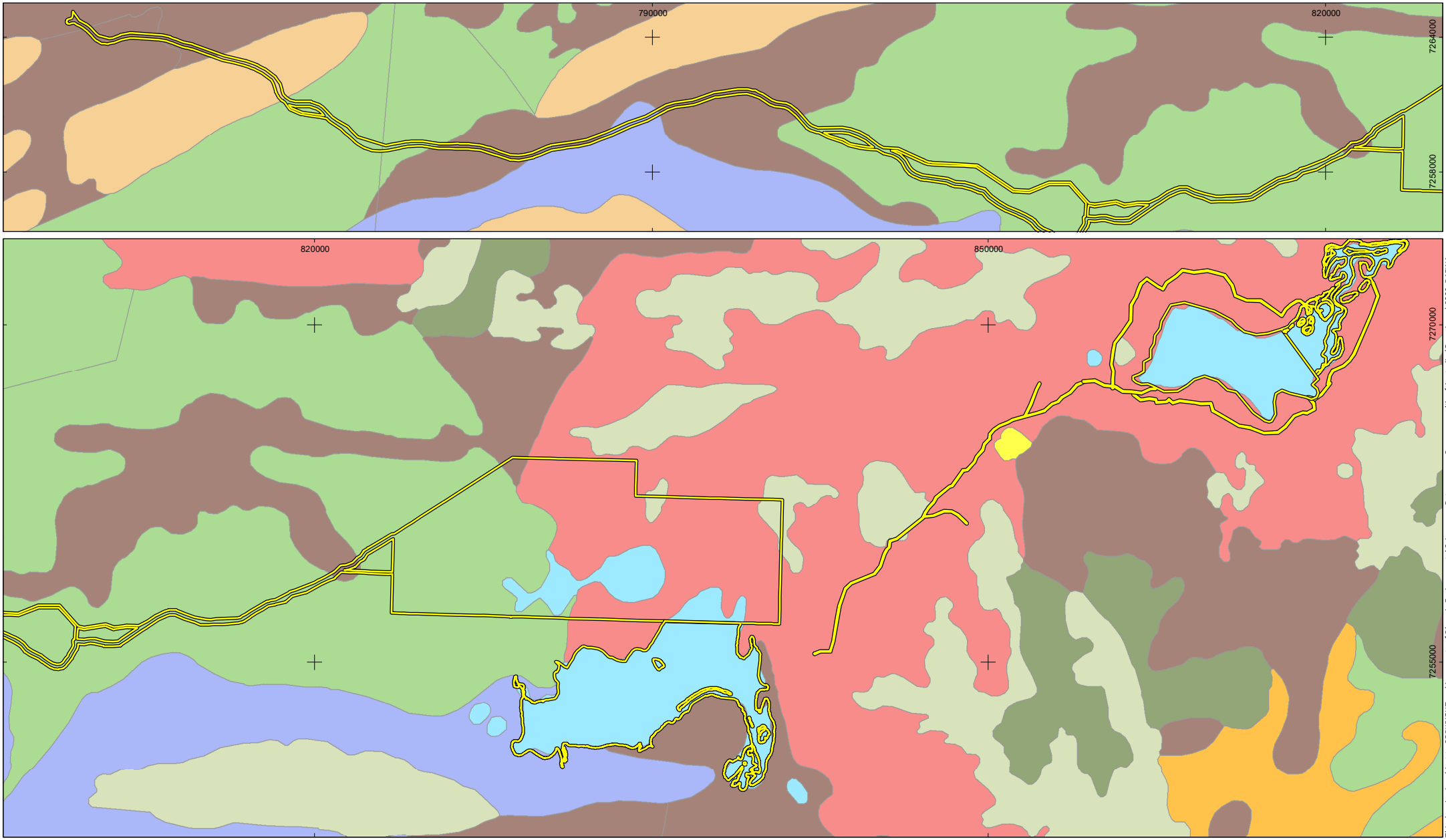

Figure 3–3
Shepherd *et al.* (2002) vegetation types of the study area

PHOENIX ENVIRONMENTAL SCIENCES

Figure 29: Shepherd et al. (2002) vegetation types (Phoenix 2018a)

Great Northern Hwy

Disturbance Envelope

Vegetation Habitat (Phoenix)

- Fresh water Lake
- Grassland 1
- Grassland 2
- Grassland 3
- Grassland 5
- Grassland 4
- Grassland 7
- Grassland 8
- Salt Lake
- Shrubland 1
- Shrubland 2
- Shrubland 3
- Shrubland 4
- Shrubland 6
- Shrubland 7
- Shrubland 8
- Shrubland 9
- Shrubland 12
- Shrubland 13
- Shrubland 14
- Shrubland 16
- Tecticornia shrublands
- Woodland 1
- Woodland 2
- Woodland 3
- Woodland 4
- Woodland 5
- Woodland 6
- Woodland 7
- Woodland 8
- Woodland 9

Basemap: Bing Satellite

Rev	Description	Drn	Chk	App
1	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH
0	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH

Datum: GDA94
Projection: MGA51
Scale at A3: 1:130000
0 1 2 3 4 5 km

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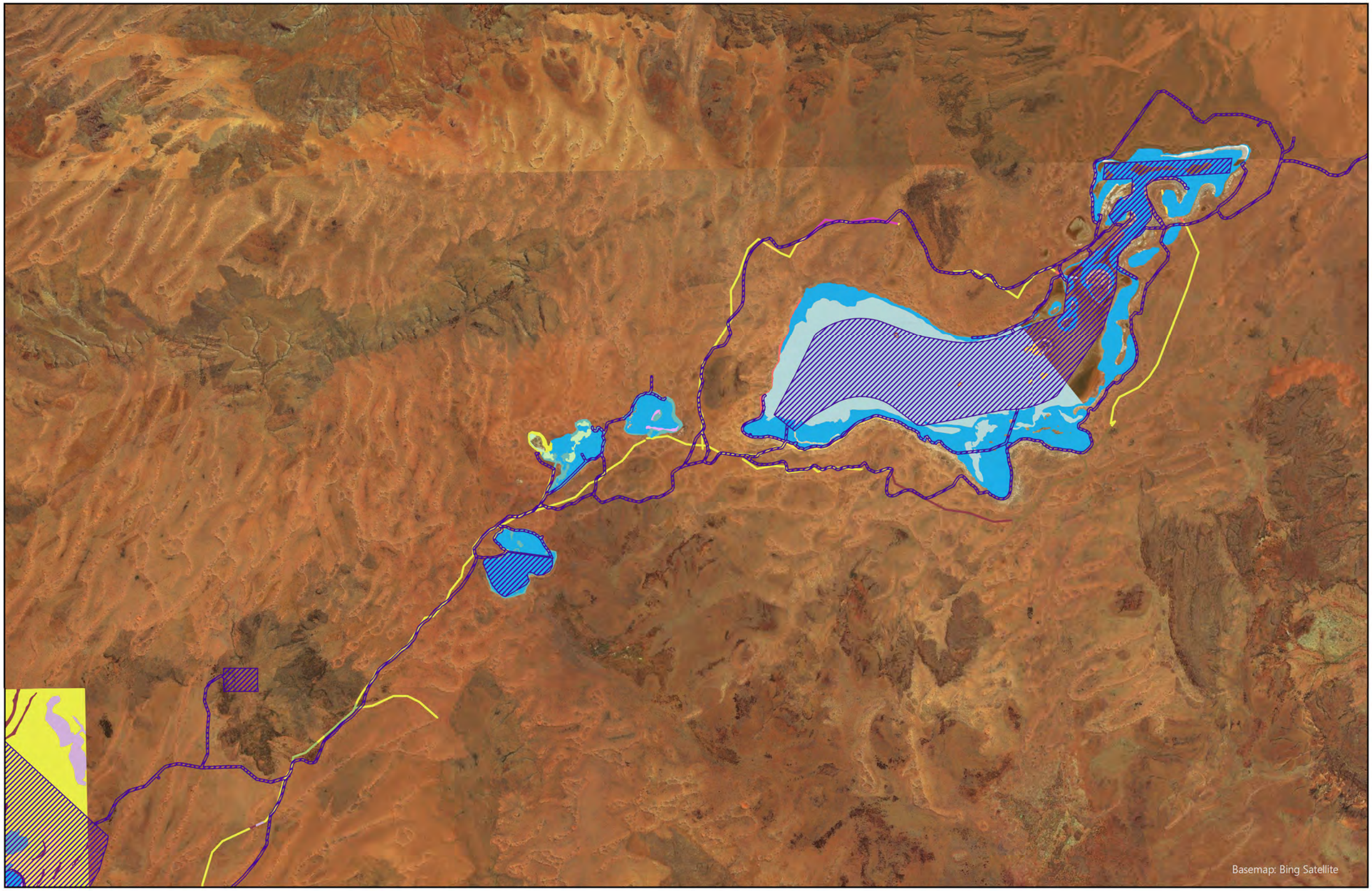
Beyondie Sulphate Of Potash Project

Vegetation Habitat

KLP_18047
Sheet 1

26/11/2018

Figure 30: Vegetation types of the study area – access road and Ten Mile Lake



Disturbance Envelope

Vegetation Habitat (Phoenix)

- Fresh water Lake
- Grassland 1
- Grassland 2
- Grassland 3
- Grassland 5
- Grassland 4
- Grassland 7
- Grassland 8
- Salt Lake
- Shrubland 1
- Shrubland 2
- Shrubland 3
- Shrubland 4
- Shrubland 6
- Shrubland 7
- Shrubland 8
- Shrubland 9
- Shrubland 12
- Shrubland 13
- Shrubland 14
- Shrubland 16
- Tecticornia shrublands
- Woodland 1
- Woodland 2
- Woodland 3
- Woodland 4
- Woodland 5
- Woodland 6
- Woodland 7
- Woodland 8
- Woodland 9

Rev	Description	Drn	Chk	App
1	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH
0	ISSUED FOR MINE CLOSURE APPROVAL	HR	GE	BH

Datum: GDA94
Projection: MGA51
Scale at A3: 1:90000

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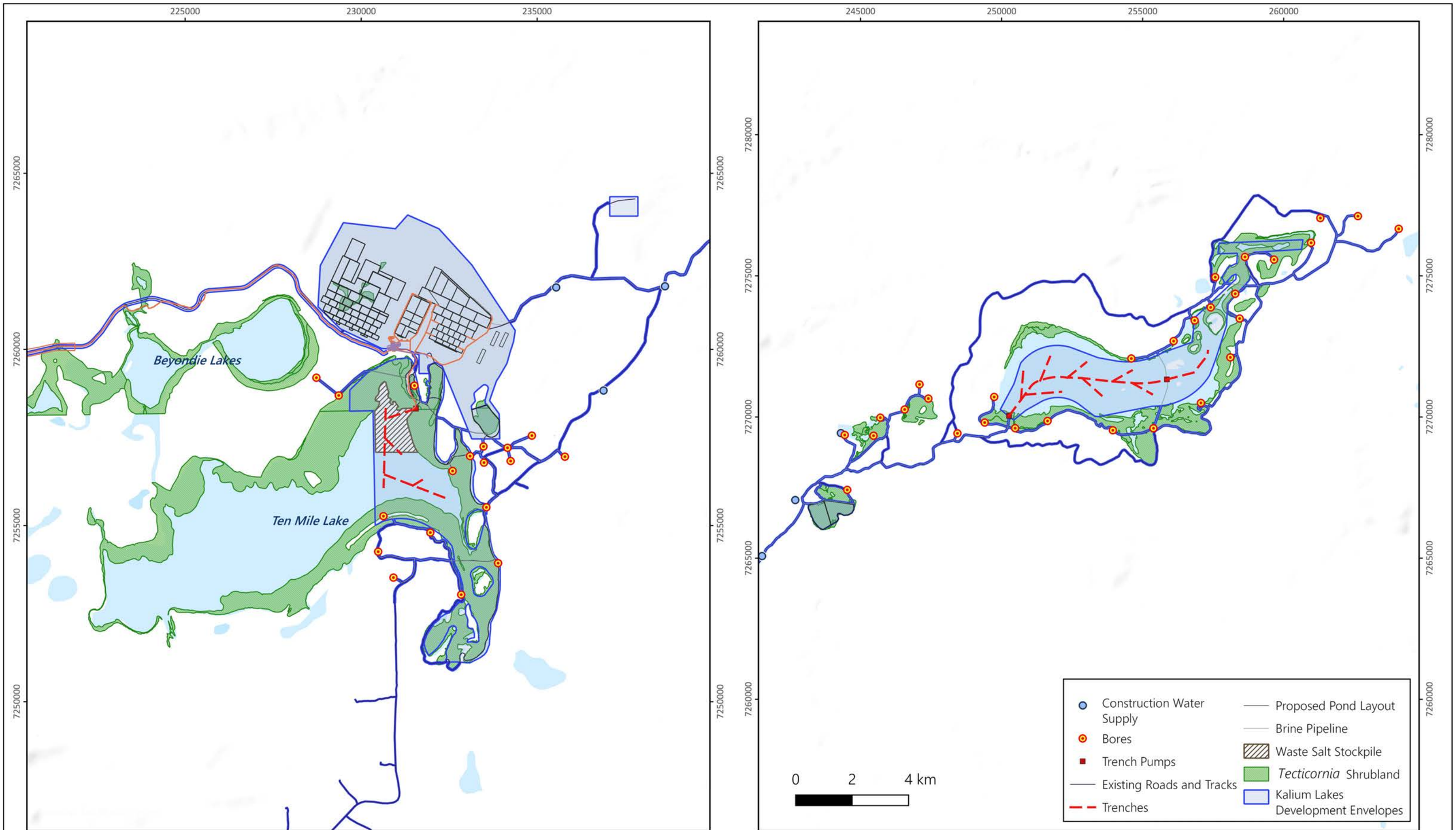
KALIUM LAKES

Beyondie Sulphate Of Potash Project

Vegetation Habitat

KLP_18047
Sheet 2

26/11/2018



Rev	Description	Drn	Chk	App
3	Updated Infrastructure	HR	GE	BH
2	Updated and Reissued	HR	GE	BH
1	Issued for Information	HR	GE	BH
0	Issued for Env Review Document Approval	HR	GE	BH

Datum: GDA94
Projection: MGA51
Scale at A3: 1:100000
0 1 2 3 4 5 km

KALIUM LAKES

Beyondie Sulphate Of Potash Project
Areas of *Tecticornia* within the Development Envelopes

KLP_18042 | 22/11/2018

Figure 32: Tecticornia shrubland vegetation

7.7 FAUNA

The section below has been sourced from Phoenix Environmental Sciences (2018b, 2018c, 2018d) with reports provided in Appendix 4.

A desktop review and field survey has been conducted over the majority of the disturbance areas. The study area for the surveys included terrestrial fauna habitat around Beyondie, Ten Mile and Lake Sunshine (Figure 33).

A desktop review of relevant databases, literature and spatial data preceded the field surveys to assess the potential for presence of conservation significant vertebrate fauna and Short-Range Endemic (SRE) species and habitats in the study area.

The field survey effort can be summarised as follows:

- Beyondie Lakes and initial haul road: systematically surveyed and included detailed habitat mapping (Level 2 survey), and waterbird and aquatic invertebrate survey;
- Ten Mile Lake: Opportunistic survey for vertebrate fauna, SRE, Night Parrot, waterbird and aquatic invertebrate fauna surveys;
- Sunshine Lake: Level 1 fauna survey and Night Parrot survey; and
- Un-named Concentrator Lakes: Level 1 fauna survey.

Survey methods included:

- On-site habitat assessment;
- Habitat mapping;
- Systematic trapping (consisting of dry pitfall traps, funnel traps, Elliott and Sheffield cage traps; ten sites);
- Avifauna surveys (ten systematic sites and some opportunistic sites);
- Bat echolocation call recording (SongMeter SM2) (seven sites)
- Infra-red remote sensor camera trapping (seven systematic sites and five opportunistic sites);
- Mole trenching (six sites);
- Night Parrot recordings and analysis (discussed further below);
- Physico-chemical testing of water quality; and
- Collection of aquatic invertebrates.

Targeted searches / foraging for evidence of conservation significant vertebrate fauna was conducted at all ten systematic trapping sites and an additional 36 opportunistic sites. A helicopter was used to undertake aerial searches for Greater Bilby burrows and select Mole Trench sites.

Survey methods for SREs comprised active searches and collection of invertebrates from the dry vertebrate pitfall traps. Searches were primarily conducted on or near the edges of salt lakes as the most prospective habitat for SREs in the study area. Aquatic invertebrates were collected using 50 µm and 250 µm nets along a single 50 m transect.

160000 180000 200000 220000 240000 260000

7280000 7260000 7240000 7220000

Great Northern Hwy

Great Northern Hwy

Kumarina Roadhouse

Marymia Rd

Beyondie Lakes

Ten Mile Lake

Lake Sunshine

LITTLE SANDY DESERT

LITTLE SANDY DESERT

LITTLE SANDY DESERT

Fauna Survey Boundary
Disturbance Envelope
Gas Pipeline
State Road
Local Road

Basemap: GA National Topographic WMS

Rev	Description	Drn	Chk	App
1	ISSUED FOR ENVIRONMENTAL REVIEW	HR	GE	BH
0	ISSUED FOR ENVIRONMENTAL REVIEW	HR	GE	BH

Datum: GDA94
Projection: MGA51
Scale at A3: 1:1

0 5 10 15 20 km

KALIUM LAKES

Beyondie Sulphate Of Potash Project
Fauna Survey Boundary

KLP_18041	26/11/2018

Figure 33: Terrestrial fauna survey effort

7.7.1 FAUNA HABITAT

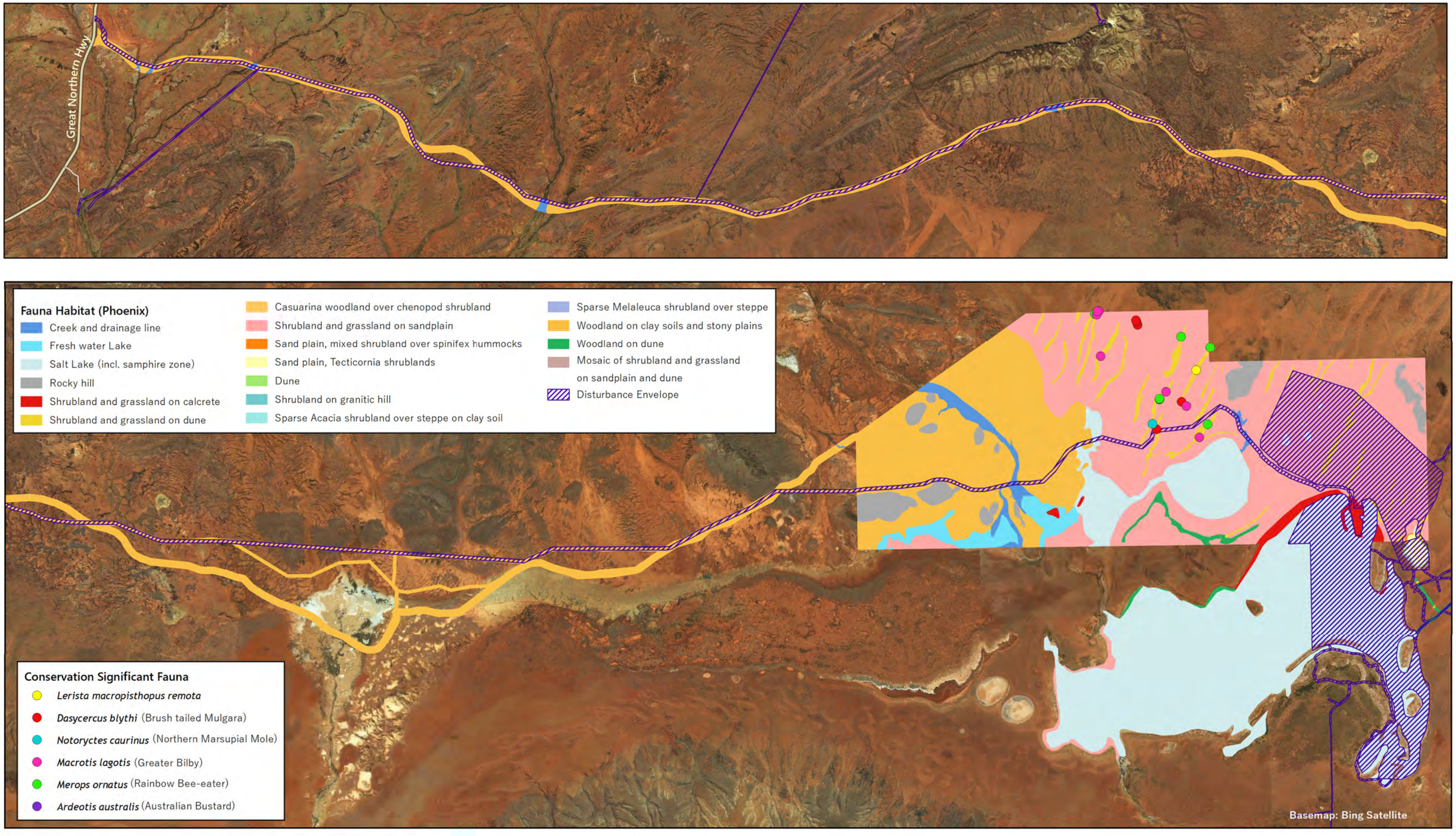
Table 8 lists the ten broad fauna habitats were mapped within the majority (78.1%) of the study area covering the Beyondie Lakes, Ten Mile Lake and Lake Sunshine (Figure 34 & Figure 35). All habitats apart from 'Fresh water lake' occur within the development envelopes.

Table 8: Fauna habitats of the study area

Habitat	Mapped extent within study area (ha)	Percentage of mapped study area
Shrubland and grassland on sandplain	5,528	36.2
Woodland on stony plain	4,458	29.2
Salt lake (incl. samphire zone)	3,225	21.1
Mosaic of shrubland and grassland on sandplain and dune	488	3.2
Rocky hill	423	2.8
Shrubland and grassland on dune	367	2.4
Fresh water lake	293	1.9
Creekline and drainage line	231	1.5
Shrubland and grassland on calcrete	137	0.9
Woodland on dune	129	0.8

All habitats represented within the study area are represented in land systems adjacent to the study area and across the broader Little Sandy Desert and Gascoyne bioregions.

Three habitat types were recorded in the survey of the un-named concentrator lakes including salt lake and mosaic of shrubland, grassland on sandplain and dune and *Casuarina*-dominated woodland (Phoenix, 2018b). With the exception of the *Casuarina*-dominated woodland (Woodland 9), the habitats were common and widespread in the broader vicinity of the study area. *Casuarina*-dominated woodland, was restricted to one of the lakes in the current survey and was not recorded in previous surveys so may be considered locally significant due to restricted distribution.



Rev	Description	Drn	Chk	App
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0	ISSUED FOR MINE CLOSURE PLAN APPROVAL	HR	GE	BH

Datum: GDA94
Projection: MGA51

Scale at A3: 1:110000

0 1 2 3 4 5 km

KALIUM LAKES

Beyondie Sulphate Of Potash Project
Fauna Habitat

KLP_18048
Sheet 1

26/11/2018

Figure 34: Fauna habitats of Beyondie and Ten Mile Lake and conservation significant fauna records

Fauna Habitat (Phoenix)

- Creek and drainage line
- Fresh water Lake
- Salt Lake (incl. samphire zone)
- Rocky hill
- Shrubland and grassland on calcrete
- Shrubland and grassland on dune
- Casuarina woodland over chenopod shrubland
- Shrubland and grassland on sandplain
- Sand plain, mixed shrubland over spinifex hummocks
- Sand plain, Tecticornia shrublands
- Dune
- Shrubland on granitic hill
- Sparse Acacia shrubland over steppe on clay soil
- Sparse Melaleuca shrubland over steppe
- Woodland on clay soils and stony plains
- Woodland on dune
- Mosaic of shrubland and grassland on sandplain and dune
- Disturbance Envelope

Conservation Significant Fauna

- *Lerista macropisthopus remota*
- *Dasycercus blythi* (Brush tailed Mulgara)
- *Notoryctes caurinus* (Northern Marsupial Mole)
- *Macrotis lagotis* (Greater Bilby)
- *Merops ornatus* (Rainbow Bee-eater)
- *Ardeotis australis* (Australian Bustard)

Basemap: Bing Satellite

Rev	Description	Drn	Chk	App
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0	ISSUED FOR MINE CLOSURE PLAN APPROVAL	HR	GE	BH

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Projection: MGA51
Scale at A3: 1:80000
0 1 2 3 4 5 km

KALIUM LAKES

Beyondie Sulphate Of Potash Project
Fauna Habitat

KLP_18048
Sheet 2

26/11/2018

Figure 35: Fauna habitats of Sunshine Lake and conservation significant fauna records

7.7.2 FAUNA

A total of 128 vertebrate fauna species were recorded during the field surveys at Beyondie Lakes, Ten Mile Lake and Lake Sunshine (Phoenix, 2018c) including seven amphibians, 43 reptiles, 50 birds and 28 mammals (eight introduced and 20 native). One amphibian, one reptile and two birds were recorded during the field survey but not identified in the desktop review, the Tanami Toadlet (*Uperoleia micromeles*), Mosaic Desert Skink (*Eremiascincus musivus*), Black-chinned Honeyeater (*Melithreptus gularis*) and Banded Lapwing (*Vanellus tricolor*).

26 vertebrate fauna species were recorded during the field surveys of the un-named concentrator lakes (Phoenix, 2018b) including five reptiles, 17 birds and four mammals.

A total of 15 waterbird species were recorded during the field surveys including ducks and duck-like birds, swans, small shorebirds, large wading birds, and a gull (Phoenix, 2018d).

The desktop review identified 27 fauna species of conservation significance that may potentially occur within the study area, three of which have since been de-listed from the *Wildlife and Conservation Act 1950* (WC Act). Potential habitat was identified in the study area for 18 of these species, with six of those species recorded during field surveys (Appendix 4).

7.7.3 SHORT-RANGE ENDEMIC FAUNA

A total of 20 invertebrate species in six orders, 10 families and 14 genera were collected during the survey (Phoenix, 2018c). Thirteen of the species recorded are considered potential SREs, and of these, eight are currently only known from the study area. Figure 36 shows the locations of the collected potential SRE invertebrates. No potential SRE species were recorded in the survey of the un-named concentrator lakes (Phoenix, 2018b).

One of the potential SREs collected, the bthyniid snail *Gabbia* 'beyondie' is a fresh water inhabitant. As it is part of the aquatic fauna it is discussed in the section below.

The salt lakes (incl. the samphire zone) are the most prospective habitat for SREs in the study area; and four species from this habitat, the two wolf spiders Gen. indet 'PES0297' and 'PES0299' and the tiger beetles *Pseudotetracha oleadorsa* and *P. murchisona*, are considered potential SREs.

7.7.4 AQUATIC INVERTEBRATES AND WATERBIRDS

Only Beyondie Lakes has been surveyed for aquatic invertebrates due to a lack of surface water in Ten Mile Lake and Lake Sunshine despite several site visits. A total of 102 taxa of aquatic invertebrates were collected during the Phoenix (2018d) survey, including 68 definite species and 34 unidentified higher taxa ('sp. indet.'). These included two species of water mite, 30 species of crustacean, 36 species of aquatic insects and two species of aquatic snail. None of the species are formally recognised as conservation significant, but several represent new or undescribed species currently only known from the study area, including two snail species in the genera *Gabbia* and *Isidorella*, ostracods in the genera *Limnocythere*, *Mytilocypris* and *Bennelongia*, and a conchostracan in the genus *Ozestheria*. The described species are generally common and/or widespread.

Species richness was greater at the fresh water sites, with the Beyondie Lakes marsh (located outside of the development envelopes) recording the highest species richness. Invertebrate

community composition was best explained by salinity followed by conductivity (but these water quality parameters are correlated) and least by water depth.

The diversity of the aquatic invertebrate fauna is comparable to other lake systems that include fresh water to saline habitats. There is a clear temporal pattern in the aquatic macroinvertebrate community indicating a complex transition during the filling cycle of the lakes. Poor taxonomic knowledge of some invertebrate groups and lack of regional surveys hindered an interpretation of the endemicity of the local fauna; most significant are the presence of two potentially new and SRE species of snails which have a low capacity for dispersal (Phoenix, 2018d).

Five waterbird species were identified in the desktop review as potentially occurring in the study area. Of these, four species were of conservation significance, all listed as Migratory under the EPBC Act and/or the WC Act (discussed in the previous section).

A total of 15 waterbird species were recorded during the field surveys including ducks and duck-like birds, swans, small shorebirds, large wading birds, and a gull. Two of these are EPBC Act and WC Act listed Migratory shorebirds, the Oriental Plover and the Common Greenshank (*Tringa nebularia*). Both were recorded in very low numbers during the survey, therefore in accordance with federal guidelines, the study area is not considered to contain nationally or internationally important habitat for Migratory bird species listed under the EPBC Act.

A higher number of waterbirds observed in the Phase 2 part of the survey indicated productivity of the lakes after several months of inundation which has allowed for the growth and development of aquatic macrophytes and invertebrates, both a food source for the birds. All observed waterbirds are common species.

The waterbird fauna of the study area is typical for an arid lake system and included three common Migratory species (two recorded, one identified through the desktop review). Opportunistic nesting by the Black Swan was also reported (Phoenix, 2018d).

Figure 5–3
Records of SRE invertebrates collected

Client: Kalium Lakes Ltd
Project: Beyondie Sulphate of Potash Project

Author: AL
Date: 17-Jan-18

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

0 2 4 8 Kilometres
1:275,000

- Study area
- Lake
- Major creeks and rivers
- Road
- Minor road

species

- 1: *Aganippe* 'beyondie 1'
- 2: *Aganippe* 'beyondie 2'
- 3: *Aname* sp. indet.
- 4: *Buddelundia* '10lk'
- 5: *Gabbia* 'beyondie'
- 6: *Gen.* indet. 'PES0297'
- 7: *Gen.* indet. 'PES0299'
- 8: *Lychas* 'beyondie 1'
- 9: *Lychas* 'beyondie 2'
- 10: *Pseudotetracha murchisona*
- 11: *Pseudotetracha oleadorsa*
- 12: *Urodacus* 'beyondie'
- 13: *Urodacus* 'yaschenkoi group'

NEWMAN
PERTH

PHOENIX ENVIRONMENTAL SCIENCES

Figure 36: Potential short-range endemic invertebrate species collected

7.8 INDUSTRY EXPERIENCE AND SCIENTIFIC LITERATURE

Industry experience with hypersaline discharge and dewatering drawdown from mining operations adjacent to and within salt lake systems in WA can provide information useful to the successful operation and closure planning of the Project. Gold mining operations throughout the WA Goldfields have been able to operate the Carbon in Leach process using hypersaline water – usually sourced from paleochannel aquifers. This technical innovation allowed may gold mines to operate in areas where there is little or no fresh water. Many mines have had to dewater hypersaline aquifers in excess of any process water requirements and have discharged excess water to salt lakes. These two activities have stimulated scientific investigations and monitoring to understand the aquifers, salt lake hydrology and biology, resulting in scientific papers and monitoring reports. A review of industry experience and relevant scientific literature relating to paleochannel aquifers, dewatering disposal to salt lakes and drawdowns from mine dewatering is summarised in the sections below.

7.8.1 HYPERSALINE DISCHARGE

Impacts and Management

An understanding of the impacts of hypersaline discharge from mining operations on Western Australian salt lake systems provides practical experience in real situations and information relevant to the likely impacts associated with the excess salt stockpile.

One of the identified risks is that the salt will dissolve in rainfall and flood events and re-distribute within Ten Mile Lake in quantities, concentrations and in patterns that significantly impact upon the lake fringing vegetation and lake ecology (aquatic invertebrates). Managing this risk raises the issue of how to avoid or mitigate saline run off from the stockpile during inundation events.

The abiotic and biotic effects on salt lake playas of hypersaline discharge water from gold mine pits in WA has been reviewed by Outback Ecology (2008). More recently, and closer to the location of the Project, impacts to the fringing samphires of Lake Austin from hypersaline discharge water were documented by van Etten and Velkoop (2006, 2009). At Lake Carey, three gold mines (Wallaby/Granny Smith (Barrick), Sunrise Dam (Anglo Gold Ashanti) and Red October (Saracen Gold Mines Pty Limited)) have monitored the impacts of discharged hypersaline groundwater for over ten years. The impacts on sediment chemistry and benthic microbial communities from the discharge were published by Gregory (2009). The Lake Carey Management Group (LCCMG) has summarised these findings in a confidential report (LCCMG 2013).

The Project is not a conventional mining project requiring aquifer dewatering and will not discharge hypersaline water to the lake surface. It will create a salt stockpile (largely NaCl and Mg Salts) on the lake surface that provides an ongoing source of salt similar to a salt lake discharge crust. A summary of the documented impacts arising from discharge of hypersaline mine water to salt lakes that may be relevant to the Project are summarised below:

- Discharging hypersaline groundwater onto a playa leads to the accumulation of salts and formation of a salt crust near the discharge point;
- Elevated levels of salts, nutrients (particularly nitrogen) and certain metals are usually found in sampling sites within the vicinity discharge areas compared to ‘natural’ sites (i.e.

lakes not receiving dewatering discharge) (Finucane, 2001; Foster, 2001; Muir *et al.,* 2004; Gregory, 2007, Gregory *et al.*, 2009, van Etten and Velkoop, 2009);

- Surface water pH is usually altered (increased) at some of the discharge sites, reflecting the pH of the discharge water (Gregory *et al.,* 2009);
- During flood events the salt crust dissolves and dissipates into the sediments as the flood waters recede (as can be seen in air photo series of locations such as Lake Carey);
- Poor abundance and species richness of diatoms exist in or near discharge areas (where there are thick salt crusts) compared to the sites unaffected by dewatering discharge (Gregory *et al.,* 2009);
- Increased salinity in the lake sediments can prevent the hatching of the resting stages of aquatic invertebrates following rainfall events resulting in depletion of the egg bank (Timms, 2005);
- Alterations to the primary producers, such as algae, will invariably affect higher order consumers such as invertebrates and subsequently waterbirds which utilise the lakes as over-wintering sites (Timms, 2005); and
- Fringing samphires may be adversely impacted by increases in soil salinity and waterlogging as a result of dewatering discharge (Timms *et al.* 2006). Reduced survivorship of *Tecticornia fimbriata* seedlings was recorded by van Etten and Velkoop (2009) due to increased salinity from discharge water.

Key observations for closure planning of the excess salt stockpile that can be gained from industry experience and the published studies are:

- Key features of the salt lakes, including lake fringing vegetation and aquatic invertebrates, require a freshwater phase to germinate/hatch and become established. Therefore, the rate of migration of salt from the stockpile during inundation events may need to be controlled to ensure that the freshwater phase in flood events is not lost; and
- Salinity changes to the lake sediments from dissolution of the stockpile and migration on to the lake surface could cause changes to primary productivity and aquatic invertebrate assemblages and should be monitored.

Given the uncertainty around the rates of migration of salts from the salt stockpile out onto the lake surface, an option to prevent salt migration from the stockpile has been identified. It is based on physical separation of the excess salt stockpile from the lake playa via a contingency protection bund around the base of the final stockpile. Modelling has identified that a 1 m high earth bund would separate the lake surface from the stockpile for a 1% annual return frequency event. This bund will be utilised to maintain separation during operations and for the closure phase.

Monitoring and Recovery

Monitoring requires control sites and impact sites, different seasons, examination of a variety of abiotic and biotic parameters, wet phase sampling and dry phase sampling (hatching of resting eggs) to determine potential productivity of the system. Monitoring is complicated due to restricted rainfall and as a result monitoring during and after sporadic inundation events is critical (Outback Ecology, 2008).

The recovery of salt lakes post hypersaline discharge is evident within the Goldfields region at Kurrawang White Lake, Lake Miranda, Lake Austin, Banker Lake, Lake Koorkoordine, Southern Star Lake and parts of Lake Carey (Gregory, 2007). Changes expected in relation to recovery may include a reduction in salinity, size of salt crusts, major anions and cations, metals and nutrients.

In addition, increases in the diversity of algae and invertebrates may indicate potential recovery of the system.

The long-term monitoring of hypersaline dewatering discharge at Lake Carey has provided valuable insights into salt lake system recovery. The impacts caused by dewatering to Lake Carey are understood to be considered negligible, in the context of the hydroperiod and salt mass balance.

7.8.2 GROUNDWATER DRAWDOWN EFFECTS

Drawdown of the surficial aquifer at Ten Mile and Sunshine Lakes will occur resulting from the extraction of hypersaline water from the trenches. The surficial aquifer is often connected to the lake surface via capillary rise and results in evaporation and concentration of salts in lake sediments. The poor connectivity between the surface and paleochannel and the confined nature of the aquifer (Advisian, 2017b) mean that the paleochannel extraction will have minimal surface effects.

Drawdown effects from mine dewatering experienced at other salt lakes in WA provide a useful practical model of the likely impacts caused by drawdown of the surficial aquifer. The examples detailed below provide information that is relevant to impact assessment and management of salt lake ecology.

At Lake Carey, the Red October mine has been excavated to below the lake surface. The entire aquifer was dewatered to enable mining to proceed. The pit is protected from flooding by bund walls and the excess hypersaline water was discharged outside of the flood protection barriers. Much of the scientific effort was focused on the impact of the salt plume from the discharge, but the dewatering allowed the soil profile to freshen and the lake playa now supports a range of plant species that would not have germinated and established under the natural surficial groundwater regime.

Toro Energy Limited proposed to develop two satellite mine pits and a water supply borefield at Lake Way and Lake Maitland. actis Environmental Services (2016) provided a review and advice on environmental management/rehabilitation of the samphires at the proposed Toro project. This also included a review of the Response to EPA submissions prepared by *ecologia* Environment on *Tecticornia* groundwater dependency (*ecologia* Environment, 2016).

The relevant findings from the literature noted above are summarised below:

- *Tecticornia* does not appear to be directly groundwater dependent;
- *Tecticornia* distribution appears to relate to flood duration and period;
- Trenches are expected to dewater the lake sediments and create a cone of depression that extends beyond the edge of the salt lake playa;
- Experience at Red October indicates that dewatered lake sediments:
    - Will leach surface salts following flood events to provide a fresh soil surface (no salt crust);
    - The leached surface provides a suitable germination and establishment environment for lake fringing vegetation including *Tecticornia, Atriplex*; and
    - The deep and extensive cone of depression at locations such as Red October has not been observed to cause lake fringing vegetation decline (B Sinclair Pers. Com.)

7.9 KNOWLEDGE GAPS

Solar salt production facilities tend to be long life operations as they rely on seawater as an input and hence do not exhaust the source of salt. Hence there is little experience with decommissioning, closure and rehabilitation of production scale salt evaporation ponds. The large scale use of plastic liners has been adopted on some tailings facilities, but generally they are retained and encapsulated. Thus the requirements to manage large scale removal and disposal of liners is not well understood or costed. Experience with smaller scale features such as process water ponds, evaporation dams has been gained with a range of options from re-use, retention and burial in-situ identified. Current planning does not include a landfill location for the liners, this will be incorporated into project planning as the requirements are clarified.

The solar evaporation process applied to a finite groundwater resource is likely to have a shorter mine life than for seawater solar salt operations. This MCP is the first of what will be a series of plans that are updated as more information becomes available as the Project is implemented. Key information gaps are identified that will enable appropriate risk management and effective closure of the Project and are summarised in Table 9.

Table 9: Knowledge gaps

Knowledge gap	Action / research	Timeframe / status
Infrastructure to be retained post-closure.	Consultation with landholders and others who may wish to take ownership and responsibility for retained infrastructure. Written agreements for any retained infrastructure.	Life of Project. As agreed with Third Party and documented.
Agreed design basis for closure landforms.	Rehabilitation strategies targeting rainfall events to be tested on exploration areas if available.	During exploration rehabilitation
Details of optimal use of topsoil and subsoil materials, timing, equipment to be used.	Rehabilitation trials on exploration areas if available	During exploration rehabilitation
Excess salt stockpile long term dissolution rates and salt re-distribution.	Monitor consolidation, dissolution rates and erosion at excess salt stockpile. Monitor surface water salinity at Ten Mile Lake after rainfall events to determine rates of salt migration from stockpile. Monitor fringing vegetation and lake biota to determine natural temporal variability and potential impacts of excess salt stockpile. Benchmark with other salt lake fringing vegetation and lake biota studies.	Operations. Operations. Planning, Construction and Operations. Operations.
Preferred closure concepts for concentrator and crystalliser ponds.	Investigate a range of closure concepts (elevated salt lake, claypan, dune/swale) and issues (retention of liners in-situ, removal and disposal of retained salts and liners). Test preferred concept(s) and means to address issues. Update MCP with preferred concept.	Commenced, complete during construction – operations. Operations. Operations.

7.10 DATA ANALYSIS AND IMPLICATIONS FOR MINE CLOSURE

Section 7 has provided the baseline data relevant to closure and rehabilitation for the Project. This section provides a brief summary of the key points arising from the data and their

implications for mine closure and rehabilitation. Planning for closure has identified the information gaps and need to gather additional data to enable detailed planning of the controls to be applied to the closure phase of the Project. The likelihood of occurrence of some of the mechanisms to cause impacts identified in the operational phase will be reduced upon cessation of operations, others may continue through the early closure phase, whilst others, which may be unlikely during the operational phase, are more likely during closure due to the consideration of longer time periods.

The points listed below have been considered in impact assessment for the Project, and are relevant to closure:

- The operation is located in an area with little economic activity or habitation;
- The key disturbance footprint of the Project is on salt lake playas, claypans, fringing vegetation and dune/swale landforms. These form the conceptual closure models for landforms at closure;
- The key disturbance footprint for the Project has been located away from the Beyondie Lakes which are known to be generally less saline and support a higher diversity of species than Ten Mile or Sunshine lakes;
- Climate is generally hot and dry and revegetation planning needs to consider the amount and timing of rainfall in the area;
- There are few surface water drainage features and they operate sporadically consistent with the climate, landform and soils. Surface water quality is highly variable, ranging from fresh to hypersaline within the same surface water feature;
- The lake biota is adapted to the extreme natural variability in water availability and quality. Specifically;
    - The lake fringing vegetation is likely to include species that are all well adapted to saline conditions, but will have different tolerances of both salt, drought and waterlogging;
    - Flood events are a key driver in defining the biology in salt lake systems – providing a brief freshwater window for germination, hatching and establishment of new populations. The frequency, level and duration of flood events is not significantly altered by the ponds or waste stockpile;
    - In between flood events, species are well adapted to salinity and long dry periods, some will be reliant upon these dry periods for continued survival;
    - The lake fringing vegetation is unlikely to be groundwater dependent;
    - Severe waterlogging events are known to kill lake fringing vegetation. The current patterning of lake fringing vegetation will be reflective of the history of these events;
- The groundwater in the lake playas and paleochannels is hypersaline and has no beneficial use, specifically;
    - The Project will dewater the shallow hypersaline aquifer, eventually preventing surface accumulation of salts through capillary rise and evaporation and allowing the lake surface sediments to leach salts in a flood event;
    - The deeper paleochannel aquifer is disconnected from the shallow aquifer and pumping is not expected to influence the shallow aquifer;
- The groundwater used for freshwater supply is remote from the lake playas and paleochannels. Specifically:
    - The calcrete aquifers represent stygofauna habitat that will require management to ensure that aquifer levels do not threaten populations;

  - Pumping rates will be used to manage aquifer levels whilst operating;
  - Once pumping ceases, aquifer levels will recover as recharge events occur;
- The product and by-products from the operation are all naturally occurring in the groundwater and surface water;
- There are a number of information gaps that need to be addressed to enable selection of closure concept; and
- The operational life of the Project provides sufficient time to support the investigation and testing of these concepts to provide confidence in their outcomes, practicality and cost.

The implications of the relevant information and information gaps for mine closure are:

- Once dewatering ceases, groundwater levels will slowly recover, with step change recovery following significant flood events. There is no direct dependence upon these levels, and it is anticipated that the annual cycling of salts in the vadose zone will trend back toward current;
- The excess salt stockpile will not be revegetated, but will be left on the lake playa of Ten Mile Lake and be disconnected from the surface water of Ten Mile Lake via an earthen bund; and
- The best way to manage the closure of the ponds is not clear from the current data. Two different landform-based closure models (elevated salt playa, and dune/swale) have been identified and will be investigated.

8 IDENTIFICATION AND MANAGEMENT OF CLOSURE ISSUES

8.1 RISK ASSESSMENT

Recent guidance from DMIRS (2018a) proposes utilising the same risk assessment for the Mining Proposal and MCP with the timing of the particular risk identified. The combined risk tables are provided in Appendix 1.

8.1.1 RISK ASSESSMENT FRAMEWORK

A rehabilitation and closure risk assessment was conducted for the Project. The purpose of the risk assessment was to:

- Identify environmental and regulatory risks and opportunities when planning for rehabilitation and closure; and
- Identify management measures to be implemented to ensure the defined completion criteria can be achieved.

Management controls were selected so that the identified rehabilitation and closure risks would be reduced to as low as reasonably practicable. In determining management controls, the following hierarchy of control principles was adopted:

- Elimination of the hazard;
- Substitution with a lower risk activity or product;
- Engineering solutions to reduce the impact of the hazard; and
- Implementation of administrative procedures to control the hazard.

In undertaking the risk analysis component of the overall assessment, the approach focussed on addressing the 'credible worst case consequence of the risk and the likelihood of the credible worst case consequence occurring'. This approach was deemed the most appropriate due to the scale of the project and the lack of potential for significant environmental impacts to occur.

The approach taken in the Environmental Risk Register (Appendix 1) was to quantify the risk using a combination of its likelihood (Table 10Table 10) and consequences (Table 11) to determine the risk rating (Table 12). The likelihood and consequences are rated for both the inherent risks (i.e. before the application of risk mitigation measures) and residual risks (i.e. after consideration of the change in likelihood and/or consequence that the risk mitigation measures).

The definitions used to determine the likelihood of an event occurring are provided in Table 10. These range from 'Almost Certain' to 'Very Unlikely'

Table 10: Likelihood definitions

Descriptor		Expected Frequency	PROBABILITY Select most relevant to the activity / risk (e.g. Probability of occurrence within lifetime of the project or Probability %)	
A	Almost Certain	More than once per month	The event is expected to occur at some time as there is a history of continuous occurrence with similar projects/activities.	91 – 100%
B	Probable	Less than once per month, but more than once per year	There is a strong possibility the event will occur as there is a history of frequent occurrence with similar projects / activities.	61 – 90%
C	Possible	Less than once per year, but more than once per five years	The event might occur at some time as there is a history of infrequent occurrence of similar issues with similar projects / activities.	41 – 60%
D	Unlikely	Less than once per five years	Not expected, but there's a slight possibility it may occur at some time.	11 – 40%
E	Very unlikely	Unlikely to ever occur	Highly unlikely, but it may occur in exceptional circumstances	0 – 10%

Consequence definitions for each of the environmental factors identified are provided in Table 11. These range from 'Insignificant' through to 'Extreme'.

Table 11: Consequence definitions

Environmental Factor	Minor 1	Moderate 2	Serious 3	Major 4	Severe 5
Biodiversity / Flora / Fauna / Ecosystem	No or insignificant impact	Minor – moderate onsite impact Minor offsite impact at a local scale	Long-term onsite impact Moderate offsite impact at a local scale Minor and short-term impact to an Environmentally Sensitive Area (ESA) or area of high environmental value	Long-term impact to ESA or area of high environmental value Long-term impact on a broad scale Adverse impact to listed species	Irreversible impact to ESA or area of high environmental value Irreversible and significant impact on a broad scale Total loss of a listed species
Water Resources	No or insignificant impact to surface water and groundwater resources	Contained low impact with negligible effect on surface water and groundwater resources	Uncontained impact that will affect surface water and groundwater resources in the short-term	Extensive hazardous impact that will require long-term remedial works	Uncontained hazardous impact with residual effects
Land Degradation	Negligible impact to isolated area	Contained low impact, not impacting on any environmental value	Uncontained impact, able to be rectified in short-term	Extensive hazardous impact that will require long-term remedial works	Uncontained hazardous impact with residual effects

Environmental Factor	Minor 1	Moderate 2	Serious 3	Major 4	Severe 5
Mine Closure	Site is safe, stable and non-polluting Post mining land use is not adversely affected	The site is safe, all major landforms are stable, and any stability or pollution issues are contained and require no residual management. Post-mining land use is not adversely affected	The site is safe, and any stability or pollution issues require minor, ongoing maintenance by end land-user	The site cannot be considered safe, stable or non-polluting without long-term management or intervention. Agreed post mining land-use cannot proceed without ongoing management.	The site is unsafe, unstable and / or causing pollution or contamination that will cause an ongoing residual affect. The post-mining land use cannot be achieved.

Once a consequence and likelihood have been determined for a hazard, the Risk Rating Matrix as illustrated in Table 12 calculates a risk rating for the hazard being assessed.

Table 12: Risk rating matrix

			CONSEQUENCE				
LIKELIHOOD			1 Minor	2 Moderate	3 Serious	4 Major	5 Severe
	A	Almost Certain	M	H	H	VH	VH
	B	Probable	M	M	H	H	VH
	C	Possible	L	M	M	H	H
	D	Unlikely	L	L	M	M	H
	E	Very Unlikely	L	L	L	M	M

VH – Very High. H – High. M – Moderate. L - Low

8.1.2 Closure Risk Assessment

The identification of mine closure related risks at the Project was informed by consultation with key stakeholders and experienced mining, environmental and rehabilitation professionals. Controls to mitigate and manage risks were identified and incorporated into closure actions and controls. It should be noted that the risk assessment process may be changed and improved periodically as the Project develops.

Closure risk assessments at the Project will be reviewed at least every three years, in parallel with the triennial MCP reviews. These risk reviews may include a formal risk assessment workshop with selected internal stakeholders, including site managers and environmental personnel. Experienced personnel who are familiar with the issues concerned will be responsible for assigning likelihood and consequence ratings to closure risks.

8.2 Closure Risks

The key issues Kalium Lakes will need to manage to successfully rehabilitate and close the Project have been identified as part of a preliminary risk assessment exercise and are listed in the Rehabilitation and Closure Risk Register in Appendix 1.

Eight key closure-related risks (those with an inherent risk rating of medium or above) were identified during the risk assessment:

1. Spread or introduction of weeds. Activities introduce and spread weeds via uncontrolled populations, dirty equipment and/or physical material movements with no subsequent control of introduced weeds;
2. Breach of excess salt stockpile bund releases brine into fringing vegetation;
3. Unsuccessful rehabilitation due to low amounts of topsoil or poor quality of topsoil;
4. Unsuccessful rehabilitation due to remaining salts in evaporation ponds or waterlogging due to presence of liners;
5. Breach of excess salt stockpile bund releases brine into surface waters of Ten Mile Lake;
6. Indirect impacts to surface water salinity due to drawdown of surficial aquifer;
7. Land degradation due to salts and plastic liners not properly disposed of; and
8. Unfinished rehabilitation of Project due to unplanned closure.

Without risk management measures, the above risk pathways are considered to be generally more likely to occur, with consequences that range up to 'High'. With the application of control measures, the residual risk ratings give a worst overall risk rating of 'Medium'.

The following sections provide a discussion of each of these risk issues, including consideration of the significance of the adverse impact associated with each risk and the identification of potential causes.

8.2.1 Spread or Introduction of Weeds

This section relates to Closure Risk 1 described above.

Rehabilitation activities may introduce weeds via dirty equipment and they may be spread by vehicle and physical material movements. Without identification and control measures, any new weeds may spread and new populations establish. The impacts may include reduced productivity in rehabilitation areas, increase weed diversity and density in surrounding native vegetation and deterioration in pastoral or native fauna habitat values.

Risk management measures identified for weeds are identified in the Mining Proposal for implementation whilst mining:

- Undertaking annual weed inspections;
- Inspecting equipment and vehicle cleanliness;
- Undertaking contingency weed spraying where necessary to eradicate new weed species; and
- Implementing Environmental Management System controls and the Annual Environmental Report to report status, actions and incidents.

8.2.2 Excess Salt Stockpile

This section relates to Closure Risk 2 and 5.

The excess salt stockpile area has been located on the surface of Ten Mile Lake to retain the salt within the environment from where it came, and to minimise the risk of impacts to surrounding vegetation. During and after rainfall events, salts will redissolve from the stockpile into flood waters. An earthen bund will be built around the periphery of the excess salt stockpile to contain

such saline run-off. . There is a risk that saline run-off may impact fringing salt lake vegetation (Samphire shrublands) if the bund was breached or overflowed, resulting in a reduction in vegetation health and fauna habitat quality and potential interference with the life cycle requirements of aquatic fauna. Samphire shrublands are considered to currently be of conservation significance as the area in which this vegetation occurs provides habitat for a number of *Tecticornia* species listed as Priority species by DBCA (Phoenix, 2018a).

The flood modelling undertaken by Advisian (2018) shows that the toe of the stockpile may be inundated to 10 cm depth at a return frequency of about five years. The high evaporation rates and infiltration into the lake sediments means that the floodwaters (at this return frequency) would only be present for a matter of weeks. The return frequency of flood events that would put any floodwater in contact with the toe of the stockpile is 50 - 63% (once every 2-3 years) (Advisian 2018). Flood quantities would be about 400 – 1,100 m^3 of water with the toe of the stockpile potentially inundated for a maximum depth of 1 - 2 cm.

This flooding frequency does enable a monitoring programme to be established during operations to measure and monitor the potential rate of migration of salts from the stockpile to the lake surface and the potential exposure of lake fringing vegetation to elevated salinity in flood water. The presence of the salt stockpile itself results in a negligible change in flood depths and extents under both operations and closure scenarios.

The lake system currently has salts available at the lake surface as a result of ongoing capillary rise, evaporation, concentration and precipitation. This process will be disrupted by the capture of the shallow groundwater into the production process, so that there will be less salt available at the lake surface. The excess salt stockpile is expected to replace the surface salt available so that the process of dissolution, evaporation and concentration of salts will continue from a linear source rather that a planar source, with chemical dominance of NaCl in salt mix increased.

Given the uncertainty around the rates of migration of NaCl from the salt stockpile out onto the lake surface, an option to prevent salt migration from the stockpile has been identified. It is based on physical separation of the excess salt stockpile from the lake playa via a contingency protection bund around the base of the final stockpile. This bund will be utilised to maintain separation during operations and for the closure phase.

8.2.3 TOPSOIL MANAGEMENT

This section relates to Closure Risk 3.

Successful rehabilitation during the mine closure phase is dependent on the availability of sufficient quantities of good quality topsoil. Risk management measures identified for topsoil management are identified in the Mining Proposal for implementation whilst mining, including measures such as topsoil stripping prior to construction and the appropriate maintenance of stockpiles. Triennial reporting of materials balances to DMIRS will also be undertaken.

8.2.4 UNSUCCESSFUL REHABILITATION OF LAKES AND PONDS

This section relates to Closure Risk 4 and 7.

There is a risk of unsuccessful rehabilitation of concentrator lakes and crystalliser ponds if pond liners used in concentrator lakes/ponds/crystalliser ponds are not properly disposed of or

perforated, or residual salts are not harvested. This may cause waterlogging or increased salinity of soils and subsequent issues for vegetation to re-establish around these areas.

As part of this preliminary assessment, the characteristics of the various lakes/ponds at closure have been reviewed and initial closure options considered. The key characteristics at closure of the concentrator lakes, concentrator ponds and crystalliser ponds (assuming full implementation of the Proposal) are summarised in Table 13. Embankments will be constructed from material under the footprint of the ponds (i.e. no borrow will be required). All ponds will be lined with HDPE liner to reduce loss of product. It is estimated that there will be a total area of 600 ha of HDPE liner from all ponds to consider for possible removal or burial. Residual salts forming the base layer of the crystalliser ponds will be harvested using a grader and sold.

Table 13: Key characteristics of lakes and ponds at closure

Item	Concentrator Lakes	Feed Ponds	Concentrator Ponds	Settling Ponds	Na Crystalliser Ponds	K Crystallizer Ponds	Bittern Ponds
Primary Purpose	Brine volume reduction to reduce pumping quantity to concentrator ponds	Provide a consistent feed for the concentrator ponds	Reduce brine volume and begin to crystallize sodium salts (waste)	Recycling of process plant mother liquor to recover potassium	Reduce brine volume to crystallize sodium salts (waste)	To crystallize potassium salts: leonite, kainite and carnallite	Magnesium brine storage ponds for process plant by-product recovery.
Underlying substrate	Constructed over existing clay pan/salt lake areas (i.e. a mix of bare areas and salt tolerant vegetation)	Located off the salt lake surface on sandy soils that supported native vegetation					
Area (total)	2 lakes; 203 ha	2 ponds; 4 ha	8 ponds; 171 ha	4 ponds; 6 ha	22 ponds; 317 ha	64 ponds; 259 ha	8 ponds; 5 ha
Volume	200 – 250 mm brine 450 mm freeboard	200 – 250 mm brine 450 mm freeboard	200 mm brine 250 mm freeboard	200 mm brine 250 mm freeboard	200 mm brine 250 mm freeboard	150 – 200 mm brine 250 mm freeboard	500 mm brine 250 mm freeboard
Salt/ Base composition	None	None	600 mm NaCl base	600 mm NaCl base	600 mm NaCl base	300 mm KTMS base	None
Liner	1 mm thick HDPE liner						
Embankment height	~700 mm	~1950 – 750 mm	~1750 – 900 mm and ~2950 – 900 mm	1450 - 750	~1900 – 1050 mm and ~1300 – 1050 mm	Leonite: 1800 – 750 mm and 1000 – 750 mm KTMS: 1500 – 700 mm Carnallite: 950 – 700 mm	1450 – 750 mm high
Embankment area	341,040m^2						
Rehabilitation materials	No topsoil as liner is located directly on samphire	268,399m^3 topsoil (100 mm stripped) stockpiled around edge of lakes					

The over-arching closure objective for the site is to be safe, stable and non-erodible. Closure options will consider landscape position, surface water and groundwater conditions, flows and potential vegetation types. Pivotal in considering closure options is considering how surface water flows will be affected. The lakes and ponds have two impediments to infiltration of rainfall and subsequent establishment of vegetation – residual salt and plastic liners. The closure options identified and resulting outcomes differ depending on the actions undertaken with respect to these two items. The results of the lake/pond closure option analysis are presented in Table 14.

Table 14: Closure options for Concentrator and Crystalliser Ponds

Option	Runoff	Revegetation	Potential issues to address

1. Remove residual salts and plastic liner. Spread soil from embankments.	Allows infiltration of rainfall near original conditions	Vegetation likely to re-establish	• For area of lining material:
			  ○ Removal/collection method
			  ○ Transportation method
			  ○ Location to dispose of
			  ○ Method of disposal (e.g. burial)
			• Limited materials to landform
			• Age of topsoil at closure.

2. Remove residual salt but leave plastic liner in situ and perforate. Spread soil from embankments.	Allows infiltration but at reduced level compared to original conditions (duplex soil effect)	Vegetation at risk from shallow plastic liner?	• Limitations to root penetration and water infiltration • Method to use to perforate plastic • Residual plastic • Limited materials to landform – depth to liner? • Age of topsoil at closure.
3. Bury gathered liner in constructed trench within pond footprint.	Allows infiltration of rainfall near original conditions	Vegetation likely to re-establish	• Depth of trench required • Limited materials to landform • Age of topsoil at closure.
4. Retain salts and liners, rehabilitate embankments as lake fringing vegetation.	Reduces infiltration to very low rates and continues evaporation and concentration cycles.	Vegetation only around fringes of feature	• Whole of catchment behaviour • Long term liner performance • Long term salt movements • Ecological development and colonisation • Acceptability.

To adequately manage the risk of unsuccessful rehabilitation of ponds and determine the best option for closure a detailed closure option analysis will be undertaken and the results will be provided in the next iteration of this MCP.

8.2.5 GROUNDWATER DRAWDOWN

This section relates to Closure Risk 6.

Brine abstraction from trenches and bores located at Ten Mile Lake and Sunshine Lake during operations may cause drawdown which could affect salt lake processes for a period post-closure. A decreased salinity as a result of a reduction in salts evaporating on the lake surface as a result of drawdown of the extractable portion of the surficial aquifer may cause a reduction in salt evaporating on the lake surface and subsequently a decrease in salinity at the lake surface.

Key assumptions in this are that:

- Drawdown is limited to small portion of each lake, with majority less than 0.5m drawdown;
- A 5 yr ARI event required to provide recharge to the aquifer, and
- Hydrological processes will gradually return to existing conditions post-closure.

To adequately manage the risk of drawdown during closure from brine abstraction, groundwater level monitoring will be undertaken as part of the *Tecticornia* Monitoring Program until pre-mining groundwater levels are reinstated. Furthermore all pumps will be shut off at closure and trenches backfilled to prevent evaporation.

8.2.6 UNFINISHED REHABILITATION

This section relates to Closure Risk 8.

In the event of unplanned closure there is the risk of unfinished rehabilitation of the Project which will impact on the post-mining land use of the area. The Site may not be rehabilitated to required standards and there may be increased potential for off-site impacts from erosion and sedimentation.

Management of the closure risk of unfinished rehabilitation will be achieved through the following measures:

- Removing all equipment from site as per MCP;
- Undertaking triennial updates of MCP;
- Forming agreements with landholder for any retained infrastructure;
- Including an allowance in rehabilitation provision;
- Applying IFRS Standard to mine closure costing and provisioning;
- MRF reporting and contributions;
- Including unplanned closure decommissioning and care/maintenance plans in the first revision of MCP; and
- Undertaking closure audit to show all equipment and infrastructure removed and site made safe.

9 CLOSURE IMPLEMENTATION

9.1 DOMAIN SPECIFIC CLOSURE WORKS

For the purpose of planning rehabilitation and closure, and consistent with industry standard closure planning process, the Disturbance Envelope has been divided into specific domains. Each domain includes items that have similar rehabilitation and closure requirements. For the Project, the following domains have been identified and are shown in Figure 37.

- Domain 1: Ponds
- Domain 2: Processing Facility and Workshops;
- Domain 3: Trenches and Borefield;
- Domain 4: Excess Salt Stockpile;
- Domain 5: Infrastructure;
- Domain 6: Landfill; and
- Domain 7: Roads and Tracks.

The closure objectives allow for some flexibility in target landforms for some of the Project domains, consistent with the early stages of closure planning. The closure work programs will vary according to the selected target landform option as the identified knowledge gaps are addressed. The domain specific closure works identified in the section below identify the likely tasks associated with the currently identified target landform options. These will be clarified over time as the knowledge gaps are addressed.

9.2 CLOSURE WORK PROGRAM

The domains are further broken down into sub-domains and specific tasks in the following sections to enable planning to be carried out at a suitable scale and level of detail.

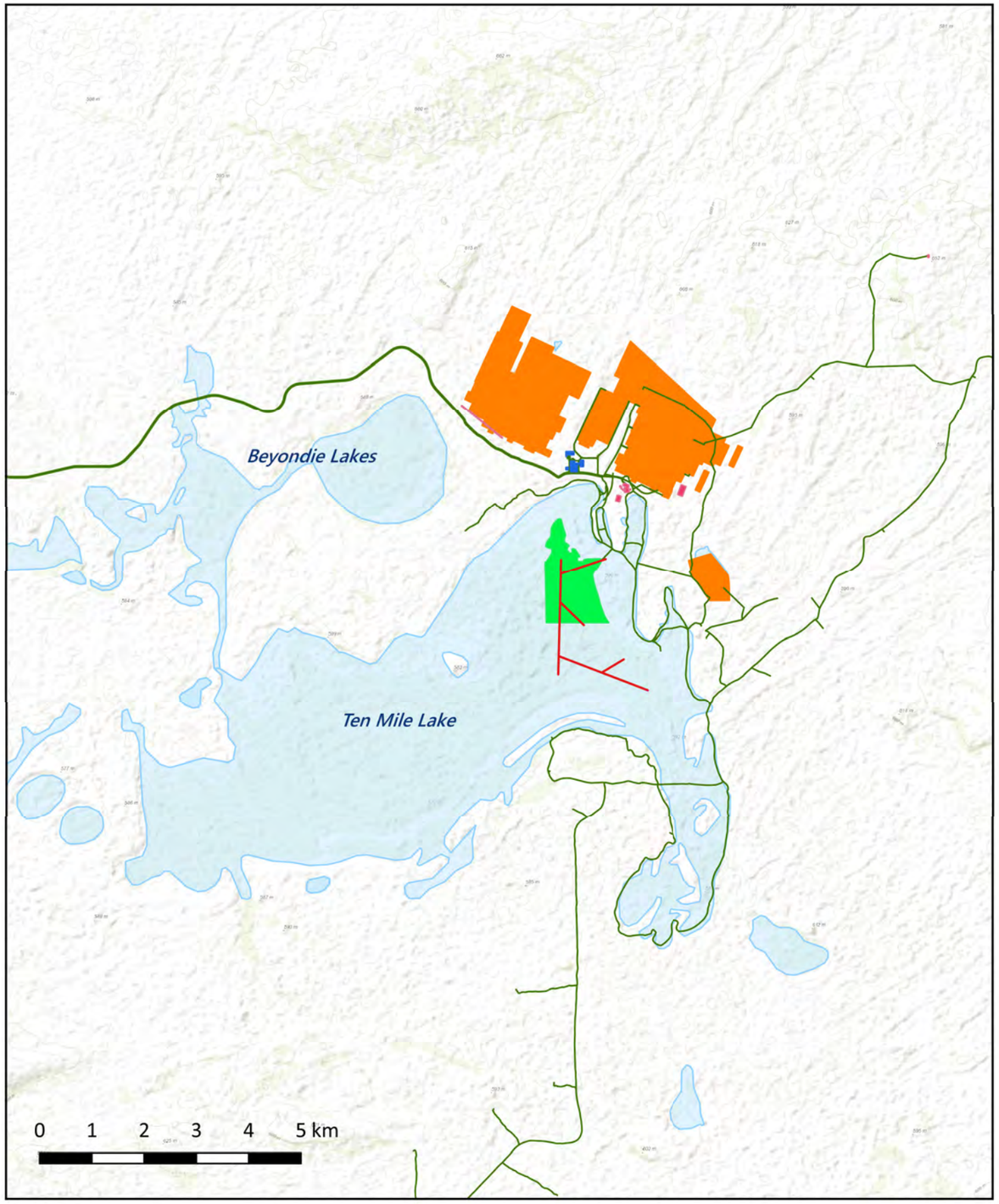
9.2.1 DOMAIN 1: PONDS

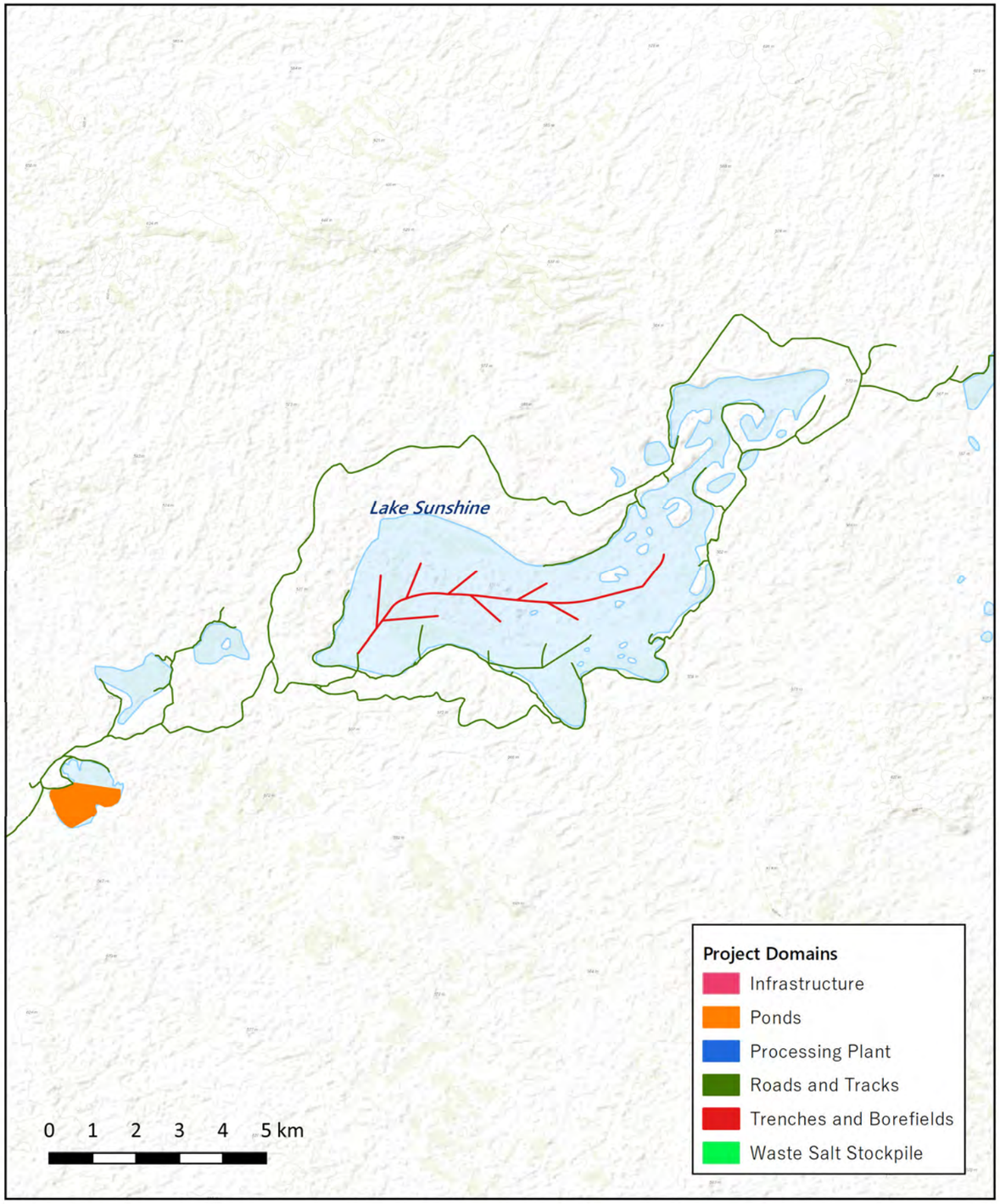
Concentrator Lakes

The Concentrator lakes are not expected to have significant crystallised salt in them. The Concentrators Lakes will continue to act as a basin for local surface water flow and the target landform is to return them to a playa/claypan.

Dune/Swale Landform

There are two potential target landforms for the Ponds – the existing landform is dune/swale – and this may be adopted as the target landform for closure, or the ponds may be retained as a modified landform as an elevated salt lake playa. The dune/swale target landform would require removal of residual salts from the crystalliser ponds, and most likely include removal of the liners for compression and burial, followed by earthworks to re-create the dune/swale landform.





Rev	Description	Drn	Chk	App
1	ISSUED FOR MINE CLOSURE PLAN APPROVAL	HR	GE	BH
0	ISSUED FOR MINE CLOSURE PLAN APPROVAL	HR	GE	BH

Datum: GDA94
Projection: MGA51
0 1 2 3 4 5 km

KALIUM LAKES

Beyondie Sulphate of Potash Project
Project Domains

KLP_18054	26/11/2018

Figure 37: Closure domains

Lake Playa/Claypan Landform

The Pond Circuit at closure will be functioning as a controlled, elevated saline area. During operations it will be managed and operated with continuing inputs of hypersaline water and harvesting of salt. At closure, the Pond Circuit will cease to have an ongoing input of hypersaline water, but will have extensive areas of crystalline salt underlain by a plastic liner, embankments and a flow system that enables water to move progressively toward the Ten Mile Lake playa.

An alternative landform target is to create an elevated salt lake playa and surrounds that would continue to evaporate and concentrate salts, but would have a limited supply that may slowly transported in surface water toward the Ten Mile Lake playa, and or be dissolved and seep into groundwater beneath the ponds. Under this scenario, there would be less earthworks, less salt on the excess salt stockpile and an overflow system designed for an agreed, specified design event.

Liners

There are options for the treatment of the plastic liners at closure, with the selected option likely to be dictated by the chosen target landform and the cost and practicalities associated with the required actions. In brief these are:

1. Liners to be punctured in situ to encourage leaching. This could be achieved with a task-specific machine or a dozer / grader with ripper tynes;
2. Liners to be removed and disposed in a licensed landfill or agreed burial area, covered and surface rehabilitated; and
3. Liners to be left entirely and in situ with the salt layer left.

With these options in mind, the sub-domains and relevant tasks are identified in Table 15.

Table 15: Ponds task list

Sub-domain	Task	Verification
Concentrator Lakes	• Remove water and any built up crystallised salt • Reveal liner edges • Cut and fold/roll liner for burial • Allow drying period to ensure trafficability • Push any embankment materials down to tie in with landform • Push topsoil materials over surface • Scarify and seed with local native species.	Audit. Rehabilitation monitoring report.
Ponds (target return to dune/swale landform)	• Harvest all salts down to minimum level to enable harvest whilst protecting integrity of liner • Remove harvested salt to excess salt stockpile. • Flood ponds to dissolve residual salts and either dry and truck or pump to excess salt stockpile • Treat HDPE liners • Push in embankment walls, spreading wall material to create dune/swale landform. • Return topsoil • Rip and seed with local native species • Establish any drainage • Monitor and maintain.	Audit. Rehabilitation monitoring report.

Ponds (target salt lake landform)	• Treat HDPE liners if and as required (they will need to be removed from some embankments as a minimum, even if an elevated salt lake is the closure landform) applying one of:
	  ○ Remove and bury locally (subject to approvals)
	  ○ Remove and bury in landfill
		Audit.
		Rehabilitation monitoring report.

Sub-domain	Task	Verification
	• Push in embankment walls, spreading wall material to create lake fringes • Seed lake fringe areas with appropriate local native species • Establish any drainage • Monitor and maintain.	
All Areas (unless otherwise specified)	• Implement post-mining monitoring and external completion report processes • All rubbish and scrap being progressively disposed of in a suitable manner • Re-establish infrastructure according to land owner agreements.	Audit. Rehabilitation monitoring report.

9.2.2 DOMAIN 2: PROCESSING FACILITY AND WORKSHOPS

The sub-domains under Processing Facility and Workshops and relevant tasks have been provided in Table 16.

Table 16: Processing Facility and Workshops task list

Sub-domain	Task	Verification
Processing Facilities and Workshop Area	• Complete residual hydrocarbon and contamination assessment • Remove mobile/fixed infrastructure for re-use or approved disposal • Remove remaining structural materials and concrete pad as necessary for approved disposal • Back-fill to bury to approved depth any materials to be left in-situ • Re-surface to match surrounding ground levels • Re-establish drainage • Revegetate in accordance with the Revegetation Process	Audit. Rehabilitation monitoring report.
All Areas (unless otherwise specified)	• Return topsoil • Rip and seed with local native species • Implement post-mining monitoring and external completion report processes • All rubbish and scrap being progressively disposed of in a suitable manner • Re-establish infrastructure according to land owner agreements.	Audit. Rehabilitation monitoring report.

9.2.3 DOMAIN 3: TRENCHES, PIPELINES AND BOREFIELD

This domain is distributed across the landscape covering a number of landforms, soils and vegetation/habitat types. The detailed prescription of actions will differ according to the specific location, but all of these areas are expected to enable the post-mining land uses of pastoralism and/or UCL. Some of the infrastructure may be passed through to a third party who will become responsible for it.

The sub-domains under trenches, pipelines and borefield and relevant tasks have been provided in Table 17.

Table 17: Trenches, pipelines and borefield task list

Sub-domain	Task	Verification
Bore holes	• Identify all bores for retention and establish written agreement with new owner • Other bore holes are to be filled and capped or rehabilitated as approved most likely to be:	Audit to confirm capped and filled. Rehabilitation monitoring report.

Sub-domain	Task	Verification
	○ Cut beneath ground level, remove collars and any concrete for burial locally or at landfill	
Pumps and Pipelines	• Power sources to be removed • Pumps to be removed for re-use, recycling or disposal • Any footings to be either removed and buried locally or at landfill • Pipelines to be cleaned with fresh water if required • Residual water to be drained from pipes and contained to prevent damage to vegetation • Pipelines to be dismantled • Pipe to either be: 1.) disposed of at licensed landfill 2.) removed and resold/recycled.	Audit to confirm removed. Rehabilitation monitoring report.
Trenches/Sumps	• Back-fill trenches/sumps with source material • Re-surface to match surrounding ground levels • Where revegetation is require, scarify and allow natural re-seeding	Audit. Rehabilitation monitoring report.
All Areas (unless otherwise specified)	• Implement post-mining monitoring and external completion report processes • All rubbish and scrap being progressively disposed of in a suitable manner • Re-establish infrastructure according to land owner agreements.	Audit. Rehabilitation monitoring report.

9.2.4 DOMAIN 4: EXCESS SALT STOCKPILE

The earthen bund is a feature that will be established prior to salt deposition and the exces salt stockpile will have been in place for some time at closure. Operational experience will be valuable in finalising the required closure actions. The stockpile may have commercial value – either whilst operating or post-closure. This plan has assumed that the excess salt stockpile exists to its maximum approved extent at closure, but that may not be the case. Planning has identified potential value in the stockpile being left as an accessible resource.

The sub-domains and relevant tasks are provided in Table 18.

Table 18: Excess Salt Stockpile task list

Sub-domain	Task	Verification
Haul Road to stockpile	• Determine potential use and value approaching closure	Updates to this MCP
Stockpile	• Review operational management experience and determine closure risks and controls in detail • Determine potential use and value at closure	Updates to this MCP
Earthen bund	• Determine potential use and value approaching closure	Updates to this MCP

9.2.5 DOMAIN 5: INFRASTRUCTURE

Some infrastructure may be retained post-closure to provide services for the rehabilitation team while other facilities may remain in place through stakeholder agreements, e.g. with local landowners, Shire, agency or Native Title Group.

The sub-domains under Infrastructure and relevant tasks have been provided in Table 19.

Table 19: Infrastructure task list

Sub-domain	Task	Verification
Accommodation camp	• Identify post-mining owner or remove and rehabilitate. • Utility services disconnected and removed. • Remove footings and bury locally or in landfill. • Landform area, spread topsoil, scarify and seed.	Audit to confirm removal. Rehabilitation monitoring report.
Communication Towers	• Identify post-mining owner or remove. • Scarify disturbance area.	Ownership documentation or Audit to confirm removal.
Drains and sumps	• Prepare post-mining drainage plan to identify retained features. • Fill and rehabilitate areas not to be retained. • Scarify rehabilitation areas as required.	Post-mining drainage plan or audit. Rehabilitation monitoring report.
All Areas	• Implement post-mining monitoring and external completion report processes • Re-establish infrastructure according to land owner agreements.	Audit. Rehabilitation monitoring report.

9.2.6 DOMAIN 6: LANDFILL

The landfill planned for the site operations is not currently sized to include the burial of liners. It will be developed for the management of normal Project waste streams and quantities. Several options for the disposal of liners will be investigated. Should the use of the Landfill site become the preferred option, the licence would be amended to accommodate disposal of liners and this MCP would be updated to be consistent. The sub-domains under Landfill therefore do not contemplate burial of plastic liners on any scale at this stage – the actions associated with the liners are described under Ponds.

The relevant tasks for a conventional landfill associated with a mine are provided in Table 20.

Table 20: Landfill task list

Sub-domain	Task	Verification
Landfill	• Back-fill landfill cell with stockpiled specified cover thickness and topsoil material, • Re-contour to match surrounding ground levels and re-establish drainage • Rip and seed with local native species • Remove fencing	Audit to confirm removal. Rehabilitation monitoring report.
All Areas	• Implement post-mining monitoring and external completion report processes	Audit. Rehabilitation monitoring report.

9.2.7 DOMAIN 7: ROADS AND TRACKS

As specifically requested by the Pastoralist, the upgraded Beyondie Road and fresh water borefield access roads will be returned to Marymia Pastoral Station owners for its length within Marymia Pastoral Lease on closure for ongoing use. Some roads and tracks will be retained for ongoing site access post-closure in support of rehabilitation related activities and may be retained longer term depending on stakeholder agreements.

The sub-domains under Roads and Tracks and relevant tasks have been provided in Table 21.

Table 21: Roads and tracks task list

Sub-domain	Task	Verification
Beyondie Road (those sections of road and track servicing the Marymia Pastoral Lease)	• Complete written agreement with Pastoralist to take responsibility for the roads and tracks	Future MCP
Roads and tracks outside of Marymia Pastoral Lease (including culverts)	• Re-contour and re-establish drainage • Replace topsoil, rip • Or leave in a condition agreed with land owner.	Audit report. Rehabilitation monitoring report.
All Areas	• Implement post-mining monitoring and external completion report processes • Re-establish infrastructure according to landowner requirements	Audit. Rehabilitation monitoring report.

9.3 ENVIRONMENTAL CONTROLS DURING CLOSURE

This section details the key environmental controls that will be applied during the closure implementation phase for the Project. Compliance with relevant approval conditions will continue as required and be reported to regulators through AERs. The final step in decommissioning and closing a mining operation will be relinquishment of the tenements. It is anticipated that the Mining Act would therefore be the final statute dictating any required controls during the latter stages of closure.

9.3.1 AIR QUALITY

During closure, Kalium Lakes will implement the following dust management activities as required:

- Visual monitoring of dust emissions will continue;
- Use of water carts to dampen soils on roads or during rehabilitation earthworks;
- Changing any dust creating works (i.e. earthmoving activities) on high dust risk days;
- Avoiding moving topsoil and subsoil in windy weather in summer;
- Use of materials such as magnesium chloride, mulches or clay fines to stabilise soils; and
- Finalising works and seeding revegetation areas to minimise the risk of dust emissions.

9.3.2 NOISE

Earthmoving during closure is not expected to result in higher noise emissions that what would occur during construction and operation of the Project. No particular noise management measures are expected to be required.

9.3.3 SURFACE WATER

The following controls may be employed, as applicable, to ensure surface water is managed during closure:

- Containment and directional drainage;
- Minimising soil disturbance;
- Revegetation of rehabilitated areas as soon as practicable; and

- Removal or covering of potential sources of contamination.

9.3.4 GROUNDWATER

The following controls may be employed to ensure groundwater is managed during closure:

- Remove potential sources of contamination such as hydrocarbons; and
- Monitoring to measure aquifer recoveries.

9.3.5 COMMUNITY COMMENTS AND COMPLAINTS

Kalium Lakes will respond to community comments and complaints received during rehabilitation operations in the following manner:

- Collect details of the complainant and issue;
- Document the issue;
- Determine and implement appropriate immediate actions to stop or modify the situation; and
- Plan and implement any actions required to address the comment or complaint in the longer term.

9.4 CONTAMINATED SITES

WA has a comprehensive legal framework for the identification and management of contaminated sites under the *Contaminated Sites Act 2003* (CS Act). The legislation, in summary, provides for the:

- Definition and identification of contaminated sites;
- Investigation of contamination;
- Publicly available reporting of contaminated sites;
- A classification system for contaminated sites with a hierarchical basis for action based on risk;
- Registration of contamination on the title of the land; and
- Ownership and liability for contamination.

The CS Act is administered by the Contaminated Sites Branch of DWER. DWER has produced and operates under an extensive set of guidelines and standards for managing contaminated sites under the CS Act. In these documents, DWER recommends that contaminated sites should be investigated and managed in a staged manner as illustrated in Figure 38 (DWER, 2014).

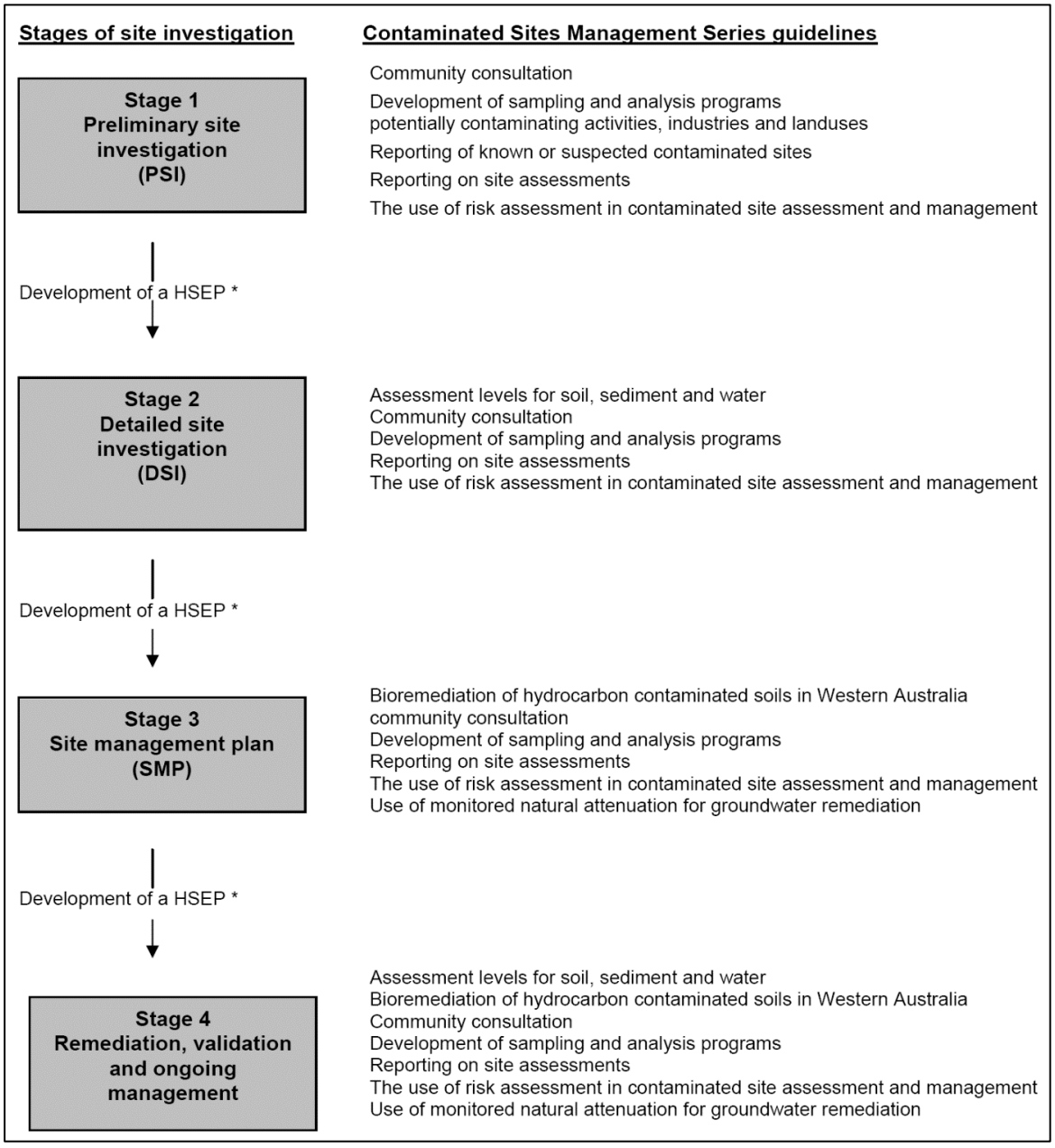
According to the Project closure risk assessment, the operational activities identified as being most likely to lead to contamination are:

- Residues from hydrocarbon storage;
- Hydrocarbon spills during rehabilitation activities;
- Spillage, leakage or inappropriate disposal of reagents or dangerous goods stored on site (including laboratory waste); and
- Workshop activities (hydrocarbon residues).

Most controls to prevent contamination will apply during the operational phase of the Project. Control measures include reporting spillages and environmental incidents, licencing conditions

(operational licence, Dangerous Goods licence), regulatory inspections and site cleanup procedures. The closure risk assessment for the Project will consider the history of these activities onsite toward the end of mine life and will re-rate the risk.

Kalium Lakes will manage any contaminated sites at the Project in accordance with the requirements of the CS Act which is independent of this MCP and Mining Act responsibilities. Progress against the CS Act requirements will be reported in the AER, with known and suspected contaminated sites identified and described.



* Health, Safety and Environment Plan. Refer to *Guidance Note Occupational Safety and Health Management and Contaminated Sites Work* (Commission for Occupational Safety and Health, 2005).

Figure 38: Staged approach to site investigations (DER, 2014)

9.5 PROGRESSIVE REHABILITATION

The Project affords limited opportunity for progressive rehabilitation as all the areas proposed for development are likely to be simultaneously utilised until closure. The largest component of ground disturbance is for the ponds, which are likely to be used for the life of mine.

Exploration areas (potentially including some production bores, monitoring bores, trenches, pipes and pumps as well as tracks and pads) form the basis for progressive rehabilitation. During operations, some bores may be exhausted and rehabilitated progressively, with removal and recycling of pumps and pipes to the extent practicable. Some trial areas will be created to test closure and rehabilitation strategies for ponds to inform future versions of this MCP.

9.6 UNEXPECTED CLOSURE / SUSPENSION OF OPERATIONS

Kalium Lakes understands that there is always the potential for unexpected closure or suspension of operations or for a period of care and maintenance.

In the event of unexpected closure or suspension of operations, DMIRS will be notified in accordance with the requirements of the Mining Act. If suspension of operations is necessary, a Care and Maintenance Plan will be prepared and submitted to the DMIRS within three months of notification.

If unexpected closure of the Project is necessary, the following works will be conducted:

- The site will be secured and signposted to discourage entry;
- The MCP will be revised to address the state of the operations at the point of unexpected closure; and
- Closure of the Project will be conducted as per the requirements of the revised MCP.

All of the closure requirements listed in this MCP are expected to remain applicable in an unexpected closure. In general:

- Disturbed surfaces not required for any other purpose will be rehabilitated to a stable target landform;
- All pipelines, bore pumps, generators and any other infrastructure will be removed;
- The required monitoring, auditing and reporting will be completed; and
- The Project land area will be returned to pre-mining land use.

9.7 DECOMMISSIONING

Decommissioning of Project infrastructure will be undertaken at the end of the Project life in accordance with Table 22. A risk assessment will be undertaken prior to commencing significant decommissioning to address potential safety and contamination risks.

Decommissioning of ponds may take several years as production ceases, final harvests are completed, equipment removed and surfaces prepared.

Table 22: Decommissioning of processing and infrastructure areas

Sub-domain	Task	Verification
Evaporation ponds	Remove pumps, pipes, level sensors Remove saleable and excess salts	Photo monitoring
Buildings and processing infrastructure	Decommission and remove services Remove buildings, processing infrastructure, services and any associated footings for disposal at landfill.	Audit
Workshops	Decommission and remove services Remove buildings and footings. Undertake a risk assessment for contamination	Audit. Any contamination identified to meet requirements of the CS Act
Hardstand areas	Remove fences and tidy area Deep rip any hardstand areas	Inspection - area ready for rehabilitation
Landfill	Cover waste with required thickness Remove fences and infrastructure	Inspection - Area ready for rehabilitation
Pipelines and water management infrastructure	Complete risk assessment prior to draining and removing pipes Pump or drain tanks, pipes and pumps to reduce liquid contents Dispose of saline water in areas adapted to saline conditions Remove pipelines and other water management infrastructure Remove footings and fences as required	Inspection - areas ready for rehabilitation
Infrastructure to be retained	Secure written agreement of party to take responsibility for infrastructure including any decommissioning requirements	New owner takes responsibility for retained infrastructure

10 CLOSURE MONITORING, MAINTENANCE AND REPORTING

This section provides an overview of monitoring and maintenance activities planned to support the closure process and demonstrate progress towards meeting completion criteria. Monitoring results, remedial actions and maintenance activities for the Project will be reported to DMIRS and DWER as part of approval reporting requirements.

10.1 MONITORING STANDARDS AND FREQUENCY

Closure and rehabilitation performance will be monitored against closure objectives and criteria. It is assumed that some closure and rehabilitation areas will require some maintenance interventions to ensure objectives and outcomes are met. The post-closure monitoring and maintenance planned to be undertaken is summarised in Table 23.

Monitoring requirements during operations are defined by legal obligations, such as tenement conditions and conditions of environmental licences and permits. This monitoring provides a useful 'baseline' data set and forms a logical basis for continued monitoring as the operations are closed and rehabilitated. Some of the monitoring will be targeted towards risks that are only active during operations, and will logically cease when the risk is no longer active, and some will still be relevant during the closure phases.

Specific monitoring and data capture will be designed to support the case for completion of rehabilitation and closure obligations with a view to enabling tenement relinquishment for the site. The monitoring programme is described in more detail in the following section.

Table 23: Post-closure monitoring program

Aspect	What is being monitored / why?	Method	Frequency	Timing / duration
Landform	Geotechnical stability at back-filled or rehabilitated sites	Visual inspection	At least once	• Within first year of rehabilitation • At 5 years if required
	Overall water management – site drainage	• Visual inspection • Surface water quality monitoring	• Upon completion of drainage works • Following flood events • As per water quality schedule	• One-off • Dependent on weather events • Until completion
Soils	Soil loss / erosion / waterlogging	• Visual inspection • Quantitative assessment (only if visual monitoring suggests necessary)	Annually	First within 12 months of rehabilitation, annually until completion criteria are met
General rehabilitation	Topsoil depth	• Visual by manual excavation at several sample locations	• At least once	Once while spreading topsoil

Aspect	What is being monitored / why?	Method	Frequency	Timing / duration
Existing Native Vegetation (adjacent to salt disposal area)	Vegetation health (risk of salt stockpile damaging lake fringing vegetation in long term)	Visual inspection	At least once	Event based following major inundation events until completion criteria are met
Native vegetation rehabilitation	Vegetation establishment and survival on significant rehabilitation areas	• Seedling counts (plot based assessment) • Survivor counts (plot-based assessment)	At least once	First within first year of rehabilitation, second at 5 years if required to confirm completion criteria are met. If not, follow up surveys are to continue until completion criteria are met
	Plant species diversity on significant rehabilitation areas	Plot based assessments	At least once	First within first year of rehabilitation, second at 5 years if required to confirm completion criteria are met. If not, follow up surveys are to continue until completion criteria are met
	Weed distribution and density on significant rehabilitation areas	Plot based assessments	At least once	First within first year of rehabilitation, second at 5 years if required to confirm completion criteria are met. If not, follow up surveys are to continue until completion criteria are met
	Fauna habitats on significant rehabilitation areas	Fauna habitat assessment	At least once	First at 5 years, follow up surveys are to continue if required until completion criteria are met
Fauna	Possible fauna entrapment in trenches and ponds prior to backfilling	Operational visual inspection regime maintained until closure	Quarterly to check that ramps are working	Review requirement annually.
	Measured abundance and diversity of lake fauna reproductive and adult phases	Established during operations as salt stockpile is established	TBA	TBA
Surface water	pH, EC, TSS at different distances from excess salt stockpile.	AS 5667.1, 1998	Daily to weekly whilst in flood	Until completion criteria achieved
	Salt crust	Satellite imagery	Annual	10 years
Groundwater	Groundwater levels as per existing licence	Shallow and deep bores with dip meter	• Maintain licence frequency until risk assessment shows reduction acceptable	Until completion criteria achieved

Aspect	What is being monitored / why?	Method	Frequency	Timing / duration
			• TBA depending upon status at closure	

10.1.1 LANDFORM AND EROSION MONITORING

Visual monitoring of back-filled areas (e.g. back-filled ponds and trenches), the earthen bund and rehabilitated areas will be conducted as part of overall site management. Such areas will be traversed by vehicle looking for signs of subsidence and erosion. These traverses will include inspections of drainage control features such as grade or level banks, sumps and drains. Should visual monitoring of erosion indicate unacceptable levels of erosion, further and more quantitative investigations and remedial actions will be implemented.

10.1.2 SURFACE WATER MONITORING

The requirement for ongoing surface water monitoring around the excess salt stockpile will be defined with the benefit of monitoring results during operations and an assessment of the post-closure risks. If required, water quality monitoring in the vicinity of the excess salt disposal area will be conducted in accordance with Australian Standard 5667.1:1998. Sampling will be restricted to after significant flood events. Surrogate monitoring of salt crust using satellite imagery may be utilised as an efficient way of determining the extent of salt migration away from the stockpile. This approach has been successfully utilised to monitor dewatering discharge at locations such as Lake Carey.

10.1.3 GROUNDWATER MONITORING

Groundwater monitoring (groundwater quality and levels) at the Project will continue post-closure according to licence specifications until such time as it is determined that it can be reduced, or completion criteria are met.

10.1.4 VEGETATION MONITORING

Vegetation fringing the excess salt disposal area at Ten Mile Lake will be inspected regularly whilst operating to determine if localised drawdown from trench dewatering, or the presence of the excess salt stockpile is affecting vegetation health. Monitoring will observe the following indicators:

- Presence/absence of species in particular locations;
- Percentage cover or leaf area; and
- Health condition rating of individual plants.

10.2 MAINTENANCE

Closure maintenance includes works to avoid failure or damage to rehabilitation areas, and may require remediation of rehabilitated areas that would not otherwise meet completion criteria.

Maintenance activities may include artificially supporting natural processes (such as leaching, plant establishment) until they can become self-supporting.

Maintenance activities likely to be undertaken during and after closure implementation include:

- Remediating landforms to control erosion;
- Improving drainage and works to prevent erosion;
- Controlling feral animals;
- Repairing fences to keep livestock or feral animals out of rehabilitation areas;
- Maintaining roads, tracks, power and water supplies;
- Replanting unsuccessful revegetation areas;
- Controlling weeds in rehabilitation areas;
- Liaising with DBCA regarding fire;
- Maintaining land management practices until completion criteria are signed off; and
- Maintaining signage.

Financial provisioning and resources will be made available for post-closure monitoring and maintenance, including provisioning for remedial work if monitoring shows that completion criteria are not being met.

10.3 REPORTING

Reporting of rehabilitation performance will be undertaken in accordance with regulatory requirements. Rehabilitation reporting will include details of:

- Rehabilitation monitoring results for the reporting period;
- Maintenance / remedial actions completed or planned; and
- New rehabilitation that has been undertaken on-site.

The results of monitoring will be used internally to assess rehabilitation performance and identify whether alternative management strategies are required or if completion criteria require review.

11 FINANCIAL PROVISIONING FOR CLOSURE

While it is not a requirement under the MCP guidelines to provide a provisional cost estimate for mine closure at this stage of the Project, Kalium Lakes nevertheless recognizes the importance of ensuring adequate funds are set aside for the rehabilitation and closure of the Project. The closure costing methodology, assumptions and financial processes used to assess provisional costs has been based on the information provided in Table 7: (Completion Criteria) and considers a range of rehabilitation and closure activities including:

- Earthmoving and landforming;
- Management of any problematic materials;
- Post-closure management of surface water drainage;
- Revegetation and topsoil stability monitoring;
- Decommissioning and removal of infrastructure (as required);
- Final rehabilitation;
- Maintenance and monitoring programs;
- Ongoing stakeholder consultation process;
- Closure project management costs; and
- Provision for unexpected closure or temporary closure.

11.1 PROCESS AND METHODOLOGY

The cost estimates for site closure are based on the application of unit rates to areas, distances (such as for trenches) or items (such as individual bores); a methodology that is considered appropriate for initial cost estimates. Where available, the actual earthmoving costs have been calculated, providing an additional level of confidence about likely costs. As required under the International Financial Reporting Standards, the salvage value of infrastructure at mine closure will not be offset against closure costs.

The cost estimate has been developed with regard to the following:

- Regulatory requirements, including mining tenement conditions;
- Closure domains having similar landform disturbance characteristics and, therefore, similar rehabilitation requirements, closure tasks and unit rates;
- Identification of areas which may require potentially contaminated materials to be reclaimed and disposed at a licensed waste disposal / treatment facility;
- Identification of infrastructure requiring decommissioning works;
- Calculation of the volumes of closure materials for movement, transfer or disposal;
- Personnel, plant and/or equipment required to complete the closure tasks by quantity, area or volume;
- Closure task rates, including the application of earthmoving equipment rates per hour; and
- Additional costs for the use of consultants, task supervision, accommodation and messing of personnel, transportation of items and personnel, monitoring, etc.

Cost estimates will be included in the annual accounts of Kalium Lakes and will form the basis for provisioning for closure. Provisioning will be based on the amount of disturbed land at the time of the estimate and will identify the timing of expenditure. The estimate will utilise assumptions as required, where quantities are not readily identifiable.

12 INFORMATION AND DATA MANAGEMENT

Management and storage of all rehabilitation and closure information and data will be undertaken in accordance with Kalium Lakes' EMS.

This MCP will be updated as required to capture and summarise any changes that may be required as the Project evolves. Examples of such changes include:

- Completion criteria and performance indicators may need to be refined;
- Changes to management measures based on monitoring results; and
- Changes to proposed monitoring strategies.

Kalium Lakes will also maintain information relevant to the closure of the Project, including:

- Aerial photographs;
- Areas of disturbance;
- Inventories of rehabilitation materials available, required and used;
- Records of significant spills, and details of clean-up;
- Data from any future baseline studies, operations monitoring, closure studies, contaminated sites investigations, and post-closure monitoring; and
- Photographs from pre- and post-closure inspections and monitoring rounds.

13 GLOSSARY

Term	Meaning
ADWG	Australian Drinking Water Guidelines
AERs	Annual Environmental Reports
ALARP	As Low as Reasonably Practicable
BoM	Bureau of Meteorology
CS Act	*Contaminated Sites Act 2003*
DAFWA	Department of Agriculture and Food Western Australia
DBCA	Department of Biodiversity, Conservation and Attractions
DEWHA	Department of Environment, Water, Heritage and the Arts
DoW	Department of Water
DPaW	Department of Parks and Wildlife (now DBCA)
DMIRS	Department of Mines, Industry Regulation and Safety
DMP	Department of Mines and Petroleum (Now DMIRS)
DotEE	Department of the Environment and Energy
EGS	Environmental Group Site
EMS	Environmental Management System
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERD	Environmental Referral Document
ESA	Environmentally Sensitive Area
GDE	Groundwater Dependant Ecosystem
GNH	Great Northern Highway
ha	Hectare
Kalium Lakes	Kalium Lakes Potash Limited
Km	Kilometres
Ktpa	Kilotonnes per annum
LOAs	Land owner agreements
m	Metre
M	Mining Lease
MCP	Mine Closure Plan
Mining Act	*Mining Act 1978*
mm	millimetre
Mm^3	Million cubic metres
MRF	Mining Rehabilitation Fund
MS	Ministerial Statement
Mt	Million tonnes
MWPA	Mid-west Port Authority
N/A	Not applicable

Term	Meaning
Phoenix	Phoenix Environmental Services
Playa	The flat-floored bottom of an undrained desert basin that becomes at times a shallow lake
PoW	Programme of Works
SOP	Sulphate of Potash
SRE	Short-range endemic
TDS	Total dissolved solids
UCL	Unallocated Crown Land
WA	Western Australia
WIR	Water Information Reporting
WWTP	Wastewater treatment
WC Act	*Wildlife Conservation Act 1950*

14 REFERENCES

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15 APPENDICES

The following appendices are provided:

Appendix 1: Rehabilitation and Closure Risk Register

Appendix 2: Flora and vegetation survey reports

Appendix 2.1: Flora and Vegetation Survey Report

Appendix 2.2: Concentrator Lakes Flora and Vegetation Survey Report

Appendix 3: Fauna survey reports

Appendix 3.1: Fauna Survey Report

Appendix 3.2: Concentrator Lakes Fauna Survey Report

Appendix 3.3: Aquatic Invertebrates and Waterbird Survey Report

Appendix 4: Hydrology and hydrogeology reports

Appendix 4.1: Surface Water Assessment Report

Appendix 4.2: Preliminary Water Supply Report

Appendix 4.3: Hydrogeological Brine Abstraction Report

Appendix 4.4: Groundwater Contours